

What Makes US Government Bonds Safe Assets?[†]

By ZHIGUO HE, ARVIND KRISHNAMURTHY, AND KONSTANTIN MILBRADT*

US government bonds are widely considered to be the world's safe store of value. US government bonds are a large fraction of safe asset portfolios, such as the portfolios of many central banks. The world demand for safe assets leads to low yields on US Treasury bonds. During periods of economic turmoil, such as the events of 2008, these yields fall even further. Moreover, despite the fact that US government debt has risen substantially relative to US GDP over the last decade, US government bond yields have not risen. What makes US government bonds “safe assets”? Our answer in short is that safe asset investors have nowhere else to go but invest in US government bonds.

Figure 1 provides some motivating evidence. The figure plots the interest rate on three-month Treasury bills (3m T-bill, solid black line), along with the Federal Funds target rate (dashed line) and the rate on the three-month Federal Funds Overnight Index Swap (3m OIS, gray line). The latter rate reflects the expected overnight Federal Funds rate over the next three months so that its maturity is comparable to the three-month Treasury bill rate. The figure shows that the Treasury bill rate is below the other money market rates. Most striking is that at times of worsening economic fundamentals—March 2008 with the demise of Bear Stearns and October 2008 with the demise of Lehman Brothers—the yield on Treasury bills falls substantially relative to the other money market rates (Federal Funds in the figure, but also relative to non-bank money

market rates such as high grade nonfinancial commercial paper which is not in the figure). In these episodes, US government debt should be expected to rise substantially due to an impending recession and the possibility of large scale transfer payments from the government. And yet, the yields on US government debt fall relative to the yields of other debt. These observations beg the question of why US government debt is a safe asset, especially given a high US debt-to-income ratio. More broadly, these observations are interesting in the context of the growing literature on safe assets (see Caballero, Farhi, and Gourinchas 2008; Caballero and Krishnamurthy 2009; and Krishnamurthy and Vissing-Jorgensen 2012); and raise the question of what makes an asset a “safe asset.”

I. Model

There are two countries ($i = A, B$) that have sovereign debt outstanding at date t of b_t^i . This debt matures at date t and must be rolled over or defaulted on. Our model determines conditions under which the time t debt of b_t^i is safe debt. Each country can issue new debt of b_{t+1}^i to roll-over the existing debt. We assume that the new debt has to pay with certainty at date $t + 1$. The maximum amount of such debt that a country can credibly issue is B_{t+1}^i , which is exogenous to our model. Without loss of generality we call country A the “large country” (i.e., the United States) and assume that $B_{t+1}^A > B_{t+1}^B$. Note that this is a statement that the maximum amount (float) of country A debt is larger than that of country B debt. It is not a statement regarding the countries' debt/GDP ratios. In fact, to make our point most clearly, let us suppose that the ratio of $\frac{B_{t+1}^i}{GDP_{t+1}^i}$ is the same across these countries

so that fundamental repayment ability of the two countries are the same. We will show that it is the larger *absolute debt capacity* of country A that makes its time t debt of b_t^i to be the safe

*He: Booth School of Business, University of Chicago, and NBER (e-mail: zhiguo.he@chicagobooth.edu); Krishnamurthy: Graduate School of Business, Stanford University, and NBER (e-mail: a-krishnamurthy@stanford.edu); Milbradt: Kellogg School of Management, Northwestern University, and NBER (e-mail: milbradt@northwestern.edu). We thank Manuel Amador and Jonathan Wallen for comments and Pierre-Olivier Gourinchas for his discussion of our work at the 2015 NBER Summer Institute.

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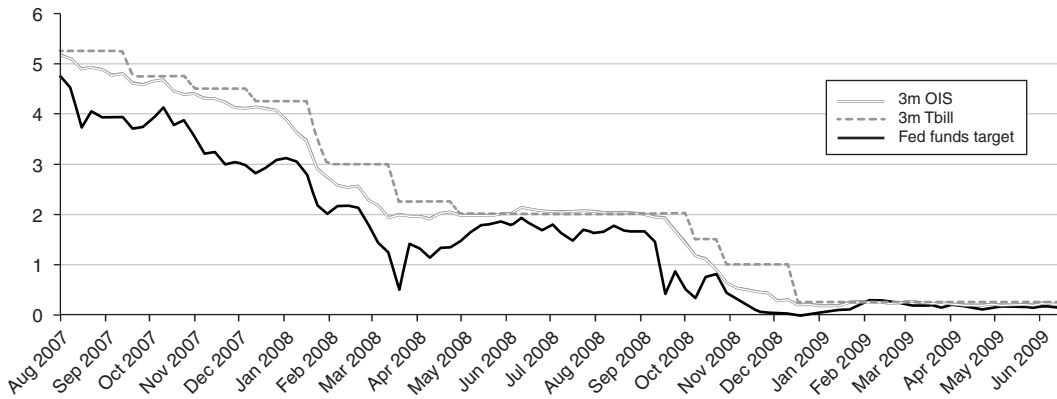


FIGURE 1. SAFE ASSET YIELDS, AUGUST 2007 TO JUNE 2009

asset, rather than the typical variables that affect debt sustainability.

