

SWEDISH HOUSE
OF FINANCE



NOBEL SYMPOSIA



Nobel Symposium “Money and Banking”

<https://www.houseoffinance.se/nobel-symposium>

May 26-28, 2018
Clarion Hotel Sign, Stockholm



RIKSBANKENS
JUBILEUMSFOND

THE SWEDISH FOUNDATION FOR
HUMANITIES AND SOCIAL SCIENCES

Risk-centric Macroeconomics and Safe Asset Shortages in the Global Economy:

An Illustration of Mechanisms and Policies

Ricardo J. Caballero*

This draft: May 31, 2018

1. Introduction

In these notes I summarize my research on the topic of risk-centric global macroeconomics, for which I've had the fortune to collaborate with an outstanding group of coauthors. Collectively, this research makes the case that a risk-markets dislocations perspective of macroeconomics provides a unified framework to think about the mechanisms behind several of the main economic imbalances, crises, and structural fragilities observed in recent decades in the global economy. This perspective further sheds light on the kind of policies, especially unconventional ones, that are likely to help the world economy to navigate this tumultuous environment.

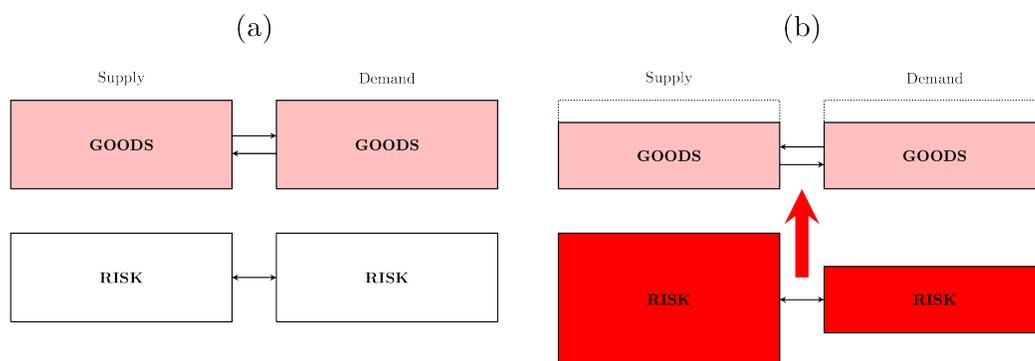


Figure 1: Output and risk supply vs. output and risk demand.

The starting point of this risk-centric perspective is the observation that economic activity generates output *and* risks, both of which need to be absorbed by economic agents for a smooth

*MIT and NBER. Contact information: caball@mit.edu. These notes were prepared for the Nobel Symposium on Money and Banking, May 26-28, 2018, Stockholm. I thank Olivier Wang for outstanding research assistance, and Martin Aragonese, Camila Caballero, Emmanuel Farhi, Arvind Krishnamurthy, Guido Lorenzoni, Helene Rey and Alp Simsek for their comments.

growth process to take place. During normal expansions and contractions, macroeconomists (and our models) mainly focus on goods markets, studying whether the demand for output is well aligned with potential output, whereas risk markets considerations are relegated to a secondary role, mostly relevant to the field of finance (Figure 1a). In sharp contrast, during severe risk-off events this hierarchy flips. Risk markets become central, and disorderly outcomes in them quickly permeate the real side of the economy through supply and demand mechanisms. That is, insufficient demand for the risks generated by the productive structure contaminates –often in a chaotic (even Knightian uncertainty) fashion– equilibrium in goods markets (Figure 1b).

These risk events take place in a global economy with heterogenous and highly interconnected financial markets, which operate in different currencies and are exposed to large swings in capital flows. These flows provide many useful services to the global economy but are often fickle. This is perhaps because foreign crises make the transition from speculation-mode to Knightian uncertainty-mode faster than when these crises take place in local and better understood markets. This difference is partly due to the fact the policy infrastructure to support risk-markets during international crises is much less developed than that to support local crises. Furthermore, the international dimension creates multiple substitutes for the distressed markets, which facilitates a speedy exodus, particularly from periphery markets.

There are important structural factors behind the buildups into these risk events, which stem from frictions in the production of financial assets (i.e., in the mapping from risk generation to asset production). These frictions are more acute in emerging markets (EMs), but fast growth in EMs relative to developed markets (DMs) combined with their increased prudence, has turned the global economy into a sort of “advanced EM,” with corresponding recurrent risk events. A central ingredient in the instability of this global integration process is the large asymmetry in safe asset production across the world, with the U.S. as the core supplier of these assets (Figure 2). Several of the mechanisms I describe below underlie this asymmetry.

