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## THE DOLLAR AND ITS DISCONTENTS

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## ABSTRACT

### The Dollar and its Discontents\*

Has the US dollar delivered the benefits that the rest of the world is expecting from its holdings of international liquidity? US government debt has been liquid and safe, and it is supplied in sufficient quantity. But it has given a low return to the countries that accumulated the most reserves, especially when those returns are measured in terms of the countries' own consumption. I argue in this paper that the countries that accumulate the most reserves should expect a low return in terms of their own consumption, and that there is little that international monetary reform can do to change that fact.

JEL Classification: F36 and F43

Keywords: dollar, foreign exchange reserves, international monetary system and triffin dilemma

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# 1 Introduction

A bird's-eye view of the international monetary system could be described as follows. There is a center and there is a periphery. The periphery uses assets of the center as reserves. There are three necessary conditions for the system to be viable (i.e., to deliver satisfactory outcomes for its participants):

- (i) the center's assets must be liquid and safe,
- (ii) they must be provided in sufficient quantity, and
- (iii) they must deliver an appropriate return.<sup>1</sup>

There are debates about whether the US dollar is meeting these conditions, and about its ability to satisfy them going forward. First, the 2008 financial crisis has put into question the safety and liquidity of US assets. Second, it is not clear whether the US economy will be able to satisfy the ever-increasing demand for international liquidity. And third, the central role of the US dollar in the current system has been criticized on the grounds that the return on the dollar is determined by the domestic objectives of the US authorities rather than a concern to provide a stable store of value for the rest of the world. This has led to debates about whether the international monetary system should evolve toward a more multipolar arrangement with a greater role for the euro and perhaps (in the longer term) the renminbi or the Special Drawing Rights (SDR).<sup>2</sup>

The purpose of this paper is to review these arguments, with special emphasis on the third one. Overall, I do not see much grounds for forecasting a rapid decline of the dollar on the basis of the first two criteria. The crisis has reduced the safety and liquidity of certain

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<sup>1</sup>In addition, if there are fixed exchange rates, the monetary policy of the center must be acceptable to the periphery. With floating exchange rates this is not as important, although minimum stability is necessary to satisfy condition (i).

<sup>2</sup>For the view that the supply of safe dollar assets might become insufficient to satisfy the global demand, see Fahri, Gourinchas and Rey (2011) and Obstfeld (2011). The critique of the dollar as an unstable store of value was developed most notably by Zhou Xiaochuan, the governor of the People's Bank of China (Zhou, 2009). See Eichengreen (2011) for a forward-looking discussion of the role of the dollar in the international monetary system.

US dollar assets, but US Treasury debt played its role of safe haven. The government debt crisis in the euro area has durably reduced the competition that US Treasury debt faces in maintaining its status as the main global safe asset. And the data suggest that there is little risk of an imminent shortage of safe US debt—although it may become a constraining factor in the long run.

Most of the paper focuses on the third criterion—the performance of the dollar as a store of value. Measuring this is more difficult than first meets the eye. I argue that for countries that accumulate international reserves through the current account (through trade surpluses), the appropriate way of assessing how well the dollar does as a store of value is by looking at the real return that countries have received on their dollar reserves *in terms of their own consumption*. And if one measures the return on dollar reserves in this way, it was indeed very low and is likely to continue to be low in the future.

To illustrate, I find that the consumption-based cumulated return that China received on its dollar reserves in the 2000s was negative, and equal to minus 17 percent. That is, by investing the equivalent of 100 units of Chinese consumption in US Treasury bills at the beginning of 2000 and rolling over this position for ten years, the Chinese authorities were left with enough dollars to buy  $100 - 17 = 83$  units of Chinese consumption at the end of 2010. The consumption-based return on dollar reserves was even lower for the other BRIC countries (Brazil, India and Russia). These low consumption-based returns are explained largely by the fact that the currencies of those countries have appreciated in real terms relative to the dollar. As a result, they have made a loss on the value of their dollar reserves in terms of their own consumption.

These findings are not due to the fact that the 2000s was a period in which the dollar happened to depreciate against all currencies. Looking at a larger sample of 28 emerging market economies shows a variety of experiences, with a number of countries receiving a positive consumption-based return on their dollar reserves. Furthermore, the larger sample reveals

an interesting fact: there is a negative cross-country correlation between the consumption-based return that a country receives on its reserves and the level of reserve accumulation. That is, countries that accumulated the most international reserves also received the lowest consumption-based returns on those reserves.

I propose a simple model to explain this finding. The model features a small open economy that accumulates international reserves to resist the real appreciation of its currency, or to accumulate international liquidity in pace with the growth in the domestic tradable good sector. In both cases, the country tends to accumulate more reserves at the same time as its currency appreciates in real terms, which decreases the consumption-based return on the reserves. Thus, there is a kind of “saver’s curse” in international finance: countries that accumulate more net foreign assets also tend, in equilibrium, to have a lower consumption-based return on those assets.

The implications of my analysis for the debate on reforming the international monetary system are discussed in the last section. The main point is that *if* the consumption-based return on dollar reserves is low for the reasons conjectured in this paper, it is not a problem that the international monetary system should try to solve. If reserves are accumulated primarily by countries that resist the appreciation of their currencies, or whose currency appreciates because of the Balassa-Samuelson effect, then the consumption-based return on their reserves must be low in equilibrium.

The paper is structured as follows. Section 2 discusses whether US dollar debt remains liquid, safe and abundant enough to support the role of the dollar as the main reserve currency. Section 3 looks at the performance of the dollar as a store of value. Section 4 concludes with a brief discussion of the policy implications.

## 2 Safety, Liquidity and Abundance

The dollar, with a share of about 60 percent of global reserves, remains the main reserve currency. This section assesses the performance of the dollar from the perspective of the first two criteria stated in the introduction. Did dollar debt assets provide liquidity and safety? Were those assets supplied in sufficient quantity? I consider each question in turn.

