On the Macroeconomics of Asset Shortages

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November 6, 2006

The world has a shortage of financial assets. *Asset supply* is having a hard time keeping up with the global demand for store of value and collateral by households, corporations, governments, insurance companies, and financial intermediaries more broadly.

These shortages have been a perennial problem in emerging markets, where many of their economic perils and idiosyncrasies stem from this feature. But we are now seeing a shortage on a global scale. It probably began with the meltdown of a substantial share of Japanese assets in the early 1990s, it was exacerbated by European stagnation and the collective emerging market crises of the late 1990s, and it consolidated in the new millennium by the fast income growth of China and commodity countries, most of which have substantial asset demand needs but are not natural asset producers. In addition to these macroeconomic factors, there are microeconomic factors contributing to these shortages. In particular, the recent rapid pace of financial development has facilitated restructuring, innovation and economic growth, but because of their margin requirements they may well have been a net collateral consuming activity, at least in the short run.

The equilibrium response of asset prices and valuations to these shortages has played a central role in global economic developments over the last twenty years. The so-called "global imbalances," the recurrent emergence of speculative bubbles (which recently have transited from emerging markets, to the dot-coms, to real estate, to gold...), the historically low real interest

*Correspondence: caball@mit.edu. These notes were prepared for the 4th ECB Central Banking Conference on "The Role of Money: Money and Monetary Policy in the Twenty-first Century," Frankfurt, November 2006. I thank Olivier Blanchard and Arvind Krishnamurthy for their comments.

rates and associated "interest-rate conundrum," and even the widespread low inflation environment and deflationary episodes in parts of the world, all fall into place once one adopts this asset shortage perspective.

Understanding the source of these developments as asset supply shortages informs optimal policy responses. The policy prescriptions that follow from this view are a mixture of conventional advice, with an emphasis on financial development and incentive preservation in capital markets, and more adventurous recommendations. In particular, since speculative bubbles are a necessary evil in this environment, it is important to learn to manage their risks rather than to obsess over choking them. By extension, the same recommendations apply to concerns about global imbalances and over the excess-liquidity consequences of low interest rate policies.

In these notes I sketch the essence of this view and of the main policy recommendations that follow from it. However, these are largely uncharted waters. My discussion has plenty of conjectures anchored by spotty academic work. Much of the research needed to understand what got us to this point, how to manage a global economy of this nature, and ultimately how to grow out it, if this is perceived to be necessary, lies ahead.

This introduction is followed by four short sections. Section 1 sketches the macroeconomic consequences and policy lessons of endemic asset shortages in emerging market economies. Section 2 discusses the global counterpart, where equilibrium considerations play a central role, and argues that low interest rates and inflation rates, as well as high (speculative) valuations, are all market-based mechanism to rebuild asset supply. It also warns on the deflationary consequences of chasing bubbles, and proposes instead to focus on the risk management of high valuation equilibria. Section 3 discusses the role of a lender of last resort in reducing net collateral demand. Section 4 concludes and is followed by a short appendix.

1 Emerging Markets

It is useful to start the discussion with emerging markets for three reasons. First, their experience informs the issue since their chronic asset shortage is an integral component of their macroeconomic performance and management. Second, there is a tendency to extrapolate directly these countries' lessons to the current global imbalances. While this is sound in some dimensions, it is not in others. It is important to understand which one is which.

Third, the coordinated crises of emerging markets in the late 1990s, as well as their fast growth in recent years, have played a central role in generating the current worldwide shortage of assets, and hence are at the core of understanding world equilibrium.

1.1 Asset shortages and bubbles

If we could ignore capital market frictions of all sorts, emerging market economies would borrow massive amounts from the rest of the world, both to build the stock of capital required to catch up with developed economies and to smooth consumption intertemporally. However, this description does not fit these economies' reality. Not only is their international borrowing limited, but they also experience chronic capital outflows from residents, ranging from households to central banks, seeking to store value in safer locations. In short, emerging market economies are not able to produce the financial assets demanded by local agents to store value.

The reasons for asset supply shortages in these economies come from a variety of microeconomic, macroeconomic, and political deficiencies. Weak bankruptcy procedures, chronic macroeconomic volatility, and sheer expropriation risk reduce the value and safety of local assets.

However, there is a latent tension between the potentially high marginal product of physical investment in these economies and the relatively low returns obtained from safer external assets. This gap creates *both* a natural source of speculative bubbles (by which I mean assets held primarily for their potential capital gains rather than for their dividends) and a potentially useful role for them. There is a sort of dynamic inefficiency. If domestic agents succeed in coordinating their investments in some local assets, their capital repatriation can lead to higher returns to those that choose to store value in local assets. This path is rational (potentially sustainable) because of the gap in returns. In turn, these additional resources relax financial constraints and facilitate domestic growth. Again, it is the gap in returns that makes this strategy potentially welfare improving.