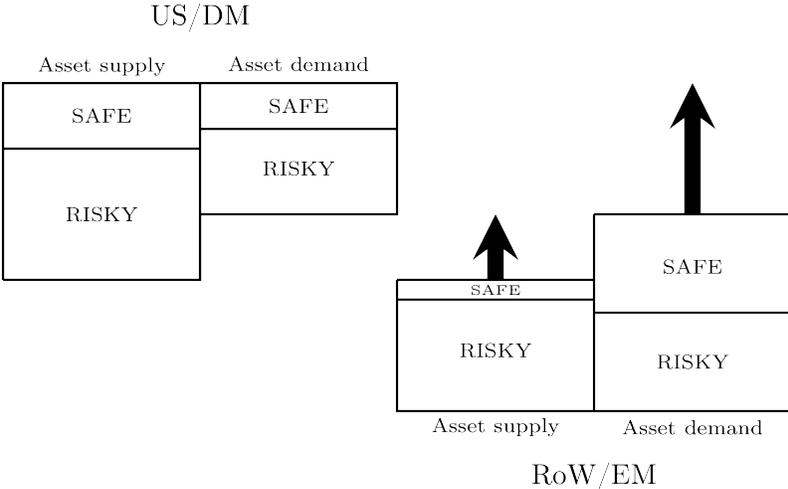


Figure 2

In order to keep the length of these notes under control while discussing many models, I only provide a pictorial illustration of the key mechanisms. All the topics I cover have an academic and a policy (even advocacy at times) dimension, and they are organized in a manner that is substantially aligned with the sequence of global macroeconomic events of the last two decades, starting with EM crises and concluding with the current environment of low interest rates and aggregate demand vulnerability. Section 2 focuses on EM crises, for which I will discuss sudden stops and financial underdevelopment, reach for yield, and contingent reserves management and multilateral facilities. Section 3 focuses on global and DM crises, for which I will discuss global imbalances, Knightian uncertainty and flight to safety, and put-option style policies (policy puts). Section 4 focuses on structural risk-based demand recessions and global contagion, for which I will discuss safety traps and currency wars. Section 5 focuses on cyclical risk-based aggregate demand recessions, speculation, and macroprudential policy. Section 6 focuses on capital flows taxation in a low interest rates environment. Section 7 contains final remarks and references to ongoing research in the above areas.

2. Risk-centric Crises in Emerging Markets

EMs are the most exposed to international risk-markets dislocations. The so called “sudden stops” refer to the rapid reversal of net capital inflows and their devastating consequences for the real economy. With the process of institutionalization of sound macroeconomic policy practice and the rapid growth in financial integration, the triggers for these sudden stops have gradually migrated (but not entirely) from conventional macroeconomic imbalances to risk-market dislocations — and the academic and policy debate has evolved accordingly.

There is a fundamental asymmetry at the root of the risk-based crises in EM: These economies are significantly better at producing output from physical capital than at producing tradable and pledgeable financial assets backed by that capital and future output stream (Figure 3). This asymmetry generates a chronic scenario of shortages of assets with fast growth, which in turn provides a fertile ground for the emergence of asset bubbles. Speculative episodes are often fueled by reinforcing reach-for-yield but fickle capital flows, which sow the seeds for the next sudden stop. The policy responses to these cycles include the large accumulation of international reserves and macroprudential policies to limit the exposure of an underdeveloped domestic financial system to these large capital flow reversals. The lack of international coordination and limited availability of insurance arrangements, however, raises the costs of these policies for the local economies and, once aggregated, may hamper the stability of the global financial system.

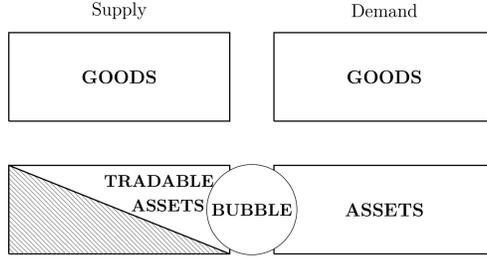


Figure 3: EM’s financial underdevelopment: shortage of tradable assets creates room for bubbles to satisfy the demand for assets.

2.1. Sudden Stops and Domestic Financial Underdevelopment

The tension between fast growth and limited asset production in EMs can be resolved by looking for a store of value abroad. However, the large wedge between the returns on those foreign assets and domestic marginal product, invites the emergence of domestic bubbly assets and collateral used to fund domestic investment.

In principle, both could be efficient outcomes: Bubbles are needed to solve a sort of dynamic inefficiency due to financial underdevelopment, and so is the real investment in profitable productive capacity. However, they are also sources of financial fragility. Once the possibility of sudden stops arises, the very same financial underdevelopment behind those bubbly outcomes gives rise to a pecuniary externality in which the private sector overinvests in the domestic bubbles and capital and underinvests in international liquidity, exposing the economy to a sudden dry-up of international (and also domestic) funding.

This is the perspective we adopted in our work with Arvind Krishnamurthy, where we focused on both the ex-ante and ex-post (i.e., during the crisis) problems of sudden stops. The starting point of our analysis is a *dual liquidity* perspective, in which the distinction between domestic and international liquidity (or collateral) is unimportant during normal times but is critical during crises, where international liquidity becomes binding. In fact, one way of thinking about bubbles in this context is as a temporary perception of domestic collateral as if it were international collateral, which becomes undone during sudden stops. With this perspective, comes the view of sudden stops as price-insensitive international liquidity dry-ups. We argued this is a better characterization of crises where everyone is trying to exit through the same narrow gate, rather than one in which crises amount to some exogenous jump in the country’s risk premium. We referred to these as vertical (as opposed to horizontal) sudden stops.

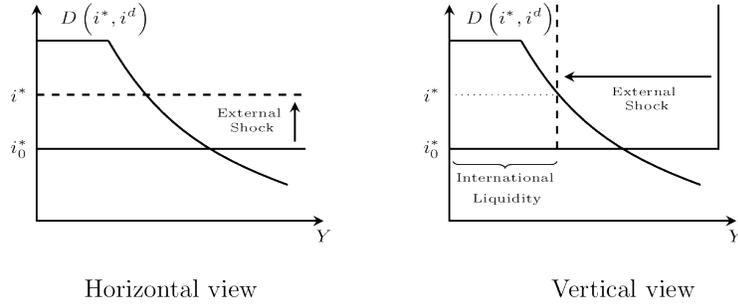


Figure 4: Horizontal and vertical sudden stops. Dollar debt interest rate on y-axis, domestic output on x-axis. D denotes constrained output demand.