### 2.1 Safety and liquidity

There is little doubt that US financial markets provided an abundance of liquid and safe assets to the rest of the world until the crisis. This is especially true of US Treasury bonds, the main asset of investment for international reserves, and the US Treasury has benefited from this by paying a lower interest rate on its debt (Krishnamurthy and Vissing-Jorgensen, 2010).

Has this perception changed during the crisis? It has certainly changed for the asset classes that were the most directly affected by the crisis, such as asset-backed securities or corporate bonds. Foreign private and official investors, who had diversified their holdings of US securities in the decades preceding the crisis, rushed back to the safety of Treasury debt after 2008. Figure 1 shows the shares of foreign holdings of US debt securities respectively invested in Treasury securities, corporate bonds, and agency and GSE-backed securities between 1980 and 2010. The share of foreign holdings of US debt securities invested in Treasuries decreased from about 80 percent in 1980 to less than 40 percent before the crisis. This trend was reversed by the crisis and in 2010, the share of Treasury debt was back to the level observed ten years earlier. This shift in investors' preferences was also observed in the relative prices of the different kinds of debt in the Fall of 2008, with a sharp increase in the spreads on US private debt relative to Treasury debt.

The main impact of the crisis, thus, was *not* to reduce the perceived safety of US assets as a whole but rather to revive old lines of differentiation between different kinds of debt

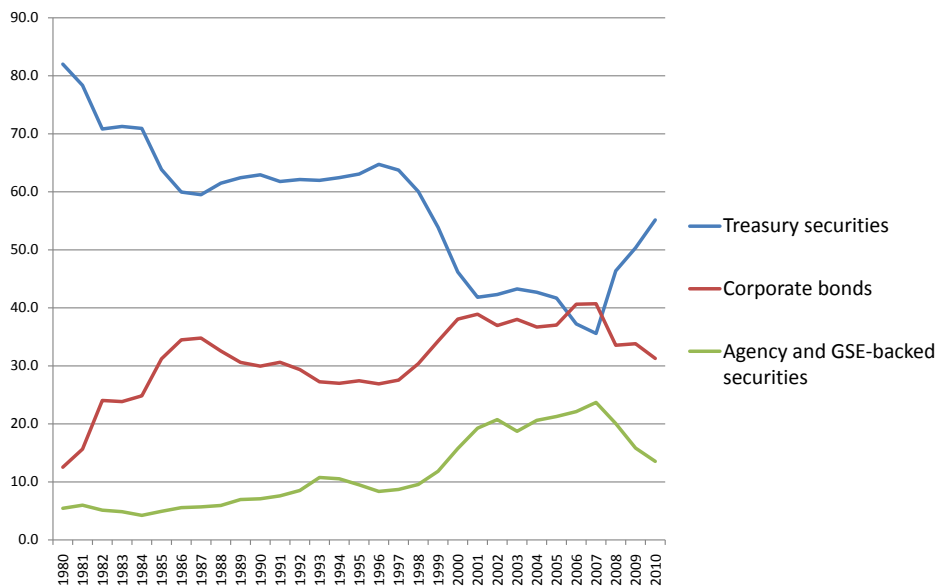


Figure 1: Shares of foreign holdings of US debt securities invested in Treasury securities, corporate bonds, and agency and GSE-backed securities (percent, 1980-2010). Source: Federal Reserve Flow of Funds Data.

that had been perceived as more and more substitutable before the crisis. US Treasury debt successfully served its function of “safe haven” and became again the first-choice asset during the crisis (McCauley and McGuire, 2009).

## 2.2 Triffin dilemma redux

Triffin (1960) famously pointed to an internal contradiction that was undermining the Bretton Woods fixed exchange rate system. The quantity of dollars that the US needed to create in order to satisfy the rest of the world’s demand for international liquidity grew at a faster rate than the US gold reserves, so that the fixed parity between the dollar and gold would be increasingly difficult to maintain (without global deflation). Triffin’s argument was about the problem of maintaining a fixed peg between the dollar and gold but it is now being updated and applied *mutatis mutandis* to today’s system of floating exchange rates by Fahri, Gourinchas and Rey (2011) and Obstfeld (2011).

These authors have proposed a *fiscal* variation on Triffin’s dilemma that can be summa-



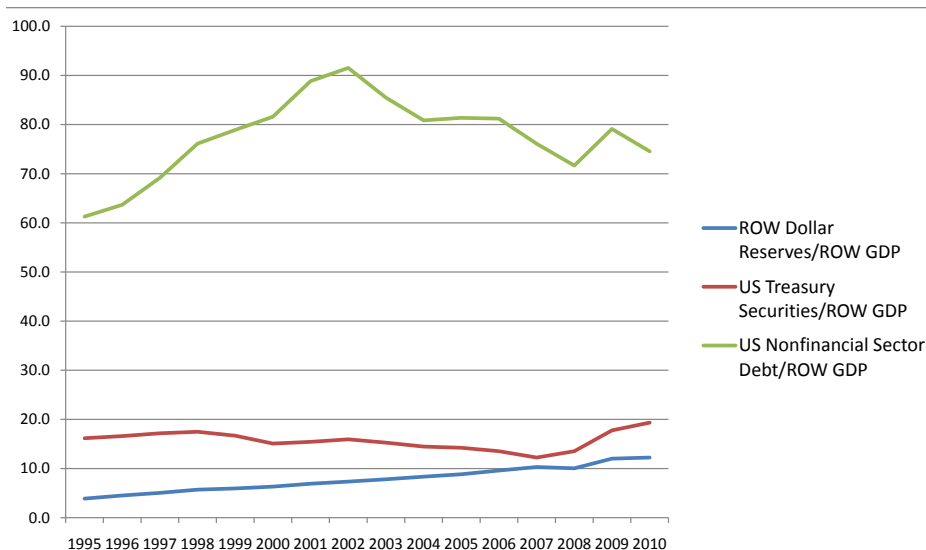


Figure 2: Global dollar reserves, US Treasury securities and US nonfinancial sector debt as shares of the rest of the world’s GDP (percent, 1995-2010). Sources: Federal Reserve Flow of Funds Data, IMF World Economic Outlook and COFER, and World Development Indicators.

ized as follows. As international reserves are primarily composed of US government debt, and the share of the US in the global economy is shrinking, the US progressively loses its fiscal capacity to satisfy the rest of the world’s demand for international liquidity. Thus, there is a dilemma between the objective of satisfying the global demand for international liquidity, which requires a secular increase in the ratio of US government debt to US GDP, and the objective of maintaining US government debt safe, which requires stabilizing this ratio.

