Debt and Money: Financial Contraints and Sovereign Finance*

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Abstract

Economic analyses of of corporate finance, money, and sovereign debt are largely considered separately. I introduce a novel corporate finance framing that focuses on financial constraints at corporate and country levels, making explicit the tradeoffs involved in relying on domestic versus foreign-currency debt to finance investments or government expenditures. The new framework provides new insights into issues ranging from the cost and benefit of foreign exchange reserves to sovereign debt restructuring.

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Finance has taken a beating lately. It is not just the financial services industry that has lost its luster with the public at large, as Luigi Zingales (2015) has distressingly reminded us. It is also the empirical validity and pertinence of classic theories of corporate finance that appear to be thrown into question by recent research. Yet, while criticism is clearly warranted, we should be careful not to throw away the baby with the bathwater. So, in this paper I want to focus on the positive and propose some valuable insights that a corporate finance perspective can bring when applied to a particular economic problem.

Stewart Myers (1984) famously began his presidential address by asking "How do firms choose their capital structures?", and promptly answering "We don't know." More than twenty years later Lemmon, Roberts and Zender (2007) began with the similar question "...after decades of research, how much do we really know [about corporate capital structures]?" and found that "The adjusted R-squares from traditional leverage regressions using previously identified determinants range from 18% to 29%, depending on the specification. In contrast, the adjusted R-square from a regression of leverage on firm fixed effects (statistical "stand-ins" for the permanent component of leverage) is 60%, implying that the majority of variation in leverage in a panel of firms is time invariant and is largely unexplained by previously identified determinants." Last year, DeAngelo and Roll (2015) have further complicated the picture by finding that leverage is actually far from time invariant and that "leverage cross-sections more than a few years apart differ markedly." This poses an even greater challenge to existing theories. Not only is most of the variation in the cross-section unexplained but also what is driving the time-series variation is poorly understood.

Does this mean that the exisiting body of corporate finance theory should be discarded? My reading of the theory is that, while admittedly it needs to say more about the determinants of corporate leverage, it is much more pertinent for understanding how financial constraints shape corporate investment and financial

decisions. The general, robust, principle that has endured since Myers (1984) is that corporations should tap the cheapest marginal sources of funds for their investments. In other words, corporations should pledge the cash-flows that are the most favorably priced by the market at any moment in time.

Taking this principle to the extreme, by recognizing the fact that sometimes the market may overvalue some claims on the corporation, another robust precept is that firms can profit by timing capital markets and issuing claims that are temporarily highly priced. A remarkable finding of Baker and Wurgler (2002) is that such market timing of equity issuance has long-run effects on a firm's capital structure. The history-dependent succession of investment and market-timing opportunities is to a large extent what shapes a firm's capital structure at any moment in time. No wonder that firm fixed effects and firm-decade interaction effects have such strong explanatory power, for to a large extent each firm has its idiosyncratic investment and/or market-timing opportunities.

But, corporate finance theory has a broader scope than just the study of corporate leverage: it is also, and perhaps mainly, about understanding financial constraints that prevent corporations from making efficient investments. If there is one deep, general, lesson from the global financial crisis of 2007-09 it is that financial constraints matter: they bite a little most of the time, a lot some of the time (and they are deadly in extreme crises). What is more, when they bite a lot the stagnation they engender persists for long stretches of time. Those who are tempted to purchase model simplicity and elegance at the price of suppressing financial constraints do so at their own peril.

So, what makes corporate finance relevant is the universal presence of financial constraints. At the margin, most economic decisions are affected by financial constraints. Understanding these constraints, therefore, helps us better understand economic decision-making. And understanding how to relax financial constraints helps us achieve more efficient resource allocation.

To illustrate what insights can be obtained from a corporate finance framing I propose here to apply a corporate finance perspective to sovereign finance and thereby suggest new insights for monetary theory and sovereign debt. I will build my discussion around a companion paper, Bolton and Huang (2016), that lays out the formal analysis, my previous research on sovereign debt, Bolton (2003), Bolton and Skeel (2004, 2005), and Bolton and Jeanne (2007, 2009 and 2011), and related literature in international finance.

1 The Capital Structure of Nations

As others have done before, one can think of countries as corporations. While obviously highly reductive, consolidating all agents in a country into a single representative decision-maker has the advantage of bringing out in a simple way the economic objectives of a nation and the constraints that it faces, in particular its financial constraints. The drawback, as with corporations, is that the consolidation buries all inside agency and governance issues. And, consolidation poses difficult empirical challenges.

If one thinks of a country as a corporation it is natural to ask what is the analog for a country of a corporation's capital structure. What is the country's debt-equity ratio? Indeed, what stands for equity for a country? In Bolton and Huang (2016) we suggest that for a country what corresponds to equity is fiat money. Of course, dollar bills don't come with voting rights, but money, in effect, entitles the holder to a share of a country's output just like a share of common stock entitles the holder to a pro-rata share of residual cash flow. That is the analogy we focus on. Much of finance theory models equity as a claim on residual cash flow disregarding voting rights. So, the analogy between money and equity, as it is modeled in finance theory, is quite close.

I will also amalgamate fiat money with domestic-currency debt and treat them

both as equity. This is, again, not so far-fetched. A domestic-currency sovereign bond is, in effect, a *pay-in-kind* (PIK) note. When corporations issue such notes they are treated as close substitutes for equity by the tax authorities and corporations typically cannot freely deduct any interest payments in kind from corporate taxable income (see Bulow, Summers and Summers, 1990). Similarly, treasury bills are held as money-like reserves by many institutions, and repurchase agreements (repos) backed by treasury bonds are widely perceived as money-like instruments, just as money-market mutual funds are seen as close substitutes for demand deposits.

What do we learn from making an analogy between fiat money and equity? Mainly, we can apply classical tradeoffs between equity and debt financing from corporate finance to sovereign finance. In particular, the theories around Myers (1977), Myers and Majluf (1984), Stein (1996) and Baker, Stein and Wurgler (2003), which trade off the costs of debt-overhang, or the costs of default, against the potential dilution costs of equity issuance seem particularly relevant. A nation with high foreign-currency debt outstanding, or with highly volatile GDP, could be better off issuing money or domestic-currency debt to finance its investments, even if this gives rise to some inflation.

There is, in short, an interesting parallel between dilution costs and inflation costs. Incumbent shareholders in a company see their ownership diluted when the company issues stock to new shareholders at a price below its intrinsic value. This does not mean that any stock issue necessarily involves dilution. As Stein (1996) and Baker, Stein and Wurgler (2003) have argued corporations can also be in situations where they are able to issue new shares when the company's stock is overvalued. In such situations the equity issue, in effect, results in more valuable ownership for incumbent shareholders. Similarly, printing more money can result in inflation and loss of purchasing power for domestic residents if the increase in money supply is larger than the increase in output. But, as with new stock issues and dilution, printing more money does not *necessarily* lead to inflation and a debasement of the

currency.

