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The Safe Assets Shortage Conundrum

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Economic actors need stores of value. Households save for retirement, for a rainy day, or to transmit wealth to their offspring. Corporations need to hold cash. Financial institutions need collateral. Central banks and sovereign wealth funds need to hold foreign assets. These stores of value come in many forms: cash, bank deposits, US government Treasury bills, and also corporate bonds, stocks, repurchase agreements, derivatives, or real assets such as real estate, land, gold, and others.

All stores of value are not created equal. They differ in their degree of liquidity—the ease with which they can be traded—and in their sensitivity to various risk factors. Among the menu of available assets, some are perceived as "safer" than others. Yet safety is an elusive concept, because nothing is ever absolutely safe. Investors will always view the safety of an asset through the prism of their own perceptions, needs, and concerns, in relation to other assets, and in relation to the perceptions of other investors.

This paper adopts a pragmatic and narrow definition: a safe asset is a simple debt instrument that is expected to preserve its value during adverse systemic events (for example, Caballero and Farhi 2017). This operational definition captures the

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emphasis of Dang, Gorton, and Holmström (2015) and Gorton (2016) on "information insensitivity," in the sense that safe assets can be transacted without much analysis or concern for adverse selection. It is also consistent with Caballero and Simsek's (2013) view that "simple" assets have special value during economic crises that are inherently complex. Finally, it also captures an essential strategic complementarity: an asset is safe if others expect it to be safe (Farhi and Maggiori 2016; He, Krishnamurthy, and Milbradt 2016). When it comes to forming beliefs about which assets are safe, reputations and history matter.

In modern economies, the financial sector and the government are the main manufacturers of financial assets: central banks issue cash and central bank reserves; Treasury departments issue government bonds and notes; banks and shadow banks issue short-term deposits or more complex instruments. The capacity of a country to produce safe assets is determined by constraints in the financial sector, the level of financial (under-) development, the fiscal capacity of the sovereign, and the track record of the central bank for exchange rate and price stability. For these reasons, the supply of safe assets, private and public, has historically been concentrated in a small number of advanced economies, most prominently the United States.

For the last few decades, with minor cyclical interruptions, the supply of safe assets has not kept up with global demand. The reason is straightforward: the collective growth rate of the advanced economies that produce safe assets has been lower than the world's growth rate, which has been driven disproportionately by the high growth rate of high-saving emerging economies such as China. If demand for safe assets is proportional to global output, this shortage of safe assets is here to stay.

The signature of this growing shortage is a steady increase in the price of safe assets, necessary to restore equilibrium in this market. Equivalently, global safe interest rates must decline, as has been the case since the 1980s. Simultaneously, we observed a surge in cross-border purchases of safe assets by safe asset demanders—many of them located in emerging economies—from safe asset producers, mostly the United States.

The early literature, brought to light by then–Federal Reserve vice-chair Bernanke's famous "savings glut" speech (Bernanke 2005), focused on a *general* shortage of assets without isolating its safe asset component (Caballero 2006). This literature aimed to explain the downward trend in interest rates as well as increasing global imbalances, that is the large current account deficits of the US economy and surpluses of Asian emerging markets. In Caballero, Farhi, and Gourinchas (2008), we showed how the endemic problem of a general shortage of assets in emerging markets was beginning to spread to the world at large through the large current account surpluses in Asian emerging markets. It was well understood then that a large share of these imbalances was caused by the sovereign's demand for assets, mainly in the form of safe assets. But the first-order macroeconomic implications of this shortage could be explained without the additional subtlety of isolating various risk characteristics or identifying the particular assets that were in chronic scarcity. The distinction, however, became increasingly important over time,

first covertly, then overtly in the aftermath of the subprime mortgage crisis and its sequels.

To start, the shortage of safe assets in the 2000s distorted the incentives of the financial system, especially in the United States, toward the issuance of "private label" safe assets: specifically, an explosion of the supply of AAA-rated securitized instruments manufactured by the financial industry (for example, using collateralized debt obligations based on mortgage-backed securities). Simultaneously, it made it easy for fiscally weak sovereigns such as Greece or Italy to issue debt at favorable yields. These additional assets, initially perceived as "safe" by naive investors, reduced the safe asset shortage and the downward pressure on global real interest rates. But when the subprime and European sovereign debt crises eventually erupted, the sudden loss of safe status of these pseudo-safe assets abruptly accelerated the underlying trend by simultaneously contracting the supply and increasing the demand for safe assets as most economic agents tried to de-lever. Safe interest rates declined precipitously, but soon reached their *effective lower bound*, that is, the rate at which cash becomes more attractive than financial assets and cannot be lowered further.[1]

In this analysis, the effective lower bound is a tipping point for the global economy. Any further intensification in the shortage of safe assets has destabilizing macroeconomic consequences: with safe real rates finding increasing resistance to further downward adjustment, the global economy is pushed below its potential, and the corresponding decline in global output and wealth decreases the relative demand for safe assets. This shift resorbs the safe asset shortage and restores equilibrium in the safe asset market.

