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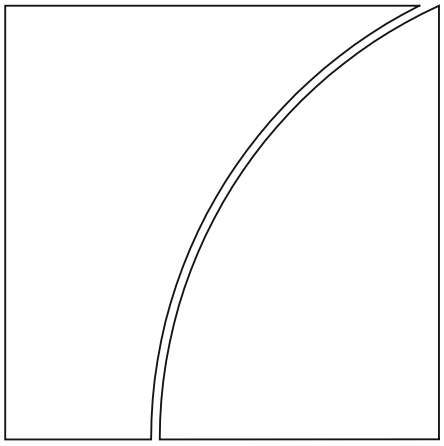

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Safe assets: made, not just born

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Keywords: safe assets; US Treasury securities; agency securities; bank deposits; Eurodollars; Triffin dilemma

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Safe assets: made, not just born

Robert N McCauley[1]

Abstract

Official reserve managers have a big stake in the debate over safe assets: their portfolios just about define such assets. This paper conveys the message that reserve managers need not worry about a shortage of safe assets. The debate turns first on whether demand for dollar safe assets will grow as rapidly as emerging market economies (EMEs). Second, it turns on whether the supply of dollar safe assets only grows with US fiscal deficits. Neither holds. On the demand side, EMEs' growth does not require ever higher dollar reserves. Indeed, the global economy may have reached "peak reserves" in 2014. On the supply side, law and policy extend state backing to various IOUs, thereby making safe assets. US government support for the housing agencies Fannie Mae and Freddie Mac has made their debt into safe assets, albeit with wobbles. Such support, including in extremis in 2008, Treasury equity also work to make US bank deposits safe. Elsewhere, government support of banks allows those from well rated countries to compete with US banks in issuing safe dollar deposits. Moreover, supranational organisations, non-US sovereigns and their agencies all compete with the US Treasury in issuing safe dollar bonds. In allocating their dollar foreign exchange reserves, central banks make room for such competitors. In particular, they hold more than a third of such reserves in instruments other than US Treasury securities.

Key words: safe assets; US Treasury securities; agency securities; bank deposits; eurodollars; Triffin dilemma

JEL codes: F31, F33, G15

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1. Introduction

Should official foreign exchange reserve managers worry about a shortage of safe assets? Academic students of international finance have argued that the demand for safe assets by emerging market economies (EMEs) could outpace their supply by advanced economy governments. Such a shortfall would necessarily make life difficult for reserve managers. After all, their fixed-income investments practically *define* the universe of safe assets.[2] Reserve managers might welcome a safe asset shortage as sports fans would welcome a beer shortage.

Academic economists have asserted a safe assets dilemma that they liken to that stated by Triffin (1960). Triffin worried that demand for US international IOUs would outgrow the US gold *stock*, the bedrock global international asset at the time. If the US economy met the demand for its IOUs, then holders would eventually stage a run on the US gold stock. This would lead US authorities to hike interest rates and plunge the world into sudden deflation. Or the US economy would not provide the external liabilities demanded and the world economy would endure a grinding deflation. Without enlightened collective action, the world faced a Hobson's choice between speeds of deflation.

The original Triffin dilemma focused on two stocks, US external IOUs and US gold. Mr Micawber might summarise: gold greater than IOUs, stability; IOUs greater than gold, instability. The safe assets dilemma, by contrast, focuses on the demand for the stock of US Treasury liabilities and the problem of their outgrowing US GDP, a *flow* of debt servicing capacity. The safe asset shortage story flags the fiscal risks of the US Treasury's satisfying a fast-growing world's need for its special liabilities.

Jeanne (2012) ably summarised Farhi et al (2011) and Obstfeld (2011) on the safe asset dilemma:[3] "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 [ie demand for US Treasury securities]. 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".[4]

Following Portes (2012) and drawing heavily on Bordo and McCauley (2017a,b),[5] this paper argues that the safe assets story relies on very strong assumptions about their demand and supply. Paraphrasing Hamlet, there are more things in demand and supply, Ricardo, than are dreamt of in your science. On the demand side, EMEs do not need their holdings of foreign exchange reserves to grow with their nominal GDP. And on the supply side, the US government does not enjoy a monopoly in producing safe assets denominated in the US dollar. In fact, the US government backstops the

[2] He et al (2016) give "the portfolios of many central banks" as prime cases of "safe asset portfolios".

[3] See also Obstfeld (2013). Gorton (2009), Gorton and Metrick (2012), Gorton et al (2012), Gorton and Ordoñez (2013), Krishnamurthy and Vissing-Jorgensen (2013), Carlson et al (2016) and Gorton (2017) consider safe assets in the US economy.

[4] See also Caballero and Krishnamurthy (2009), Gourinchas and Jeanne (2012), Caballero and Farhi (2013), Caballero et al (2017a, b).

[5] See Borio et al (forthcoming) for a theoretical critique.

production of dollar safe assets by government-sponsored enterprises (GSEs or US agencies) and US banks. Creditworthy governments outside of the United States produce dollar safe assets themselves and back their production by their agencies, banks and supranational organisations. US Treasury securities amount to just two-thirds of estimated dollar-denominated fixed-income assets of central banks.

