Global Safe Assets

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Abstract

Will the world run out of 'safe assets'? What would be the consequences on global financial stability? We argue that the world will not run out of stores of value. But in a world with competing private stores of value, we argue that the global economic system tends to favor the riskiest ones. Privately produced stores of value cannot provide sufficient insurance against global shocks. Only public safe assets may, if appropriately supported by monetary policy. We draw the implications for the global financial system. [TO BE EDITED]

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1 Introduction

The notion that the global economy could be faced with a shortage of safe assets has become a significant theme in recent policy debates (see *inter alia* Caballero, 2010b, Garcia, 2011, Credit Suisse, 2011, and especially International Monetary Fund, 2012, chap 3). Safe assets are a cornerstone of modern financial systems. They provide a reliable store of value, serve as collateral in financial transactions, fulfill prudential requirements, and serve as a pricing benchmark. Should they disappear, the argument goes, the danger is that the financial system itself might crumble. Markets for collateralized transactions (repos) would collapse; financial institutions would have difficulties meeting their prudential requirements, and the pricing and well-functioning of riskier segments of the financial system could be derailed altogether. More daunting perhaps, households, retirees, firms would live in a world without a suitably safe store of value. Without this safe anchor, the financial system would experience greater systemic instability. As recently as April 2012, the IMF in chapter 3 of its Global Financial Stability Report (2012, p.1), expressed the concern that "the shrinking set of assets perceived as safe, now limited to mostly high-quality sovereign debt, coupled with growing demand, can have negative implications for global financial stability."

Indeed, a convincing link can be established between macroeconomic shortages of safe assets and some of the most disturbing features of our recent global financial history. For instance, Caballero, Farhi and Gourinchas (2008) or Bernanke (2005) discuss how the rapid economic growth of emerging economies, coupled with a relative backwardness in financial development created a global shortage of stores of value. This shortage depressed world interest rates and fueled 'global imbalances.' This growing external demand for safe stores of value also proved a powerful stimulant for US and European financial markets. Between 2002 and 2007, they manufactured large amounts of 'quasi-safe' private label safe assets through the securitization of riskier assets (see Bernanke, Bertaut, DeMarco and Kamin, 2011).

The global financial crisis arose when many of these 'private label' safe assets –perceived as safe because they were bestowed with a AAA rating– lost that quality. The sudden realization that many of the safe assets undergirding the entire financial system were of questionable value led to a 'sudden financial arrest' (see Caballero, 2010a). In the subsequent unraveling, most of these 'private label' safe assets disappeared. In the euro area, the strains associated with the crisis quickly morphed into concerns about the safety of sovereign debts, as governments simultaneously tried to shore up their financial sector and to sustain domestic economic activity. This led to further shrinkage in the global supply of safe assets at the same time that deleveraging financial institutions, anxious investors and panicked reserve managers all tried to fly to safety.

In short, macroeconomic shortages of safe assets can create financial instability. Crises, when they occur, further exacerbate the shortage that gave rise to it. Policy responses designed to cope with the crisis such as liquidity injections and monetary easing prolong the conditions for financial instability and delay the necessary balance sheet adjustment of households and financial institutions (see BIS, 2011).

Could this *diabolical* positive feedback loop lead to the ultimate disappearance of safe assets –a recognition that nothing is really safe– with potentially disastrous consequences for financial stability?

We argue in this paper that this analysis is incomplete. In particular, it ignores that the global economy also exhibits poweful *stabilizing* mechanisms. One such mechanism, at work both before and during the crisis, is the decline in the natural real interest rate, resulting from the excess demand for stores of value.Figure 3 plots three different measures of global real interest rates: a world short term real rate, defined as the GDP weighted average of G7 3-months nominal interest rates minus ex-post inflation, a U.S. 10 year real rate defined as the annualized yield on 10-year government bonds minus annualized 10-year expected inflation from the Survey of Professional Forecasters, and the 10-year annualized yield on Inflationindexed Treasuries. All three measures illustrate the strong decline in global real interest rates. In the case of the short term real rate, it reached -2.7 percent (p.a.) towards the end of 2011. The decline in the natural rate operates both on the intensive and the extensive margins. At the intensive margin, it increases the market value of existing safe assets, hence their supply. Simultaneously, it improves the solvency of borrowers, especially sovereign ones. In addition, the mechanism operates also at the extensive margin, stimulating the supply of *additional* stores of value, i.e. stimulating borrowing. The important economic insight is that while this additional borrowing can further fragilize the economy, as emphasized in Diamond and Rajan (2011) and BIS (2011), it also contributes to an increase in stores of value, i.e. a self-correcting mechanism. It is the tension between the fragility induced by the additional leverage, and the stabilization induced by the additional supply of stores of value that is of interest to us. In particular, we are interested in understanding the way in which monetary policy can potentially contribute to the strengthening of the financial system. As we will see, monetary policy will be important along two margins. First, it will need to accompany the decline in the natural rate that occurs when the scarcity of stores of value becomes more acute. Second, monetary policy can also play an important role as a backstop for public securities. We show that a natural way to eliminate the financial instability arising from the asset scarcity consists in supplying public safe assets. In turn, the safety of public asset may require a monetary backstop. We show that this backstop can increase significantly the safety of public securities, with minimal or no consequences in terms of price stability.

This mechanism is illustrated in its purest form in the Samuelsonian's emergence of pure rational bubbles (e.g. fiat money) in economies that suffer from a shortage of stores of values (Samuelson, 1958). As we show with a model,[1] if these bubbles were 'safe', in the sense of

[1]This model makes a number of simplifying assumptions. For instance, the financial bubbles we will consider here are of the 'rational' kind. A good argument can be made that departures from fundamental valuation may not simply reflect rational behavior, but also cognitive biases, institutional constraints, and limits to arbitrage. That we do not consider these here does not mean these things are not important,

being perfectly substitutable with other existing assets in short supply, then the problem of asset shortages would be easily solved and quite trivial to analyze. But financial bubbles, even of the rational variety, can amplify financial instability. They suffer from an important design flaw: their current valuation rests on the common belief that their future value will be preserved. Uncertainty about the future value can lead to a collapse and a relapse of the asset shortage.

The preceding discussion suggests that the relevant question is not whether the world economy can suffer from a shortage of stores of value. Through endogenous and self-correcting macroeconomic responses, the economy as a system will strive to compensate for any shortage. The more interesting question lies in the composition of this asset supply and how to make it less 'fragile.' Here, we would argue in favor of coming back to the basics. It is of the essence of a safe asset that it cannot become unsafe. The definition of safe assets has a key impact on the the financial sector and so should not be left entirely to the private sector. The authorities should commit themselves to a clear definition of safe assets and back it with a policy regime that makes those assets credibly safe. Claims on the private sector are inherently risky and should stay so to limit moral hazard: for this reason they may not provide a good basis to produce safe assets. Besides money, government debt remains the best candidate for the status of safe asset. Central banks, furthermore, have a role to play in making the government debts safe.

The paper is structured as follows. The first section reviews basic conceptual issues and stylized facts related to safe assets. The second section discusses whether there is (or will be, going forward) a gap between the supply and the demand of safe assets. We discuss, in section 4, the role that fiscal and monetary policies play in the supply of safe assets. Section

simply that we can convey our point in a simple manner without making reference to them. Similarly, our model does not feature financial frictions –beyond the fundamental market incompleteness that gives rise to a demand for stores of value. Financial frictions and/or agency problems are critical to many policy questions and this simplification is also meant to keep our analysis as simple as possible, not to claim these are not important policy considerations.

5 discusses the role that safe assets play in the global economy.

2 Conceptual Issues & Stylized Facts

At a primitive level, a safe asset is simply a secure store of value, i.e. a secure promise of future repayment. In a world with complete financial markets and no financial frictions, safe assets would play no specific role. Households and firms could smooth consumption, finance projects and more generally diversify risks away using state-contingent Arrow-Debreu securities and there would be no need for safe assets per se. When instead markets are incomplete and/or in presence of financial frictions, the inability to convert future cash flows into current resources when needed (i.e. the inability to create secure claims on future resources in sufficient quantities) creates a precautionary motive: the real sector (households and firms) now needs to hoard assets in a form easily convertible into real resources. This is where the demand for safe assets arises in the real economy.