This tipping point was quickly reached at the onset of the last financial crisis and contributed to the severity of the Great Recession. Today, interest rates in safe-assets-producing countries remain at or close to the effective lower bound, with very limited scope for large additional declines. The safe asset shortage remains a key source of fragility for the global economy.

In this article, we begin by describing the main facts and macroeconomic implications of safe asset shortages. Faced with such a structural conundrum, what are the likely short- to medium-term escape valves? We analyze four of them: 1) a valuation rise through the exchange rate appreciation of safe asset producer economies, and the US dollar in particular; 2) the issuance of public debt; 3) the production of private safe assets; and 4) changes in regulatory frameworks, global risk sharing, as well as re-profiling of central bank asset purchase practices to reduce the demand for safe assets. Each of these comes with its own macroeconomic and financial trade-offs, which we discuss.

[1] As is well-known, this effective lower bound is not necessarily equal to zero since storage and transportation costs may make cash unattractive even when interest rates are slightly negative. More importantly, there are many reasons besides the standard cash–bonds substitution one for why rates are difficult to reduce from very low levels: as one example, see Brunnermeier and Koby (2016) on the "reversal rate," defined as that rate below which further reductions cause more harm to the financial system than they benefit aggregate demand.

Table 1
A List of Safe Assets—Pre- and Post-Crisis

	Billions of US$		*% of world GDP*	
	2007	*2011*	*2007*	*2011*
US Federal government debt held by the public	5,136	10,692	9.2	15.8
Held by the Federal Reserve	736	1,700	1.3	2.5
Held by private investors	4,401	8,992	7.9	13.3
GSE obligations	2,910	~~2,023~~	5.2	~~3.0~~
Agency-and GSE-backed mortgage pools	4,464	~~6,283~~	8.0	~~9.3~~
Private-issue ABS	3,901	~~1,277~~	7.0	~~1.9~~
German and French government debt	2,492	3,270	4.5	4.8
Italian and Spanish government data	2,380	~~3,143~~	4.3	~~4.7~~
Safe assets	20,548	12,262	36.9	18.1

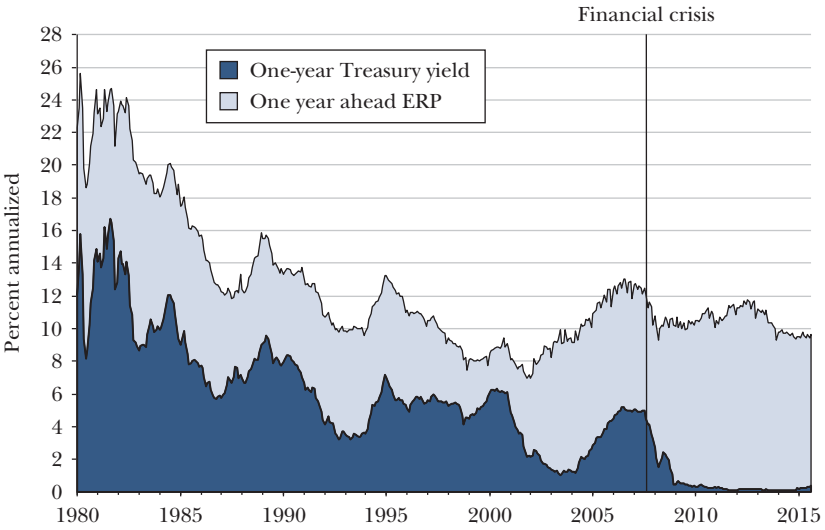
Source: Barclays Capital (2012). Data came from Federal Reserve Flow of Funds, Haver Analytics, and Barclays Capital.
Note: Numbers are struck through if they are believed to have lost their "safe haven" status after 2007. GSE means "government-sponsored enterprise." ABS means "asset-backed security."

Safe Asset Shortages and Their Macroeconomic Consequences

There have been a number of attempts in the literature to estimate the size of the pool of safe assets. All of these use somewhat crude rules to categorize assets. Table 1 presents one such measure, which includes debt from the US, German, French, Italian, and Spanish governments, together with assets held by the US "government-sponsored enterprises" such as Freddie Mac and Fannie Mae, which were heavily invested in mortgage-backed assets and were widely perceived to have the full backing of the US government. The table illustrates the collapse in the quantity of global safe assets from 2007 to 2011. Explicit US government debt rose, but mortgage-backed debt issued by the US government-sponsored enterprises was no longer perceived as safe, and neither was debt from the Italian and Spanish governments. The global quantity of safe assets plummeted as a result. Eichengreen (2016) offers an alternative and more detailed breakdown of safe assets, in which one category includes all OECD sovereign debt rated AA or above. This measure also shows a dramatic fall in safe assets during the financial crisis.