There is a continuum of risk-neutral investors at date t . In total the investors have f units of goods to invest. They must invest their funds in either the debt of country A or B . Importantly, there is no other asset, or storage technology, in which to invest. We can think of these investors as foreign central banks who collectively have f funds that they must invest in the safe sovereign debts of other countries, and they face a portfolio choice of buying country A and/or B debt.

Given the past debt of b_t^i that is due at date t , country i faces a rollover problem. Suppose that country i issues b_{t+1}^i units of bonds at price p_t^i that will be endogenously determined in equilibrium. For simplicity, we assume that each country issues as much safe debt as it can, so that $b_{t+1}^i = B_{t+1}^i$.¹ Then country i 's proceeds from the bond issue are $p_t^i B_{t+1}^i$. The country rolls over its debt and does not default as long as

$$p_t^i B_{t+1}^i \geq b_t^i.$$

¹This assumption can be justified based on the idea that the government of country i chooses how much debt to issue in order to maximize the chance of the country i 's survival (therefore the rent enjoyed by the incumbent government) in refinancing its existing debt. The maximum debt issuance becomes strictly optimal if we introduce noise in the country's fundamental repayment ability so that country i survives probabilistically, as in He, Krishnamurthy, and Milbradt (2015). For simplicity, we abstract away from such noise in this paper.

If the country defaults, we assume that debt holders receive zero and that the country is shut out of the debt market going forward.

II. Analysis

Denote $f^i \equiv p^i B_{t+1}^i$ as the proceeds from the country i 's bond issue at date t ; it is also the funding that goes to country i . There are three conditions that characterize the equilibrium:

- (i) Country i does not default on its debts if

$$f^i \geq b_t^i.$$

- (ii) Investors pay f to purchase bonds of the two countries:

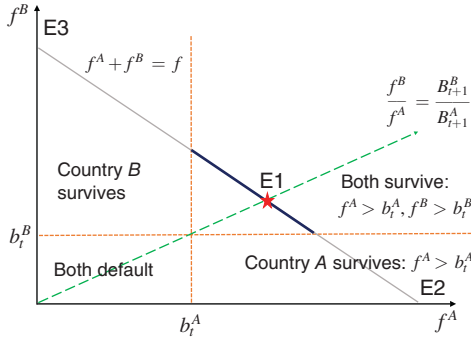
$$f^A + f^B = f.$$

- (iii) If investors purchase some of the bonds of both country A and B , then the returns on these bonds must be equal by the absence of arbitrage:

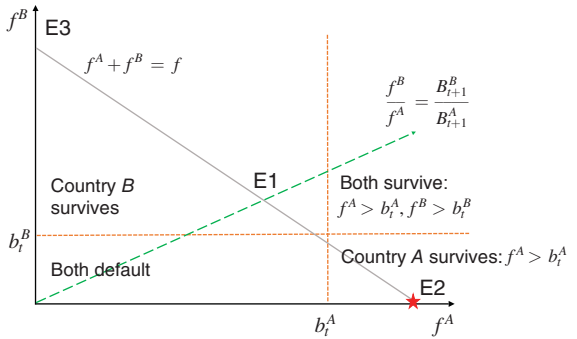
$$\frac{B_{t+1}^B}{f^B} = \frac{B_{t+1}^A}{f^A} \Rightarrow \frac{f^B}{f^A} = \frac{B_{t+1}^B}{B_{t+1}^A}.$$

These three equilibrium conditions help us graphically illustrate our main points using a series of figures. We start with a benchmark parametrization in which joint safety of both countries arises in equilibrium. We then individually vary parameters such that the debt

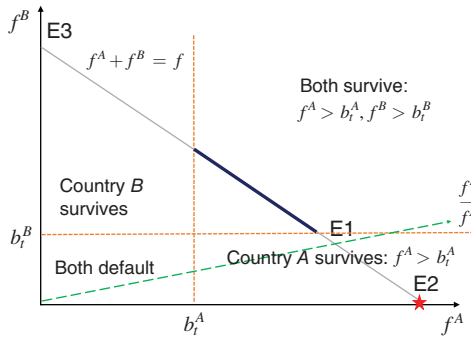
Panel A. Joint safety equilibrium



Panel B. Larger initial debt b_t^A by large country A



Panel C. Large country A is prospectively able to (and chooses to) issue a larger amount of safe debt B_{t+1}^A