Real estate, and land in particular, are among the assets with best defined property rights in many of these economies and therefore become the initial focus of attention. Corporate assets from the bellwether companies of the country follow behind. Eventually, the large asset appreciations attract foreign investors who further fuel local speculation.

Not all is virtuous in the bubbly equilibrium, however. There is an inher-

ent macroeconomic fragility in coordination-dependent speculative booms. In the same way as these start, investors' moods can change rapidly, causing an implosion in local asset values and widespread international liquidity scarcity as the savings that once were stored in safe heavens are now deployed in riskier local assets, and there is a surge in capital outflows for those that can still do it.

1.2 Policy considerations

What should the local authorities do in dealing with such an environment? In particular, should they prevent the emergence of local bubbles altogether, or should they, on the contrary, wait until after a crash has taken place to intervene? These are the questions we address in Caballero and Krishnamurthy (2001, 2006a).

It turns out that the same financial underdevelopment that limits the number of assets produced by the economy and gives value to bubbles, biases the private sector incentive toward undertaking an excessive number of risky investments. When an individual agent decides to bring back some of its resources stored abroad (or borrow from foreigners) to speculate in local markets, it raises the return on holding local assets and the value of domestic collateral, but it also increases the systemic risk in the event of a crash. If domestic financial markets are well developed, and hence borrowers can transfer much of their future earnings to lenders and investors, the agent internalizes the value of resources in the event of a crash. In contrast, if domestic financial markets are underdeveloped, the ex-post arbitrage opportunities are limited since existing assets can only capitalize a small share of the return from the additional resources. In this context, the private sector takes (socially) excessive risk and, once domestic bubbles develop, it reallocates too many resources toward them, overexposing the economy to a deep crash.

This excessive risk taking justifies intervention. An important question is whether policies should focus on preventing excessive risk taking or on improving the handling of a crisis should one occur. While optimal policy typically involves elements of both, the optimal package overweights prevention in emerging markets (relative to developed economies) since the government has limited options once in a crisis, as it often finds itself involved in the

turmoil and deprived of credit.[1]

There are two broad categories of potential policy interventions. Those that address the excessive risk taking but not the underlying shortage of sound assets, and those that address the shortage itself. Among the former are measures such as imposing liquidity ratios on financial intermediaries or sterilizing capital inflows. However, these are not free of their own limitations. The former policy requires the ability to monitor financial intermediaries, whose individual incentives to go around the system and take excessive risks rise as competitors are bound by regulation. The latter policy is costly for the government and requires that it has sufficient credibility to create a large amount of financial assets, which is often a constraint. More importantly, neither of these policies addresses the fundamental shortage of assets and, worse, they risk exacerbating the problem if overdone.

Monetary policy can also be used as an incentive (rather than as a palliative) mechanism. In Caballero and Krishnamurthy (2005), we show that by modifying the inflation targeting rule so that it automatically rewards prudent behavior in the event of a crash, monetary policy improves private sector risk management practices. This can be done, for example, by having an explicit rule that overweights nontradables, so that the private sector anticipates that the central bank will let the exchange rate fluctuate more freely in the event of a crisis, and hence discourages excessive reallocation from dollar-assets to speculative peso assets. However, this strategy may also backfire if domestic derivative markets are limited, and the additional exchange rate volatility depresses non-speculative investment and domestic intermediation. Moreover, there is some circularity in the problem, since well-functioning derivative markets require collateral assets, but it is their scarcity that is the root problem behind the fragility monetary policy is seeking to alleviate.

Ultimately, the long term solution to the problem is financial development, as sound assets crowd out the reason for the emergence of speculative bubbles. If the government has enough taxation credibility, then it should begin by developing the domestic public bond market. Absent this credibility, public debt is just another speculative bubble.

[1] A theme I do not develop here is what should the government do with the resources it chooses to store for precautionary reasons. For this, see e.g. Caballero and Panageas (2005).

2 The World Economy

For a variety of reasons, many of which I mentioned in the introduction, as of late the world has been experiencing a situation in which assets are in short supply. In essence, globalization spreads the shortages from specific regions to the world at large. While many of the elements of the analysis in the previous section extend to this context, there are two key differences and considerations. First, an important factor behind the significant potential for crises in emerging markets is the existence of a large number of assets that can substitute for local assets at a moment's notice. This is not the case for the world as a whole or for a large economy like the US. Second, not all regions of the world are equal in their ability to supply financial assets, and hence the global shortage of assets leads to large capital gains and flows toward the asset-producing regions of the world. These are the themes we develop in Caballero *et al* (2006a) and, in particular, in Caballero *et al* (2006b).