Another important observation that follows from this parallel is that the cost of inflation, like the cost of dilution, is at its core a wealth redistribution cost. The cost of inflation (if there is any) is the transfer of wealth from the old to the new holders of money. We know from Myers and Majluf (1984) that a rights issue that is taken up by all exisiting shareholders cannot involve any dilution cost, for all old shareholders receive the same pro-rata share increase at the same price, so that in the end they still hold the same pro-rata share in the company. Equally, if new money were issued to all holders in proportion to their holdings then there would be no cost of inflation. Another way of making the same point is that a stock split should not affect firm value, just as a change in currency denomination should not affect the value of a country's real GDP.

While no-one has as far as I know made the analogy between corporate equity and fiat money (and domestic-currency debt), there is an extensive literature in international finance on the risks associated with foreign-currency sovereign debt issues. Much of the literature following Eichengreen, Hausmann and Panizza (2003) takes it for granted that all but the most economically advanced countries can issue only foreign-currency debt. They use the term *original sin* to refer to situations where emerging market countries have little choice but to finance themselves with foreign currency debt.

Such extreme situations are not unlike the constraints faced by many start-up firms, whose only source of external finance is debt. However, as economies and firms grow and establish a reputation for creditworthiness, their financial options expand to the point where the classical tradeoff described above between debt and equity financing becomes meaningful. It is worth pointing out in this respect that in recent years many emerging market countries have successfully issued domestic-currency debt in international markets, so much so that the original sin state is less and less descriptive of the financial reality they currently face.

To gain better appreciation for what a corporate finance framing of sovereign finance can deliver I will now turn to a brief description of the model developed in Bolton and Huang (2016) and the key results it delivers. I will then discuss its empirical implications and limitations, before considering the lessons from corporate finance for sovereign debt restructuring.

2 The Bolton and Huang Model

The basic model structure is a classical three period corporate finance framework, but applied to a small open economy. At date 0 the nation may undertake an infrastructure investment of size $k > 0$. At date 1 the initial endowment of goods $w > 0$ is divided between consumption c_1 and inputs for production. At date 2 output is realized and consumed. The investment at date 0 can be financed with either debt or money.

There is a representative risk-neutral household maximizing her life-time utility of consumption,

$$U(c_1, c_2) = \beta c_1 + c_2, \tag{1}$$

where $c_t \geq 0$ for $t = 1, 2$ and $\beta < 1$. Households can store their initial endowment or sell it to firms. Storage results in some depreciation, so that one unit stored from dates 1 to 2 depreciates to $\delta < 1$. The economy comprises a continuum of identical households and firms operating in perfectly competitive markets.

Production at date 1 requires the endowment (consumption good) as an input: if a firm obtains x in inputs at date 1 its output at date 2 is $y \equiv \theta Q(k) f(x)$, where $f' > 0$, $f'' < 0$, and θ is a productivity shock with p.d.f. $h(\cdot)$ and c.d.f. $H(\cdot)$ on the support $[\theta_L, \theta_H]$. The factor $Q(k)$ reflects the increase in productivity from infrastructure investments k at date 0. By investing k productivity is boosted by the factor $Q(k)$, where $Q(0) = 1$, $Q' > 0$ and $Q'' < 0$. To streamline the notation

we shall whenever possible denote

$$\Omega(k,x) \equiv Q(k)f(x).$$

At date 1 households start out holding their endowment w and firms hold money m. Inputs are purchased from households with money in a competitive market at date 1, and consumers use their money savings to purchase firms' output at date 2, so that money plays the dual role of *means of exchange* and *store of value*.

Firms are owned by entrepreneurs who maximize date 2 output (their consumption is a fraction of final output) and the continuation value of the firm $V(m_2)$, which is strictly increasing in m_2, the representative firm's holdings of cash at the end of period 2.[1] At date 0 the representative household of the country can issue claims against date 2 output to finance the investment k.

Quantity Theory of Money. The model is set up so that the quantity theory of money holds. Under the sufficient conditions that $f'(w) > 1$ and $\bar{\theta} \geq 1$, it is optimal for households to sell their entire endowment at date 1 as inputs for production to firms, so that $x = w$, the competitive price of inputs is $p_1 = \frac{m}{w}$, and the price of goods at date 2 is

$$p_2(\theta) = \frac{m}{\theta f(w)}.$$

We show that households cannot do better than sell their entire endowment for a price p_1 at date 1, and firms cannot do better than sell their production for $p_2(\theta)$ at date 2. Given these expressions for equilibrium prices at dates 1 and 2, it is straightforward to see that a doubling of the quantity of money m simply doubles the price of goods at dates 1 and 2.

Modigliani-Miller theorem for nations. The model also delivers a Modigliani-Miller theorem for the frictionless economy. To see this, consider next the situation of the country at date 0 when it invests in a positive net present value infrastructure

[1] The value $V(m_2)$ is the value of future inputs for production that can be bought with m_2 (see Bolton and Huang, 2016). Money has value at date 2 if firms value end-of-period money holdings, solving the Hahn problem (1965).

investment that raises the country's productivity. The country raises k from international capital markets at a world price of 1. It can pay for k by either increasing its money supply by $(\Delta - 1)m$, where $\Delta > 0$ is such that the new money printed is worth k, or by issuing a foreign-currency denominated debt claim $D \geq k$ repayable out of period 2 output. In the frictionless economy the country can commit not to default and not to print more money. Under full commitment we then have $D = k$ and

$$\frac{(\Delta - 1)m}{E[p_2(\theta)]} = k,$$

where

$$p_2(\theta) = \frac{\Delta m}{\theta Q(k) f(w)}.$$

That is, foreign sellers of capital at date 0 must be made whole and get a claim worth the same (in expectation) as the amount invested. When they exchange k for money $(\Delta - 1)m$, the total money supply at date 2 is Δm and total output for any productivity shock realization θ is $\theta Q(k) f(w)$, so that the price is $p_2(\theta)$ as given above. By spending their money holdings $(\Delta - 1)m$ foreign investors can then get output $(\Delta - 1)m/p_2(\theta)$. In expectation the output obtained must be worth the same as the capital invested.

Modigliani-Miller equivalence obtains when:

$$\frac{\bar{\theta}\Omega(k, w)}{\Delta} = \bar{\theta}\Omega(k, w) - k.$$

The left-hand side is the expected consumption obtained at date 2 by residents under a money-financed investment and the right-hand side is the expected consumption under a debt-financed investment. We show that this is the case under full commitment. The equivalence holds even with risky debt financing as long as there are no deadweight costs of default, and for any combination of debt and money financing.

As in all corporate finance theories, capital structure for the nation only matters in the presence of frictions. In Bolton and Huang (2016) we introduce two frictions.

First, a classic willingness to repay problem for foreign-currency debt: When date 2 realized output is too low relative to the country's outstanding debt obligations, the country strategically defaults even if it incurs costs in the form of output losses as a result of default. Second, the nation may not be able to perfectly commit to keep money issuance under check so as to keep inflation under control. The government (acting in the interest of the representative agent) then trades off the dilution costs of money against the expected default costs of debt, to determine the optimal form of financing of investment.