The two panels in Figure 4 capture stylized versions of the horizontal (left) and vertical (right) perspectives. They both plot equilibrium dollar-debt interest rates (y-axis) and domestic output (x-axis). Output is constrained by available liquidity, and the constrained demand for the latter is a decreasing function of both international and domestic liquidity costs (the latter captured by the interest rate i^d). In the horizontal view, a sudden stop happens because the dollar-credit spread of the country spikes, shifting the effective supply of international liquidity up. In the vertical view, it is international liquidity that becomes binding during a crisis, as the vertical supply shifts to the left. In both cases, the final result is a rise in credit spreads, a sharp drop in output, and the reversal of capital inflows, but the similarities end there.

In terms of ex-post policy (i.e., during the sudden stop), an expansion of domestic liquidity is effective in stabilizing output in the horizontal view while it is ineffective in the vertical view since the binding constraint is a lack of international, not domestic, liquidity. That is, in the horizontal view domestic and international liquidity are good substitutes, which naturally facilitates the countercyclical response of the local central bank. In contrast, in the vertical view domestic and international liquidities are poor substitutes, thus there is little the local central bank can do ex-post, aside from supplying the international liquidity it has hoarded in advance.

Turning to the ex-ante questions, we ask whether the above outcome could be constrained efficient: Is the private sector doing the best it can given the fickleness of capital flows? We argue that the very same financial underdevelopment behind the shortage of sound assets in EMs also leads the private sector to underinsure against international-liquidity dry-ups. The reason for this underinsurance result is that the effective demand for international liquidity is constrained by limited domestic collateral, which introduces a gap between the social value of an extra unit of international liquidity and the private reward for a domestic lender of that unit of international liquidity. This gap is depicted in Figure 5 by the distance between the marginal product of capital (i.e., the dashed horizontal line) and the equilibrium expected return from a dollar-loan, i^* .

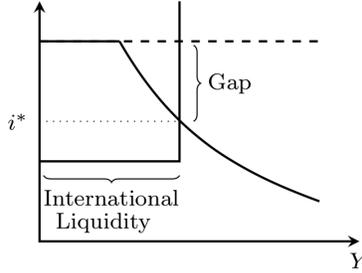


Figure 5: Gap between private and social marginal values of international liquidity in the vertical view.

This simple diagram captures a variety of phenomena around sudden stops. Underinsurance against them can take many forms: For instance, as a dollarization of liabilities or as a domestic real estate boom funded with capital inflows. Along the same lines, Figure 6 reproduces Figure 5 but replaces the dollar-rate for the current exchange rate on the y-axis via the uncovered interest parity condition (UIP). In this space, it illustrates the incentive of a central bank to defend the currency (via interest rate hikes) during a sudden stop (the so called “fear of floating”), since the domestic interest rate becomes largely disconnected from domestic activity, thus other goals, such as the stabilization of the currency, gain priority.

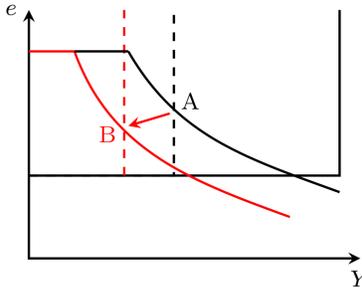


Figure 6: Exchange rate e in units of domestic currency per unit of foreign currency on the y-axis. Anticipated defense of the exchange rate shifts the vertical curve inwards (less hedging).

For advanced EMs that have achieved credibility of their macropolicy framework, these incentive problems, both of the private sector and policymakers, can be ameliorated by modifying the inflation targeting regime so that the explicit target is increased during sudden stops. A related mechanism that endogenizes such a rule is to overweight the basket of nontradable goods (equivalently, underweights tradables). Through these modifications, fear of floating is reduced and its anticipation lowers the extent of the underinsurance problem. More abstractly, there is a variety of policies that implement the optimal mechanism more directly and do have parallels in actual EMs’ policies, such as sterilization and taxation of capital inflows. However we show that they typically need to be extremely large to work (sterilization) or are hard to implement, as they are often not coalition incentive compatible (i.e., there is a strong incentive to circumvent the regulation).

In work with Guido Lorenzoni, we explore the related theme of currency overvaluation during a boom. We show that when the export sector faces borrowing constraints, it may well be the case that optimal policy includes a combination of currency weakening during the boom and in the early stages of the capital flow reversal phase. By doing so, the export sector’s net worth rises during the sudden stop (a sort of shift to the right of the vertical constraint), which is when its pull is needed the most. These results are illustrated in Figure 7, which shows an example of the path of the equilibrium (blue) and optimal (red) exchange rate (top panel, measured as units of foreign currency per unit of domestic currency) and size of the export sector (bottom panel) for an economy that experiences an abrupt end of its overvaluation phase in period 5. Note that, somewhat paradoxically, because the export sector is better capitalized under the optimal policy (vertical constraint shifts to the right), the exchange rate depreciation at the sudden stop is less acute.