The most direct implications of a fall in the supply of safe assets can be seen in Figure 1. The two black lines in Figure 1 illustrate the paths of the short-term interest rate (dark area) and of the expected return on equity (area under the top line). The difference between the two lines is the equity risk premium (light area). Short-term rates feature a widely noted downward secular trend and a sharp drop during the Great Recession. The evolution of the expected return on equity is markedly different. It features the same downward trend as the short-term interest rate until the early 2000s, then remains more or less stable. The disconnect between a stable expected return on equity and a declining short-term interest rate is particularly salient after 2002, and even more so since the beginning of the Great Recession,

Figure 1
US Interest Rate and Expected Equity Risk Premium (ERP)



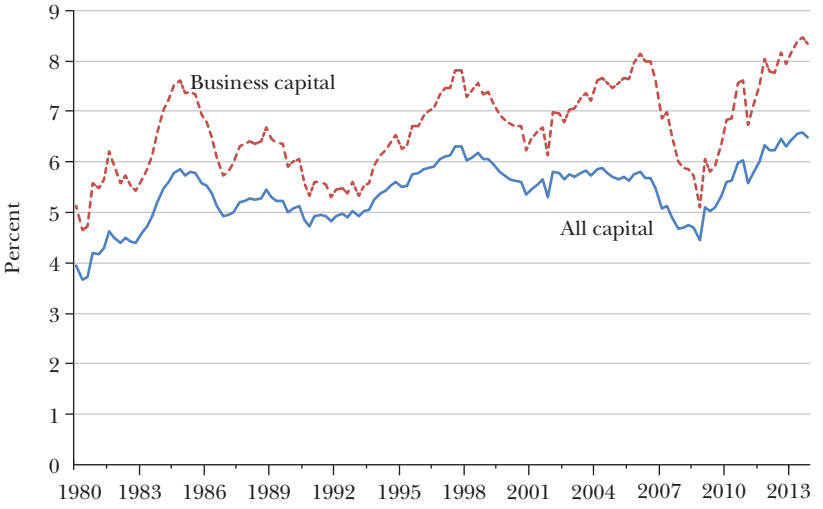
Source: One-year Treasury yield: Federal Reserve H.15; ERP: Duarte and Rosa (2015).
Note: The graph shows the one-year US Treasury yield (dark area) and the one-year expected risk premium (ERP) (grey area), calculated as the first principal component of 20 models of the one-year-ahead equity risk premium. The figure shows that the equity risk premium has increased, especially since the Global Financial Crisis.

as the latter combined a greater demand for safety and a diminution in the quantity of what were perceived as safe assets.[2] It suggests a shift towards safe assets and away from riskier ones. Figure 2 documents that over the same time period, estimates of the return to physical capital remained remarkably stable. This implies that a similar disconnect is observed between returns to capital and safe interest rates, which can also be in large part attributed to an increase in risk premia attached to physical investment (Caballero, Farhi, and Gourinchas 2017).[3]

While the underlying trend towards safe assets may have been gradual throughout the 1990s and 2000s, it was partially masked by the rapid increase in the supply of pseudo-safe assets, privately engineered by the US financial sector, as well as the increase in debt issuance by fiscally weak sovereigns such as Italy or Greece.

[2]Less consistent with the persistence of the "safety" premium is the fact that within fixed income, some credit-spreads have compressed significantly. Our conjecture is that this within-asset-class phenomenon is the result of search for yield among those intermediaries constrained by mandates and regulations rather than by their own demand for safety. It is also the kind of situation that can lead to sharp spikes in risk spreads during risk-off scenarios.
[3]Similarly, Del Negro, Giannone, Giannone, and Tambalotti (2017) find supportive evidence that the decline in safe real interest rates in the United States was driven mostly by an increase in the premium for safety and liquidity of short-term Treasury bills relative to less-liquid and less-safe assets.

Figure 2
The Average Real Return to US Capital



Source: Real after-tax returns to business capital and all capital, computed by Gomme, Ravikumar, and Rupert (2011) and adjusted for the share of intangibles in total capital from Koh, Santaeulàlia-Llopis, and Zheng (2016).
Note: The real after-tax return to capital is constructed as total after-tax capital income, net of depreciation divided by the previous period's value of capital. Business capital includes nonresidential fixed capital (structures, equipment, and intellectual property) and inventories. All capital includes business capital and residential capital.

As noted earlier, because such assets were considered safe by naive investors, this reduced the downward pressure on safe real rates.