The fiscal Triffin dilemma is illustrated in Figure 2, which shows global dollar reserves as well as the outstanding stocks of US Treasury securities and the debt of the US nonfinancial sector. These variables are expressed as shares of the rest of the world’s (i.e., non-US) GDP.<sup>3</sup> Several facts stand out.

First, comparing the global stock of dollar reserves with the outstanding stock of US

<sup>3</sup>The global dollar reserves were estimated by multiplying the global stock of reserves (minus gold) by the share of the dollar in the allocated reserves reported in the IMF COFER data. This is not an exact measure because the COFER data do not report the currency composition of reserves for all countries.

Treasury securities suggests that there is some truth to the “fiscal Triffin dilemma” view. The global stock of dollar reserves was increasing at a faster pace than the stock of US Treasury securities before the crisis, so that by 2007 the two curves were about to cross each other. This trend was interrupted by the crisis and the stock of US Treasury securities started to increase faster than global reserves, but this was only thanks to US fiscal deficits that were clearly unsustainable in the long run.

Second, the picture is rather different if one compares the global stock of dollar reserves with the total stock of US nonfinancial sector debt. This larger debt aggregate includes—in addition to Treasury securities—municipal securities, commercial paper, corporate bonds, mortgages and consumer credit.<sup>4</sup> The debt of the US nonfinancial sector provides a rough measure of the total stock of dollar debt that foreign central banks can invest in, directly or indirectly (through asset-backed securities or by holding claims on the US financial sector). And indeed, foreign central banks were diversifying their reserve portfolio away from Treasuries and into other forms of US debt before the crisis.<sup>5</sup> This trend of diversification was interrupted by the crisis, but looking forward, one can well imagine that foreign investors will view US Treasury securities and other US debt securities as more and more substitutable again. The stock of US nonfinancial sector debt amounts to more than 70 percent of non-US GDP, which leaves significant room before the global demand for dollar liquidity is constrained.

Another lesson from Figure 2 is that any dollar shortage comes from an increase in the rest of the world’s demand for reserves relative to its own GDP, not from the fact that the US economy is producing less debt or that its economy is shrinking relative to the rest of the world. The stock of US debt securities has been roughly constant as a share of the rest of the world’s GDP, but the stock of international dollar reserves almost doubled between 2000

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<sup>4</sup>These data come from the Federal Reserve flow of funds data, Table L.2 (Credit Market Debt Owed by Nonfinancial Sectors).

<sup>5</sup>According to the flow of funds data, the foreign official sector’s investment in US agency and GSE-backed securities was larger than its investment in US Treasury securities in 2007.

and 2010, from about 6 percent to about 12 percent of non-US GDP. Clearly, extrapolating this trend—assuming that the rest of the world will continue raising its reserves-to-GDP ratio by 6 percent every decade as it did in the 2000s—will sooner or later result in a dollar shortage. It is not clear, however, why the rest of the world would accumulate international reserves at such a pace. There is no historical precedent for such a trend, and no convincing theoretical explanation for why it should continue. In fact, to the extent that emerging market economies “graduate” and start looking more like advanced economies, they should lower rather than increase their holdings of international reserves as a share of their GDP.

It is not even clear that the increase in global reserves observed in the 2000s reflects primarily a larger demand for international liquidity. The countries with an authentic need for international liquidity are emerging market economies that have an open capital account and are exposed to capital flow volatility and sudden stops. But these economies account for a relatively small share of reserve accumulation. A large fraction of the reserves were accumulated by oil-exporting countries and by China for reasons that seem to have little to do with liquidity per se. Oil-exporting countries save oil revenue for future generations. China accumulates reserves for reasons that are debated but most likely to resist the appreciation of its currency.<sup>6</sup> It is in the interest of these countries to diversify their publicly-held foreign assets into equity, as indeed they have started to do, in a limited way, with their sovereign wealth funds.

Another concern is that US Treasury debt might lose its quality as a “safe asset”, as some euro area government debts already have. It is not clear, however, that the US should brace itself to face the same problems as the euro area. The main lesson from the euro crisis is probably the huge difference that it makes to have a central bank that is expected to provide a monetary backstop to a government debt rollover crisis and prevent a default. As long as

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<sup>6</sup>As argued in Jeanne (2011), the Chinese authorities do not need *liquid* foreign assets for that purpose—illiquid foreign assets would do the job. In addition, China does not really need international liquidity to deal with capital flow volatility and the risk of sudden stops, given its relatively closed capital account.

market participants expect that (i) the US Fed would prevent a default of the US Treasury in the event of a rollover crisis and (ii) a US fiscal adjustment will occur (sooner or later), the debt of the US will remain a safe asset, from the point of view of both the default risk and the inflation risk. The governments at the periphery of the euro area do not enjoy the same leeway because the European Central Bank does not satisfy the first condition (Jeanne, 2012). The euro area debt crisis seems to have been caused by factors that are specific to the euro, and it should strengthen rather than diminish the status of the dollar as the main reserve currency.