2.1 Unwillingness to Repay versus Willingness to Inflate

The first friction – a country's unwillingness to repay its debts when they are too high – is standard in the international finance literature (see for example Eaton and Gersovitz, 1981, and Bulow and Rogoff, 1989). In our model, a country that promises to repay D in foreign currency (i.e. output) at date 2 to foreign investors may choose to default if the cost of default is smaller than the cost of servicing the debt. When the country defaults it suffers a percentage loss in final output $\phi > 0$ and can only consume $(1-\phi)\theta\Omega(k,w)$. Therefore the country defaults on its debt obligation D whenever $\theta\Omega(k,w) - D < (1-\phi)\theta\Omega(k,w)$.

If

$$\theta_D = \frac{D}{\phi\Omega(k,w)}$$

denotes the cutoff at which the country defaults, then the credit risk holders of the country's debt face is given by $\Pr(\theta < \theta_D)$. Should the country decide to finance its investment through a foreign-currency debt issue then, to compensate foreign investors for holding credit risk, the face value of debt D must be set so that

$$\Pr(\theta \geq \theta_D)D = k.$$

The expected cost of default is then given by:

$$\Pr(\theta < \theta_D)E[\theta \mid \theta < \theta_D]\phi\Omega(k,w).$$

The second friction – the dilution or inflation costs that may follow from a money-financed investment – while somewhat familiar to a corporate finance audience is typically not formally modeled in the international finance literature. Even for a corporate finance audience the way we model the potential costs associated with printing money may seem slightly unusual. Although the general idea of dilution costs is direcly inspired from Myers and Majluf (1984) the way we model these costs is closer to Dittmar and Thakor (2007) and the 'market-driven' corporate finance literature (Baker, 2009).

If the country funds k by printing money (or issuing domestic currency debt) the costs it potentially faces relate to exaggerated inflation expectations of foreign investors, which result in an unwarranted debasement of the currency. More formally, it is not known at date 0 whether the future government at date 2 will be a *monetary dove* or a *monetary hawk*. A *monetary-dove* administration expands the money supply at date 2 for domestic residents by an extra amount $(\Delta_1 - 1)\Delta_0 m$, which results in a higher nominal price level, and thereby brings about a transfer of wealth from foreign investors to domestic residents. A *monetary-hawk* government does not expand the money supply at date 2.

Domestic residents believe that they will have a monetary-dove government at date 2 with probability $\lambda \in (0, 1)$. Foreign investors' beliefs may differ as in Scheinkman and Xiong (2003). Moreover, foreign investors' revised beliefs that they will face a monetary-dove administration at date 2, conditional on a money issue $(\Delta_0 - 1)$ at date 0, are increasing in Δ_0. In other words, denoting by $\mu(\Delta_0)$ foreign investors' conditional belief that a monetary-dove government will be in place at date 2, the model assumes that $\mu' \geq 0$. A simple functional form is $\mu(\Delta_0) = \underline{\mu} + \gamma\Delta_0$, with $\underline{\mu} < \lambda$ and $\mu(\Delta_0) > \lambda$ for a sufficiently large Δ_0.

The key tradeoff can be illustrated for the special case when $\mu' = 0$ and by contrasting 100% debt financing with 100% money financing. Under money financing, the country issues money $(\Delta_0 - 1)m$ at date 0 to fund k, which results in a price

level at date 2 of

$$E[\hat{p}_2(\theta)] = \frac{m\Delta_0\Delta_1}{\bar{\theta}\Omega(k,w)}$$

under a monetary-dove, and

$$E[p_2(\theta)] = \frac{m\Delta_0}{\bar{\theta}\Omega(k,w)}$$

under a monetary-hawk government. Therefore, foreign investors require a payment in money $(\Delta_0 - 1)m$ in exchange for the investment k such that

$$[\frac{\mu}{E[\hat{p}_2(\theta)]} + \frac{1-\mu}{E[p_2(\theta)]}](\Delta_0 - 1)m = k.$$

Substituting for $E[\hat{p}_2(\theta)]$ and $E[p_2(\theta)]$ in this equation, it is a matter of simple algebra to derive the required increase in money supply at date 0:

$$\Delta_0(k) = \frac{(\frac{\mu+(1-\mu)\Delta_1}{\Delta_1})\bar{\theta}\Omega(k,w)}{(\frac{\mu+(1-\mu)\Delta_1}{\Delta_1})\bar{\theta}\Omega(k,w) - k}. \tag{2}$$

Foreign investors assign a present value of k to $(\Delta_0(k)-1)m$ but domestic residents value $(\Delta_0(k) - 1)m$ at

$$(\lambda + (1-\lambda)\Delta_1)\bar{\theta}\Omega(k,w)\left(\frac{\Delta_0(k)-1}{\Delta_0(k)\Delta_1}\right).$$

Therefore, domestic residents perceive a cost from currency debasement or loss in purchasing power of

$$(\mu - \lambda)\bar{\theta}\Omega(k,w)\frac{(\Delta_1 - 1)(\Delta_0(k) - 1)}{\Delta_0(k)\Delta_1}$$

whenever $\mu > \lambda$. They compare this cost to the costs of default under foreign-currency debt financing.

Optimal Financing. When comparing these costs, the algebra is considerably simpler if one further assumes that θ only takes two values $\theta \in \{\theta_L, \theta_H\}$ with $\Pr(\theta = \theta_H) = \pi \in (0,1)$. The tradeoff between money and debt financing is then brought out most interestingly when debt financing exposes the country to default in the low productivity state θ_L. Then the repayment promise the country must make

to be able to raise k through an external debt issue is given by $D = k/\pi$ and the country incurs expected costs of default under debt financing of $(1-\pi)\theta_L\phi\Omega(k,w)$. Under monetary financing, on the other hand, expected dilution costs are

$$(\mu-\lambda)(\pi\theta_H+(1-\pi)\theta_L)\Omega(k,w)\frac{(\Delta_1-1)(\Delta_0(k)-1)}{\Delta_0(k)\Delta_1}.$$

Comparing these two expressions one obtains the following simple condition that succinctly summarizes when monetary financing dominates debt financing:

$$(\mu-\lambda)(\pi\theta_H+(1-\pi)\theta_L)\frac{(\Delta_1-1)(\Delta_0(k)-1)}{\Delta_0(k)\Delta_1}<(1-\pi)\theta_L\phi\Omega(k,w). \quad (3)$$

2.2 Implications and Caveats

The original sin notion of Eichengreen, Hausmann and Panniza (2003) can be interpreted as a special case of this framework. When $(\mu-\lambda)$ is very large, international investors distrust an emerging market issuer to keep its inflation under control so much, and demand compensation for holding inflation risk that is so large, that the country is better off financing its investments with foreign-currency debt. But that is no panacea, as the country then exposes itself to the risk of a debt crisis and the cost of default.[2] Arguably, the framework outlined above underestimates the risk and cost of debt crises when the country borrows in foreign-currency denominated debt. An obvious cost that has not been brought into the analysis but that is considered in Bolton and Huang (2016) is the cost of *debt overhang*, which can depress growth even if there is no actual default. Another cost associated with foreign-currency debt, which has been emphasized in the international finance and macroeconomics literatures is the cost of *self-fulfilling debt crises* (see Calvo, 1988, Chang and Velasco, 2000, Burnside, Eichenbaum and Rebelo, 2001, Cole and Kehoe, 2000, Jeanne and Wyplosz, 2001, and Jeanne, 2009). When the country has to engage in costly fire-sales of assets in order to service its foreign-currency debt