When the financial crisis arrived in 2007–2008, the safe asset scarcity resurfaced with a vengeance. The collapse in the supply of safe assets and the increase in the demand pushed down the natural safe rate—that is, the short-term real rate required for full employment—well below zero. But nominal interest rates were already quite low and central banks around the world quickly found themselves unable to decrease nominal or real rates further. With real safe rates unable to decrease so as to clear markets, the demand for safe assets remained too elevated and the economy had to slow down and operate below its potential. This is a modern version of the paradox of thrift: faced with elevated safe real rates (relative to their equilibrium level), households prefer to save and postpone consumption; simultaneously, faced with low demand and elevated risk premia, firms prefer to postpone investment. Aggregate demand suffers and a recession ensues. In short, unable to clear markets via prices (the safe real rate), the economy clears by adjusting quantities (Caballero and Farhi 2017; Caballero, Farhi, and Gourinchas 2015, 2016).

An acute shortage of safe assets creates a situation similar to a liquidity trap, which we dub a "safety trap." Unlike the safety trap, a liquidity trap corresponds

to a situation of excess savings *across* asset classes. In both types of traps, real rates cannot fall sufficiently, causing a recession. There are, however, two important differences between safety traps and liquidity traps. First, exiting a safety trap requires an increase in the supply of, or a reduction in the demand for, safe assets, *regardless of the demand and supply of other assets*, while the more general liquidity trap calls for a reduction in saving or a general increase in stores of value. From a policy perspective, this implies that government policies that leave the supply of safe assets unchanged will be less effective (an issue we will revisit below in some detail). Second, safety traps can be very persistent or even permanent despite the presence of long-lived assets, because the risk premia attached to long-lived assets bounds the value of these assets and the associated wealth effects on aggregate demand, even with persistently low interest rates.[4]

When prices have some degree of flexibility, safety traps and the resulting recessions or periods of sluggish growth can also trigger deflationary forces, which raise real safe interest rates, further depressing output, in a familiar deflation cycle (Eggertsson, Mehrotra, Singh, and Summers 2016; Eggertsson, Mehrotra, and Robbins 2017; Caballero and Farhi 2017; Caballero, Farhi, and Gourinchas 2015).

In the discussion so far, we have considered the world economy as a single unit. The dynamics between net safe asset producers and safe asset absorbers adds substantial richness to the picture. In an open economy, the scarcity of safe assets in one country spreads to others via capital outflows, until safe rates are equalized across countries. As the global scarcity of safe assets intensifies, the global safe interest rate drops and capital flows increase to restore equilibrium in global and local safe asset markets. Once the zero lower bound for global interest rates is reached, global output becomes the adjustment variable. The world economy enters a regime of increased interdependence, since countries can no longer use monetary policy to insulate their economies from world capital flows (Caballero et al. 2015). A country with an acute scarcity of safe assets spreads its recession to other countries via capital outflows, or equivalently, current account surpluses. Surplus countries (like the eurozone) are exporting their weak domestic aggregate demand. Deficit countries, like the United States, are absorbing the weak domestic aggregate demand of the rest of the world.

The global economy can remain fragile for long periods of time, even if some countries like the United States and the United Kingdom have managed to largely erase their output gaps over time, since any intensification in safe asset scarcity in some countries could lead to the re-emergence of a global safety trap.[5]

In summary, the world economy seems to have transitioned to an environment of recurrent global safety traps: we might emerge from one, only to relapse at the

[4] In a permanent liquidity trap, in the absence of risk premia, the value of long-lived assets would become arbitrarily large as interest rates fall to zero, increasing the supply of assets and eliminating any asset shortage.

[5] According to the IMF *World Economic Outlook* (April 2017), the 2016 output gap for the UK economy was –0.17 percent while that of the US economy was –0.42 percent. The output gaps for the eurozone and Japan were estimated at –0.7 percent and –1.71 percent, respectively.

next wave of economic bad news. The next four sections explore market and policy mechanisms that may reduce, perhaps temporarily, the underlying imbalance.

Foreign Exchange Appreciation of the Currencies of Safe Asset Producers

The main market mechanism to restore equilibrium in a safety trap is an increase in the valuation of safe assets, a process that is hampered by limits on how low rates can go. However in a global economy, there is a second valuation channel: the exchange rate. An appreciation of the currency in which these assets are denominated, primarily US dollars, increases the real value of these assets for non-US holders. However, to absorb the trend increase in the net demand for safe assets, the currency of safe asset issuers needs to appreciate at a rate at least equal to the difference between the rate of growth of non-issuers and that of issuers.

The central problem of this particular "solution" is that it depresses net exports, and potentially output, for safe asset issuers. While consumers in these countries enjoy the ongoing revaluation of their income in terms of greater buying power of foreign-made goods, domestic producers experience all the burden of adjustment. In Caballero et al. (2015), we refer to this phenomenon as the *paradox of the reserve currency*.