In choosing which assets to invest into, households and firms will look for the following characteristics (see International Monetary Fund, 2012, ch. 3): low credit or market risk; high market liquidity; limited inflation risk; low exchange rate risk and limited idiosyncratic risk. A quality of safe assets that has been emphasized by Dang, Gorton and Hölmstrom (2010) and Holmström (2008) is that they are "information insensitive". A bond with a zero default risk is information insensitive in the sense that its value depends only on the yield curve up to the maturity of the bond, and not on the characteristics of the issuer. Once this bond has been certified as safe (for example by a credit rating agency), investors can agree about the value of the bond without collecting further information about its issuer. Information insensitiveness implies that there is no informational asymmetry about the asset, so that its market will not be affected by illiquidity coming from adverse selection problems.

In the short run at least, money is the safe asset par excellence. By extension, a safe asset can be defined as any debt asset that promises a fixed amount of money in the future with no default risk. Safety is also in the eye of the beholders and depends on his liquidity needs. An agent who is likely to need liquidity in the nearer future will find short-term bonds safer than long-term bonds. An agent looking for a long-term safe asset will have to worry about the inflation risk. An agent trading with the rest of the world will have to worry about exchange rate risk. These individual variations in the demand for safe assets notwithstanding, one can define safe assets as cash (including insured deposits) plus any debt that is tradable, liquid and enjoying a top credit rating.

The safety of a given asset does not depend only on the characteristics of the issuer, it is also determined by the features of the system in which the asset is traded. For example, the liquidity of the asset is determined by the depth of the market (e.g. thin market externalities as in Pagano (1989)). The safety of bank deposits depends on the extent to which they are insured by the government or backed by the central bank's lending-in-last-resort. Any asset can be made safe by an implicit or explicit promise by the central bank to buy it if its price falls below a certain price. Thus, for a safe asset to be truly information insensitive (in the sense of Gorton), it is not enough to look at the individual characteristics of the asset: the behavior of key participants in the system, such as the central bank, must also be taken into account.

One crucial role of the financial sector is to produce safe assets out of assets that are less safe. The relationship between the real sector and the financial sector is represented in Figure 1. The real sector is composed of households, firms and the government and the financial sector is composed of banks and financial institutions, including those that belong to the shadow banking system.[2] The arrows correspond to the outstanding stock of debt

[2] In the classification of the US flow of funds, the financial sector includes banks, broker-dealers, mutual funds etc. For the purpose of our analysis, the central bank will be considered a part of the government rather than the financial sector.

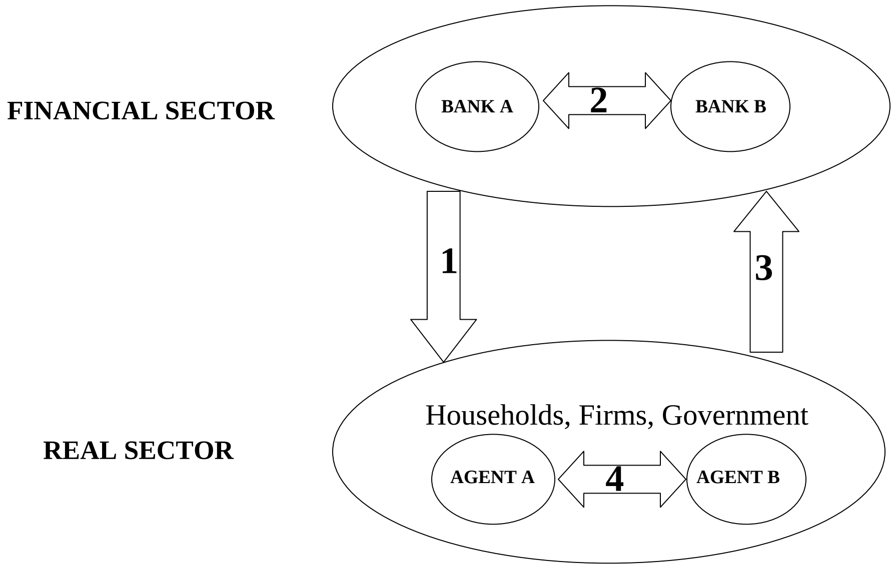

Figure 1: Debt claims in Real and Financial Sector

claims between different agents of the economy. The first arrow (labeled "1") represents the financial sector's debt claims on the real sector, some of which (Treasury bonds, cash reserves at the central bank) are safer than others (e.g., household mortage loans). The second arrow represents debt claims that are internal to the financial sector (e.g., between banks in the interbank market, or banks' wholesale funding from money market funds) and the third arrow are debt claims that the real sector holds on the financial sector (e.g., bank deposits or shares in money market mutual funds). Finally, the fourth arrow corresponds to debt claims that are internal to the real sector (e.g., Treasury or corporate bonds that are directly held by households).

The real sector's claims on the financial sector tends to be more liquid and safe than the financial sector's claims on the real sector (liquidity transformation). Figure [to be added] illustrates this in the case of the US since 1945. It shows the financial sector's total debt claims on the real sector, and the part of these claims that can be considered as safe (as shares of GDP). The latter is smaller than the real sector's safe claims on the financial sector. The details of how claims are classified are given in the appendix [to be added].

The banking sector is able to transform less liquid assets into more liquid assets in several ways. First, it pools risks, both on the asset and on the liability side (Diamond and Dybvig, 1983). More recently, it has distilled safe assets out of assets that were not so safe through securitization and tranching, for example by creating senior tranches of mortgage-backed securities. The liquidity transformation chain has become increasingly complex, with more and more institutions involved in smaller steps of the liquidity transformation process (Shin 2012). There was an explosion of claims that are internal to the banking sector (arrow 4 in Figure 1) due to securitization, increased leverage and the development of shadow banking (illustrate with Figure showing growth of banks' balances sheets as a share of GDP).

Financial institutions have their own demand for liquidity and safe assets, and this demand has gone up with the size of their balance sheets. This demand can be satisfied in two ways: by holding safe claims on the real sector, such as Treasury bonds or senior tranches of asset-backed securities, or by holding safe claims on other financial institutions. These two sources of safe assets correspond to Holmström and Tirole (1998)'s distinction between "outside" and "inside" liquidity. Inside liquidity is created by lending between agents that are inside the sector, whereas outside liquidity consists of claims on agents that are outside the sector.[3] Holmström and Tirole (1998) considered only two sectors in their original model, the government and firms. Inside liquidity is obtained through lending between firms, whereas outside liquidity consists of government debt. Here, we define outside liquidity from the point of view of the financial sector, so that it may also include safe claims on firms and households (what Bernanke et al. (2011) calls "private label safe assets"). As noted by Bernanke et al. (2011), one problem with "private label safe assets" is that their quality tends to deteriorate when there is a negative aggregate shock, i.e., precisely when they are

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needed the most. The government's commitment technology (i.e. its ability to tax) makes its debt intrinsically safer than that of the private sector.

Outside liquidity and inside liquidity are substitutable in normal times: the financial sector can work with less outside liquidity if it can create more inside liquidity. However, inside liquidity in the Holmström and Tirole (1998) model is not designed to withstand aggregate shocks. Only outside liquidity can, and must be provided in greater quantity in a crisis. From this perspective, one can define the "outside safe assets" of the financial sector as the liquid and safe claims on the real sector that are held by financial institutions. These outside safe assets can be viewed an input into the production of liquidity by the financial sector. It is these "outside safe assets" that people have in mind when they worry about the implications of a shortage of safe assets for financial stability.

Indeed, the recent episodes of financial instability were triggered by the downgrading of outside safe assets that turned out to be not safe (MBS in the US, and government debt in the euro area). This directly affected the banking/financial sector which held those assets. The shock was amplified, inside the sector, by fire sales and network externalities (Brunnermeier, 2009). In addition, certain debt markets stopped functioning because they relied on using assets that were no longer safe as collateral.