Overall, a shortage of safe US debt securities does not seem likely to become a binding constraint soon for reserve-accumulating countries. This does not mean, however, that individual countries will not feel at times constrained in their access to international liquidity, as they did for example at the time of the Lehman crisis in the Fall of 2008. The provision of swaps by the US Fed was important, at that time, to restore a measure of confidence in the global banking system (Aizenman, Jinjark and Park, 2011). The fact that those swaps were perceived to restore confidence even in countries that had a comfortable buffer stock of reserves raises important questions about the extent to which dollar reserves can provide a good substitute to international lending-in-last-resort in dollars. These questions have been actively discussed in debates about “global financial safety nets”. The problem revealed by the crisis, however, is not so much a shortage of international liquidity as the fact that in a world where the wholesale dollar funding market is a source of financing for non-US banks, there is a need for the US Fed to sometimes act as international lender of last resort.

### **3 The Dollar as a Store of Value**

The third question is whether the dollar has performed well as a global store of value. There is more to this question than meets the eye, and indeed I will spend the rest of the paper discussing it. Those who claim that the dollar is not a good store of value point to two facts:

that the interest rate on US debt is low and that the dollar is depreciating. However, it is not completely clear how these two facts should be combined to measure the opportunity cost of holding dollar reserves. I attempt to clarify these conceptual issues in the first subsection. I then present some measures of the real return on dollar reserves for emerging market economies. Finally, a model is presented to help explain and interpret some of my findings.

### 3.1 Measuring the return on dollar reserves: conceptual issues

A common approach to estimating the opportunity cost of reserves is to assume that each dollar of reserves could instead be used to repay the country's long-term external dollar debt.<sup>7</sup> According to this approach, the opportunity cost of holding reserves is the difference between the return on the reserves and the (usually higher) interest rate that the country pays on its external dollar debt. The implicit assumption is that an additional dollar of reserves is financed, at the margin, by issuing one more dollar of external debt—i.e., through the financial account. Note that in this case, a dollar depreciation should not be considered as a cost, since it also reduces the value of the debt that has been issued to buy the reserves.

The premise of this approach is that reserves are accumulated through the financial account (with capital inflows) rather than through the current account (with a trade surplus). If this were true, we should not a priori expect to observe a relationship between reserve accumulation and trade surpluses. However, we do observe such a relationship in the data. Figure 3 plots, for a sample of 28 emerging market countries, the accumulation of international reserves between 2000 and 2007 (vertical axis) against the trade balance cumulated over the same period (horizontal axis).<sup>8</sup> There is a statistically and economically significant positive correlation between the two variables, suggesting that countries accumulate more

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<sup>7</sup>See, for example, Edwards (1985), Rodrik (2006), Jeanne (2007), Jeanne and Rancière (2011).

<sup>8</sup>The countries are Argentina, Brazil, China, Colombia, Dominican Republic, Ecuador, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, the Philippines, Poland, Russia, South Africa, Thailand, Tunisia, Turkey, Ukraine, Uruguay and Venezuela.

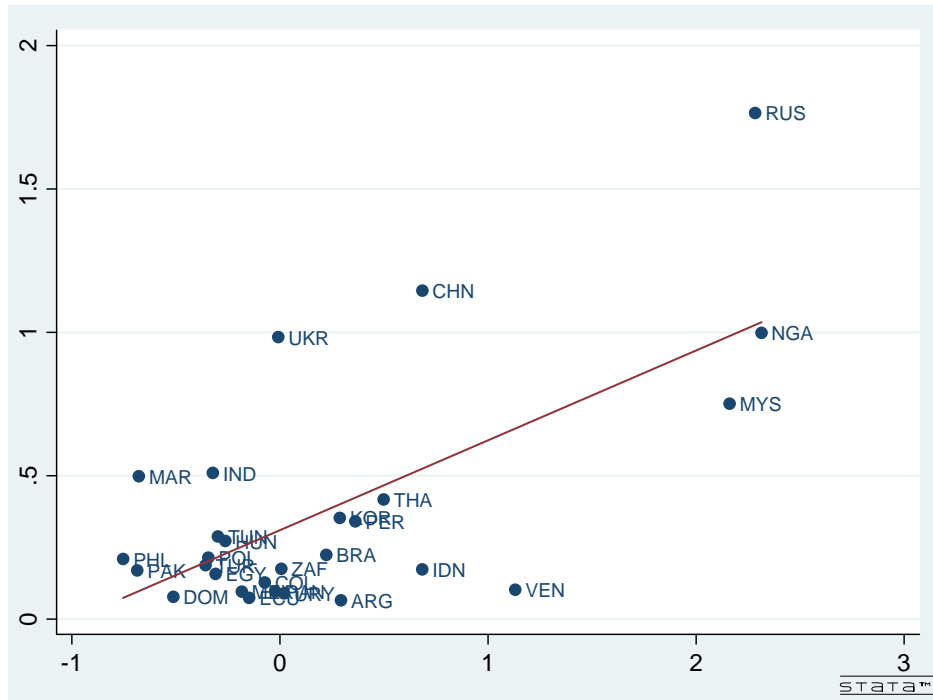


Figure 3: Cumulative trade balance (horizontal axis) and increase in international reserves (vertical axis) over 2000-07 normalized by 2000 GDP. Source: World Development Indicators.

reserves by having larger trade surpluses.<sup>9</sup>

Figure 3, obviously, does not say anything about the direction of causality, which could flow both ways, or from a third variable. It could be that countries have current account surpluses or deficits for reasons that have nothing to do with reserve accumulation and that part of the accumulated foreign assets end up as reserves at the central bank.<sup>10</sup> But, as argued in Jeanne (2011), the causality could also go the other way around, from the accumulation of reserves to a current account surplus. This is especially likely to be the case in countries where, because of capital controls or other financial frictions, the accumulation of foreign assets by the public sector cannot be “undone” by capital inflows to the private sector. Then the accumulation of reserves results in an accumulation of net foreign assets for the country as a whole, and thus a current account surplus. We do not really know which

<sup>9</sup>The correlation is statistically significant at the 1 percent level.

<sup>10</sup>This view is adopted in most of the recent literature; see for example Carroll and Jeanne (2009) or Song, Storesletten and Zilibotti (2011).

view is correct (more research is needed),<sup>11</sup> but I would like to explore the consequences of assuming the second view for the opportunity cost of accumulating reserves.