The rest of this paper advances these themes. The second section takes issue with the idea that EMEs have accumulated reserves in a purposive manner as interpreted by the safe assets story. This section presents evidence consistent with this accumulation arising as a by-product of currency management by EMEs over the dollar cycle. The third section argues that government backing allows US agencies and US banks to supply safe assets. The Great Financial Crisis (GFC) amply demonstrated the associated fiscal risks, but equally the strength of the backing. The fourth section argues that non-US governments compete to supply safe US dollar assets, both directly and indirectly. The US Treasury faces significant competition in producing safe assets even in the US dollar.

2. Reserve "demand": precautionary or by-product?

Two different stories can explain the rapid growth of official foreign exchange reserves in the years before the GFC. The precautionary account posits a coherent demand for reserves on the part of EMEs seeking to insure themselves against the costs of a sudden stop – actually a sudden reversal – of private capital flows. The second recognises some such demand but holds that the bulk of reserve acquisition arises from policies to manage the exchange rate. This in turn is seen as part of a larger policy to shield the traded goods sector from an appreciated exchange rate.

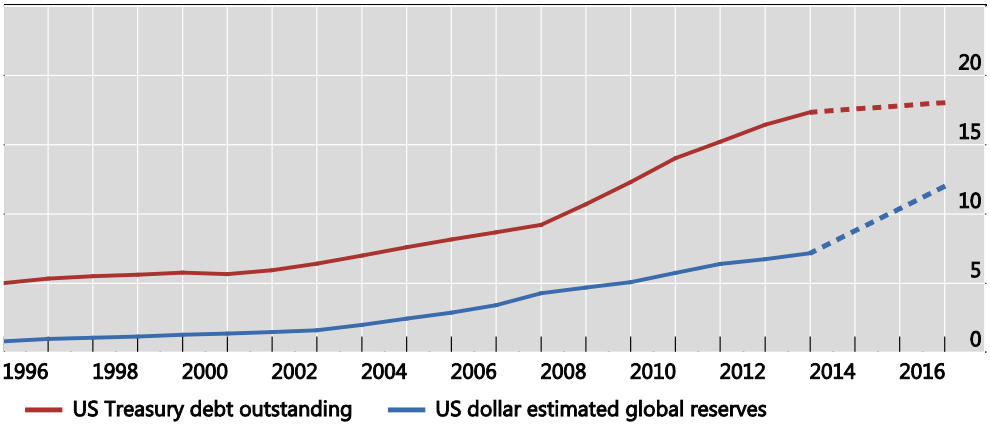
The simplest view of the safe assets shortage juxtaposes the stock of US Treasury securities with their holding by official reserve managers (Graph 1). Early work on the safe assets story drew on the evidence of the early 2000s. Then dollar foreign exchange reserves were indeed approaching outstanding US Treasury securities.

The GFC broke that trend, but five years later one could imagine its return. US recession and the fiscal stimulus in response resulted in large US fiscal deficits. Thus, through 2013, US Treasury debt grew faster than US dollar foreign exchange reserves. But this could not go on: between the end of 2007 and 2013, the consolidated US government debt (at nominal value) rose from 57.8% of GDP to 96.9% of GDP. A more normal US fiscal policy would bend the red line in Graph 1 down to a growth rate at or below the US economy's 4%. A shortage could bind if EMEs were to grow at 6% while maintaining their ratio of foreign exchange reserve to GDP.

Indeed, the IMF (2012) projected a 61% rise in global foreign exchange reserves by end-2016, lending plausibility to a shortage. Such double-digit growth would have well exceeded global growth, much less US growth. This projection would have carried global official foreign exchange reserves to near $18 trillion and US dollar reserves to about $12 billion. Back on Graph 1, if the red line had flattened out and the blue line had risen smartly, a safe asset shortage might well have bound.

US Treasury debt and US dollar official FX reserves, 2013[1]

Outstanding amounts, in trillions of US dollars — Graph 1



[1] Dashed lines represent projections.

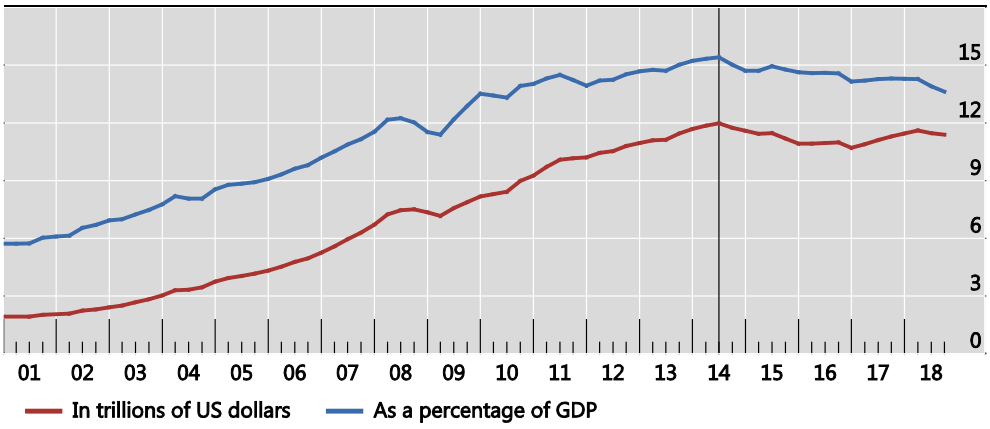
Sources: IMF, Currency Composition of Official Foreign Exchange Reserves and *International Financial Statistics*; US Department of the Treasury; BIS calculations.