3 Supply and Demand of Safe Assets

The recent concerns about safe assets stem from the notion that there is a gap between the increasing demand for safe assets coming from the financial sector and the shrinking supply from the real sector. We are skeptical on both counts.

First, it is not clear that there is a durable increase in the demand for safe assets from the financial sector. The financial sector's supply of safe assets to the real sector has not increased (relative to GDP). This can be seen clearly in Figure 4. The figure reports estimates of the holdings of safe assets by the household and non-financial business sectors, as a fraction of

GDP.[4] The figure shows a remarkable stability. As a fraction of domestic output, holdings of safe assets by the real sector remain stable, around 82 percent of GDP. Two notable deviations from that long term ratio occurred. One in 1981 to 1986, during the Savings and Loans bubble, the other after 2002 during the most recent housing bubble. But even during these episodes, the increase in holdings of safe assets represented at most 20 percent of output. Except for these two episodes, the figure does not demonstrate a growing demand for safe assets. It follows that most of the demand for (and supply of) safe assets occurs within the financial system itself. The Flow of Funds accounts are not the ideal sort of data to illustrate this since to a large extent it nets holdings of the financial sector onto itself. Nevertheless, we can trace out the contours of this increased demand by looking at holdings of US safe assets by the rest of the world. By and large these positions reflect demand arising from foreign financial institutions (or foreign subsidiaries of domestic financial institutions) as well as foreign official agencies. Figure 5 reports the holdings of US safe assets by the rest of the world, expressed as a fraction of US GDP. It also reports holdings of US official assets (Treasuries and Agencies) only. The figure shows a dramatic increase, from less than 3 percent in 1946 to more than 45 percent at the end of 2011. This dramatic rise is mostly the result of foreign demand for US official assets, increasing from 1 percent to 38 percent of US GDP over the same period.

It is unclear why the financial sector would need more safe assets from the real sector as an "input" to supply the same quantity of safe assets to the real sector. One could argue that there is more demand for outside safe assets because of the expansion of leverage and balance sheets inside the financial sector. But in normal times, this larger demand is satisfied by inside liquidity. Inside liquidity may collapse in a crisis and my have to be replaced by outside liquidity for a while. However, if the reduction in inside liquidity is persistent, the

[4] Safe assets are defined as non-credit instruments (checkable deposits and currency, foreign deposits, time and aving deposits, shares of money market mutual funds, repos) and credit instruments (commercial paper, Treasuries and agencies and munis).

most efficient adjustment is perhaps a change in the internal structure of the financial system (e.g. less leverage) such that it can continue to operate with less inside liquidity and the same quantity of outside safe assets as before the crisis. This adjustment may occur naturally, but it may also be encouraged by financial regulation that will for example reduce leverage and the need for inside liquidity.

Similarly, it is not clear that the increase in international reserves reflects exclusively an increase in the demand for safe assets. The reasons behind international reserve holdings by countries like China are varied and precautionary saving is only one of them. A reasonable case can be made that some of these countries could invest their publicly-held foreign assets in a less liquid form (Jeanne, 2012a).

Second, the concerns about a looming shortage in the supply of safe assets may themselves be exaggerated. In general equilibrium there are mechanisms by which the demand for safe assets generates its own supply. The interest rate (or price of safe assets) is endogenously determined. When the supply shrinks or demand increases, the decline in interest rates endogenously increases the face value of the safe assets. The lower interest rate also helps to make the borrower solvent.

In the limit, the supply of stores of value can be completely demand-determined. We present below a stylized overlapping-generation model of store of value based on Caballero et al. (2008). The relevant properties of the model are as follows:

- a stable store of value does not have to be backed by the income of a solvent borrower (Samuelson bubble);
- however, bubbles may burst, and risky bubbles tend to crowd out safe bubbles, leading to financial instability;
- income-backed safe asset can crowd out risky bubbles.

Thus there is a benefit from using an income-backed asset rather than a bubble as a safe asset. We will use this as an argument for going back to a narrow definition of safe assets, as the central bank liabilities plus government debt.

3.1 Ingredients

Consider the following adaptation of the continuous time model of Caballero et al. (2008). We consider the world economy as a closed economy. There is some endowment in quantity X_t, growing at a constant rate g. The demand for stores of value (equivalently here 'safe assets') arises from the *asynchronicity* between income and consumption decisions. The focus on consumption-saving decisions is done mostly for modeling simplicity. One could equivalently focus on the asynchronicity between sales and investment decisions in a production economy, or on a precautionary motive due to liquidity shocks (as in Holmström and Tirole (1998)). In this endowment economy, the simplest way to model a demand for stores of value is to introduce a discrepancy between the timing of income receipts and the timing of expenditure decisions.

We implement this as follows. Every period, a fraction θ of the total population is born. The same fraction θ dies, leaving total population constant. Each newborn generation receives some income at birth. However, it only consumes when it dies. Income received at the beginning of life needs to be saved, which generates a demand for stores of value. We further assume that agents are risk neutral, so all assets must offer the same expected rate of return.

What stores of value are available? To start with, assume that there is a single financial asset with market value V_t. All households currently alive save by holdings claims to this asset. Households about to die sell their financial claims in exchange for the endowment, which they consume. To fix ideas, let's assume that the financial asset is a perpetual claim to a fraction δ of the endowment. Assume also that with an instantaneous probability α, this asset 'disappears.' What that means is that the resale value of the asset falls to 0, destroying the savings of existing agents. When this happens, a new asset appears, i.e. representing a claim to a fraction δ of the endowment, just like the old asset. The only meaningful difference is that this new asset is initially owned by the newly born generation. We can offer three possible interpretation of this asset crash. First, it can be interpreted as a forceful transfer of ownership from old to young, a 'revolution' where old capitalists (i.e. owners of the financial claims) are expropriated to the benefit of the young (i.e. non-owners). Altenatively we can interpret the collapse as a 'debt crisis', if we think of the financial asset as a government security (a claim to future tax revenues). The default on existing public debt hurts current holders of government securities (the old), to the benefit of future taxpayers (the young). Lastly, we could stretch the interpretation of the model and interpret a crash as the outcome of a 'counterparty crisis.' In this interpretation, a crisis occurs when the current holders of the asset are unable to find potential buyers. This could be the case, for instance, if the buying agents need to obtain some financing which they cannot secure. At that point, a firesale occurs since the asset becomes worthless to the sellers, and agents with the most 'cash in the market' are able to acquire it for a fraction of its original price. In the extreme, the cash-rich newborn generation is able to acquire the asset at no cost. Hence, this simple framework can be interpreted in a variety of ways, from a counterparty risk/firesale crisis, to a full-blown debt crisis.[5]

To summarize, in the model a financial asset is characterized by two characteristics: δ and α. δ captures the extent to which the asset represents a claim on *physical output*. With a constant riskfree rate r, and absent default risk ($\alpha = 0$), the value of the asset is equal to $V_t = \delta X_t / (r - g)$.[6] Given r and g, a higher δ increases total asset supply V_t/X_t. Hence δ measures the *fundamental* value of the asset. In particular, if $\delta = 0$, the asset has no fundamental value since it never pays any dividend. α captures the *fragility* of the financial

[5] One notable oversimplification is that these different 'crises' have no implications on the path of aggregate output X_t. This could be relaxed by assuming that aggregate output, or its growth rate is also affected by the crisis.

[6] This is simply Gordon's formula for a stock whose dividend grows at rate g. To see this, note that under risk neutrality $V_t = \int_t^\infty \delta X_s e^{-r(s-t)} ds$.

claim. With a constant interesr rate r and growth rate g, the value of the financial asset is $V_t = \delta X_t / (r - g + \alpha)$.[7] Everything else equal, a higher value of α reduces the expected return on the asset, hence reducing total asset supply. Intuitively, a shortage of assets could develop when either δ is low, or α is high (low fundamental, high fragility).