When equilibrium full-employment interest rates in an economy are well above the effective lower bound, a reserve currency status for countries that issue safe assets is mostly an economic blessing as it allows for lower funding costs (Gourinchas and Rey 2007). But when the global economy nears the effective lower bound, safe asset issuers, faced with a wave of foreign investors seeking to invest in safe assets, will find that their currency tends to appreciate, exacerbating their own safety trap. In this setting, being the issuer of a reserve currency in which safe assets are denominated becomes a disadvantage.

This perspective also has policy implications within the set of safe-asset-producing economies. When interest rates are constrained above the equilibrium full-employment real interest rate and global output needs to decline as a result, the distribution of this global recession across countries depends on the exchange rate. By depressing the value of their currency, countries can stimulate their economy at the expense of their trading partners. This creates fertile grounds for "beggar-thy-neighbor" devaluations achieved by direct interventions in exchange rate markets, which stimulate output and improve the current account in one country at the expense of the others. The recent evolution of currency values for advanced economies illustrates this pattern. The accommodating monetary policy of the United States from 2008–2014 was associated with a substantial depreciation of the US dollar, which helped to reduce US current account deficits. In turn, the Bank of Japan (in 2013) and the European Central Bank (late 2014) launched large-scale asset purchase programs, that contributed to the depreciation of the yen and the euro against the dollar, shifting the adjustment burden back onto the US economy.

Beyond exchange rates, the general principle is that at very low interest rates, safe assets acquire a public good dimension since their production helps stimulate output in other countries, and these benefits are unlikely to be fully internalized by the economy that is issuing the safe assets. A free-rider problem arises, which manifests itself both in quantities (under-issuance of safe assets) and in prices (beggar-thy-neighbor devaluations). The US economy has clearly experienced the short end of this bargain in recent times.

The Role of Public Debt and Infrastructure Investment

One obvious solution to a shortage of safe assets is for countries that produce safe assets to issue more of them. This solution seems feasible as long as the cost of servicing public debt remains negligible, which is to say as long as interest rates stay well below the issuer's rate of growth. However, this solution is also potentially fragile and even bubble-like, because it is susceptible to rollover risk. More specifically, it requires taking the risk of becoming exposed to a coordination-failure-type run on public debt (Farhi and Maggiori 2016), or to the exploding debt dynamics that might follow a sudden decline in the demand for safe assets. While the shortage of safe assets creates space for more debt issuance than in other environments, in practice this margin is likely to be limited.

The capacity of a government to issue more safe public debt depends on two factors: the fiscal capacity of the government to borrow, and the risk that increased provision of public safe assets may crowd out provision of private-sector safe assets. In a situation with a shortage of safe assets, the relevant form of fiscal capacity is the government's perceived ability to commit to raising future taxes, even if the economic crisis were to last for a long time or worsen. On the other hand, the risk of crowding out private safe assets depends on how much these anticipated future taxes reduce the private sector's capacity to issue safe claims backed by risky dividends. Naturally, crowding out of private-sector safe assets is less likely when the securitization capacity of the economy is already impaired—since few private-sector safe assets can be constructed at such a time. In a safety trap, issuing additional public debt increases the supply of safe assets and stimulates the economy.

A substantial share of the contraction in the supply of safe assets from 2007 to 2011, shown in Table 1, resulted from a perceived violation of the fiscal capacity condition of some large eurozone economies. Since then, other economies, and the same economies with external backing, have been rebuilding this supply of safe assets.

The macroeconomic desirability of an expansion in public debt during a time of safe asset shortage is distinct from (and complementary with) the more conventional advocacy for (cheaply funded) fiscal expansion during liquidity traps and/or secular stagnation situations. The mechanism operates through a swap of risky for riskless assets in private sector portfolios. In this sense, policies that increase the gross supply of safe assets—such as "helicopter drops" of money, safe public debt issuances, and versions of central bank's quantitative easing involving swaps of "positive-beta"

private risky assets for "zero- or negative-beta" public safe assets—stimulate aggregate demand and output. Recent examples of such policies include the so-called QE1 episode in the United States from December 2008 through March 2010 and the long-term refinancing operation that started in late 2011 in the eurozone.[6]

In contrast, "Operation Twist" type policies involving swaps of "negative-beta" long-term government debt for "zero-beta" short-term public debt are ineffective or even counterproductive (Caballero and Farhi 2017). Examples of these policies would include the QE2 policy enacted by the Federal Reserve from November 2010 to June 2011 and the following QE3 policy from September 2012 to December 2013.

In a globally connected economy, an expansion in the supply of safe assets from the public debt issuance of core economies spreads across the world economy. This raises the concern that the quantity of safe assets issued by core economies and necessary to fulfill a growing global demand may be too large and eventually weaken the fiscal capacity of core economies.