The seemingly inexorable rise in reserves proved, well, exorable. In retrospect, the world may have reached "peak reserves". Dollar appreciation in 2014 led EME central banks to intervene to support emerging market currencies, drawing down foreign exchange reserves (Graph 2). In the event, global reserves only approached $12 trillion at their peak in 2014 and have declined at writing in September 2018 to $11.4 trillion, not far from the level at writing of IMF (2012). Meanwhile, US fiscal policy has returned to large deficits at near full-employment. There is no shortage of US Treasury debt for foreign exchange reserve managers to buy (Graph 3).

The decline of global reserves in the face of dollar strength favours the currency management story over the intentional, precautionary accumulation story. Consistent with the latter, the IMF projection presumed that the growth of foreign exchange reserves would match the growth of domestic money in emerging markets. Instead, it turned out that the Chinese economy, for instance, could grow by a third even as it reported a decline in reserves by a quarter from about $4 trillion to about $3 trillion.

Global foreign exchange reserves[1]: "peak reserves"?

Graph 2

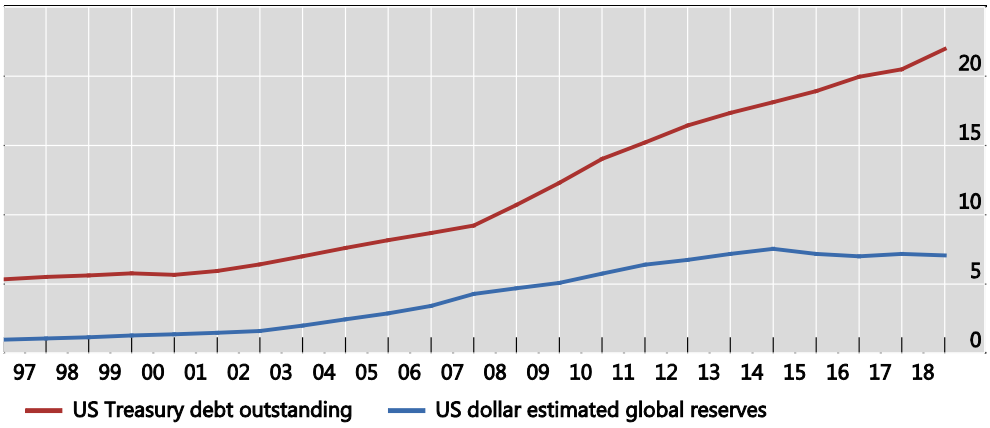


[1] The vertical line represents the maximum level of FX reserves in the last 18 years.

Sources: IMF, *Currency Composition of Official Foreign Exchange Reserves*, *International Financial Statistics* and *World Economic Outlook*.

US Treasury debt and US dollar global official FX reserves[1]

Outstanding amount, in trillions of US dollars Graph 3



[1] Reserves information up to 2018Q3 and US Treasury data up to December 2018.

Sources: IMF, *Currency Composition of Official Foreign Exchange Reserves*, *International Financial Statistics*; US Department of the Treasury; BIS calculations.

In sum, as the chair of the US Treasury (2019) Borrowing Advisory Committee wrote to the Secretary in January 2019, "the share of [Treasury] holdings by foreigners has declined… most likely [as] a technical result of debt outstandings growing faster than foreign [exchange] reserves". Those concerned about the shortage of safe assets worried that the US Treasury might be induced to become over-indebted and possibly lose its top credit rating as it met the demand from emerging markets. At present, it is hard to argue that foreign official buying of US Treasury securities is driving the US Treasury's enlarged borrowing.

3. Supplying US safe assets without fiscal deficits

The safe assets story gives the US Treasury a monopoly and assumes that only fiscal deficits lead to net increases in their supply. Neither of these is strictly correct.

Even on its home turf, the US Treasury faces competition in the supply of safe assets. In particular, both GSEs and banks compete for investment of official foreign exchange reserves. The safety of these obligations depends in the first instance on the quality of the GSEs' and banks' assets and in the second instance on their capital bases. Bank depositors also know that banks have access to Federal Reserve liquidity and that small depositors provide stable funding owing to deposit insurance.

Ultimately, however, the US Treasury backs these obligations. In 2008 the US Treasury recapitalised both the GSEs and major US banks. In this ultimate sense, the Treasury may have monopoly control over the production of safe dollar assets, at least at home.

Implicit Treasury support thus transforms private assets and private equity into safe assets. In the process, safe assets come into being without any immediate counterpart in the US federal government's cash borrowing requirement.

If the investment habitat of official reserve managers in the United States serves as a measure of safe assets, then the domestic competitors have claimed a substantial

share. At mid-2017, central banks held almost $4 trillion in US Treasuries, over $400 billion in agency securities, almost $500 billion of claims on banks in the United States and another $200 billion in corporate paper, mostly bonds (Table 1, first column).

Portfolio shares are best conceived in relation to fixed income instruments. The substantial holdings of equities, which approached $1 trillion in mid-2017, or about a sixth of the portfolio in the United States (Table 1, second column), at first seems surprising. After all, central banks that hold equities as part of their reserves, such as the Swiss National Bank, are exceptions rather than the rule. Nugeé (2015, p 66) counts just 25, though the number continues to rise, especially among large holders.