If one assumes that international reserves are accumulated at the margin by raising the trade balance, then the decision to accumulate reserves should be viewed as, essentially, an intertemporal consumption-saving decision. Accumulating one more dollar of reserves means, for the country as a whole, saving this dollar by reducing domestic absorption, in the same way as an individual saver accumulates wealth by postponing his consumption.<sup>12</sup> For the same reason that individuals should determine their consumption and saving by looking at the real (rather than nominal) interest rate, the authorities of a country that accumulate net foreign assets on behalf of the domestic citizens should care about the return on those assets expressed *in terms of domestic consumption*.

Accordingly, I will measure the *consumption-based* real return on dollar reserves as,

$$r_t = i_{\$t} + \Delta s_{t+1} - \Delta p_{t+1}. \quad (1)$$

The consumption-based return on a dollar bond is equal to the dollar interest rate, plus the rate of nominal depreciation of the domestic currency relative to the dollar (which gives the return on the dollar bond in terms of domestic currency), minus the domestic CPI inflation rate (which gives the return on the dollar bond in terms of domestic consumption).

### 3.2 Consumption-based returns on dollar reserves for the BRICs

This subsection provides estimates of the consumption-based real return on the dollar reserves of the four BRIC countries (Brazil, Russia, India and China), which are also the four emerging market countries that have accumulated the most international reserves over the

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<sup>11</sup>Gagnon (2012) presents evidence suggesting that reserve accumulation raises the current account balance.

<sup>12</sup>Alternatively, the country could be reducing investment rather than increasing saving. The evidence in Gourinchas and Jeanne (2011), however, suggests that the margin of adjustment is saving rather than investment.

last decade.<sup>13</sup> If a country invests 100 units of domestic consumption in dollar bonds in January 2000, how many units of domestic consumption can the country purchase by selling those bonds at a later date? The answer is given in Figure 4 for the BRIC countries. For each country, the purchasing power of the dollar assets in terms of domestic consumption was computed by cumulating the consumption-based real interest rate from equation (1), starting from a base of 100 in January 2000.<sup>14</sup>

A country has a positive (negative) consumption-based return on its dollar bonds between January 2000 and a given month if the index is above (below) 100 in that month. For example, the fact that the index fell to 83.0 in December 2010 for China, means that investing 100 units of Chinese consumption in dollar bonds in January 2000 yielded the equivalent of 83 units of Chinese consumption at the end of the decade. As shown in Figure 4, all four countries had a negative consumption-based return on dollar bonds in 2010.

These results suggest that the dollar has not performed well as a store of value. In fact, the return on dollar reserves is worse than most people think once it is measured in terms of the countries' own consumption. These low returns are driven in part by the low level of US interest rates, but for the most part they reflect the fact that the currency of the BRIC countries appreciated in real terms relative to the dollar, implying that the dollar reserves have depreciated in terms of home consumption.<sup>15</sup>

The return is not as low for China as for the other BRIC countries because China has resisted the appreciation of its currency relative to the dollar. One problem with return estimates based on observed exchange rates is that they do not take into account the real exchange rate adjustments that we may expect to take place in the future. For example, China may have a certain level of pent-up appreciation that was not observed in 2010 but

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<sup>13</sup>China is the country that accumulated the most reserves by far (\$2,710 billion between 2000 and 2010). Russia came second, with \$435 billion of reserves accumulation. Brazil and India accumulated about the same amount of reserves (around \$250 billion).

<sup>14</sup>I used monthly data and took the three-month US Tbill interest rate for the dollar interest rate. The investment was staggered over time, with one-third of the foreign assets reinvested every month.

<sup>15</sup>The Brazilian Real depreciated sharply relative to the dollar from 2000 to 2003 but appreciated after that.



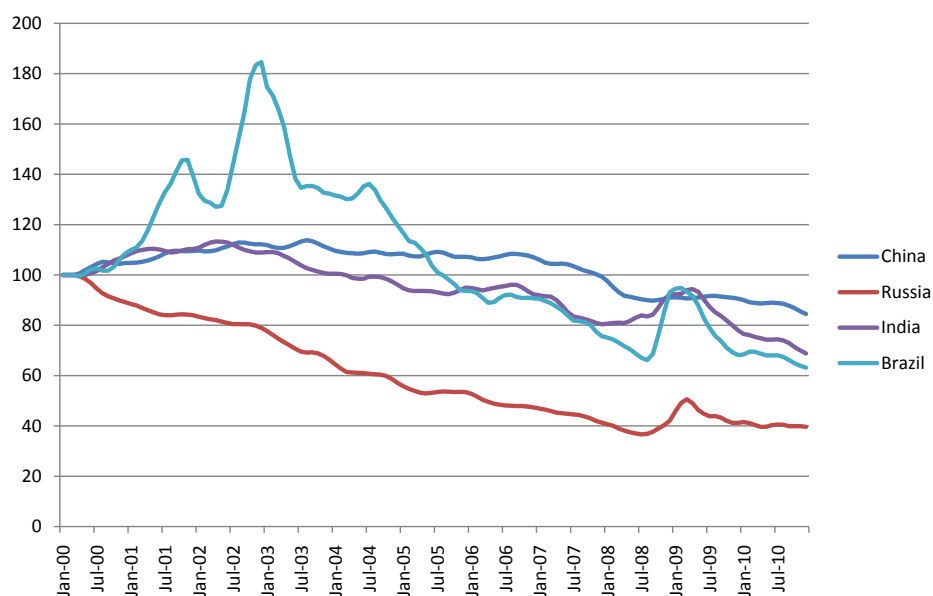


Figure 4: Consumption-based payoff on dollar reserves for the BRIC countries (2000:01-2010:12)

was “in the pipeline”.