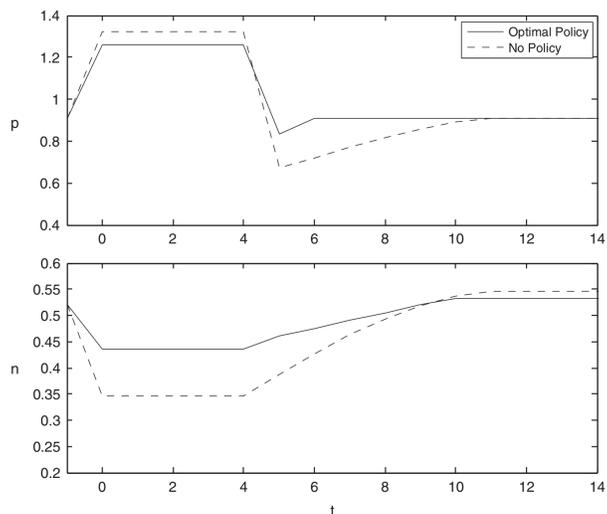


Figure 7: Laissez-faire vs. optimal path for exchange rate p in units of foreign currency per unit of domestic currency (top panel) and number of export units n (bottom panel). The appreciation lasts from $t = 0$ to $t = 4$.

2.1.1. References

1. Caballero, Ricardo J., and Arvind Krishnamurthy. 2001. “International and domestic collateral constraints in a model of emerging market crises.” *Journal of Monetary Economics*, 48(3): 513 – 548.
2. Caballero, Ricardo J., and Arvind Krishnamurthy. 2002. “A Dual Liquidity Model for Emerging Markets.” *American Economic Review*, 92(2): 33–37.
3. Caballero, Ricardo J., and Arvind Krishnamurthy. 2003. “Excessive Dollar Debt: Financial Development and Underinsurance.” *The Journal of Finance*, 58(2): 867–893.

4. Caballero, Ricardo J., and Arvind Krishnamurthy. 2004. “Smoothing sudden stops.” *Journal of Economic Theory*, 119(1): 104 – 127. Macroeconomics of Global Capital Market Imperfections.
5. Caballero, Ricardo J., and Arvind Krishnamurthy. 2005. “Inflation Target and Sudden Stops,” in *The Inflation Targeting Debate*, ed by Ben Bernanke and Michael Woodford, Chicago Press.
6. Caballero, Ricardo, and Arvind Krishnamurthy. 2005. “Exchange Rate Volatility and the Credit Channel in Emerging Markets: A Vertical Perspective.” *International Journal of Central Banking*, 1(1): 207–245.
7. Caballero, Ricardo J., and Arvind Krishnamurthy. 2006. “Bubbles and capital flow volatility: Causes and risk management.” *Journal of Monetary Economics*, 53(1): 35 – 53.
8. Caballero, Ricardo J., and Guido Lorenzoni. 2014. “Persistent Appreciations and Overshooting: A Normative Analysis.” *IMF Economic Review*, 62(1): 1–47.

2.2. Reach for yield

A classic theme in the capital flows literature is whether these flows are driven by pull (domestic) or push (foreign) factors. In my recent work with Alp Simsek we study the role of fickle reach-for-yield capital flows (a push factor) in exacerbating the severity of sudden stops. The fickleness stems from the fact that these flows are often from non-specialists prone to perceive Knightian uncertainty when crises strike in these foreign markets.

The basic idea of this work is that while fickleness is a destabilizing force for local liquidity crises, international diversification is a stabilizing force. In this context, we show that when countries are sufficiently symmetric in terms of their expected returns, the capital flows are on net stabilizing despite their fickleness. The reach-for-yield phenomenon arises when there is a significant departure from this symmetric benchmark in terms of expected returns.

To study that departure we first model the equilibrium of a block of high return EMs that excludes interaction with a lower return but less crisis-prone DM block, and then open it up to this interaction. The horizontal dashed line in the top panel of Figure 8 shows the equilibrium fire sale price in a country experiencing a local (vertical) crisis, when a block of homogeneous but not perfectly correlated EMs have cross holdings on each other. In this case, the gain from international diversification is substantial as autarky equilibrium prices are equal to zero (this is a normalization in the model). The horizontal dashed line in the bottom panel portrays the (ex-ante) outflows from a representative EM (which goes entirely to other EMs when not integrated to DMs).

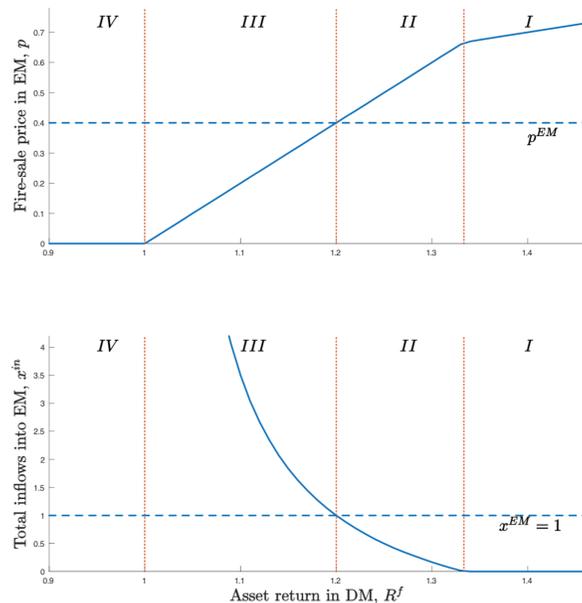


Figure 8: Reach for yield: The solid lines plot the equilibrium fire-sale price p and inflows x^{in} in the EM as a function of the return in the DM, R^f . The dashed lines illustrate the price and inflows that would obtain in the EM block in isolation (without any DM-EM flows).