Holdings of foreign official institutions of US dollars, June 2017 Table 1

	In billions of US dollars	%		
In the United States		Share in US	Share in fixed income in US	Share in global fixed income
US Treasury	3,993	66%	78%	65%
Coupon	3,663	60%		
Bills	330	5%		
US agency	427	7%	8%	7%
Mortgage-backed securities	384	6%		
Notes	43	1%		
Bills	0	0%		
Corporate	204	3%	4%	3%
Bonds	157	3%		
Asset-backed securities	14	0%		
Commercial paper	33	1%		
Bank deposits[1]	494	8%	10%	8%
Equity	954	16%	0%	0%
Total in US	6,072	100%	100%	84%
Outside the United States				
Non-US bonds[2]	477	48%		8%
Bank deposits[3]	514	52%		8%
Total outside US	1,099	100%		16%
Grand total	7,170			100%
Memo:				
Total $ reserves[4] (est'd from IMF)	*7,097*			
"Agency" share of global fixed income				*15%*
Bank share of global fixed income				*16%*
Long-term share of global fixed income[5]				*78%*

[1] Includes currency and deposits, loans and trade credit and advances. [2] Sovereign, sub-sovereign, agency and supranational; estimated as one-half of the AAA- and AA-rated bonds in the ICE Bank of America Merrill Lynch Foreign Government and Supranational and ICE Bank of America Merrill Lynch Index. [3] Estimated as cross-border US dollar liabilities less such in the US plus two thirds of unallocated by currency (from BIS LBS Table A8-F) plus local liabilities in dollars (unpublished). [4] Estimated as total reserves times the US dollar share of allocated reserves. [5] By original maturity; bank deposits assumed to be short-term.

Sources: BEA, Table 3.1, US international investment position for liabilities to foreign official agencies; US Treasury et al (2018); IMF, COFER data; ICE Bank of America Merrill Lynch; BIS international banking data by location; author's calculations.

But many other central banks also hold equities as part of the investments for their employee pension funds.[6]

US Treasury securities predominate among central bank holdings of US fixed income instruments. Their share was 78% in mid-2017 (Table 1, third column). In order, bank deposits, agency securities and corporate securities comprise the balance.

Do big reserve managers prefer US Treasury securities because "few spread markets will be large enough to absorb more than a small fraction of their assets" (Nugeé (2015, p 68))? This view can be questioned in view of the size of the US corporate bond market at $5 trillion, according to the Bloomberg Barclays US corporate index. The sum would accommodate more than the $200 billion that officials have invested in US corporate obligations.

The small share that officials have invested in the US corporate bond market may reflect less its size than its (lack of) quality. Only a tenth of the Bloomberg index consists of bonds rated AAA (only about $100 billion in mid-2017) or those rated AA (less than $400 billion). Central banks have little taste for the risks of BBB-rated bonds, which nowadays form the largest part of investment grade US corporate bonds. Many such bonds are just a notch or two downgrade away from non-investment grade, or junk-bond status, a no-go for almost all reserve managers.

Reserve managers seek not only substantial size but also the ability to trade in and out without moving prices, ie liquidity. And US corporate bonds do not offer good liquidity. However, another asset class, US agencies, provides better liquidity. The next section discusses how reserve managers reacted to their credit difficulties.

3.1 US agencies

The changing balance of official investment in US Treasury and agency securities points convincingly to the role of credit, not size. The share of US Treasury securities in the official portfolio in the United States rose in response to the losses by the privately owned US GSEs, Fannie Mae and Freddie Mac in 2008. In the US Treasury et al (2008) survey of June 2007, officials had invested half as many dollars in agency securities as in Treasury securities (Table 2, memo item). Among the agency securities, the predictable cash flows of coupon-bearing agency debentures and short-term bills appealed to reserve managers. Their holdings of such amounted to twice their holdings of MBS, with their unpredictable cash flows.

These holdings compensated reserve managers with yields higher than those available on US Treasury securities for credit risk that might well be borne by the US Treasury. In investor presentations abroad, senior executives of the agencies had emphasised their key role in US mortgage finance as well as their credit line with the US Treasury. Both hinted, and events bore out, that the agencies would enjoy government support in the event of big losses. In the first half of 2008, reserve managers anxiously received reports of agency losses. They followed with care the Congressional legislation to provide what the Secretary of the Treasury termed a "bazooka", an instrument so powerful that it would not have to be used. At the BIS bimonthly meeting on 8 September 2008, the press quoted Governors of the People's Bank of China and the Bank of Japan as well as the Chief Executive of the Hong Kong

[6] In addition, the US Treasury data include holdings by sovereign wealth funds; see Annex.

Foreign official holdings of US Treasury and agency securities, 2007-2010 Table 2

30 June:	2007	2008	2009	2010
US Treasury securities	1,611	1,910	3,176	3,071
Coupon securities	1,452	1,684	2,604	2,617
Bills	159	226	572	454
Agency securities	831	1,097	829	721
Debentures	236	435	475	445
MBS	515	532	320	276
Bills	80	130	34	24
Memo: Ratio of agency to US Treasury	*52%*	*57%*	*26%*	*23%*

Sources: US Treasury et al (2008-2011); author's calculations.