3.2 Equilibrium

Since agents are risk neutral, the arbitrage equation for the value of the asset is:

$$r_t V_t = \delta X_t + \dot{V}_t - \alpha V_t$$

where r_t represents the riskfree rate. This equation states that the riskfree interest rate r_t is equal to the expected return on the financial asset. The expected return on V_t comprises two terms. The first term, $\left(\delta X_t + \dot{V}_t\right) / V_t$ is the return on the financial asset if there is no crisis. The last term, $-\alpha$, represents the rate of capital loss in case of crisis (-1) times the flow probability of crisis α. The expected capital loss in case of crisis lowers the expected return to the tree. In equilibrium this must be compensated by either a lower value of the tree, or a higher expected capital gain $\dot{V}_t / V_t$.

Denote W_t the aggregate financial wealth at time t. By construction, the following must hold at any instant:[8]

$$W_t = V_t = X_t / \theta$$

The first equality simply states that there is only one asset, so financial wealth must equal the market value of the financial asset. The second equality says that equilibrium in the good market requires that consumption (θW_t) equals output X_t.

[7] To see this, note observe that $E_t [X_s] = X_t e^{(g-\alpha)(s-t)}$.

[8] This condition must also hold when a crisis occurs. To see this, note if a crisis occurs at time t, the existing wealth right before the crisis W_{t^-} is destroyed, but new wealth W_{t^+} is immediately formed, equal to the value of the new asset. Since the new asset has exactly the same properties as the old one, its value is unchanged, so $W_{t^-} = W_{t^+} = V_t$. While holders of the old asset are expropriated and do not consume, aggregate consumption (from newly born who exit) will equal θW_{t^+} and must equal aggregate endowment X_t.

Combining these equations, one can solve for the equilibrium interest rate in this economy:

$$r_t = \delta\theta - \alpha + g.$$

The global equilibrium features a number of interesting characteristics. First, total asset supply and demand are always equal to $1/\theta$ *independently* from the fundamental and fragility characteristics of the financial asset. The model captures the evidence presented in Figure 4, that the ratio of safe assets to domestic output remains quite stable through time. The intuition behind this result is straightforward: the real interest rate always adjusts so as to keep asset supply constant, relative to output. Equivalently, the price of the financial claim (inversely related to the interest rate) rises when asset supply is scarce and falls when it is abundant.

Second, the signature of asset scarcity lies in a depressed value of the world interest rate. A lower value of δ (low fundamental value) or a higher value of α (high fragility) lower the equilibrium interest rate r. This offers a possible interpretation of the global financial crisis: the sudden realization that many existing stores of value were fragile can be thought of as a shift from an equilibrium with α close to zero, to one where α is much higher. The resulting decline in equilibrium interest rates represents a powerful endogenous response to this sudden shortage of stores of value. By increasing the face value of existing assets, it stabilizes the world economy and remedies the initial scarcity. We can interpret this endogenous response as a response along the *intensive* margin.

Third, if we interpret the increase in α as the increased probability of a global debt crisis, then the model predicts, somewhat counterintuitively, that we should expect a *decline* in the risk free rate, not an increase. This is precisely because the increased riskiness of the existing stores of value reduces their price (and hence their supply) at given interest rates, while the decline in equilibrium interest rate restores the initial price, and hence the market value, of these securities. In this world, a riskier fundamental asset does not necessarily command a lower price. This is consistent with the fact that, for instance, the yield on US Treasury securities did not change much following the downgrading of US public debt in July 2011.[9]

Fourth, the model provides a characterization of the Wicksellian, or natural, real rate of interest that would obtain in a flexible price environment. If the world economy had a single monetary authority, absent inflationary pressures, this natural rate would represent the relevant target for monetary authorities (see Woodford (2003)).[10] A sharp decline in the natural rate would thus require a similar drop in the policy rate, so as to prevent the global economy from sliding into recession. Hence, the model provides a natural rationale for the fact that policy rates should decline rapidly and in a coordinated fashion when a global asset shortage emerges. This policy easing does not generate inflationary pressure, as long as the real interest rate does remain equal to the natural rate. In fact, if α is sufficiently high, the natural real interest rate in the model could well turn negative.[11] In that case, global monetary authorities may find themselves constrained by the zero-lower-bound on nominal interest rates. In that situation, the observed low policy rates (close to zero) could still be contractionary since they would implement a real interest rate in excess of the policy rate. Our analysis is therefore potentially compatible with the classic analysis of liquidity traps.

The preceding discussion highlights that the natural interest rate plays a powerful role in matching safe asset demand and safe asset supply. It also indicates that -absent cost-push shocks- monetary conditions need to respond to global asset shortages.

3.3 Samuelsonian bubbles

A case of particular interest is the one where $\delta = \alpha = 0$. In that case, the asset never pays a dividend ($\delta = 0$), so its fundamental value is 0. Yet, this financial asset is 'robust' in the

[9]The model does not say that the yield on all assets would go down. In fact, risk adjusted, the yield on risky asset would remain unchanged and equal to $r + \alpha$.

[10]We abstract here from domestic considerations. Of course the latter may imply that monetary conditions vary across countries. But global monetary conditions would nonetheless need to be consistent with the world natural rate of interest. So if some countries might adopt more contractionary monetary policies than described above, this would have to be offset by more expansionary conditions elsewhere.

[11]Note that since α is a flow probability, it is not constrained to be smaller than 1.

sense that property rights are secure ($\alpha = 0$). Substituting these parameter values into the equilibrium conditions, one sees immediately that the asset will be traded in equilibrium and its value will still be $V_t = W_t = X_t/\theta$, while the natural interest rate will equal $r = g$.

The financial asset in this case is a pure bubble as in Samuelson (1958)'s model of money with overlapping generations: its value derives from the liquidity and storage services it provides to young and old. As in that model, newly born are happy to purchase this financial claim even if it does not pay any dividend, simply because they know that future newly born will want to purchase it from them.

This extreme case illustrates the extent to which the economy exhibits also *endogenous* forces to create '*sui-generis*' stores of value. This result captures the *extensive* margin of adjustment, through the creation of new stores of value, potentially without any fundamental value. But of course there is nothing in the model to guarantee that bubbles are robust. Put differently, if bubbles were always robust there would never be any need to worry about asset shortages! The natural interest rate would be equal to the growth rate, and there would always be enough stores of value so that $r \geq g$.

The problem becomes more interesting (and realistic) if we assume instead that bubbles are 'fragile.' Let's maintain the assumption that $\delta = 0$ (no fundamental value), but assume now that $\alpha > 0$. It is still the case that $V_t = W_t = X_t/\theta$. However, the interest rate is now $r = g - \alpha$. Agents in the economy are cognizant of the fact that the bubble may collapse any instant with flow rate α. As a consequence, they require a premium for holding the asset over the risk free rate. With risk neutral investors, that premium is exactly equal to the probability of collapse so $\dot{V}_t/V_t = r_t + \alpha$. In equilibrium, the bubble remains constant relative to the size of the economy, since the riskfree rate is equal to $g - \alpha$.

The case of the 'fragile' bubble ($\delta = 0;\ \alpha > 0$) yields a number of interesting additional results. First, it indicates that the economy is willing to trade-off robustness and/or fundamental characteristics in exchange for a store of value. It matters much more that there is *some* financial asset, however imperfect, rather than none. In this economy, not trading is the worst possible outcome. Because of the asynchronicity between income and expenditures, without access to financial assets the newborn cannot save, and hence cannot consume when needed.

Second, as before, it is through the macroeconomic response of the interest rate that asset supply adjusts, offseting the deficiencies of the underlying asset and ensuring that there are enough stores of value. As before, $V = W = 1/\theta$, even if the only financial claim is a fragile bubble. These results indicate that the worry outlined in the introduction –that the financial system could collapse onto itself because of a disappearance in stores of value– is not the relevant one. The economy always produce sufficient quantities of financial claims. As the fundamental characteristics of the underlying asset change, so does the interest rate.

What this discussion underscores is that one needs to worry instead about the risk characteristics of the underlying assets and how they affect global financial stability. In particular, it is easy to imagine that one might prefer financial claims with a lower risk of collapse.[12] In the context of the model, we can investigate this issue by considering what happens when more than one financial asset are available, with different characteristics. Would the economy naturally select the safer asset? We address this question formally in the next subsection. We consider first the case where all available financial assets are stochastic bubbles. The subsequent section introduces assets with fundamental value alongside bubbles.