Suppose now that we introduce a block of DMs that experience no liquidity crises but whose assets have a lower return than those from EMs. The solid lines in the figure illustrate this scenario. In region I, we see a situation where the return in DM is high (but possibly lower than the hold-to-maturity return on EM assets). In such a case, EMs do all their liquidity provision in DM assets and equilibrium fire-sale prices rise substantially, while EMs experience net capital outflows prior to a potential crisis (there are no inflows, and outflows remain at one). However, as the return in DM’s assets starts to fall, at some point fickle capital inflows into EM start rising (region II), which depresses fire sale prices in the event of a crisis. These are reach-for-yield flows, which turn into a net-negative once in region III, with fire-sale prices that are worse than without integration to DM and where EMs experience net capital inflows prior to crises.

On the policy front, we show that in regions III and IV, it may be beneficial for the EM block to tax capital inflows, as long as they collectively face a sufficiently elastic supply of safe assets (a condition that may not hold in the current global environment of safe asset scarcity, see section 5.2 below).

2.2.1. References

1. Caballero, Ricardo J., and Alp Simsek. 2018. “Reach for Yield and Fickle Capital Flows.” *American Economic Review, Papers and Proceedings*, Vol 108, pp. 493-98.

2.3. Contingent Reserves and Multilateral Financial Arrangements

The tendency for the private sector to underinsure against sudden stops is a (precautionary) reason for central banks in EMs to accumulate international reserves. Usually, these are accumulated in the form of ultra-safe sovereign bonds, primarily U.S. treasuries. This practice has important global systemic consequences, which I will discuss later, but it also has substantial costs for individual EMs. For this reason, I advocated for contingent instruments and special purpose vehicles (SPVs) involving the international financial institutions (IFIs) to help insure well behaved EMs against risk-based sudden stops.

My work with Stavros Panageas contains the models and quantitative analysis behind many of these recommendations, which often involved some contingency linked to commodity prices (for commodity producers) and VIX options structures.¹ The following table (Figure 9) illustrates the large expected gains from a VIX-based contingency for realistic calibrations, particularly so for countries whose sudden stops are mostly due to global risk factors. The first column shows an estimate of the likelihood of a VIX jump, conditional on the country experiencing a sudden stop, which is very high at around 70 percent for EMs in general and close to 90 percent for the relatively stable East Asian economies. The second column reports the average gain in reserves during a sudden stop from the hedging strategy, which exceeds 40 percent for the average economy in our sample and in many instances more than doubles international reserves.

Country	$Pr(J = 1 \mid SS = 1)$	Expected gain (options)
Argentina	0.80	0.60
Brazil	0.60	0.14
Chile	1.00	1.40
Indonesia	1.00	1.40
Korea	1.00	1.40
Malaysia	0.67	0.26
Mexico	0.00	0.00
Thailand	1.00	1.40
Turkey	0.75	0.46
Average	0.72	0.39
High-risk Countries	0.71	0.36
East Asia	0.88	0.86

Figure 9: Expected gains in reserves on entering a sudden stop when following the hedging strategy in Caballero and Panageas (2006).

Some of the markets for these contingencies, especially those linked to global factors, already exist and are well developed (although probably not enough to absorb a massive EM reallocation toward them, which reinforces the next point). However, there is much scope for improving the liquidity of the EM asset class as a whole, which would not only reduce the severity of sudden stops but would also expand the effective supply of reliable assets, and in so doing would attack the fundamental structural deficiency on which many of the risk dislocations build. A specific proposal I made a few years back is for the IMF and other IFIs to play the dual role of monitors and investors

¹VIX is a weighted average of the implied volatility of (synthetic) 30 days options on the S&P 500 Index, and is often described as a “fear index.”

in a variety of SPVs and collateralized debt obligations (CDOs) whose assets are EM debt from countries that meet certain macroeconomic health criterion.²

In recent years the IMF has created useful contingent credit line facilities, and the Fed implemented large swap lines with foreign central banks during the worst days of the Global Financial Crisis (GFC).³ These are all welcome steps from a risk-based perspective of crises. Still, we lack a larger, coordinated, and more dependable international liquidity arrangement that matches the existing domestic liquidity tools and their independence from the political process.