[2] Current Credit Suisse CEO Tidjane Thiam recently declared "I did a lot of infrastructure development in my life. To fund them with foreign currency is madness. OK? Madness." [*Thiam Criticizes Foreign Debt Reliance*, Simon Clark, *Wall Street Journal* 7 October 2015]

obligations, then the mere expectation of such fire-sales may trigger a debt crisis, even if the country is perfectly willing and able to service its debt under more favorable expectations and interest rates. The Bolton and Huang (2016) framework does not allow for such self-fulfilling crises and therefore arguably tilts the balance too much in favor of foreign-currency debt financing.

A simple but revealing insight from condition (3) is that countries with relatively high productivity even in crisis times (a high θ_L) and a large deadweight cost of default ϕ, for example due to the risk of a banking crisis in the event of default (as in Bolton and Jeanne, 2011) could be better off financing their investments by printing money (or issuing domestic-currency debt).

A more general lesson for monetary theory is that the optimal quantity of money depends on a subtle tradeoff between inflation and expected debt default costs. In general, there is no simple rule for the evolution of the optimal quantity of money in an economy with financial frictions. How much a nation should rely on printing money as opposed to foreign-currency debt financing depends on the value of investments to be funded, the evolution of differences of beliefs on the risk of inflation, and the expected risk of default on the nation's debt. As Baker and Wurgler (2002) have shown for corporate leverage, a country's optimal quantity of money and ratio of domestic-to-foreign currency debt can be understood as the history-dependent outcome of a succession of changes in inflation expectations, exchange rates, growth opportunities, and the evolving tradeoffs the country faces with respect to its best sources of funding over time.

A corporate finance framing can also deliver novel implications for countries' foreign currency reserve management. There has been renewed focus on foreign exchange reserves in recent years as a result of the spectacular buildup in reserves by several Asian countries in the aftermath of the Asian financial crisis of 1997-1998. What accounts for this buildup, and what are the implications? Two leading hypotheses have been explored in the international finance literature, a "mercantilist"

and "precautionary savings" motive, but neither has found substantial empirical support (see Aizenman and Lee, 2007 and Jeanne, 2007). The mercantilist view is that foreign exchange reserve buildup reflects an attempt by the country to lower its exchange rate, thereby increasing the competitiveness of its export industry and generating current account surpluses (Dooley, Folkerts-Landau and Garber, 2004). The precautionary savings theory is that countries build up reserves to be able to dampen negative terms of trade and "sudden stop" shocks, thereby achieving better consumption smoothing (see Jeanne, 2007, Caballero and Panageas, 2007, Durdu, Mendoza and Terrones, 2009 and Jeanne and Ranciere, 2011). There is also the special category or commodity exporting countries that build reserves in an effort to forestall the "Dutch disease" (Van der Ploeg and Venables, 2011) or to soften fluctuations in commodity export revenues (Céspedes and Velasco, 2012).

A key conceptual difficulty for determining the optimal size of foreign exchange reserves is to decide what the opportunity cost of building and holding reserves is. A shortcut that a number of empirical studies rely on is to take the cost of building reserves to be the difference between the promised interest rate on the country's foreign-currency debt and the return on reserves (see Jeanne, 2007). The idea is that to add a dollar to reserves the country must borrow the dollar at rate R and then invests that dollar in US treasuries at rate r, thus incurring a cost $(R - r)$. But, as Jeanne (2007) has pointed out and Summers (2007) has emphasized in his dicussion of Jeanne: "In a perfect capital market, where all assets are perfect substitutes and reserves are financed by issuing domestic debt, holding reserves costs nothing at all." [pp 69 *Brookings Papers on Economic Activity*, 2007, Volume 1].

A corporate finance framework can further illuminate this issue. Basically, the marginal cost of building reserves is the dilution cost associated with printing more money or issuing more domestic currency debt. To the extent that foreign investors are more pessimistic than domestic residents about future expected inflation, they will undervalue the domestic currency to the point that purchases of foreign currency

involve an opportunity cost. For some countries this cost may be too large to make it worthwhile to accumulate substantial reserves. Importantly, however, this cost may be small for other countries (or even negative in special circumstances). This is the case for countries with low inflation (or possibly even deflation) expectations. Indeed, there may be a strictly positive return associated with purchases of foreign currency assets through domestic currency issuance for such countries.

Two prominent examples of countries that have been in this position are Japan and Switzerland. Japan's foreign exchange reserves increased from just over 7% of GDP in 2000 to 26% in 2014. During this period Japan's inflation rate has been in deflation territory, hovering around 0% (except for 2014 when its inflation rate peaked at 2.7%). Japan's buildup of reserves is mostly the result of cumulative current account surpluses, which have not been entirely offset by capital account deficits, as Figure 1 illustrates. Even more striking is Switzerland's buildup of reserves, which from 2007 to 2012 increased from 10% to 70% of GDP, and now stand at 100% of GDP. While Switzerland also ran substantial current account surpluses the rapid buildup of reserves is due to the fact that in some years both current and capital accounts were in surplus, as can be seen in Figure 1. This buildup against domestic currency issuance has been achieved essentially for free, with Switzerland's inflation rate declining from 2.5% in 2007 to a negative value by 2014.

These two examples (along with Denmark), and those of other countries that have failed to take advantage of similar opportunities of favorable exchange rates to build reserves (in particular during episodes of massive 'hot money' inflows), point to the importance of a better understanding of the dynamics of foreign currency reserve management. Indeed, the recent studies of Dominguez, Hashimoto and Ito (2012) and Céspedes and Velasco (2012) provide compelling evidence of the important GDP advantages countries with substantial foreign currency reserves have obtained during the financial crisis of 2007-09. Alas, our understanding of foreign currency

reserve management, what is a reasonable target reserves-to-GDP ratio, when to build up reserves, when to draw them down, how to combine reserves with foreign currency debt liabilities, is still rather imprecise as the following quote from Larry Summers broadly illustrates:

> "Soon after I arrived at the Treasury as undersecretary of international affairs in 1993, I was briefed about the Exchange Stabilization Fund. One of the first questions I asked was why this fund was the size that it was. Greenspan reported to me somewhat sheepishly their conclusion that, depending upon certain assumptions that were difficult to pin down, the optimal level [of reserves] was somewhere between $20 billion and $2 trillion." [pp 67 *Brookings Papers on Economic Activity*, 2007, Volume 1]