3.4 Competition between pure bubbles

Suppose now that there are two financial assets in the economy, V and B. Both assets are Samuelson-type bubbles with no fundamental value ($\delta = 0$). However, they differ in their degree of fragility. The instantaneous crash rate on the V asset is denoted α, as before. We denote the crash rate on B by λ, that may differ from α. The arbitrage equation for both

[12] This is not obvious in the current model since asset crashes have no aggregate, only distributional, consequences. But this assumption is obviously made for tractability rather than realism.

assets is:

$$\dot{B}_t = (r_t + \lambda)\, B_t,$$

$$\dot{V}_t = (r_t + \alpha)\, V_t.$$

The interesting question from our point of view is: can these two bubbles co-exist? Suppose they do. Then the two arbitrage equations, together with the market clearing conditions $W_t = B_t + V_t = X_t/\theta$ characterize the equilibrium. Defining $b_t = B_t/X_t$ and $v_t = V_t/X_t$, the market clearing conditions implies $0 \leq v_t, b_t \leq 1/\theta$. Combining this with the arbitrage equations gives:

$$r_t = g - \alpha - (\lambda - \alpha)\, \theta b_t.$$

The equilibrium interest rate now depends on the relative size of the B-bubble versus the V-bubble.

A few interesting observations arise from this result. First, the interest rate will always be between the interest rate of the $V-$bubble only economy $(r = g - \alpha)$ and the interest rate of the $B-$bubble only economy $(r = g - \lambda)$. Second, as before and regardless of the composition of the supply, the total supply of stores of value is constant and equal to $1/\theta$. Suppose now to fix ideas that $\lambda > \alpha$ so that the $B-$bubble is more fragile than the $V-$bubble. Inspecting the dynamics of the $B-$bubble, we find

$$\dot{b}_t = (\lambda - \alpha)\,(1 - \theta b_t)\, b_t \geq 0$$

This implies that there are only two possible steady states. In the first one $\bar{b} = 0$ so that the economy never uses the more fragile asset. However, it is easy to see that this equilibrium is unstable. As soon as $b_t > 0$, then $\dot{b}_t > 0$ and the $B-$bubble expands relative to the $V-$bubble. The other steady state is $\bar{b} = 1/\theta$. That steady state is stable, meaning that the all paths starting with $b_t > 0$ converge to it. In that steady state, the fragile crowds out entirely the safer one, a sort of '*Gresham-law*' applied to bubbles. Why should the fragile bubble expand against more robust ones? The answer is that the rate of growth of fragile bubbles needs to be higher, in equilibrium, to compensate for the fact that the bubble is more likely to pop. To see this, note that the arbitrage equations imply $\dot{b}_t/b_t - \dot{v}_t/v_t = \lambda - \alpha > 0$.

While asset crashes have no aggregate consequences in this model, it is easy to imagine situations where asset crashes would generate real volatility and declines in aggregate demand, firesales, bank failures etc...[13] So the result that the financial sector might endogenously load on fragile financial assets as stores of value should be a source of concern. Note further that this is an issue even in the absence of asymmetric information considerations. Many papers in the literature suggest that risk-shifting is taking place because of limited liability, or because of implicit bailout guarantees. Instead, we emphasize a purely macroeconomic (as opposed to informational) reason why the financial system might become more fragile.

Finally, observe that in our set-up financial bubbles can only exist if the interest rate r is lower than the growth rate g. To see this, note that the expected growth rate of bubbles is given by r. If the interest rate permanently exceeds the growth rate, the bubble grows faster than the economy, eventually absorbing all resources. By backward induction, such a bubble can never get off the ground. For bubbles to arise, the economy needs to exhibit dynamic inefficiency: every period, new investment into the bubble equals gX, while the expected rate of return on that investment is rX. With $r < g$, the real sector becomes a net source of funds to the financial sector.

The link between dynamic inefficiency and the possibility of rational bubbles is discussed at length in the literature (e.g. Tirole, 1985, Blanchard and Weil, 2001, Ventura and Martin,

[13] Asset crashes in the model have no real consequence. To see this, suppose that one asset crashes. Then it will reforms itself with exactly the same value so that the total supply of asset is unchanged. If it did not, the other bubble would have to expand to fill the capacity, but this require a drop in the interest rate, which would affect the pricing of the other asset.

2011 and Farhi and Tirole, 2011). Many recent contributions emphasize that it is possible for an economy to sustain bubble even if the economy is dynamically efficient. The key observation is that the market interest rate may be low (which is needed to sustain bubbles) while the social return to capital may be high (which is what is needed for productive dynamic efficiency). The wedge between the market and the social rates of return to capital can in turn arise from financial or informational frictions. In short, one can study set-ups where bubbles can arise even if rates of return to capital exceed the growth rate. But even in these settings, lower interest rate increase the likelihood that bubbles can emerge and survive. To the extent that financial bubbles are always 'fragile', they increase financial instability.

The question of relevance then becomes whether the provision of safer assets can reduce or even eliminate financial bubbles. We consider this question next.

3.5 Introducing a safe asset

Now let's introduce a safe asset. To do this, assume that the V-asset from the previous section has the following characteristics: $\delta > 0$ and $\alpha = 0$. We want to think of an asset with characteristics of that type as safe asset, as opposed to pure bubbles with $\delta = 0$ and $\alpha > 0$, since it has some fundamental value ($\delta > 0$) and is not fragile ($\alpha = 0$). The question is whether this safer asset can co-exist with the fragile bubble. Since fragile bubbles crowd out more robust ones, one might be tempted to conclude that the same will be true here, that the bubble will crowd out the safe asset. This is not the case. To see this, observe that the equilibrium conditions yield:

$$r_t = \delta\theta + g - \lambda\theta b_t$$

so that the dynamics of the bubble become:

$$\dot{b}_t = \left(\delta\theta + \lambda\left(1 - \theta b_t\right)\right) b_t \geq 0$$

It is easy to check that the only equilibrium is the one with $b = 0$ as long as $\delta > 0$. To see this, note that otherwise, any $b > 0$ implies that $E\dot{b}/b > 0$ so that the pure bubble grows faster than the economy. As argued before, this cannot be an equilibrium. By backward induction, the only possible equilibrium satisfies $b_t = 0$.

The immediate benefit of introducting a safe asset is that it rules out fragile bubbles. In fact, it not only eliminates them asymptotically, but also immediately. As soon as the safe asset is introduced, the interest rate rises sufficiently to destroy the value of the bubble-asset. The reason for this is quite intuitive: with the safe asset, the economy is dynamically efficient (since $r = g + \delta\theta > g$). This *immunizes* the economy againts fragile bubbles. Note that throughout, the total asset supply remains unchanged. Only the composition changes.

By extension, the result can be generalized to a generic fundamental asset $(\delta > 0, \alpha \geq 0)$. As long as the fundamental part of the asset is sufficiently large (high δ), and the asset is sufficiently robust (low α), this should immunize the economy against fragile bubbles. This provides a formal way to think about the required characteristics for a 'safe asset.' Following the same steps as before, the equilibrium interest rate satisfies

$$r_t = \delta\theta + g - \alpha - (\lambda - \alpha)\,\theta b_t$$

while the dynamics of the bubble satisfy:

$$\dot{b}_t = [\delta\theta + (\lambda - \alpha)(1 - \theta b_t)]\, b_t$$

with $0 \leq b_t \leq 1/\theta$.

Inspection of the equilibrium conditions indicate that two cases are relevant:

- when $\lambda \geq \alpha - \delta\theta$, the only solution is $b = 0$. To see this, note this implies $\dot{b}/b > 0$ if $b > 0$, so the b bubble is always growing faster than the economy. This condition is always satisfied if the $v-$only economy is dynamically efficient, that is if $r = g + \delta\theta - \alpha > g$ or

$\delta\theta > \alpha$. This result completes our earlier discussion: a safe asset makes the economy dynamically efficient by ruling out the possibility of financial bubbles.