2.3.1. References

1. Caballero, Ricardo J., and Stavros Panageas. 2008. “Hedging sudden stops and precautionary contractions.” *Journal of Development Economics*, 85(1): 28 – 57.
2. Caballero, Ricardo J. 2003. “The Future of the IMF.” *American Economic Review*, 93(2): 31–38.
3. Caballero, Ricardo J. 2001, *Macroeconomic Volatility in Reformed Latin America: Diagnosis and Policy Proposals*. Washington D.C.: Inter-American Development Bank
4. Caballero, Ricardo J. 2003. “On the international financial architecture: Insuring emerging markets.” *Journal of Financial Transformation*, 7: 8–12.
5. Caballero, Ricardo J. 2000. “Macroeconomic Volatility in Latin America: A View and Three Case Studies.” *Economia*, 1(1): 31–108.
6. Caballero, Ricardo J., and Stavros Panageas. 2006. “Contingent Reserves Management: An Applied Framework.” In *External Vulnerability and Preventive Policies*. , ed. Ricardo Caballero, César Calderón and Luis Felipe Céspedes, 399–420. Central Bank of Chile.
7. Caballero, Ricardo J. 2002. “Coping with Chile’s External Vulnerability: A Financial Problem.” In *Economic Growth: Sources, Trends, and Cycles*. , ed. Norman Loayza and Raimundo Soto, 377–416. Banco Central de Chile.
8. Caballero, Ricardo J. 2002. “International Liquidity Management Problems in Modern Latin America: Their Origin and Policy Implications.” In *Latin American Macroeconomic Reforms: The Second Stage*. , ed. Jose Antonio Gonzalez, Vittorio Corbo, Anne Krueger and Aaron Tornell, 207–230.
9. Caballero, Ricardo J., and Stavros Panageas. 2007. “A Global Equilibrium Model of Sudden Stops and External Liquidity Management.”

²A similar proposal, the Sovereign bond-backed Securities (SBBS), is currently being considered by the European Systemic Risk Board to create a new regional safe asset.

³Australia, Brazil, Canada, Denmark, UK, ECB, Japan, South Korea, Mexico, New Zealand, Norway, Singapore, Sweden, Switzerland, from December 2007 to February 1, 2010.

10. Caballero, Ricardo J., Kevin Cowan, and Jonathan Kearns. 2005. “Fear of Sudden Stops: Lessons from Australia and Chile.” *The Journal of Policy Reform*, 8(4): 313–354.

3. Risk-centric Crises in Developed Markets and the Global Economy

The acute scarcity of store of value assets in EMs has some parallels at the global level, particularly since the crash of the Japanese bubble in the late 1980s and the collective EM crisis of the late 1990s. The symptoms of scarcity of assets have been recurrent and pervasive. For example, Figure 10 illustrates that the pre-GFC phase of the global economy exhibited a “conservation law” of speculative bubbles, that migrated through several asset classes.

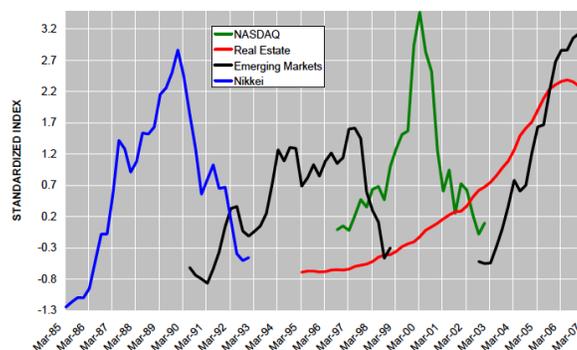


Figure 10: Conservation law of bubbles pre-GFC.

However, in recent decades, and partly because of the large participation of central banks and sovereign wealth funds, global asset demand has been biased toward safe assets. This phenomenon was a key factor behind the GFC and has deep implications for the functioning of the global economy going forward. I will discuss the buildup into the crisis and its mechanisms in this section, and the recovery and structural implications in the next sections.

The so called global imbalances (primarily the large current account deficits in the U.S.) were one of the most talked about global phenomena before the subprime crisis. While I never shared the view that these imbalances would in themselves bring the U.S. financial system down through an EM style sudden stop, I believe that they did create a very significant risk-based fragility through the incentive for DMs financial systems to increase leverage and to put their own production of “safe” assets into overdrive, with ever more creative and complex financial engineering to extract safe tranches from subprime products. It is in this sense, and not in the sudden stop one, that the U.S. crisis had an international origin. From then on, capital flows quickly turned the U.S. subprime crisis into the GFC, which exposed many of the fragilities of the Euro area, triggering several rounds of crises in this region. Appropriately for a massive risk markets driven crisis, and having to deal with severe political obstacles, DM central banks implemented large unconventional

asset-market put policies, which prevented a complete meltdown of the global economy.⁴

3.1. Global Imbalances and Low Interest Rates

Much of the focus of the global imbalances literature at the time was on the large current account deficit of the U.S. In work with Emmanuel Farhi and Pierre-Olivier Gourinchas, we modeled and argued that this was a capital account induced phenomenon reflecting the U.S. comparative advantage in producing store of value assets relative to the high saving economies of Asia in particular. Moreover, the faster rate of growth of the latter region implied a structural and increasing force to contend with. Figure 11 captures this tension.

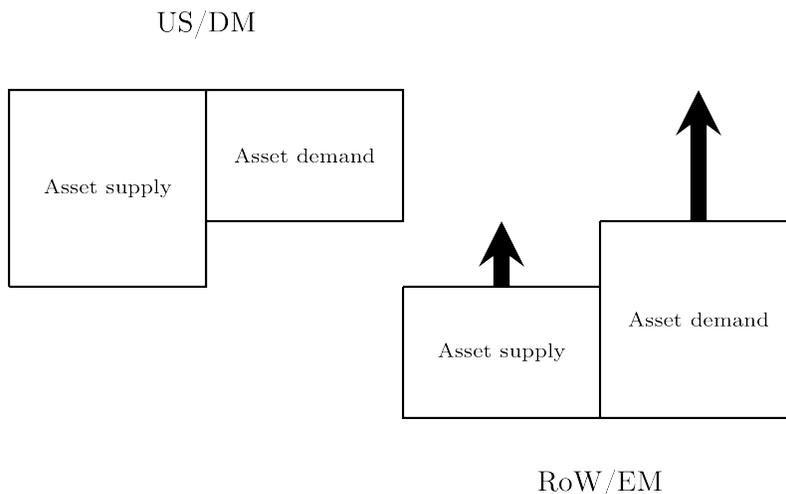


Figure 11: U.S./DM produces many assets, RoW/EM produces few assets but has high and growing demand for them.