Recent advances in the corporate finance literature on the dynamics of corporate savings and cash management can provide a helpful reference point for the analysis of a country's foreign exchange reserves management (see Almeida, Campello, Cunha and Weisbach, 2014 for a recent survey). But there is an important difference between corporate cash management and foreign exchange reserve management. When a corporation's cash holdings reach the point where the marginal corporate value of cash equals the after-tax value of cash to shareholders, it is optimal for the corporation to pay out a dividend (Bolton, Chen and Wang, 2011, 2013, 2014). There is no exact analog for a dividend payout for the holders of a country's currency, which raises the question of what payout means for a country that has accumulated excessively large foreign exchange reserves. Typically, foreign exchange reserve drawdown in practice means foreign exchange intervention to support a falling exchange rate. This is analogous to a stock repurchase. Engaging in such repurchase operations makes sense when there is a risk that the value of the domestic currency depreciates excessively as a result of potentially self-fulfilling

inflation expectations. Past experience with such interventions, however, is not encouraging, for countries in such situations have found that their foreign currency reserves are insufficient to fund large enough interventions to have a long-lasting impact on the exchange rate. Note also that for countries like Switzerland, Japan and Denmark it does not make sense to spend their "excessive" reserves supporting an already over-valued exchange rate. So how should these countries pay out their excess reserves? The obvious answer seems to be in the form of fiscal transfers. But, this begs the question of what the criteria should be for when such transfers are justified.

Another important caveat to the analogy of fiat money and equity is that fiat money is not just a store of value but also, and mainly, a means of exchange. As long as the velocity of circulation of money is constant a relatively straightforward parallel can be made between the purchasing power of money and a stock's earnings per share. But in practice the velocity of circulation of money is endogenous and time-varying, which limits the suitability of the analogy.

As we mentioned before, treating a country as a consolidated unit with a representative agent is another considerable oversimplification. In reality a country's capital structure, the currency composition of its debt and its money supply (M2), is not solely determined by the country's government, but also by private actors, corporations, banks, and households acting independently and imposing externalities on each other. One simple first approach to disaggregating a country into a government and a private sector with multiple agents is the dual-agency framework proposed by Tirole (2002, 2003), in which private firms move first by investing and financing their investments with a combination of domestic and foreign debt and the government moves second by introducing policies that are friendly to domestic firms (see also Jeanne, 2003). The dual agency problem faced by international lenders is that they must deal not only with the private sector borrower's, but also with the government's strategic behavior. A central prediction that emerges from

this framework is that private agents (borrowing firms and international lenders) choose to distort their debt contract in an effort to mitigate the agency problem with respect to the government. They engage in either more short-term debt financing (Tirole, 2003) or more foreign-currency debt financing (Jeanne, 2003) so as to reduce the government's ability to introduce policies that favor domestic borrowers at the expense of international lenders. Basically, the argument is that by making their debt structures more fragile borrower and lender are able to keep unwelcome ex-post government policies in check.

In a fully dynamic model, however, the timing of moves between the debt contracting parties and the government is blurred and it is less obvious to what extent debt fragility is deliberately designed to discipline governments. Recently Du and Schreger (2015) have considered such a dynamic model to study the interaction between the currency compositions of sovereign and corporate debts. In line with the dual-agency analysis of Tirole, they show that when corporations rely more on foreign-currency debt, the government is more willing to reduce inflationary pressures so as to avoid a depreciation of the domestic currency, which could have potentially crippling consequences for corporate balance sheets. In a cross-country analysis of emerging market debt they also find that, although governments have recently reduced their reliance on foreign-currency debt (thereby reducing the risk of default), corporations have not. Interestingly, they find that this gives rise to a higher risk of default on domestic-currency government debt because of governments' greater concern to keep inflation under control.

Externalities can also be present between private borrowers. Applying the classic notion of fire-sale externalities in corporate finance (see Shleifer and Vishny, 2011) to an international finance setting, Korinek (2010) shows that when decentralized firms' borrowing constraints vary endogenously with the real exchange rate, they may rely excessively on foreign-currency debt. Indeed, a commonly observed pattern around financial crises is that the lending boom that precedes the crisis is increasingly

funded with foreign currency debt. What is more, reliance on this debt accelerates in response to monetary tightening shortly before the crisis, as interest rates on foreign debt are then relatively lower. Why they are lower is not entirely clear. Some authors have suggested that international lenders are far-sighted and rationally anticipate a bailout in the event of a crisis (see Schneider and Tornell, 2004). Whether that is true is difficult to ascertain, but the reality indeed seems to be that more often than not distressed foreign-currency borrowers, in particular banks, are bailed out by their governments in a crisis, thereby effectively consolidating private sector and government foreign-currency debt.

This is an important mechanism behind several countries' rapid buildup of foreign currency debt. For example, the government debt of Spain and Ireland shot up in the crisis of 2007-09 as a result of bailouts of banks and the consolidation of private with government debt (see Acharya, Drechsler and Schnabl, 2014). Such foreign-currency debt buildups are obviously not the consequence of a carefully weighed capital structure decision, but the outcome of uncoordinated and poorly regulated private borrowing choices. The exposure of country balance sheets to such unplanned consolidation is a problem specific to sovereign debt and complicates the determination of the optimal capital structure of nations in situations where debt can be accumulated both in the private and public sectors.

It does so doubly, for as Bolton and Jeanne (2011) and Gennaioli, Martin and Rossi (2014) have analyzed, a sovereign debt crisis then also sparks a banking crisis for two main reasons. First, banks typically hold a significant fraction of sovereign debt on their balance sheet so that a sovereign default puts their solvency at risk. Second, an insolvent sovereign can no longer offer a backstop to banks and thus puts them at risk of a run. Sovereign defaults that bring about a banking crisis, and the shut-down of the banking system, also result in exceptionally large output contractions, as the Argentina crisis of 2001-02 and the Greek crises of 2007-15 show. In light of the risks of economic devastation countries face when

their banking systems become hostages to a foreign-currency debt crisis, it is all the more important to rely on equity or domestic-currency debt financing (provided, of course, that the costs of such financing are not prohibitive). For, an important advantage of domestic-currency debt financing is that it does not put the banking system at risk.

The core analysis outlined in the previous section not only oversimplifies the problem by only considering a sovereign state as a single consolidated unit, but also by confining the analysis to a small open economy setting. As Gourinchas and Jeanne (2012) have argued, global economic growth and the growing share of output from emerging market economies (with a high savings rate) could produce a global scarcity of safe assets. They refer to this as the modern incarnation of Triffin's (1960) dilemma. The supply of domestic-currency debt issued by reserve-currency countries can tap into this global demand for safe assets and at the same time provide a cheap source of funding for investment in these countries. Thus, in a global context, the market-timing opportunities that countries like Switzerland and Japan have exploited to build large foreign-currency reserves may be related to this global scarcity of safe assets. In other words, the supply of safe assets by countries to the world economy is likely to be an important dimension of the capital structure of nations puzzle for reserve-currency countries. Which countries are more likely to be able to play this role of suppliers of safe assets has recently been analyzed by He, Krishnamurthy, and Milbradt (2015). They argue that in periods of high global demand, countries with large outstanding stocks of debt are well placed to extract the convenience yield associated with reserve assets, even if they expose themselves to roll-over risk in periods of lower global demand for safe assets.