2.1 Global imbalances and low interest rates

The starting point of the analysis is the observation, already present in the previous section, that capital's ability to produce output is only imperfectly linked to its ability to generate assets. A higher capacity to produce output makes the underlying capital more valuable, but the possibility to sell the rights over that output in advance, and hence to create an asset from it, depends on a series of institutional factors that vary widely across the world.

On one end, developed Anglo-Saxon economies, and the US in particular, have managed to combine good growth conditions with an unmatched ability to generate sound and liquid financial assets appealing to global investors and savers. On the other end, emerging market and oil-producing economies have seen large increases in their disposable income, but remain largely unable to generate an adequate supply of good quality assets. Lastly, continental Europe and Japan have been hampered by limited growth and by lagging behind the Anglo-Saxon economies in terms of their ability to produce financial assets.

Other things equal, such configuration leads naturally to the so-called "global imbalances," as the Anglo-Saxons supply financial assets to the rest of the world and experience current account deficits as an unavoidable counterpart. These "imbalances" can go on for a long time and are exacerbated

by the rapid growth of China and emerging markets more broadly. Moreover, it turns out that "other things" are not equal, and they tend to reinforce the direction of flows, as a series of demographic and precautionary motives have increased the demand for assets in the global economy.

Much has been said about China's policy of international reserves accumulation and its responsibility for global imbalances. Some of this concern may be justified, but I believe this to be a second-order issue. Ultimately, China is a fast-growing economy with ever-increasing demand for store of value instruments, which its economy is largely unable to generate at the moment. If China had an open capital account, its citizens would seek these assets abroad directly. Since it does not, it is the government that accumulates the international assets and instead issues implicitly collateralized sterilization bonds to its citizens. Unlike the typical sterilization episode, these bonds yield very low returns, which simply reflects the excess demand for store of value they partially satisfy.

The shortage of assets also helps explain the secular decline in long-run real interest rates over the last decade, despite occasional efforts from central banks around the world to raise them (recall the interest rate conundrum). While central banks may be able to control short rates, the long rates are kept low by the high valuation of scarce assets.

These secular forces behind low real interest rates and large net capital flows toward the Anglo-Saxon economies are occasionally interrupted by speculative episodes which raise local asset values in emerging markets. This is the mechanism described in the previous section. The emerging market crises of the late 1990s corresponded to an abrupt and systemic end of one such episode. The result was a massive rise in capital flows to the US and a sharp decline in safe interest rates. In fact it does not seem unreasonable to conjecture that some of the dot-coms bubble in the US resulted from that rapid reallocation. By the same token, the crash in the real estate and stock markets in Japan in the late 1980s was probably an important factor behind the US current account deficits that began to build in the early 1990s.

In summary, endogenous real interest rate drops are market-mechanisms to raise the value of existing assets and therefore replace some of the lost assets after a crash, and to cover part of the asset shortage created by secular forces.

2.2 Speculative bubbles and low inflation

The emergence of speculative bubbles and a drop in inflation (perhaps into a deflation), are yet two other market mechanisms to bridge the asset gap.

For reasons similar to those discussed in the emerging markets section, in a world with substantial asset shortages speculative bubbles are not only likely to arise, but also provide an important service to those seeking to store value. In fact, in Caballero *et al* (2006a), we show that under certain conditions, bubbles *must* exist.[2] That is, in the absence of a speculative bubble, there is an excess demand for financial assets and a corresponding excess supply of goods (see the appendix).

The conditions for the must-have-bubbles result are not unreasonable. In fact, they are natural within an environment in which assets are in short supply. All that is needed is that the rents accruing to assets currently traded are expected to decline over time relative to the size of the economy (but not too fast). For example, it seems sensible to expect that rents from currently owned land are not likely to keep up with the economy's rate of growth for the indefinite future. Moreover, these conditions are strict only because they are needed for fully rational bubbles to exist. In reality, which is patently less perfect than this fully-rational environment, much weaker conditions are likely to suffice. If the world is in a situation where even fully rational bubbles could be justified (or nearly so), we should not be at all surprised that speculative bubbles take hold so easily.[3]

In reality, agents' portfolios also contain nominal assets issued by the government. This addition gives the economy another adjustment mechanism, since a change in the price level affects the real value of these assets. On the phase of an asset shortage, a drop in inflation or an outright deflation

[2]Note that this is never the case for a single emerging market economy, since in that case there are many substitute assets.