**Table 1. Consumption-based return on dollar reserves in the BRIC countries (2000:01-2007:12)**

|               | Brazil | Russia | India  | China  |
|---------------|--------|--------|--------|--------|
| Observed      | -27.8% | -60.4% | -21.4% | -4.9%  |
| FEER-adjusted | -31.1% | -62.0% | -26.6% | -27.7% |

One way of adjusting for such unrealized appreciation is to estimate the consumption-based returns on dollar reserves that would be observed if the real exchange rate were equal to its “fundamental equilibrium value”. According to the fundamental equilibrium exchange rate estimates of Cline and Williamson (2008),<sup>16</sup> the Brazilian Real, the Russian

<sup>16</sup>The concept of fundamental equilibrium exchange rate was developed by Williamson (1994). In a nutshell, the fundamental equilibrium exchange rate is the real exchange rate that one would observe if the current account balance satisfied a certain norm of sustainability. The estimates depend on the assumptions that are made about the norm for current account sustainability and the trade elasticities. See Cline and Williamson (2008) for details.

Ruble, the Indian Rupee and the Chinese Renminbi were undervalued by, respectively, 4.8 percent, 4.2 percent, 7.1 percent and 31.5 percent relative to the US dollar in February 2008. Table 1 reports the consumption-based returns on dollar reserves that were observed in the four countries between January 2000 and December 2007 (first row) as well as the counterfactual return that would have been observed if the exchange rates had been equal to their fundamental equilibrium levels as measured by Cline and Williamson (2008). The adjusted consumption-based return is now close to -30 percent for China, close to the levels of Brazil and India.

The BRIC received a low consumption-based return on their dollar reserves primarily because of the real appreciation of their currencies, not because US interest rates were lowered by the “exorbitant privilege”.<sup>17</sup> The recent literature offers a range of estimates for the amount by which US interest rates are lowered by the foreign demand for US debt. The regressions in Warnock and Warnock (2009) suggest that foreign official inflows reduced the 10-year Treasury yield by 50 basis points in 2005 but that the impact on short-term interest rates was smaller. Krishnamurthy and Vissing-Jorgensen (2010) find that if the foreign official sector were to sell all its holdings of Treasury bonds in 2008, the short-term yield on those bonds would increase by 40 to 60 basis points relative to corporate bonds.

If I assume that foreign official demand for Treasury bonds lowered the US 3-month T bill interest rate by 0.5 percent on average over 2000-07 (probably an overestimate in view of the evidence mentioned above), then it reduced the cumulated return on dollar assets by about 4 percent. This is only a fraction of the valuation loss that the BRIC countries incurred on their dollar reserves because of the appreciation of their currencies.

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<sup>17</sup>The fact that the US government can pay lower interest rate on its debt because of the foreign demand for dollar reserve assets is sometimes called the “exorbitant privilege”. The term is also used by Gourinchas and Rey (2007) in a slightly different sense, to denote the apparent excess return that US investors earn on their foreign portfolios compared with what foreigners earn on their US portfolios.

### 3.3 A broader look at the data

This subsection looks beyond the BRIC countries and takes a broader look at the consumption-based returns that emerging market economies have received on their dollar reserves. I show that the consumption-based return on dollar reserves between 2000 and 2007 exhibits a high degree of cross-country heterogeneity. Furthermore, the consumption-based return is negatively correlated with the accumulation of reserves—that is, countries that accumulated more reserves tended to have a lower return.

For a given country, the consumption-based real return on a dollar of reserves between time  $t$  and  $t'$  is given by,

$$1 + r = \frac{(1 + i_{\$})S'/P'}{S/P}, \quad (2)$$

where  $S$  and  $S'$  are the nominal exchange rates (domestic currency per dollar) and  $P$  and  $P'$  are the domestic currency prices of domestic consumption, at respectively time  $t$  and  $t'$ , and  $i_{\$}$  is the nominal interest rate on the dollar cumulated between time  $t$  and  $t'$ . The denominator is the number of units of domestic consumption that one dollar buys at time  $t$ , and the numerator is the number of units of domestic consumption that the same dollar invested in dollar bonds at time  $t$  buys at time  $t'$ . This relationship is essentially the same as equation (1) but cumulated between time  $t$  and  $t'$ .

Defining the real exchange rate as the price of US consumption in terms of domestic consumption,  $Q = SP_{US}/P$ , the consumption-based real return can also be written,

$$1 + r = (1 + r_{\$})\frac{Q'}{Q}, \quad (3)$$

where  $1 + r_{\$} = (1 + i_{\$})P_{US}/P'_{US}$  is the US *real* interest rate. The domestic consumption-based real return, thus, is the US real interest rate plus the rate of real depreciation of the domestic currency relative to the US.

I measured the consumption-based real return on dollar reserves for the same sample of

28 emerging market countries as in Figure 3 by applying equation (3) between  $t=2000$  and  $t'=2007$  (before the financial crisis). Taken together, the countries in my sample have accumulated \$2,890 billionn between 2000 and 2007, 60 percent of global reserve accumulation. The country that accumulated the most reserves was of course China, which accounts for 47 percent of the reserves accumulated by this group.<sup>18</sup>

In order to see how the consumption-based real return on dollar reserves varies across countries, Figure 5 plots the real return,  $r$  (on the vertical axis), against the logarithmic increase in international reserves,  $\log(R_{2007}/R_{2000})$  (on the horizontal axis).<sup>19</sup> Two facts are noteworthy.

First, there is significant cross-country dispersion in the cumulated return on dollar reserves. The consumption-based return on dollar reserves was negative on average, but a number of countries received a positive consumption-based return on their dollar reserves (because their currencies depreciated against the dollar). Thus, the negative returns that we have obtained for the BRIC countries are not a feature of the whole sample—the dollar did not depreciate against all currencies.