From a general equilibrium perspective a number of important questions arise concerning the demand and supply of reserve assets in the current environment. First, when Switzerland and Japan build up foreign exchange reserves by supplying Swiss Franc and Yen denominated reserve assets to the global economy does this

result in a net increase in the global supply of reserve assets? If these countries are buying US dollar or Euro denominated bonds, arguably all they are doing is swapping one reserve asset for another. On the other hand, if Swiss Francs are printed to purchase stocks and build an equity portfolio, as the Swiss National Bank has done, this would amount to a net increase in global reserve assets. Second, if reserve-currency countries are net suppliers of reserve assets this necessarily implies that other countries are net borrowers in foreign-currency denominated assets. If the net borrowers are primarily governments who fund their expenditures with foreign-currency denominated debt, then a perverse outcome of the increased supply of reserve assets is greater fragility and default risk for the countries who borrow in foreign-currency debt. However, if the net borrowers are primarily banks or corporations, then the greater global supply of reserve assets can improve the efficiency of global money markets and reduce global deflationary pressures. Third, if multiple reserve-currency countries supply reserve assets in a global decentralized market for reserve assets, will the equilibrium in this market result in an efficient allocation of reserve assets?

3 Reflections on Sovereign Debt Restructuring

The framework outlined above models the cost of default on sovereign debt as a percentage loss in output following default. The size of this loss in the year following the Argentina default in 2001 was 11% of GDP. Although Greece did not technically default on its debt, in the years following the Greek government's revelation in November 2009 that Greece was in financial distress Greece's GDP shrank in total by over 25%. What causes such a large output loss following a default is first and foremost the collapse of the banking system and the freezing up of credit markets. In addition, a combination of trade sanctions and the withdrawal of trade credit also results in a collapse of trade. Both the breakdown of credit markets

and the collapse of trade involve enormous ex-post inefficiencies, that bring about huge suffering mostly for innocent bystanders. Is this a necessary and inevitable byproduct of well-functioning sovereign debt markets? Is this 'stick' needed to be able to impose repayment discipline on sovereigns?

The IMF was created in 1944 with a core mission of helping forestall sovereign debt defaults and the economic devastation that may follow. Until the Russian debt crisis of 1998 the exclusive *modus operandi* of the IMF in sovereign debt crises has been built around bailouts (so called IMF Stand-By Agreements) to avoid default at all cost. With the important exception of the heavily indebted poor countries (HIPC) initiative in 1996, which resulted in substantial debt cancellations for a number of overindebted developing countries, debt relief was not an option. This bailout model reached its limits with the Russian default in 1998, and the subsequent default of Argentina in 2001, when moral hazard concerns became too evident to be ignored. Another more prosaic reason why the bailout model reached an impasse is that the IMF balance sheet became simply too small to carry increasingly large bailout packages.

With the return of sovereign debt defaults, the question of how to handle sovereign debt crises other than through bailouts, how to facilitate debt restructuring and avoid the economic costs of an outright, chaotic, default, inevitably came to the forefront. Policy discussions culminated with the proposal in 2001 of a new sovereign debt restructuring mechanism (SDRM) by the deputy managing director of the IMF, Anne Krueger. The SDRM was seen as a bankruptcy procedure for sovereigns similar to corporate (chapter 11) or municipal (chapter 9) bankruptcy procedures. As with corporate bankruptcy the main benefits of the SDRM were seen to be a stay on debt collection actions, an orderly and fair debt reduction process adjudicated by an independent court, and debtor-in-possession financing provided by the IMF to sustain the distressed sovereign during the debt restructuring period.

Although there was considerable worldwide support for the SDRM in 2002, the

IMF ultimately failed to secure the backing of a few key member countries, in particular the US, Mexico and Turkey. The proposal was eventually shelved and the only significant outcome from the debates around the SDRM was a push towards the systematic inclusion of collective action clauses (CACs) in sovereign debt contracts. These clauses make it easier for sovereign bondholders to renegotiate bonds in situations where the sovereign is near default (typically CACs require a supermajority of bondholders to approve a haircut, which is better than a requirement of unanimity for corporate bond restructuring in the US; see Gelpern and Gulati, 2006).

Collective action clauses can facilitate a bond restructuring, but they do nothing to stop individual creditor debt collection actions. Now, the worry that in the absence of any intervention there would be a multiplicity of disruptive lawsuits by individual creditors was a primary reason for introducing the SDRM in the first place. This concern has recently taken unimaginable proportions following the court ruling by U.S. Federal Appeals Court for the Second Circuit in October 2012 (later upheld on appeal in August 2013). Without getting caught up in the byzantine legal technicalities of the case, the ruling prevents Argentina from servicing its restructured debt (following the default of 2001 Argentina restructured a significant portion of its defaulted debt in 2005) as long as it does not make whole the hold-out creditors who have refused the terms of its 2005 restructuring offer. As a result of the New York Court ruling, Argentina was forced to default on its restructured bonds in August 2014. It was not just Argentina who was affected by being shut out of international debt markets since 2001 (and the holders of the 2005 restructured debt who no longer get their claims serviced), it is also the entire sovereign bond market that is now left in legal limbo regarding the status of sovereign bond contracts and a sovereign's ability to service their bonds.

While the Argentina saga has been unfolding the other major development in the sovereign debt universe has been the Eurozone debt crisis of 2009-2015. Following an unsuccessful first bailout in May 2010, Greece was able to wipe out a

debt obligation of over 100 billion Euro to its private creditors in an orderly debt restructuring in March 2012. This debt writedown, however, was accompanied by a second major bailout, followed by a third bailout agreed to in August 2015, after a dramatic but ultimately unsuccessful attempt by the new Greek administration to extract further debt write-offs from its creditors. Even though the debt write-off of 2012 represented around 50% of GDP, Greece's debt-to-GDP ratio now still stands at 180% of GDP.[3]

All in all, following nearly two decades of debate, several attempts at introducing a more orderly sovereign debt restructuring procedure, and despite the evidence of the massive economic costs wrought by the disorderly resolution of sovereign debt crises, there has been virtually no progress in shaping a more efficient and fairer debt restructuring regime. If anything, the costs of default are higher than ever, pushing over-indebted sovereigns to desperately continue servicing unsustainable debt obligations and thus prolonging and deepening debt-overhang burdens.

That the move towards a bankruptcy regime for sovereigns is slow and contentious is not entirely surprising in light of the history of US corporate bankruptcy reform. After all, it took over 100 years for the US to perfect an efficient corporate bankruptcy law, which is increasingly seen as the model to follow around the world (see Skeel, 2001). The Bankruptcy Reform Act of 1978, although initially heavily criticized, is by now well established. Three core principles underpinning corporate bankruptcy are now widely accepted as essential: 1) an automatic stay of all individual debt collection actions to prevent an inefficient and disorderly run by creditors to the courthouse; 2) debtor-in-possession financing to preserve the going-concern value of the firm; and 3) enforcement of absolute priority rules.[4]

[3] The other widely covered debt restructuring episode occurred in Cyprus in 2012, where bank deposits in excess of 100.000 Euros were partially bailed in as a condition for a bailout package of around 10 billion Euros.