- when $\lambda < \alpha - \delta\theta$ –which require the economy to be dynamically inefficient–, the bubble may survive. If they survive, these 'robust' bubbles have a finite size given by:[14]

$$\bar{b} = \frac{1}{\theta} - \frac{\delta}{\alpha - \lambda} > 0$$

while the corresponding value of the safe asset is

$$\bar{v} = \frac{\delta}{\alpha - \lambda} > 0$$

with an interest rate $r = g - \lambda$.

The second result indicates that the introduction of a safe asset, even if it does not remove all fragile bubbles, removes the riskier ones. In particular, observe that $\lambda < \alpha - \delta\theta < \alpha$ so the types of bubbles that can survive need to be *more robust* than the safe asset itself. Second, when it survives, a bubble expands the supply of stores of value. To see this, note that the interest rate increases from $g + \delta\theta - \alpha$ in the absence of bubble to $g - \lambda$ with the bubble. The size of the safe asset is lower in the presence of the bubble (it is $1/\theta$ in that case versus $\delta/(\alpha - \lambda) < 1/\theta$ in the bubbly equilibrium).

The equilibrium conditions also indicate a trade-off between the fundamental value of safe assets (δ) and their fragility (α). The cut-off condition to eliminate all pure bubbles is $\alpha \leq \delta\theta$. If an asset is robust ($\alpha = 0$) this condition is automatically satisfied, regardless of the value of δ. Otherwise, a higher fragility needs to be compensated by a higher fundamental value. Finally, an increase in the fragility of the bubble (λ) tends to increase the market value of the safe asset : $\partial\bar{v}/\partial\lambda > 0$, indicating that a sudden perception of riskiness about

[14]The equilibrium in that case exhibits the saddle path property so the size of the bubble is fixed.

the fragile bubbles generates a flight to quality and an increase in the market value of the safe asset.

The key result then, is that in presence of fundamental assets, 'normal' equilibrium conditions are restored: safe assets command a premium, more fragility induces capital flight to the safe asset, and safe assets crowd out fragile ones. The discussion also highlights that the two dimensions (fundamental and robustness) are essential in the determination of safe assets.

These results are relevant for our discussion in a number of ways. Going back to our previous discussion one might consider that the only safe assets, in the sense of a low α and high δ are are *public* safe assets: government securities that represent credible claims on future tax revenues (by extension, we can also include money among these assets as a low α, $\delta = 0$ security). Instead, one might consider that *private* label safe assets, of the kind considered by Bernanke et al. (2011) exhibit much higher volatility (a higher λ and a lower δ, equal to 0 in the limit).

This discussion offers a way to think about the different stages of the crisis. Initially, the world experienced a decline in its global δ, due for instance to the consequences of the Asian financial crisis, or the collapse in the dotcom bubble (see Caballero et al. (2008) for an analysis of global imbalances along these lines). Interest rates declined. With a low δ, the condition above for the elimination of fragile bubbles were not satisfied, so 'private label' assets were issued, both by the US and European financial sectors. The low interest rates also fueled leverage, and therefore an increased demand for safe asset 'internal' to the financial sector. This corresponds to a situation where $\alpha > \delta\theta$.

With the onset of the financial crisis, some fragile bubbles collapsed and there was a general re-assessment of the fragility of all financial claims, i.e. an across the board increase in α. Increased financial fragility further reduced interest rates, opening the door to more 'private label' bubbles to emerge. In this context, the low α assets –e.g. US Treasuries–

capture a premium.

3.5.1 Who is supplying the safe asset?

Eliminating private risky assets with a given degree of frability λ requires introducing public safe assets with $\alpha - \delta\theta < \lambda$. As soon as $\alpha < \delta\theta$, then all fragile bubbles are eliminated and the financial system is strengthened. In the limit of $\alpha = 0$ this could be achieved with an arbitrary low level of δ. So in principle, the model says that it is possible even for a tiny issuer of assets (in the limit of $\delta = 0$) as long as $\alpha = 0$. This is unrealistic as it implies that a country like Switzerland can underwrite the entire supply of safe assets to the world. But this limit result does not survive in the more realistic case where $\alpha \geq \underline{\alpha} > 0$. In other words, suppose that there is some incompressible amount of fragility in any asset. Then the requirement that $\delta\theta > \underline{\alpha}$ has important implications for the 'size' of the issuers. Suppose for instance that the fiscal authority in country i issue a public asset with fragility $\underline{\alpha}$. The asset is a claim to future tax revenues τX^i where τ is the implicit average rate of taxation. If country i were under autarky, the supply of this public asset would be enough to ensure root out fragile bubbles as long as $\tau\theta > \underline{\alpha}$. Suppose that this condition is satisfied. Now ask the following question: can country i stabilize the world financial system? The public asset of country i represents a claim to a share $\delta = \tau\omega^i$ of the world output, where ω^i is the share of country i in world output: $\omega^i = X^i/X$. The condition for financial stability becomes

$$\tau\omega^i\theta > \underline{\alpha}.$$

The important consideration is that this condition imposes a minimum size on country $i : \omega^i > \underline{\alpha}/(\tau\theta)$. For instance, with an average tax rate of 20 percent, a marginal propensity to consume out of wealth θ of 5 percent and a lower bound probability of collapse of 0.2 percent per period (one collapse every 500 periods), the minimum size is equal to 20 percent of world output. This simple calculation justifies why the supply of safe assets needs to be sufficiently large, otherwise not the aggregate fundamental value of the asset is insufficient.

Consequently, the provision of safe assets lies with large economies with a sufficiently fiscal capacity, i.e. a deep and liquid market for Treasury securities backed by a substantial share of world output. This helps understand why countries like the United States can play that role, while Switzerland or Germany might be too small.

Coming back to the crisis, the problem with the supply of safe assets does not seem to be that the quantity was insufficient, but rather that the definition of safe assets has been elusive and shifting. In the old times, safe assets were well defined as central bank liabilities (cash) and government debt. With securitization and tranching, new classes of assets came to be used as safe assets (e.g., senior tranches of MBS) in the US, but they turned out to be not so safe. And more recently in Europe, certain government debts have lost the status of safe assets. As a result of those shifting lines of demarcation, the definition of what truly constitutes a safe asset became blurry, leading to a sentiment that no asset is safe any more.

Against this backdrop, we would argue in favor of coming back to the basics. It is of the essence of a safe asset that it cannot become unsafe. The definition of safe assets has a key impact on the the financial sector and so should not be left entirely to the private sector. The authorities should commit themselves to a clear definition of safe assets and back it with a policy regime that makes those assets credibly safe. Claims on the private sector are inherently risky and should stay so to limit moral hazard: for this reason they may not provide a good basis to produce safe assets. Besides money, government debt remains the best candidate for the status of safe asset. We now discuss the conditions under which government debt can remain a safe asset.

4 Safe Assets and the Fiscal-Monetary Nexus

For government debt to remain a safe asset, the government must remain solvent. This leaves open the question of how the monetary authorities can help the fiscal authorities to remain solvent. One view is that the monetary authorities should entirely focus on price stability and let the government remain solvent adjusting fiscal policy conditional on low seigniorage (monetary dominance). This implies, in the limit, that the monetary authorities should stand ready to let the government default if it is faced with a debt rollover crisis. The alternative would be to start monetizing the government's debt, which would replace a bad outcome (default) by one that may well be worse (high inflation). This view of the relationship between central banking and fiscal policy is widely accepted in policy circles and it is supported by the academic literature on monetary policy. However, as suggested by the current problems in the euro area, this view may be inconsistent with the objective of keeping government debt a safe asset, and thus have a significant adverse effect on financial and banking stability.

We would argue that the conventional view misses something subtle about the desirable relationship between central banking and government debt. In fact, the central bank's monetary backstop may help to make government debt a safe asset without taking a large risk of debt monetization in equilibrium, as explained by the following model.[15]

The model has three periods, $t = 0, 1, 2$. The riskless real interest rate is normalized to zero and investors are assumed to be risk-neutral. The government must roll over some debt d_{-1} in period 0 by issuing new debt, which is a promise to repay d_0 units of currency in period 1. There is no fiscal income in period 1 so the government must roll over its debt until period 2. Debt is repaid with a fiscal income y in period 2, the level of which is not known in period 0, when the debt is issued. The level of fiscal income, y, is revealed in period 1. The central bank can buy some government debt in period 1 to avoid a default but this increases the price level in period 2. The price level in periods 0 and 1 is given by $p_0 = p_1 = 1$, but p_2 could be higher. The price level responds to an increase in money supply with a lag because of nominal stickiness.