Second, there is a negative correlation between the return on dollar reserves and the increase in reserves. That is, countries that increased their reserves the most also received the lowest consumption-based returns on those reserves, because their currencies tended to appreciate the most against the dollar. The correlation is negative and significant at the 5 percent level.<sup>20</sup> It is also economically significant. For example, it implies that other things

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<sup>18</sup>The US nominal cumulative interest factor was obtained by cumulating the average interest rate on 3-month Treasury bills between January 2000 and December 2007, which gives  $1 + i_s = 1.284$  and the result was then divided by the ratio of the US CPI in December 2007 to the US CPI in January 2000,  $P'_{US}/P_{US} = 1.249$ , which gives  $1 + r_s = 1.028$ . The average US real interest rate was thus positive over the sample period, although quite small (0.36 percent per year on average). The changes in the real exchange rate with the US dollar between 2000 and 2007 were similarly computed using the countries' CPIs and nominal exchange rates with the dollar. For the nominal exchange rate I used the average levels in 2000 and 2007 to smooth out high-frequency noise.

<sup>19</sup>The estimated returns for the BRIC countries are not exactly the same as in the previous section (for example, China now has a slightly positive return) because the underlying data are different. In particular, I now use annual averages for the exchange rates and CPI instead of monthly data.

<sup>20</sup>This result is driven in part by the cases of Argentina, Russia and Ukraine. The correlation is still negative

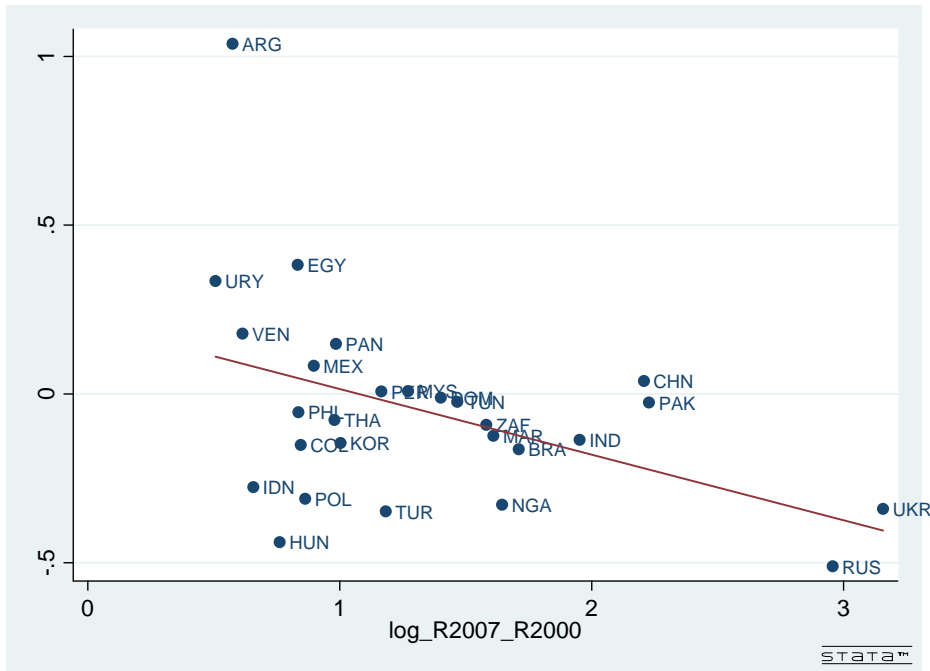


Figure 5: Consumption-based real return on dollar reserves (vertical axis) and reserve accumulation (horizontal axis) (2000-07)

equal, an increase in the reserves-to-GDP ratio of the magnitude observed in China should be correlated with a 24 percent fall in the cumulated consumption-based return on the dollar reserves.

Why do countries that accumulate the most international reserves also receive the lowest consumption-based return on those reserves? I now present a simple model that explains this result.

### 3.4 A model

The purpose of the model is to understand how the consumption-based return on international reserves is related to the level of reserve accumulation in equilibrium. The model has two periods  $t = 1, 2$  and features a small open economy with a representative consumer who consumes a tradable good and a nontradable good. Domestic consumption is a Cobb-Douglas

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but no longer statistically significant if one excludes these countries.

index of the consumptions of nontradable good and tradable good,  $C = C_N^{1-\alpha} C_T^\alpha$ . By an abuse of language that is common in the literature, I will call the tradable good “dollar” and the inverse of the price of domestic consumption in terms of dollar the “real exchange rate”. Denoting the real exchange rate by  $Q$ , the consumption-based real gross return on dollars is given by

$$1 + r = (1 + r_\$) \frac{Q_2}{Q_1}, \quad (4)$$

where  $r_\$$  is the (exogenous) dollar return. This equation is the analog of (3).

The consumer receives exogenous endowments of tradable and nontradable goods, respectively, denoted by  $Y_{Tt}$  and  $Y_{Nt}$  ( $t = 1, 2$ ). The endowment of nontradable good is constant ( $Y_{N1} = Y_{N2} = Y_N$ ) but the endowment of tradable good can change over time.

An important variable of the model is the change in the real exchange rate between period 1 and period 2. One can see that the real exchange rate  $Q$  is proportional to  $C_T^{-(1-\alpha)}$ , so that (4) can be rewritten,<sup>21</sup>

$$1 + r = (1 + r_\$) \left( \frac{C_{T1}}{C_{T2}} \right)^{1-\alpha}. \quad (5)$$

Next, I assume that reserves are the only foreign assets. This assumption could be interpreted as the fact that the country’s capital account is closed, but it also captures more generally the existence of frictions that prevent the accumulation of reserves to be offset by private capital flows. The amount of reserves accumulated in period 1, thus, is equal to the trade surplus,

$$R = Y_{T1} - C_{T1}. \quad (6)$$

As for the consumption of tradable good in period 2, it is equal to the tradable endowment

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<sup>21</sup>Given the Cobb-Douglas preferences, spending on the tradable good is a fraction  $\alpha$  of total spending,  $Q_t C_{Tt} = \alpha C_t$ , which implies  $Q_t = \alpha (C_{Nt}/C_{Tt})^{1-\alpha}$ . Then noting that the consumption of nontradable good is constant (since the supply is) one obtains  $Q_2/Q_1 = (C_{T1}/C_{T2})^{1-\alpha}$ .

plus the reserves augmented by the interest payment,

$$C_{T2} = Y_{T2} + (1 + r_{\$})R. \quad (7)$$

The expressions for  $C_{T1}$  and  $C_{T2}$  can then be used to substitute out the ratio  $C_{T1}/C_{T2}$  in equation (5), which gives

$$1 + r = (1 + r_{\$}) \left[ \frac{Y_{T1} - R}{Y_{T2} + (1 + r_{\$})R} \right]^{1-\alpha}. \quad (8)$$

This expression shows that the consumption-based return on the reserves,  $r$ , decreases with the level of reserve accumulation,  $R$ .