[4] This does not mean that bankruptcy is now free of contentious disputes between creditor and debtor interests. Far from it, as the political battles around the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 show.

It took nearly as long to refine a resolution procedure for failed banks. Only after the Savings and Loans crisis of the 1980s, and the passage of the Federal Deposit Insurance Corporation Improvement Act of 1991, has the modern bank resolution model around "prompt corrective action" and FDIC receivership taken shape. In Europe a formal bank resolution procedure under the Single Resolution Mechanism has only been adopted in 2014 and will only start in 2016. Finally, the model for the resolution of systemically important financial institutions (SIFIs) has only been proposed for approval by the Financial Stability Board (FSB) this year, following years of protracted and complex negotiations between bank regulators. A critical difference between bank resolution and corporate bankruptcy is the fundamental importance of resolving the failed institution without disrupting the day-to-day operations of the operating affiliates of the bank. For any hint of disruption can trigger a bank run and a contagious banking panic.

Unlike for non-financial corporations, it is impossible to implement a comprehensive automatic stay for banks while allowing banks to continue operating normally. The choice is essentially between a bank holiday or business as usual. This is why the benchmark FDIC receivership intervention is to engineer, whenever feasible, a "purchase and assumption" takeover of a failed bank by a healthy bank over a week-end, so that the failed bank's operating affiliates can be open for business on the next Monday.[5] This surgically efficient intervention is typically not possible for a failed SIFI, for which there is no readily available healthy acquirer on hand, especially in a financial crisis. This is why the new resolution model proposed by the FSB for SIFIs is to resolve the institution at the holding company level, while ensuring that operating affiliates are made whole and remain open for business at all times. Resolution of a SIFI then essentially means the write-off of long-term

[5] When the failed bank's liabilities are too large to be entirely assumed by the acquiring bank the FDIC may also absorb some of the liabilities to facilitate the transaction. In the rare situations when the failed bank has to be closed down the FDIC liquidates the bank's assets and uses the proceeds as a priority to meet its deposit insurance obligations.

liabilities held by the holding company, which will be part of the so-called required 'Total Loss-Absorbing Capacity' or TLAC of a SIFI (proposed TLAC requirements are in excess of 16% of bank assets).

Why do I mention SIFI resolution in the context of sovereign debt restructuring? Because, so far, the main inspiration for how to design a sovereign debt restructuring mechanism has been corporate or municipal bankruptcy (see Krueger, 2001, Bolton, 2003, Bolton and Skeel, 2004, 2005, Hagan, 2005, Hagan and Krueger, 2005, and Buchheit et al., 2013). While this is in many ways a relevant parallel to understand the benefits of a stay on debt collection, debtor-in-possession financing, and the importance of the absolute priority rule, it may miss the mark by underestimating the immediate economic disruptions that are likely to follow the activation of a sovereign debt restructuring procedure. As Bolton and Jeanne (2011) argue, a key difficulty in many countries with sovereign debt restructuring is that it puts the banking system at risk, to the point where banks may no longer be able to operate normally. This became abundantly clear in the summer of 2015 in Greece, where an extended bank holiday had to be declared to forestall an imminent run caused by the very public and tense debt restructuring debates. The problem with the Greek precedent, however, is that it has made the prospect of any form of debt restructuring even more remote. Sovereign debt relief is less politically feasible than ever, at least in the Euro zone, with the consequence that debt overhang will be a heavy and prolonged burden, possibly for decades to come.

So how can a sovereign debt restructuring be organized with minimal economic disruption? This is where the parallel with the proposed resolution procedure for SIFIs is pertinent. The key feature of the SIFI resolution model is the earmarking of a special category of debt that will be written down in the event of financial distress, and the requirement that SIFIs issue a fraction of their liabilities as 'bail-in-able' debt. Under the intended resolution scenario, a distressed US SIFI, say, would be

put under the resolution authority of the FDIC[6], who would essentially write down the long-term bail-in-able debt held by the bank holding company so as to make the SIFI solvent again, and otherwise allow all SIFI affiliates to continue operating as usual. One can envision sovereigns being similarly required to issue a fraction of long-term bail-in-able bonds, that cannot be held by banks, and that can be written down in special circumstances of economic or financial distress. The write-down would immediately put the sovereign back on a sound financial footing and not create any disruptions to its banking system.

Interestingly, the creation of two classes of sovereign debt, a junior and senior debt, has been at the center of a number of proposals to ease the Euro zone debt crisis, but for slightly different reasons. The first such proposal by Delpla and Von Weizsäcker (2011) is to create two classes of Eurobonds, blue and red bonds. The blue bonds are senior and are jointly backed by all Euro-member states, and the red bonds are junior and would only be backed by the issuing country.[7] Only red bonds would be bail-in-able and as such should not be held by banks. One key advantage of this scheme is to increase the attractiveness of blue bonds as global reserve assets, and, as such, to lower the cost of sovereign debt funding for the Euro zone as a whole. Another benefit of this proposal is to strengthen fiscal responsibility for Euro member governments. The part of the proposal that has received the greatest attention, and generated most of the controversy, is the blue bond part, as it is seen as a step towards a fiscal union for Euro member states, which some states are adamantly opposed to. Another proposal by Brunnermeier et al. (2011) is to create European safe bonds, what they refer to as *ESBies*. These are similar to blue bonds but they do not entail any fiscal union, since they would be issued by an intermediary agency in the form of securities backed by Euro member sovereign bonds. In other words, ESBies are created through securitization rather

[6] *Orderly Liquidation Authory*, or OLA, is a misnomer.

[7] The *Eurobills* proposal by Hellwig and Philippon (2011) prefers a variant of blue bonds in the form of short-term (joint liability) bonds to guarantee seniority.

than through direct consolidation by Euro member state fiscal authorities. As such, there is no explicit joint guarantee involved.

Arguments over the desirability of a fiscal union, and the inevitable transfers from rich to poor member countries that it entails, have distracted attention from the other part of the Delpla and Von Weizsäcker proposal – the red bonds – which is more relevant for sovereign debt resolution. It is important to note that a blue-and-red bond, or a bail-in-able and non-bail-in-able debt, construction is possible without any fiscal mutualization. As with TLAC for SIFIs each sovereign nation can issue both types of debt and implement a streamlined sovereign debt restructuring mechanism that would involve minimal economic disruptions. This simple sovereign debt resolution scheme would, in effect, be set up like a contingent convertible debt for sovereigns. Alternatively, it can also be seen as a coarse type of GDP-indexed debt instrument, where the debt write-down would be triggered if the country's GDP falls below a pre-determined threshold. Admittedly, some regulation of the bail-in-able debt requirement may be necessary, and the conditions under which the bail-in-able debt can be written down will also have to be carefully calibered, but these institutional design challenges don't appear to be insurmountable.