Monetary Authority as welcoming the US Treasury's support for the two agencies (Vidaillet et al (2008)): the bazooka was fired.

Notwithstanding the seeming success of this moral hazard bet, central banks as a group proceeded to disinvest in US agency paper (Setser (2009)). In mid-2008, officials held 57% as many dollars in US agency securities as in US Treasury securities; a year later, a quarter as much (Table 2, memo item). Fortuitously, they found themselves selling into US Treasury and Federal Reserve bids for GSE paper (see below). In 2017, with the agencies still in conservatorship, foreign officials owned only a bit more than a tenth as many US agency as Treasury securities.

Why did central banks in aggregate buy on the rumour (of Treasury support) and sell on the news?[7] Bernanke (2015, p 231) recalls:

> The implicit guarantee did keep most investors from abandoning the companies' MBS [mortgage-backed securities] and debt, but even there [in the bond market] confidence was waning, notably overseas. Foreign central banks and sovereign wealth funds (such as those that invest the earnings of oil-producing countries) had loaded up on Fannie and Freddie MBS because they were considered close substitutes for U.S. government debt and were highly liquid—easily bought and sold…As doubts grew about the GSEs, both Hank Paulson and I received calls from central bank governors, sovereign wealth fund managers and government officials in East Asia and the Middle East. Were the companies safe? Would the U.S. government stand behind them? Several of my callers had not realized that the government did not already guarantee the GSEs. News coverage had alerted them to the risk.

In Russia, news that the central bank held US mortgage agency paper in the midst of a mortgage crisis led to difficult public discussion (see Box). It was easier to sell than to explain why the spread over US Treasury yields came with little credit risk.

[7] By contrast, the Central Bank of Brazil (2009, p 13; 2010, p 14) reported an increase in its portfolio weight on agency paper until December 2006, then a decline until June 2008, then an increase in December 2008. But then the weight declined again from 7% in 2008 to 4% in 2009.

In addition, the Treasury recapitalisation of two GSEs did not put the "full faith and credit" of the federal government behind the agencies. Instead, the government entered a keep-well arrangement to cover losses in order. This kept their debt off the US Treasury's balance sheet and from counting towards the debt limit. With the ultimate government backing of the two agencies unresolved – indeed the Obama administration never proposed legislation – some official investors judged it wiser to steer clear. In particular, between June 2008 and June 2009, officials almost halved their holdings of agency debentures and bills, from $662 billion to $354 billion. In cutting holdings of debentures and bills while holding MBS in their dollar portfolios, reserve managers signalled more confidence in the principle of government support than in the enterprises that once embodied it.[8]

As reserve managers assessed the risks of agency securities, they could take comfort from the arrival of the US Treasury and the Federal Reserve on the bid side of the market. The US Treasury, using power under the Housing and Economic Recovery Act of 2008, employed State Street to buy $220 billion in Fannie and Freddie MBS starting in October 2008 and ending in December 2009.[9] To fund the purchases, the US Treasury sold more of its debt than required to fund the federal government's deficit. In effect, the US Treasury replaced agency securities with its own securities, for which foreign official demand rose by half between June 2008 and June 2009 (Table 2). The US Treasury grossed up its balance sheet to limit the effect on mortgage rates of the run from agency to Treasury securities.[10] By mid-2009, foreign officials had actually increased their holdings of agency MBS relative to June 2008.

The Federal Reserve arrived later in December 2008, but bid to buy precisely the GSE debentures that officials proved unwilling to hold. Its purchases of $97 billion between then and June 2009 amounted to almost half of the reduction of official holdings from $532 billion in June 2008 to $320 billion in June 2010. Federal Reserve purchase of agency MBS started in January 2009 and reached trillions of dollars, and no doubt also gave comfort to foreign official holders.

The upshot is ironic. Reserve managers' actions revealed the judgement is that US agency securities lost some of their safety *after* US government support became explicit in September 2008. To some extent, reserve managers may have felt the constraint of domestic public opinion. In addition, the persistent absence of a political settlement on the terms of government support for US housing finance looks to have undermined even very strong de facto support.

[8] By contrast, Gorton et al (2012) attach a safe-asset weight of 1 to agency debentures (where 1 is equivalent to US Treasuries) and only .85 to agency MBS. Official reserve managers' behaviour suggests that the reverse would have been more appropriate.

[9] See https://www.treasury.gov/press-center/press-releases/pages/tg1111.aspx for the announcement of the orderly wind-down of the portfolio in 2011 and, for monthly data on the Treasury and Federal Reserve purchase, https://www.fhfa.gov/DataTools/Downloads/Pages/Treasury-and-Federal-Reserve-Purchase-Programs-for-GSE-and-Mortgage-Related-Securities.aspx.

[10] This asset purchase programme of the US Treasury nicely illustrates that the central bank does not have a monopoly of this instrument, unlike its monopoly control over the short-term interest rate (Borio and Disyatat (2009); McCauley and Ueda (2009)). The US Treasury's ultimate means of payment, ie Treasury securities, directly met foreign official demand for more Treasury securities. By contrast, foreign officials could neither hold the Federal Reserve's means of payment, ie excess reserves, nor were they disposed to hold them indirectly through deposits in banks.