Because the current account deficit was driven by asset demand, it also induced a steady decline in U.S. interest rates, immortalized in the so called “Greenspan conundrum” (the fact that despite hiking the federal funds rate, long rates kept dropping as a result of the global inflows toward U.S. treasury bonds). Ben Bernanke’s famous “global savings glut speech” was based on similar and parallel observations. Figure 12 captures the mechanism in our model, through a Metzler diagram. The left panel reflects the asset demand and supply per unit of output (W/X and V/X , respectively) in the U.S./DM, while the right panel does the same for the RoW/EM. The gaps between demand and supply in each panel reflect the net foreign asset positions per unit of output (NA). The arrow pointing downward for the equilibrium interest rate reflects that the weight of the right panel is rising over time as RoW/EM is growing at a faster pace than U.S./DM ($g^{DM} < g^{EM}$).

⁴Credit is also due to the massive Chinese fiscal expansion, which supported the entire EM world.

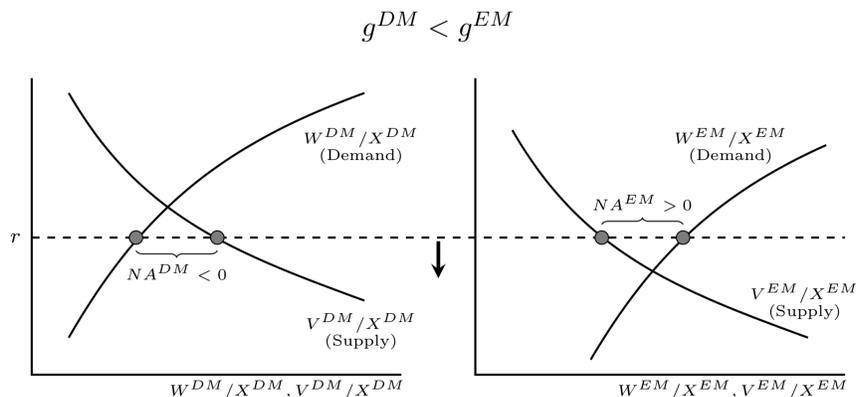


Figure 12: Metzler diagram.

Finally, in work with Pol Antras, we show that these patterns of reverse flows (from EM to DM) are exacerbated by trade-protectionism, as trade integration and capital inflows are complements in less financially developed economies. This complementarity arises because trade integration increases the return to capital in EM proportionally more than in DM (because trade allows the EM to reallocate capital toward less financially dependent sectors).⁵

3.1.1. References

1. Caballero, Ricardo J., 2006. "On the Macroeconomics of Asset Shortages," in *The Role of Money: Money and Monetary Policy in the Twenty-First Century*. The Fourth European Central Banking Conference, Andreas Beyer and Lucrezia Reichlin, editors. Pages 272-283.
2. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2008. "An Equilibrium Model of "Global Imbalances" and Low Interest Rates." *American Economic Review*, 98(1): 358–93.
3. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2008. "Financial Crash, Commodity Prices and Global Imbalances." *Brookings Papers on Economic Activity*, 1–68.
4. Antras, Pol, and Ricardo J. Caballero. 2009. "Trade and Capital Flows: A Financial Frictions Perspective." *Journal of Political Economy*, 117(4), 701-744.

3.2. Reach for Safety and Leverage

While our global imbalances models were motivated by a rising demand of safe assets, our original analysis did not have explicit risk in it. In a paper with Arvind Krishnamurthy we added risk and focused on the implications for the asset supplier economy (the U.S.). Our model shows that

⁵In contrast, in the classical Heckscher-Ohlin-Mundell paradigm trade integration and capital inflows are *substitutes*.

during the boom phase of this economy, a large external demand for safe assets not only puts downward pressure on the safe interest rate but also increases the leverage of its financial system and, somewhat paradoxically, it initially compresses risk-premiums. These effects increase the vulnerability of the domestic financial system to a recessionary shock. That is, even without the risk of an EM style sudden stop, the nature of the inflows makes the U.S. more vulnerable to domestic shocks.

Figure 13 illustrates the mechanism. It shows the risk premium and interest rate (left panel) and asset value and external debt (right panel) graphed over time. Foreign inflows in search of safe assets start at $t = 0$. At $t = 6$ domestic shocks to output turn negative (while capital inflows continue). The figure shows that the risk premium and interest rate fall upon entry. After that, the risk premium rises gradually as leverage accumulates, and it accelerates after $t = 6$. The interest rate drops uniformly over time. It does so rapidly when the inflows start, gradually afterward since risk builds during the boom, and sharply again once domestic shocks turn negative. The right panel of the figure shows that domestic asset values rise upon entry and during the boom, before falling rapidly when output shocks turn negative. External (safe) debt accumulates throughout.⁶