While the experience of Japan over recent decades suggests that the capacity of a core economy to issue debt may be extremely large in a safe asset scarcity environment, it is a concerning situation. Again, this overall phenomenon is secular, to the extent that core economies naturally grow at a slower pace than emerging markets economies, which are heavy net users of safe assets. This is also compounded by a series of demographic factors that are increasing the demand for safe assets and reducing the effective tax-base for safe asset issuers.

This situation is a modern version of the old "Triffin dilemma," an argument made by economist Robert Triffin in various writings in the early 1960s. The original Triffin dilemma referred to the tension between the growing global demand for US dollars under the Bretton Woods system of fixed but adjustable exchange rates and a constant dollar price of gold, and the (largely) fixed amount of gold reserves held by the US government. The dilemma was that either the US monetary authorities would have to tighten monetary policy eventually, holding down the demand for US dollar assets but also causing a global recession, or the United States would find itself unable to back the stock of dollars with gold reserves, which would eventually make the system of fixed exchange rates unsustainable—as eventually happened. In the modern version of the Triffin dilemma, the demand for safe asset debt from certain countries grows with the world economy faster than the issuer's own economy (Gourinchas and Rey 2007; Farhi, Gourinchas, and Rey 2011; Obstfeld 2011; Farhi and Maggiori 2016). Expanding issuers' public debt in line with global demand runs the risk of exhausting fiscal capacity, or of a coordination failure type run on their debt. Moreover, should the environment change and the safe asset scarcity disappear, issuers could rapidly face exploding and unsustainable debt dynamics.

[6]In this context, "beta" refers to the extent to which the return on a financial asset is correlated with other returns in the market. A safe asset as defined here should have a beta of nearly zero—that is, the value of the asset should not change (much) depending on whether other assets are experiencing rising or falling returns.

Nevertheless, the issuance of safe assets has a public good dimension: production of safe assets *anywhere* expands output *everywhere* and the positive spillovers are unlikely to be fully internalized. Thus, while safe asset issuers may rightly be concerned about the risks of exhausting their fiscal capacity, the current environment is likely one of under-issuance of public debt by core economies.

In the meantime, financial engineering, such as the pooling of risks among quasi-safe sovereigns to create a larger share of safe debt from *existing* public assets can add another layer of supply of safe assets. The overall approach here involves tranches: that is, it combines a number of risky assets into a pool, then creates a series of derivative assets. The most "junior" tranche of these assets bears all of the losses, up to a certain percentage of the total. Intermediate (or mezzanine) tranches bear losses above that amount. The most senior tranches are the safest, because they only bear losses after all the lower tranches have been wiped out. Of course, junior tranches also need to offer a higher rate of return to offset their greater risk, while the most senior and safest tranches pay the lowest rate of return. This general approach is a key component of various proposals to group together sovereign bonds issued in euros. The proposal for "European Safe Bonds" (ESBies) is one prominent example (Brunnermeier et al. 2016), where liabilities for individual bonds remain with each sovereign, but the pooled assets issue a union-wide safer senior tranche. Another example is for the IMF to oversee joint tranching of emerging-markets debt as proposed in Caballero (2003), where sovereigns also keep individual liabilities but the pooled-assets issue a hard-currency safe asset tranche.[7]

From this perspective, publicly funded infrastructure investment becomes particularly attractive, as it both boosts growth in the asset-producing countries, increasing fiscal capacity, and does so with maximum issuance of safe asset per unit of installed capital.

Could other sovereign safe asset issuers come on line to add significantly to the existing, primarily US-based, supply of safe assets? As an historical precedent, the *Economist* (2015) mentions the passing of the safe asset baton from the United Kingdom to the United States in the 1930s. One could imagine an expansion in the supply of Chinese safe assets in this context, but this is probably a few decades away from becoming a significant factor. Furthermore, even if it did, the benefits of the emergence of another major issuer could be mitigated by a rise in self-fulfilling instability arising from coordination problems as investors substitute away from one issuer and into another (Nurkse 1944; Farhi and Maggiori 2016).

Private Substitutes

If the public sector is unable to expand the production of safe assets, the private sector will face powerful incentives to increase their issuance, as it did

[7]Other eurozone proposals that use tranching include the Blue Bonds/Red Bonds of Delpla and Weiszacker (2010) and the collateralized debt obligation proposal of Corsetti et al. (2016).

in the past. Private substitutes can take many forms. For example, corporations have an incentive to make themselves a safer source of return, for instance by withdrawing from investing in risky projects and instead distributing a stable dividend or buying back their own shares—both patterns that have been observed in recent years.