Box: Bank of the Russian Federation and US housing agency debt

One central bank shifted in the course of 2008 from a large holder of the debt of the US housing agencies to a very small holder. The story epitomises the buy on the rumour, sell on the fact behaviour of official investors with regard to US Treasury support for these agencies.

The initial holding at the end of 2007 was in many respects typical, but in one respect unusual, if not unique. The Central Bank of the Russian Federation (2008, p 130) reported holdings of Federal Home Loan Bank, Fannie Mae and Freddie Mac securities of $101 billion. These holdings had recently risen smartly, up from just $38 billion in 2006. The $101 billion represented a high 22% of overall reserves. Even more unusual was that with 83% of the paper matured in less than one year. Most official holdings of US agency debt carried medium- to long-term maturities.

"In early May, Fannie announced a first-quarter loss of $2.2 billion—its third straight quarterly loss—cut its common stock dividend, and announced plans to raise $6 billion through an equity offering" (Paulson (2010, p 134)). In May 2008, First Deputy Chairman of the Bank of Russia Alexei Ulyukayev reported losses on holdings of US agency securities. After the *New York Times* headlined, "U.S. weighs takeover of two mortgage giants" (Labaton and Weisman (2008)), on 11 July – a correct report judging from Paulson (2010, p 145) – the Russian Finance Ministry described the debt as "de-facto not inferior to U.S. sovereign debt obligations in their credit quality…", according to *Reuters* (Bryanski (2008)). Most investment professionals would find little to disagree with in this statement.

In Beijing for the Olympics in early August, Treasury Secretary Paulson (2010, pp 160-161) "learned…[that] Russian officials had made a top-level approach to the Chinese suggesting that together they might sell big chunks of the GSE holding to force the U.S. to use its emergency authorities to prop up these companies. The Chinese had declined to go along with the disruptive scheme…" Such hearsay passes in the memoir genre, but it is worth pausing to recognise how asymmetric the costs any such joint disinvestment would have entailed. As noted, the Russian holdings of US agency debt were concentrated in the bills of the mortgage agencies, so just not rolling over paper maturing at par might well have sufficed. Like most official investors, the Chinese had invested in long-term agency securities, so outright sales into stressed markets could well have required taking sizeable losses.①,②

After the US Treasury Secretary Paulson fired what he had described to Congress as a "bazooka" on 7 September 2008, placing the two GSEs in conservatorship, Ulyukayev told *Reuters* that Russia had reduced its holdings to less than $60 billion and "most likely we will continue to decrease the share a little" (Fabrichnaya and Bryanski (2008)). As the crisis worsened, public discussion of the holding intensified. The Central Bank of the Russian Federation (2009, p 140) reported holdings of $3 billion at the end of the year 2008.

① The size of Chinese holdings is not clear. Bernanke (2015, p 231) reports that "in 2008, China alone had more than $700 billion in GSE mortgage-backed securities, slightly more than it held in long-term U.S. Treasuries". The US Treasury et al (2009, p 8), however, reported total mainland China holdings of US agency long-term debt at end-June 2008 at $527 billion, of which $369 billion was mortgage-backed securities. It is possible that Bernanke is citing Board staff estimates that included Chinese holdings that were showing up in other countries owing to the Treasury and Federal Reserve survey not having penetrated through custodial layers. ② Steil and Walker (2010) plot Treasury International Capital data that show a much sharper drop of Russian holdings of agency securities in late 2008 than Chinese holdings of them. The data include private holdings.

Whatever their motives in reducing their holdings of US agency securities, dollar reserve managers remain substantial holders. The exclusion of US agency securities from working definitions of safe assets (eg, Eichengreen (2016); Caballero et al (2017b)) does not respect this rump of holdings, which is concentrated in MBS.

3.2 Banks in the United States

Officials held almost a half trillion dollars of bank deposits in the United States as of mid-2017. This represented about 8% of their holdings in the United States.

The Great Financial Crisis shook official investors' faith in the safety of bank deposits. Their response was to cut back on holdings of bank deposits starting in late 2007 by almost half (Pihlman and van der Hoorn (2010); McCauley and Rigaudy (2011); Jones (2018)). Subsequently, they rebuilt their holdings. More persistent has been the shift from unsecured deposits to repos. This reflected the experience of

some official repo counterparties with Lehman Brothers, who emerged whole from the bankruptcy.

US Treasury data allow us to distinguish outright deposits with banks in the United States from reverse repos in which the officials take a security as collateral, generally for very short periods. These data show that just almost two-thirds of placements with banks in the United States are reverse repos.[11]

In general, it is best to aggregate deposits in the United States and outside the United States in assessing the contribution of bank deposits to the de facto safe assets chosen by central banks. This is done in the first subsection of the next section.

4. Supplying dollar safe assets outside the United States

Both banks and high-quality bond issuers outside the United States provide safe assets to reserve managers. Thus, the US Treasury faces competition in producing safe assets in dollars not only from the agencies and banks at home, which it supported in extremis in 2008-09. In addition, it faces competition from banks abroad as well as supranational, sovereign, sub-sovereign and agencies that issue dollar bonds.[12] Judging from the estimated portfolio of reserve managers, this competition amounted to about $1 trillion in mid-2017.