Panel D. Negative beta: Lower world fundamental (larger initial debts)

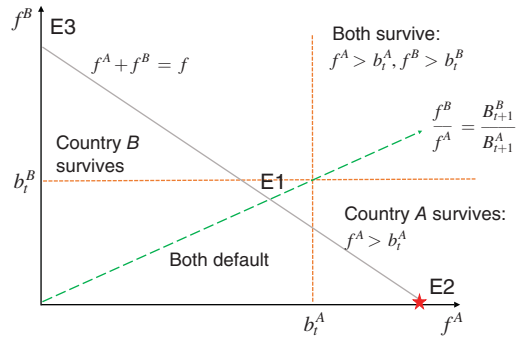


FIGURE 2. DIFFERENT CASES OF SAFE ASSET EQUILIBRIUM

issued by one country becomes the safe asset in equilibrium.

A. Benchmark: Joint Safety and Equilibrium Selection

Panel A of Figure 2 illustrates the equilibrium for parameters such that both countries are able to rollover their debts, and hence the debts of both countries are safe. The x-axis is f^A , the funding going to country A, while the y-axis is f^B , the funding going to country B. The small-dash lines delineate default and no-default regions, corresponding to condition (i): the vertical (horizontal) line is for country A (B). In the upper right quadrant, each country receives sufficient funding to rollover its period- t debts (by issuing $t + 1$ bonds) so that both countries are safe. The gray downward sloping line corresponds to condition (ii), the aggregate budget

equation stating that the f of the investors equals the sum of the proceeds of each country's debt issuance. In panel A of Figure 2, the aggregate budget equation crosses through the upper-right quadrant: the interval indicated by the thick black line are all points so that it is feasible to rollover both country's debts. The upward sloping dashed-line that begins at the origin is the no-arbitrage condition (iii). We have drawn this line for a special case of the model where $b_{t+1}^i = B_{t+1}^i = b_t^i$, which corresponds to a "steady-state" version of the model. In this case, the line for condition (iii) connects through the intersection of the boundaries of the no-default regions since $\frac{B_{t+1}^B}{B_{t+1}^A} = \frac{b_t^B}{b_t^A}$.

There are three potential equilibria in this case, which we have marked as E1, E2, and E3. Equilibrium E1 is where both country's debts are safe. If investors expect that others invest in

both countries' debts in the right portions so that both countries are safe and returns are equalized, then point E1 is an equilibrium. However, this is not the only equilibrium. Equilibrium E2 corresponds to a case where investors expect that country *B* will receive no funding and default for certain. Given this belief, investors find it optimal to purchase country *A*'s debt only. As a result, only country *A* receives funding, and point E2 is an equilibrium. Finally, the converse case occurs at point E3, where country *A* defaults and country *B* receives all of the funding.

We analyze the model assuming that date-*t* investors with *f* units of savings coordinate on the equilibrium that is welfare maximizing for these date-*t* investors. This seemingly ad-hoc equilibrium selection criterion in fact shares the similar flavor as in He, Krishnamurthy, and Milbradt (2015), from the perspective of welfare in the resulting equilibrium. In that paper, we use global games techniques to refine the selection of equilibria in a richer model, and provide results that are consistent with the simpler analysis in this paper (i.e., the "nowhere else to go effect"). Under this welfare-maximum selection criterion, the equilibrium (designated by a star) is at point E1. Investor welfare is highest when the amount of safe assets in the economy is highest as in this case investors receive the highest return on their investment of *f*. Thus the joint safety region corresponding to point E1 is the best equilibrium for investors.

B. Safe Asset Equilibrium: Size Benefit and Negative Beta

Size Benefit.—Figure 2, panel B, depicts the case where country *A*'s date-*t* debts are sufficiently larger than the benchmark case in panel A so that the joint safety possibility E1 disappears. In this case, the only equilibria that are possible are points E2 or E3. But point E2 yields higher investor welfare because country *A* has a larger float of debt than country *B* ($B_{t+1}^A > B_{t+1}^B$). That is, investors have more safe assets in equilibrium E2 compared to equilibrium E3. Therefore, we have a situation where a country with a large debt to rollover causes the country's bonds to be selected as the safe asset.²

²The large debt of country *A* can lead to loss of safety of country *A*. This case will occur if *f* is small, in which case

We can relate the shift in equilibrium from E1 to E2 to world events. Worsening turmoil in both the United States and the world in 2008 led to increased financing needs for countries. As a result, the joint safety equilibrium disappeared, and investors concentrated their safe asset demand on the largest safe debt market: US government debt (country *A* in the model).