[3]The reason these conditions ensure a bubble is that they put an upper bound on the present value of fundamentals (rents), which under the right assumptions is not enough to satisfy the demand for assets in the economy. The gap must be filled by a speculative bubble. The question arises of why can't the interest rate drop as much as it needs to make the present value of fundamentals as large as is needed to satisfy asset demand. The answer is again in the excess demand for store of value. As the economy grows, so does its demand for assets, which ensures capital gains from selling assets in the future. These capital gains mean that the rate of growth of the economy is a lower bound for equilibrium interest rates, from which the upper bound on the present value of fundamentals follows since rents are growing at a rate lower than the economy.

when the shortage is due to a crash in asset values, is a market mechanism to revalue nominal assets and cover the gap.

2.3 Policy implications

The way out of the current juncture is ultimately one of financial development in the regions of the world that have limited capacity to generate store-of-value instruments relative to their demands.[4] Financial development also reduces the incentive and space for inefficient risk-shifting in emerging markets.

But this process of financial development is slow. In the meantime, the world must learn to operate in a high-valuations environment. Failing to understand that some of the observed "anomalies" are symptoms and market-based solutions can have dire consequences if policymakers start chasing bubbles, "global imbalances" and low real interest rates.

For instance, if the government attempts to and succeeds at bursting an equilibrium bubble, the immediate impact of destroying these assets is to create an excess demand for financial assets and a corresponding excess supply of goods. In the short run, the real interest may drop to zero if the economy comes to a halt, but the relief from this adjustment is minor if capitalizable dividends are small relative to the bubble they are supposed to replace. The rest of the adjustment falls on the real value of nominal assets. However, in reality the value of these assets is too small to offset a significant crash in asset values. For example, even a relatively minor correction such as that experienced by the US stock market at the beginning of the millennia is about twice the size of all the nominal liabilities issued by the U.S. government and held by the private sector. Reasonable increases in the supply of these assets will not suffice, and a sharp decline in the price level becomes the main escape valve of the economy. Complementing this environment with price inertia and a Phillips curve naturally yields a protracted and costly deflationary episode while the economy waits for the Pigou-mechanism to make up for the lost assets.

Instead, policies should focus on managing the risks associated to high valuation equilibria. There are two main senses along which speculative equilibria bring about risks: Aggregate and location. The former refers to

[4] Financial development is likely to operate on both ends, by increasing the supply of assets and by reducing the demand for assets (precautionary savings).

the size of the collection of all speculative valuations in the economy. It turns out that inflation targeting should suffice to control excessive bubbles. If valuations grow in excess, then the economy enters a region of excess supply of assets and excess demand for goods; inflationary pressures build and hence automatically trigger monetary policy tightening. Unfortunately, as mentioned earlier, the same argument does not apply for deflationary pressures as crashes are often more abrupt than booms. The good news is that if speculative valuations are the result of a shortage of assets, then they are likely to be less prone to crashes absent some strange shock or misguided policy intervention.

Note, however, that while the value of the aggregate bubble is pinned down, there is nothing that determines its location. This observation hints at several policy conclusions: First, chasing a bubble is likely to move it around rather than eliminate it in the aggregate. This can be costly, as it forces the economy to experience crashes and disruptive reallocations without the reward of a more stable bubbleless economy. Second, monetary policy is **not** a good instrument to address location problems. These must be dealt with more sector/investment specific instruments, such as some sort of combination of policy induced caps and backing. Third, since high valuations must develop, it is better that they take place in non-resource consuming activities. In this sense, bubbles on land and gold are better than a speculative boom on some industrial activity.[5] Although the ideal is probably that the bubble spreads across a wide variety of assets, thus reducing the cost-impact on sectors that use land, commodities, etc., as inputs of production. Fourth, taking the previous argument to the limit, the impact of loose monetary policy on intermediaries' lending practices has the virtue of creating multiple bubbly assets and hence preventing excessive concentration of bubbles. Of course this effect must be traded off against the more conventional risk-shifting concern. But the point is that there is a trade-off, rather than just a bad effect, as it would be in an environment without an asset shortage.

In summary, the policy conclusion is that in an environment with asset shortages, it is important to recognize that speculative valuations are part of the equilibrium. In this context, the best policy is to minimize the resource misallocation they may cause and to protect their stability. The latter can be achieved by fostering the spreading of the aggregate bubble across many

[5] I hesitate to describe the dot.com bubble as such, since in that case there were plenty of technological externalities which may have offset the privately wasted physical investment.

assets (i.e., foster an extensive rather than an intensive margin), by not chasing them indiscriminately, and by providing some sort of implicit or explicit backing to some of the speculative assets. The good news is that in a world of low interest rates, even a pledge of a small share of the tax receipts can back a large amount of assets, as long as the total revenue from these taxes grows in tandem with the economy.