Instead, the main current obstacle to a more orderly sovereign debt restructuring model is a lack of imagination, ambition, and political will. The IMF (2013) has recently rekindled discussions around the need for a more orderly sovereign debt restructuring regime, and the Brookings Institution has released a careful report calling for: 1) the introduction of aggregation CACs, that allow for debt restructuring across all outstanding bonds of a sovereign (subject to supermajority approval), and 2) the creation of a *Sovereign Debt Adjustment Facility* that both aim to achieve the same goals as the SDRM but with a somewhat lighter touch (see Buchheit et al., 2013). Interestingly, the same report proposes a special sovereign debt restructuring procedure for the Euro zone on the grounds that: "The Euro area differs from other integrated regions both in that its members have fewer instruments to

deal with debt crises—they cannot devalue or inflate—and because a crisis in one member can have catastrophic consequences for others (by threatening the common currency)." [Buchheit et al., 2013, page IV]. This is the most ambitious recent proposal. It is hardly a radical manifesto, yet it has even less political support than the SDRM had in 2002.

An important reason for the change in political sentiment is that the Euro zone debt crisis of 2009-2015 has hardened the stance of many European central bankers and politicians, in particular following the agreement in Deauville on October 19, 2010 between Angela Merkel and Nicolas Sarkozy, to condition funding by the European Stability Mechanism (ESM) on a partial bail-in. When Euro periphery debt spreads shot up at the peak of the crisis in 2011, many prominent commentators blamed the Deauville agreement, and once it became a priority to "do whatever it takes" to smother the surge in periphery debt spreads, and save the Euro, any allusion to debt restructuring or bail-in was unwelcome. The inevitable consequence is, again, prolonged debt overhang in the Euro zone. We are now in the paradoxical situation where too-big-to-fail banks are subject to strict bail-in requirements, whether under the European Single Resolution Mechanism, the Dodd-Frank Act, or the FSB's proposed resolution regime for SIFIs, but no bail-in policy and conditions have been formulated for sovereign states.

4 Conclusion

I hope that this discussion has shown that much can be learned from an analogy of sovereign finance with corporate finance. Of course, the fact that nations like corporations can be severely financially constrained is not really a revelation, and this paper mostly revives old themes in light of new evidence or new research in corporate finance. An early intellectual arbitrage between the two fields has been around the notion of debt overhang first introduced for corporations by Myers (1977)

and later applied to developing countries by Sachs (1984) and Krugman (1988). This analogy provided the conceptual foundations for the movement that led to the heavily indebted poor countries (HIPC) debt relief initiative of 1996.

The parallel between corporate equity and a nation's currency explored in Bolton and Huang (2016) offers in a way a completion to the debt overhang analogy, allowing for the articulation of a key tradeoff for the capital structure of nations, and making more specific what inflation costs are associated with domestic currency financing. Inflation expectations associated with money issues involve a cost for domestic residents to the extent that they result in a transfer of wealth to foreign investors and a loss of purchasing power.

When should a country borrow in foreign currency or domestic currency, when should a country build foreign exchange reserves, and how is debt overhang affected by the currency composition of the debt? These are some of the questions that can be addressed in this framework. The theory builds not only on core corporate finance notions from Myers (1977) and Myers and Majluf (1984), but also on insights from the more recent market-timing perspective of Baker and Wurgler (2002).

Optimal financing choices for a country may change according to the country's circumstances and changes in global financial markets. Therefore, the capital structure of a nation at any moment in time will be the sum of numerous history-dependent tradeoffs, as Baker and Wurgler (2002) have argued for corporations. A nation's financing choices at any given moment, however, are not necessarily optimal choices. They are as likely to reflect political and ideological constraints as a carefully balanced decision in the best interest of the nation. Therefore, compared to corporations one should expect country fixed effects to explain an even greater fraction of cross-country variation in Debt-to-GDP ratios or the composition of public debt than firm fixed effects for corporate leverage. Some evidence to that effect is given in Forslund, Lima, and Panizza (2011), who study the determinants of public debt composition for a sample of over 85 developing countries for the

period of 1994 to 2006 and find that when country fixed effects are added standard explanatory variables such as inflation or the country's current account balance are statistically insignificant. The main significant variable positively associated with the domestic-currency debt share is GDP growth. In contrast, Table I reports that the adjusted R-square from a regression of Debt-to-GDP on country fixed effects for 22 countries over the period 1980-2015 is 78%, implying an even larger time-invariant, unexplained, variation of countries' Debt-to-GDP ratios than Lemmon, Roberts and Zender (2008) found for corporate leverage for the US.[8]

Obviously, the corporate finance framing of a nation's optimal capital structure outlined here is just a sketch meant to suggest questions for future research. One important question that I have not discussed is how the severity of debt overhang problems is related to the currency composition of the nation's debt. One would expect that if the government mostly funds public expenditures with domestic currency debt this would reduce debt overhang problems, as the government can always service the debt by printing money (and, if necessary, repurchase the debt by printing money). Other important avenues for future research are capital structure dynamics and governance issues. What are the governance implications of debt relief? Some of the HIPC countries that have benefited from debt relief now find themselves again in a debt overhang situation. If debt relief may beget future over-indebtedness and debt overhang, does this mean that debt relief is never warranted?

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Table I

Explanatory Power of Country and Year Fixed Effects

The dependent variable is the ratio of domestic debt outstanding to GDP $(\text{Debt/GDP})_{jt}$ where countries are indexed by j and years are indexed by t. Model (1) only includes country dummies. Model (2) only includes year fixed effects, with year dummies constant across countries. Model (3) includes both country and year dummies. Table 1 reports adjusted R^2 results for the sample of 22 countries over 1980-2015 and 1995-2015.

	Adjusted-R^2 for Model with:		
	Country Dummies (1)	Year Dummies (2)	Country Dummies and Year Dummies (3)
1980 to 2015	0.781	0.008	0.798
1995 to 2015	0.778	0.024	0.802

The regression equations for Model (1)-(3) are as follows:

$$(\text{Debt/GDP})_{jt} = \alpha + \theta_j + \varepsilon_{jt} \quad (1)$$

$$(\text{Debt/GDP})_{jt} = \alpha + \delta_t + \varepsilon_{jt} \quad (2)$$

$$(\text{Debt/GDP})_{jt} = \alpha + \theta_j + \delta_t + \varepsilon_{jt} \quad (3)$$

where θ_j represents the country dummy, δ_t is the year dummy, ε_{jt} is an error term, and α is a constant.

Due to some missing observations before 1995, the regressions are re-run over the narrower sample period 1995-2015. The results are similar. Country fixed effects explain 77.8% of the Debt/GDP variation, while year fixed effects only account for 2.4%, country and year fixed effects together account for 80.2% of the variation in Debt/GDP ratios.

Figure 1: Foreign exchange reserves for Japan and Switzerland

This figure plots the Foreign exchange reserves, yearly change in reserves, current and capital account balances for Japan and Switzerland.