[15] The analysis in this section is based on Jeanne (2012b).

There is a debt rollover crisis in period 1 if the fiscal income y turns out to be insufficient to repay the debt d_0. In this case, two things may happen: either the central bank buys the government's debt to prevent a default (monetary backstop), or it lets the government default. We denote the probability of a monetary backstop by α. For simplicity, we assume that there is no repayment in a default (the haircut is 100 percent).

The equations of the model are:

$$g = q_0 d_0,$$

$$d_0 = m' - m + q_1 d_1,$$

$$p_2 = \frac{m'}{m},$$

$$q_0 = \Pr(y > d_0) + \alpha \Pr(y < d_0) = 1 - (1-\alpha)F(d_0),$$

$$q_1 = \frac{1}{p_2}.$$

The first two constraints are the budget constraints, where q_t is the unitary price of debt at time $t = 0, 1$. The third equation says that the price level increases proportionately with money supply (with a lag). The third equation gives the equilibrium value of the period-0 price of government debt, q_0, which is equal to the probability of repayment. The probability of repayment, in turn, is equal to the probability that the government is solvent ($d_0 < y$) plus the probability that the government is insolvent but rescued from a default by the central bank ($F(\cdot)$ denotes the cumulative distribution function of y). The fourth equation gives the equilibrium value of q_1, which could be lower than 1 because of an inflation premium.

If $y < d_0$, the central bank has a choice between maintaining a zero inflation rate, and letting the government default at $t = 1$, and rescuing the government from a default by increasing money supply. The monetary backstop avoids a default if $d_1 \leq p_2 y$, that is if $q_1 d_1 \leq y$. If the government creates the minimum amount of money to avoid a default we have,

$$m' = m + d_0 - y.$$

The price of debt in period 0, thus, must satisfy the following equation,

$$[1 - (1 - \alpha)F(d_0)]\, d_0 = g.$$

This equation endogenizes the debt repayment $d(\alpha)$, as a decreasing function of the probability of monetary backstop α and satisfies $d(1) = g$. A higher probability of monetary backstop reduces the default risk premium. It does not increase the inflation premium between period 0 and period 1 because inflation occurs (if it does) between period 1 and period 2.

Figure 2 shows how the probability of default (blue line) and inflation (green line) depend on the probability of monetary backstop. To construct the figure, the initial debt was set to $d_{-1} = 1$, and the fiscal income was assumed to be normally distributed with mean 1.3 and standard deviation 0.2, implying that the government is solvent with probability 93 percent if it does not pay a default risk premium on its debt. However, in the absence of a monetary backstop ($\alpha = 0$) the government has to pay a default risk premium that raises the debt repayment and endogenously reduces its solvency. For our parameter values, the government is in fact unable to refinance its debt in period 0 in the absence of monetary backstop, and must default with probability 1. The probability of monetary backstop must be higher than 43 percent for the government to be able to roll over its debt. When this is the case, the probability of inflation remains relatively small. For a full monetary backstop ($\alpha = 1$), the probability of inflation is equal to the probability that the government is insolvent conditional on not paying a risk premium, which is about 7 percent.

The monetary backstop, thus, does not simply replace a bad outcome (default) by another (inflation), it reduces the probability of a bad outcome altogether by allowing the government

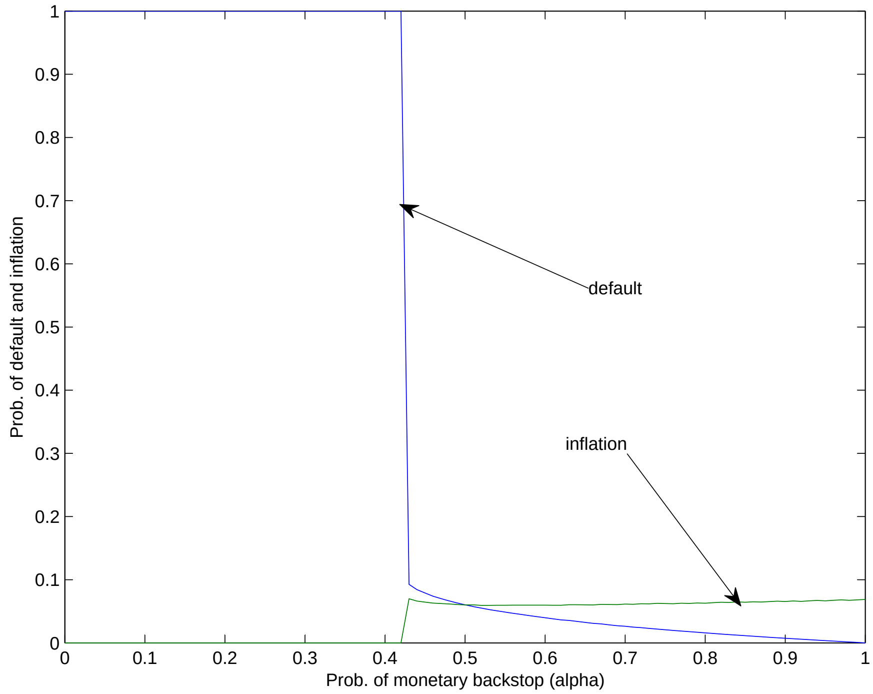

Figure 2: Variations of probability of default and inflation with probability of monetary backstop

to roll over its debt at a low interest rate and mitigating the risk of explosive debt dynamics.

We would interpret the different between the euro area and countries that do not presently have a government debt crisis in spite of bad fiscal fundamentals (the US, Japan or the UK) as a difference in the probability of monetary backstop. Because of the way that the euro area was designed, it has a lower probability of monetary backstop than the US, the UK or Japan. This puts the euro area at a disadvantage in the production of safe assets.

We will then discuss non-monetary options to reestablish government debt as a safe asset in the euro area (euro bonds, etc.)

5 Safe Assets in the Global Economy [sketch]

This section will discuss the implications of our analysis for the competition between safe assets (which to some extent can be interpreted as a competition between reserve currencies).

The main points will be as follows.

- Global banking tends to be in the currency that offers an appropriate supply of safe assets. This role is fulfilled now primarily by the US dollar.

- Based on our analysis, the central role of the dollar is comforted rather than weakened by the crisis. In particular, the fiscal-monetary nexus seems more conducive to the production of safe assets in the US than in the euro area.

- Thus we would not predict an imminent decline of the US dollar. But that does not mean that a decline of the dollar will be smooth if and when it occurs. One lesson from our analysis is that the status of safe asset is supported by virtuous feedback loop mechanisms that may turn vicious.