3 Economizing Assets: A Lender of Last Resort

Financial intermediaries have significant demands for store of value. However, in a world with limited asset supply, hoarding collateral assets is expensive. This encourages intermediaries to take larger risks by trimming the backing of their financial obligations.

There are limits on how much collateral-trimming is feasible and desirable. If excessive, the risk of a systemic crisis rises and may trigger panics, especially when agents are confused by Knightian uncertainty (which is often the case during financial turmoil). Facing this risk, it is tempting for a regulator to force financial intermediaries to increase their collateral position. But this regulation can be costly if imposed in response to a situation created by widespread scarcity of collateral assets. Of course this consideration must be traded off against the standard risk-shifting and moral hazard concerns. But the point is, again, that the scarcity of collateral assets establishes a meaningful trade-off and mechanically applying rules suitable for other environments can be counterproductive.

The question arises whether there are more efficient means of intervention in this environment. This is the issue we address in Caballero and Krishnamurthy (2006c).

We show that when Knightian uncertainty is a concern and a source of collateral freezing, a lender of last (not intermediate!) resort (LLR) can play an effective role even if it is less informed than the private sector. Moreover, very little of the gain needs to come from the direct intervention of the LLR, as the benefit of the policy derives primarily from improved efficiency in the use of private collateral.

The reason the LLR has this power is that it exploits a *collective bias* in the implicit assessment of the probability of extreme aggregate events by

private agents. We show this result in a context where financial intermediaries understand the risks of their own market, but are uncertain about the risks in other markets. In particular, they fear not being able to collect on their claims if other markets are hit before theirs. In response to this uncertainty, intermediaries demand for other intermediaries to fully collateralize their contingent liabilities, which inefficiently locks scarce collateral assets.

The LLR may know less about each market than do intermediaries, but it does know that it is impossible for all intermediaries to come out second in the event of a crisis. This knowledge is enough to leverage the value of a LLR facility, as for any given level of resources pledged by the LLR, intermediaries collectively magnify its value and free collateral accordingly.

4 Final remarks

In these notes I have argued that many of the main macroeconomic events of the last two decades, both for developing and developed economies, can be understood by recognizing a powerful, yet largely ignored ingredient in the analysis of these events: the world seems to have a severe shortage of assets.

This ingredient has positive and normative implications. Among the former, emerging market boom-bust cycles, global imbalances, low real interest rates, deflationary episodes, recurrent bubbles, and financial panics, all follow naturally from this view.

As for policy, perhaps the main advice is the importance of recognizing the source of these symptoms and the fact that some of them are simply the market's attempt to fill the asset gap. In this context, knee-jerk reactions to the emergence of speculative bubbles and global imbalances can be dangerous and counterproductive.

The world already paid dearly during the 1970s for failing to identify the nature of the shock that had just hit the world economy. Let us hope we do not repeat the mistake, this time around by failing to identify the shortage of assets as the root cause of the seemingly puzzling recent macroeconomic developments.

5 Appendix

The following model illustrates a situation in which the economy must have a bubble. Suppose that the financial wealth of a country, W, is composed of the present value of rents, F, and a bubble, B. The flow counterpart of F is a dividend f. Total output in the economy is made of these rents and some endowment, totalling y and growing at a rate g. These goods are non-storable and consumption is proportional to financial wealth (hence, there is a non-ricardian feature): $c_t = \theta W_t$.

Equilibrium in the goods market requires that:

$$\theta W_t = y_t$$

Now suppose that dividends grow a rate $g - \rho < g$, then, for a given sequence of real interest rates $\{r_t\}$, we have:

$$F_t = f_t \int_t^{\infty} e^{\int_t^s (r_\tau + \rho - g) d\tau} ds < \frac{f_t}{\rho}$$

where the last inequality follows from the fact that in this economy the interest rate converges to g from above. To see this, note that the standard arbitrage equation is:

$$r_t W_t = f_t + \dot{W}_t$$

Replacing W by y/θ and rearranging, yields:

$$r_t = \theta \frac{f_t}{y_t} + g > g.$$

Replacing W by its components and dividing by the propensity to consume, we find that:

$$F_t + B_t = \frac{x_t}{\theta}$$

to imply:

$$B_t \geq \max \left\{ \frac{y_t}{\theta} - \frac{f_t}{\rho}, 0 \right\}$$

It follows that if the share of income from rents is not too large, the economy must have a bubble in equilibrium.

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