4.1 Offshore dollar bank deposits

Central banks have placed dollars on deposit with banks outside the United States since the 1960s for reasons of country risk, convenience and, not least, yield. Since the early 1990s, when the Federal Reserve reduced reserve requirements to zero on large US deposits, money market arbitrage has generally kept dollar yields in the United States and abroad in line, leaving country risk and convenience as the determinants of the onshore/offshore choice. BIS international banking data have cast light on this choice since the 1960s.

According to BIS data, official deposits in banks outside the United States amounted to about one-half a trillion dollars in mid-2017 (Table 1, bottom rows). Most of these were cross-border, but a small amount were local deposits by central banks into banks located in the same country.

Taking bank deposits in the United States and offshore bank deposits together, officials held about $1 trillion in mid-2017. This was about a sixth of the fixed income portfolio. By mid-2017 they had almost restored their share of mid-2007, before central banks disinvested massively.[13] At first blush, this reading appears inconsistent

[11] The TIC data for June 2017 show $272 billion in repos with foreign official institutions, $104 billion in non-negotiable deposits, $39 billion of CDs and $12 billion other, giving a repo share of 64% (https://www.treasury.gov/resource-center/data-chart-center/tic/Documents/bltype_history.csv). See Jones (2018, Figure 2) for the time series of repos at banks in the United States with foreign official institutions.

[12] See Flandreau (2013) on Commonwealth and colonial bonds as safe assets in Nineteenth Century Britain.

[13] Central banks cut back their claims on banks over quarters rather than in days, as did US money market funds. See Baba et al (2009).

with the finding of Jones (2018, Figure 8), who finds that bank deposits have fallen to just 3% of overall reserve holdings at the end of 2017. The source is the IMF's Special Data Dissemination Standard (SDDS) for foreign exchange reserve holdings, which uses a reporting template that distinguishes repos from uncollateralised (or "naked") deposits.[14] In contrast, BIS-reported data do not distinguish these two. So the apparent conflict is resolved if today the overwhelming share of central bank placements with commercial banks is collateralised.[15]

4.2 Offshore dollar bonds: supranationals, sovereigns and agencies

Reserve managers' investment in dollar bonds issued by non-US borrowers has to date eluded measurement. Dollar bonds issued by high-quality sovereigns, provinces, non-US agencies and supranational organisations have all attracted investment by central bank reserve managers for 40 years or so. These sell bonds in the US domestic bond market ("Yankee bonds") or offshore in the eurodollar bond market. Many seek the widest distribution and the keenest pricing by selling so-called global bonds that are both registered with the US Securities and Exchange Commission (SEC) and sold through eurobond channels. Often they offer so-called benchmark bonds in billions of dollars, sizes an order of magnitude larger than the minimum for index inclusion.

No official data on reserve managers' holdings of such bonds exists. However, a commercial bond index provider, ICE Bank of America Merrill Lynch, has aggregated the most preferred of such bonds into two indices (see Annex). Index inclusion requires a bond to be issued in a minimum amount and to bear a fixed coupon. The index is made up of the bonds, in order, of non-US sovereigns, supranationals, government-guaranteed issuers, agencies and local authorities.

While the indices contain bonds of a minimum rating of BBB, central banks' investment habitat focuses on the highest rated, AAA- and AA-rated bonds.[16] Excluding BBB and A-rated bonds reduces the indices by $458 billion from $1.392 trillion to $934 billion in December 2018. The total for June 2017 was $953 billion.

How much of these high-quality bonds issued by non-US governments or supranational organisations are held by central banks? The best approach to answering this question is to ask the issuers what their bond underwriters report regarding the distribution of issues in the primary market. Their responses, drawing on material in investor presentations and direct contacts, are shown in Table 3. An important qualification is that the concept of official investors is broader than central banks, including not only sovereign wealth funds but also the treasuries of the issuers named on Table 3.

[14] See Euro-currency Standing Committee (1999) for the design of this template.

[15] That said, the 3% seems low in relation to the observation above regarding dollar deposits in banks in the United States. It may be that uncollateralised working balances are atypically large in the dollar and with banks in the United States, eg for clearing purposes.

[16] This is a conservative cut-off. Morahan and Mulder (2013) find that 29.9% of respondents use an AA rating as a minimum and 50.7% use a single-A rating.

Dollar bonds of selected issuers and estimated official purchases Table 3

Issuer	In billions of US dollars[1]	% purchased by official accounts
European Investment Bank	117	45.5%[2]
European Stability Mechanism	0	73.0%[3]
KfW	137	52.4%[4]
OeKB	11	53.6%[5]
World Bank	96	53.5%[6]
Grand total	361	
Memo: AAA- and AA-rated bonds in Foreign Government and Surpranational indices	*953*	

[1] Face value of bonds from named issuer in ICE Bank of America Merrill Lynch Foreign Government and Supranational indices. [2] Estimated as the simple average of issues of benchmark dollar bonds in the years 2015-18 inclusive. [3] ESM's second dollar bond in 2018. [4] Estimated as the simple average of issues of benchmark dollar bonds in the years 2013-18 inclusive. [5] Estimated as the simple average of issues of benchmark dollar bonds in the years 2014-18 inclusive. [6] Average of two examples of global dollar benchmark bonds given in World Bank Treasury investor presentation downloaded on 5 January 2019.

Sources: EIB, ESM, KfW, OeKB; World Bank; author's calculations.