Figure 2, panel C, presents a similar result of debt float in a different way. We break the steady state parametrization of earlier, and we suppose that country *A* is prospectively able to (and chooses to) issue a larger amount of safe debt. We take a case where the joint safety region is budget feasible. However, to achieve this joint safety equilibrium, country *B* would have to sell bonds offering a lower yield to investors than country *A*. The dashed line, corresponding to condition (iii), is now flatter compared to the benchmark case in panel A. Since returns across the bonds must be equalized in any equilibrium by condition (iii), point E1 with joint safety cannot be an equilibrium. Given the default possibility, the only equilibrium that emerges is at point E2 where only country *A* debt is safe. Again, we have the result that the debt issued by the large country has an advantage in being the safe asset over the debt of the small debt country.³

These cases also point to a novel channel of contagion from the US financial crisis of 2008 to the European sovereign debt crises of 2010 and beyond. During and after the US financial crises, the supply of US safe assets rose through both the increased financing needs of the US Treasury and through the Federal Reserve's quantitative easing program whereby the government purchased mortgage-backed securities and paid with interest-bearing bank reserves. The expansion of supply in US debt can be seen as a shift from equilibrium E1 to equilibrium E2. European sovereign debt (country *B*) then loses its safety properties, precipitating a sovereign debt crisis. A novelty of the mechanism of our

there may not be enough funds to rollover country *A*'s debts, so that both E1 and E2 become infeasible and equilibrium is at E3. For example, if the world demand for safe assets (*f*) falls, then country *A* will face rollover risk. This is explored in further detail in He, Krishnamurthy, and Milbradt (2015).

³There is a symmetric case where the dashed line crosses the budget equation in the upper left quadrant. This case, which corresponds to one where $B_{t+1}^B > B_{t+1}^A$ will lead investors to choose country *B* as the safe asset, given that country *B* offers the maximum safety to investors.

model is that the shift in equilibrium from E1 to E2 can lead to a fall in the interest on US government debt. That is, the debt crisis in Europe is not precipitated by a rise in the US interest rate, but rather through a shift in safe asset status. This shift equates to a negative beta: we further develop this point next.

Negative Beta Asset.—The movement of US Treasury yields during the 2007–2009 financial crisis, as illustrated in Figure 1, highlights the negative beta of US Treasury bonds. The negative beta is one of the defining features of a safe asset: in bad times, the price of the safe asset rises (the yield falls) in a flight to quality. In our simple model, the safe asset is the debt issued by the large country *A*, which indeed exhibits a negative beta. To see this, consider the following thought experiment. Suppose that the countries in our model also receive some fiscal surplus $\theta^i = \theta B_{t+1}^i$ at date 1, which can be used to repay the existing debt b_t^i due today. Here, a negative θ represents a deficit. This modification only affects the default condition (i), which now becomes

$$\theta B_{t+1}^i + f^i \leq b_t^i.$$

Now consider a negative shock to θ which corresponds to bad times. Relative to the benchmark case in Figure 2, panel A, this negative fundamental shock shifts the two vertical and horizontal lines outward (proportionately), as indicated by panel D in Figure 2. There, the joint safety equilibrium in point E1 fails to survive given a sufficiently negative shock to θ . Instead, the resulting equilibrium moves to point E2, in which investors only buy country *A* bonds. To summarize, following a negative fundamental shock our model predicts a rise in the price of country *A*'s debt, implying that the debt of country *A* has a negative beta.

III. Conclusion

The safety of a safe asset depends on investor beliefs. Safety is endogenous, and when investors believe an asset will be safe, their actions can make that asset safe. Our simple model highlights the “nowhere else to go” aspect of safety, and illustrates the benefit of a large debt size. Other considerations such as the ability of a sovereign to service its debt, as measured for

example by its fiscal surplus, will also be important in a full-blown model. We analyze this case in He, Krishnamurthy, and Milbradt (2015), and uncover another interesting result. The safety of an asset does not depend on the absolute fiscal surplus of a country, but the country's fiscal surplus relative to other countries' fiscal surplus. That is, even if the US fiscal position deteriorates, US government debt will remain a safe asset as long as the US fiscal position remains superior to other countries.⁴

Our perspective on asset safety emphasizes coordination, as opposed to (exclusively) the income process backing the asset, as in conventional analyses of credit risk. In the world, the assets that investors own as their safe assets are largely government debt, money, and bank debt. For these assets, valuation has a significant coordination component as in our model, underscoring the relevance of our perspective.

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⁴ Additionally, while in our model all of the safe assets in which investors invest have the coordination element, it is straightforward to extend the model to consider a case with some fully collateralized safe assets. As we discuss in He, Krishnamurthy, and Milbradt (2015), as long as there are not too many of these assets, the coordination aspect of our model continues to be relevant.

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