However, the closest private sector alternative to sovereign safe assets arises from the private sector's incentive to financially engineer substitutes. Over time, there has been a dramatic structural transformation of the composition of privately produced "safe" assets (as documented by Gorton, Lewellen, and Metrick 2012). In the early 1950s, demand deposits at banks were a safe asset. As the financial sector became more sophisticated, this category of "safe" assets expanded to include money-like debt (for example, commercial paper, money market funds, repurchase agreements) and private label AAA asset-backed securities. What is relatively new, relative to post–World War II history, is that the global economy is going through a complex structural period where the standard valuation adjustment for safe assets—via interest rate changes—have run out their course.

While it is possible in principle to create private-sector safe assets with sufficient overcollateralization (Hall 2016), this solution remains fragile since the private sector's ability to insure against a truly systemic event is limited (Holmström and Tirole 1998). In fact, much of the initial impetus behind the subprime crisis resulted from the financial sector trying to extract a (seemingly) safe asset tranche from pooled lower-quality assets (for discussion of this topic, see Caballero 2010; Stein 2012; Gorton 2016). But even the most senior and seemingly safe tranches on private assets may contain some irreducible tail-risk, making these assets unsafe when faced with truly systemic events. This creates substantial instability in the absence of an explicit public insurance overlay (Caballero and Kurlat 2009; Stein 2012). Indeed, as we argued earlier, this particular private sector attempt to create safe assets played a significant role in pushing the world economy into the Great Recession.

In essence, the financial sector in the lead-up to the financial crises was able to create *micro*-AAA assets from the securitization of lower-quality assets. But the industry remained largely unprotected against a truly systemic event, and the complexity of the instruments made them vulnerable to a panic, which duly took place. Overcollateralization does not solve such a problem: complex private safe assets are not truly robust against the potentially chaotic unraveling that follows a systemic panic, in the absence of an explicit public backstop. That is, private safe assets are not *macro*-AAA assets. As Gorton (2016) lucidly writes:

> And leading up to the recent crisis there was a shortage of long-term safe debt, so agents were increasingly using privately-produced long-term debt, AAA/Aaa asset-backed and mortgage-backed securities (ABS/MBS). The outcome of this … was the financial crisis … So, now more attention is paid to safe assets . . . This is as it should be because almost all human history can be written as the search for and the production of different forms of safe assets.

Stein (2012) expresses a similar concern about short-term liabilities created by the banking industry, which are supposedly safe but may also be subject to tail risk. His proposal to assure the safety of these assets is that the US Treasury floods the market with short-term debt. While this may improve the overall supply of safe assets temporarily, the structural problem will not be remedied, but merely postponed until the political-fiscal capacity is reached, as discussed above.

Some form of private–public partnership could help expand the private supply of safe assets. For example, one alternative would be providing fiscal backstop for the severe tail risks of safe private assets, while monitoring collective moral hazard (for example, Caballero and Kurlat 2009; Farhi and Tirole 2012). Caballero and Kurlat (2009) suggest that banks would continue with their role in the provision of safe short-term assets, but would be required to buy tail-risk macroeconomic insurance from the government. It is obvious that the design of such a program raises difficult questions. It is extremely hard, and for that reason inefficient, for the private sector alone to produce tail-risk systemic insurance. Conversely, it seems highly inefficient for the public sector to use its political debt capacity insuring nonsystemic events that can in principle be handled by the private sector. Of course, a public sector backstop also raises the question of the fiscal capacity of the government to honor that backstop, when and if needed.

Reducing the (Net) Demand for Safe Assets

If expanding the production of safe assets sufficiently is difficult, could we find areas in which safe asset demanders might be encouraged to hold fewer of them? The first area that comes to mind is the enormous pool of safe assets on central banks' balance sheets. For example, of the $18 trillion of outstanding US Treasuries, the quintessential liquid safe asset, more than 30 percent is stationed at central banks—two-thirds at foreign central banks and one-third at the Federal Reserve itself. Overall, the total assets of major central banks around the world rose from roughly $6 trillion in 2008 to $16.3 trillion by 2016. Finding alternative—if necessarily riskier—assets for central banks to hold could help to address the safe asset shortage.

Central banks hold safe assets for two main reasons: 1) to be able to intervene in foreign exchange markets if desired, which typically involves hoarding of foreign safe assets; and 2) as a result of quantitative easing policies, which involves the accumulation of domestic safe assets and occasionally riskier ones. (Although in some countries, like Japan, the policies of foreign exchange market intervention and quantitative easing can become mixed at times).

The accumulation of safe assets in the form of foreign exchange reserves, especially in emerging markets, reflects in part a precautionary motive against the occurrence of a sudden stop of capital inflows: that is, the holdings of safe assets by these central banks is for self-insurance purposes. This is an an inefficient mechanism of systemic insurance, which could be partially replaced by more powerful global risk sharing arrangements including swap lines, credit facilities backed by

international financial institutions like the IMF or the World Bank, and reserve sharing agreements (for a discussion, see Caballero 2003; Farhi, Gourinchas, and Rey 2011; Farhi and Maggiori 2016). The IMF and the Federal Reserve implemented some of these policies with foreign central banks during the peak of the financial crisis. The Federal Reserve's swap lines were credited with limiting the spreading of the US subprime crisis to the rest of the world as foreign banks that had funded themselves in dollars ran into trouble.