Putting aside the brand-new dollar issuer, the European Stability Mechanism, the reports from the underwriters of central bank share of benchmark dollar issues in the primary market cluster around 50%. Taken together, the issuers represent more than a third of the AAA- and AA-rated bonds in the indices (Table 2, memorandum item).

Using this share, we estimate the holdings of these bonds by central banks at just shy of one-half trillion dollars (Table 1). Even though the universe of US corporate bonds is three times larger the universe of supranational, sovereign and non-US agency dollar bonds, holdings of the latter are three times that of the former. This reflects the relatively weak credit profile of the US corporate issuers market as compared to these international dollar bonds.

5. Conclusions

The US Treasury does not have a monopoly in the production of safe US dollar assets, at least insofar as such assets are measured by the holdings of official reserve managers. It is hard to be sure what He et al (2016) intend when they say that US government bonds are a "large fraction" of the "portfolios of many central banks". However, this chapter finds that they are about two-thirds of global US dollar reserves. Since dollar reserves are about two-thirds of total foreign exchange reserves, the "large fraction" looks to be less than half, without taking into consideration any domestic assets of central banks.

This current two thirds' share of US Treasuries represents a rise over the share observed before the GFC. Genberg et al (2005, p 42) put the share at about half in

2003. By mid-2008, the share had fallen to 44%, only to jump to 64% in 2009 (McCauley and Rigaudy (2011)).[17]

If reserve managers fled to the quality of US Treasuries during the GFC, it was not because they held much in the way of the AAA-rated, "super-senior" tranches of private mortgage-backed securities. In June 2008, the US Treasury et al (2009) identified official holdings of private asset-backed securities of only a piddling $18 billion. These pseudo-safe assets in fact were retained to a striking extent by the underwriters, including European banks' US securities affiliates, especially after AIG stopped serving as a risk-sink for the mortgage securitisation business (Erel et al (2014); McCauley (2018)).

Instead, the US Treasury faces competition at home that broadly enjoys US government support. Likewise, it faces competition abroad from highly creditworthy sovereigns and others that enjoy foreign government support.

At writing, the risk of an excess of US Treasury securities seems more clear and present than any shortage. And it would be hard to blame the US federal government's trillion dollar deficits so far as the eye can see (US Treasury (2019) on the demand from central banks. The world economy may have already passed "peak reserves" in 2014, so the recent surge in the US federal government's debt owes nothing to official demand.

[17] The 2009 US Treasury share was back to that of 20 years earlier in 1989 (Fung and McCauley (2000)). Note that the earlier estimates make no allowance for foreign government and supranational dollar bonds, and thus, on the evidence of Table 1, are 5-10% too high.

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Annex: Sources for the instruments held in dollar reserves

This paper draws on four sources to assemble the official portfolio of US dollar investments as of June 2017. Three are official and straightforward; one depends on a combination of data compiled by a market source and informed estimation.

The Treasury International Capital (TIC) annual survey of portfolio investments in the United States (US Treasury et al (2018)) provides the bulk of dollar investments in the United States. In addition, TIC data on the own and custody liabilities of banks in the United States to foreign official institutions form the basis of the Bureau of Economic Analysis compilation of bank-related liabilities.

Similar liabilities of banks outside the United States are reported by the Bank for International Settlements (BIS). These data cover both cross-border liabilities to the official sector and local foreign currency liabilities. The latter would capture, for instance, a dollar deposit of the Bank of England in a (foreign or domestic) bank in the United Kingdom.

While the official sector provides these three sources, the final one is market-based. ICE Bank of America Merrill Lynch compiles indices of dollar bonds issued by various official obligors outside the United States of which central banks hold about half. The larger index, the ICE Bank of America Merrill Lynch Foreign Government and Supranational index, contains all such bonds with more than one year of remaining maturity, a fixed coupon and more than $250 million outstanding. These numbered 716 in early December 2018, with an aggregate value of $1.176 trillion. Its short-term counterpart contains such bonds with a year or less to maturity, with $150 million or more outstanding. These numbered 128 in early December 2018, with an aggregate value then of $216 billion. These indices are marketed separately to allow portfolio mandates to exclude the shortest-term bonds.

These sources come with various limitations. On the one hand, the TIC data include holdings by sovereign wealth funds like the Norwegian Government Pension Fund in their definition of official investors. As a result, the decomposition of official investments by instrument should add up to more than the estimated global dollar reserves from the IMF, which exclude the holdings of sovereign wealth funds. On the other hand, the US Treasury et al (2018) survey has difficulty in pinning down the ultimate beneficial owner of US securities that are held by custodians, particularly those outside the United States. This difficulty could lead to an undercounting of officially held US securities.

The estimate of officially held bonds issued by obligors outside the United States is new to this paper and comes with several caveats. First, the sovereign, supranational and other official issuers in the index certainly do not exhaust the universe of bonds issued by non-US obligors that are held by central banks. For instance, judging from the TIC data, central banks must hold dollar corporate bonds issued by firms incorporated outside the United States. Second, the proportion of the bonds in the index that are held by central banks is estimated with no great precision based on reports from underwriters in the primary market placement of such bonds, which are provided to the issuers themselves. The author asked the treasuries of some of the most prominent supranational and agency issues for summaries of such reports. Such data were generally publicised in investor presentations.

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