**Proposition 1** *Other things equal, the consumption-based real rate of return on foreign reserves is decreasing with the level of reserve accumulation.*

The intuition behind this result involves the fact that reserves are accumulated through a trade surplus. Increasing the level of reserves implies a larger trade balance in period 1 and a lower trade balance in period 2. But the trade balance is related to the real exchange rate. Other things equal, the trade balance can increase in period 1 and decrease in period 2 only if the real exchange rate appreciates in period 1 and depreciates in period 2. This induces a real exchange rate appreciation between period 1 and period 2 that decreases the consumption-based return on the reserves. The model, thus, brings out a kind of saver’s “curse” in international finance: accumulating more reserves changes the relative prices in a way that reduces the consumption-based return on the reserves.

The positive correlation between reserve accumulation and real appreciation could come from another mechanism. It is reasonable to assume that countries in which the tradable sector grows at a higher rate will want to accumulate more reserves. This could be because more trade requires more international liquidity or because those countries want to resist the period-1 real appreciation that results from the growth in the tradable sector (as argued by Aizenman and Lee (2007) or Dooley, Folkerts-Landau and Garber (2004)). Either way, we

would expect  $R$  to be positively correlated with  $Y_{T2}$  across countries in equation (8). But this also implies a negative correlation between reserve accumulation and the return on the reserves. In this case, the negative correlation comes from the fact that countries that tend to accumulate more reserves are also countries whose currencies tend to appreciate because of the growth in their tradable sector.

## 4 Policy Implications

I have reviewed the performance of the US dollar as a reserve currency according to three criteria: (i) dollar debt assets must be liquid and safe, (ii) they must be provided in sufficient quantity, and (iii) they must deliver an appropriate return. I found that the dollar performed relatively well according to the first two criteria but rather dismally according to the third one. This is not so much because of the exorbitant privilege (which did reduce returns, but only moderately) as because of the valuation loss that reserve-accumulating countries incur in terms of their own consumption due to the appreciation of their currencies.

It is not clear, however, how this problem can be fixed by reforming the international monetary system. Let us consider various proposals that have been made in the debate on reforming the international monetary system.

One approach is to expand the set of assets eligible to be accumulated as reserves. Reserve-accumulating countries could accumulate foreign debt assets denominated in currencies other than the dollar or even non-debt assets such as equity or real assets such as natural resources.<sup>22</sup>

Such diversification should dilute the exorbitant privilege and spread it across a larger range of assets. But it will not significantly increase the consumption-based real return on the foreign exchange reserves of countries whose currencies have an inherent tendency to appreciate. If the countries that accumulate the most reserves do so through trade sur-

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<sup>22</sup>As some countries have started to do with their sovereign wealth funds.



pluses, and their currencies tend to appreciate for fundamental reasons, then those countries must have a low return on their reserves in terms of their own consumption. This is true irrespective of the foreign assets that they invest in.

This conclusion also applies to proposals that would use the SDR as a new reserve currency.<sup>23</sup> If the SDR is simply a denomination unit for a basket of existing currencies in which countries can already invest their reserves, investing the reserves in SDR should not yield a return higher than the return from investing in the underlying currencies. Governor Zhou seems to have had something more ambitious in mind when he proposed to enhance the role of the SDR in the international monetary system. First, he argued that “the basket of currencies forming the basis for SDR valuation should be expanded to include currencies of all major economies, and the GDP may also be included as a weight” (Zhou, 2009). This implies that the Chinese currency should enter the SDR basket with a significant weight. Second, he proposed that the IMF set up “an open-ended SDR-denominated fund based on the market practice, allowing subscription and redemption in the existing reserve currencies by various investors as desired”. This implies that China could bring its dollar reserves to the Fund, exchange them against reserves that would be in part denominated in its own currency, and thus limit the valuation loss coming from an appreciation of the renminbi.

The question with this proposal is who pays for the valuation loss that China would no longer be incurring. If China provides the IMF with sufficient renminbi-denominated assets to avoid a currency mismatch in the IMF balance sheet, there would be no benefit to China. But if the IMF bears a currency risk, the insurance provided to China would have to be backed by transfers from the other members of the IMF. This is why no agreement could be reached at the end of the 1970s about the proposal to create a “substitution account” at the IMF.<sup>24</sup> No country would be willing to provide such a guarantee, and indeed there would

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<sup>23</sup>I will not discuss here proposals to use the SDR as an input into global financial safety nets (see, e.g., Obstfeld (2011), (Truman, 2010)). The development of more effective global financial safety nets should reduce the demand for international reserves.

<sup>24</sup>The international community discussed in 1980 a proposal to establish an SDR-substitution account at the

be little rationale in terms of efficiency or equity to compensate countries for the valuation losses that they incur on their reserves because of the appreciation of their currencies.

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IMF. Countries would be able to convert dollar reserves into SDR-denominated assets in the account. But if subsequently the dollar depreciated against the SDR, who would suffer the exchange rate loss? No agreement was reached on that question and the SDR-substitution account was not created. Kenen (2010)'s analysis is sympathetic to the proposal but acknowledges that the cost of the SDR-substitution account might have been significant for the United States if it had been the guarantor.

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