6 Conclusions [to be completed]

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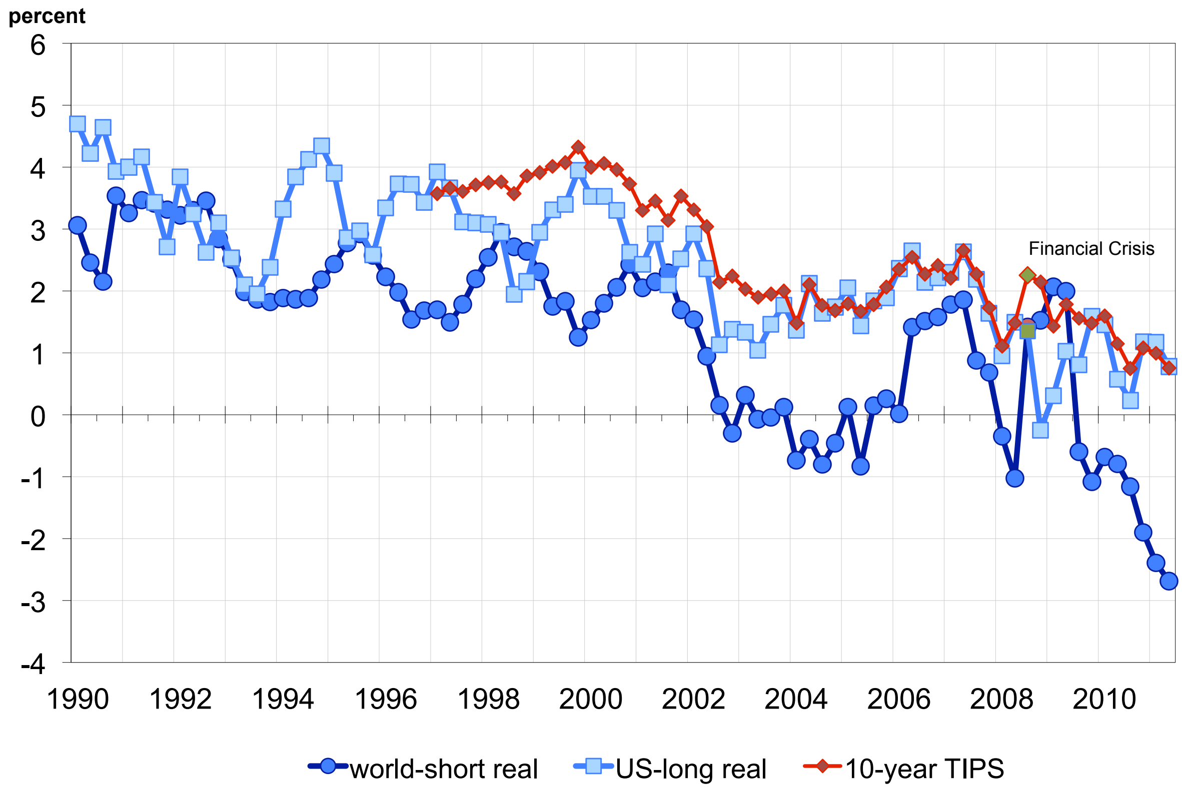

Figure 3: World Real Interest Rates, 1990Q1-2011Q3. Source: Global Financial Database, OECD, International Financial Statistics, Survey of Professional Forecasters.

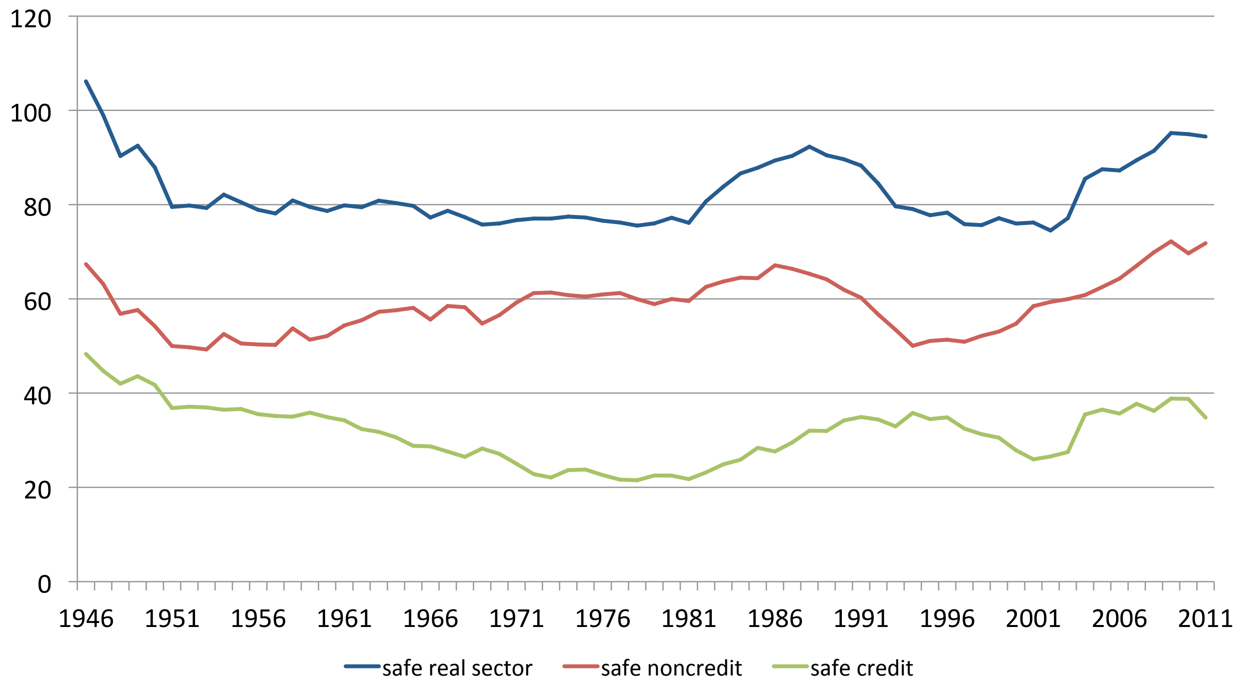

Figure 4: Holdings of Safe Assets by US Households and US Non Financial Business Sectors. Percent of GDP. Source: Flow of Funds Accounts

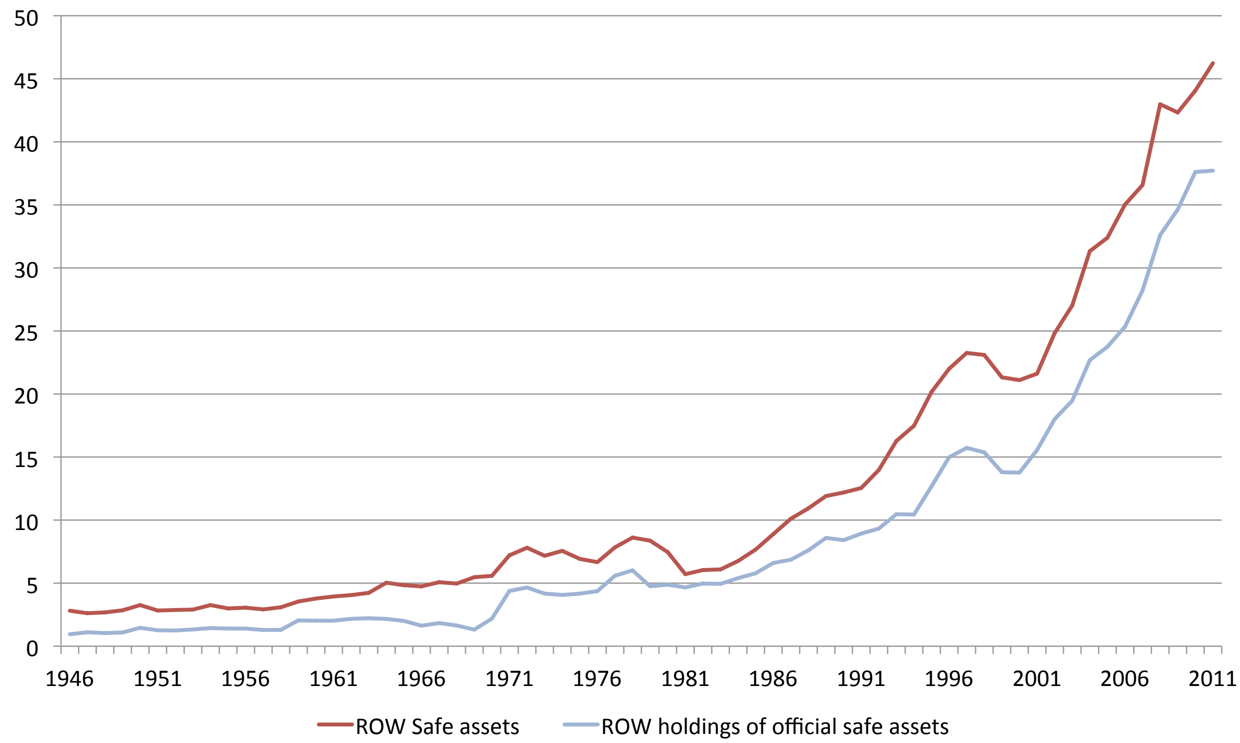

Figure 5: Holdings of Safe Assets by the Rest of the World. Percent of US GDP. Source: Flow of Funds Accounts