A central bank holding safe assets as a result of quantitative easing policies faces a very different situation. After all, quantitative easing is not an insurance policy. It is a policy adopted after an adverse economic event has already occurred, designed to compress risk-spreads. As such, it is not clear at all that it needs to involve the purchase of safe assets. In fact, if a shortage of safe assets is the main reason behind the economic downturn, and the constraints on those that demand these assets to shift their portfolios into riskier assets are severe, reducing the available supply of safe assets via central bank purchases may aggravate the problem. In that situation, it makes more sense for a central bank engaged in quantitative easing to purchase riskier assets, such as the mortgage-backed securities purchased by the Federal Reserve, or even riskier assets such as the equity shares and real estate bonds purchased by the Bank of Japan in its quantitative easing program.

To sum up, reducing safe asset hoarding by emerging and advanced economies' central banks may require different steps. For emerging markets, holding safe assets issued by a limited number of high-income countries, it requires alternative forms of global pooling of macro-risks. For high-income countries, whose central banks hold a substantial share of the world's safe assets, it requires consideration for the policy spillovers of the different quantitative easing options available. Put differently, in the current environment, developed markets' central banks should not be hoarding assets that have a large safe asset component beyond those required for the conduct of conventional monetary policy.

A final area in which the demand for safe assets might be reduced involves some rethinking of the regulatory framework. Flow of funds data indicate that one key source of the global demand for safe dollar assets originates within the global financial sector (Gorton, Lewellen, and Metrick 2012; Gourinchas and Jeanne 2012). Well-intentioned but perhaps shortsighted new regulatory requirements implemented in the aftermath of the financial crisis have significantly increased the mandated safe asset holdings of financial institutions, especially banks and insurance companies, under the Basel III criteria currently being phased-in. Finding ways to safeguard the stability of the financial sector without generating high demand for safe-assets would also alleviate the scarcity.

Taking Stock

In the short- and medium-run, the world economy is likely to remain unpleasantly close to a structural safety trap, unless some powerful steps are taken. As

Gorton, Lewellen, and Metrick (2012) showed, the share of safe assets relative to total US assets has been remarkably stable over the long-run of recent decades, suggesting that the long-run trend toward increased scarcity of safe assets has been mostly due to demand factors, such as central banks' international reserve accumulations, regulatory changes, and demographic factors.

The ongoing pressures driving the imbalance in safe asset markets has in recent decades helped to drive the steady decline in interest rates on safe assets. However, interest rates on these assets cannot fall much further. When the equilibrium full-employment interest rate needs to be negative, but cannot adjust sufficiently downward, then (other things equal) the equilibrating mechanism is an endogenous decline in safe asset demand through a reduction in aggregate income and wealth. That is, equilibrium is achieved through recession.

Another top-down way of thinking about the general macroeconomic malaise caused by the shortage of safe assets is to consider the physical investment that is required to match the saving needs of society. If the saving side of society has a disproportionate desire for safe assets, then it effectively wants to fund only a small share of the overall risky investments required for economic growth. A central role played by the financial sector is to intermediate risk between the savers who want safe assets and the borrowers who are taking on a greater degree of risk. One result of such intermediation is that the interest rates associated with the relatively small tranches of safe assets are compressed against the zero lower bound, while other risk spreads remain elevated. If the financial sector cannot fully manage this transmutation, then it will be hard to sustain the levels of physical investment needed to generate growth in core economies—and it will be hard for these core countries to carry out an ongoing expansion of the quantity of safe assets. From this perspective, publicly funded infrastructure investment becomes particularly attractive, as it both boosts potential growth in the asset producer countries and does so with maximum issuance of safe assets per unit of installed capital.

In the short- and medium-term, the quantity of safe assets may increase via stronger exchange rates in the safe asset issuers, and via public debt issuance in those countries. Over time, a lasting solution to the shortage of safe assets will require a combination of finding alternative sources of safe asset supply and a reduction in demand. Some years down the road, current emerging markets, especially China, may eventually provide global safe assets in substantial quantities, but for now, this avenue holds little promise. Reconsidering how and why central banks hold safe assets as reserves and as part of quantitative easing, and also rethinking the rules that require private financial firms to hold safe assets, are potentially ways to increase the quantity of safe assets available in the market. In the meantime, as the global economy struggles to find ways to reduce the shortage of safe assets, we are likely to continue to see the multiple symptoms of this economic illness: very low interest rates on safe assets, bubbly expansions of seemingly safe assets, recessions, episodic sharp appreciations of core currencies, and so on.

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