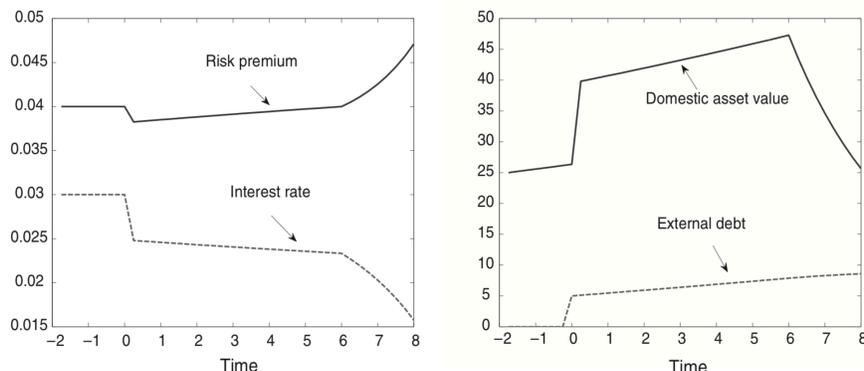


Figure 13: Risk premium and interest rate (left panel) and asset value and external debt (right panel) graphed over time. $t = 0$ is the date of foreign entry. $t = 6$ is when domestic output shocks turn negative.

In recent work with Alp Simsek, we dub this phenomenon of capital inflows into safe assets as Reach-for-safety flows (to parallel the Reach-for-yield flows), and show that while stabilizing for the world economy, they can be destabilizing for the recipient country. This is in tune with the persuasive empirical case made by Pierre-Olivier Gourinchas and Helene Rey that, in terms of gross capital flows, in aggregate the U.S. behaves as a venture capitalist and insurer of last resort.

⁶Incidentally, from the perspective of the private sector, one can think of Quantitative Easing (QE) policies targeted toward safe assets as equivalent to these foreign inflows. In this case, as an attempt to contain an excessive deleveraging and boost asset prices.

3.2.1. References

1. Caballero, Ricardo J., and Arvind Krishnamurthy. 2009. “Global Imbalances and Financial Fragility.” *American Economic Review*, 99(2): 584–88.
2. Caballero, Ricardo J., and Alp Simsek, 2018, “A Model of Fickle Capital Flows and Retrenchment,” MIT mimeo.

3.3. Complexity, Knightian Uncertainty and Flight to Safety

Up to this point, the story for these imbalances is one of the U.S. as a global supplier of assets and insurance. The parallel question with the EM underinsurance phenomenon is whether the U.S. was selling too much insurance to the rest of the world. This may well have been the case but there was more. A key issue for understanding the severity of the subprime crisis and the GFC that followed is the form of that insurance (or, more accurately, of the assets created to replace the sales of U.S. treasuries to foreigners within the financial system), which came from the large private supply of complex financially engineered safe assets. This complexity gave rise to massive uncertainty once things began to unravel.

It was this perspective that led Arvind Krishnamurthy and I to work on Knightian uncertainty for understanding crises. In a paper that was coincidentally and timely published in October 2008, we argue that a central aspect of extreme crises is the unusual nature of the shock that surprises even sophisticated market participants, causing them to question their models. We show that a central feature of that environment is a sort of double-counting of risks. In term of the risk-centric diagrams, we can capture this mechanism by splitting the risk-supply box into the perceived supply faced by two agents of equal size. Each of them thinks that it is absorbing more than its fair share of the risk, so collectively they perceive more risk than the underlying economy is generating, which creates an immediate imbalance in risk-markets, that quickly contaminates goods markets (Figure 14).

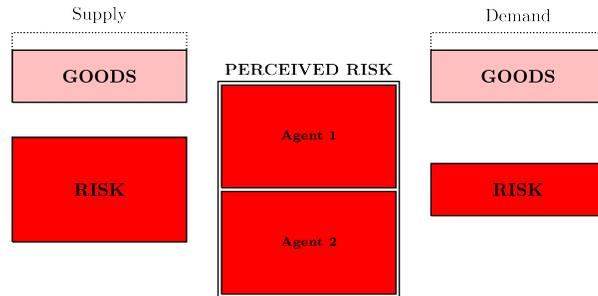


Figure 14

Where does the complexity come from? In work with Alp Simsek we modeled the financial system as a complex network, where banks understand the risks of their immediate neighbors, but not those of the neighbors of the neighbors, and so on. With a sufficiently large shock in the

network, those distant linkages become relevant, triggering Knightian uncertainty responses, which in our model consist of legacy asset (fire) sales ($A_0 = S$) to generate precautionary liquidity for a potential cascade.

In practice the surprise that turns risk into uncertainty is seldom the direct effect, but it is the second and higher rounds that do. For example, CDS prices of Lehman during the subprime crisis clearly anticipated that the investment bank could go under, but few anticipated that so could a large money market fund (Reserve Primary Fund) that was holding Lehman debt. Similarly, and even more indirectly, a few years earlier CDS prices anticipated that Russia could default on its debt during the EM crisis of the late 1990s, but few anticipated the degree of exposure of LTCM, not only to Russia itself, but to the reappraisal of risk that followed.

Figure 15 illustrates the mechanism. The top panel shows a small liquidity shock with a contained domino effect, where distant banks are not uncertain about the environment and hence turn into buyers ($A_0 = B$) of liquidated assets (the environment is simple). The bottom panel illustrates a larger liquidity shock and domino effect, which makes the environment uncertain for distant banks. In this case the equilibrium features a much larger flight to quality than in the certainty benchmark (the environment is endogenously complex) and all banks turn into sellers ($A_0 = S$).

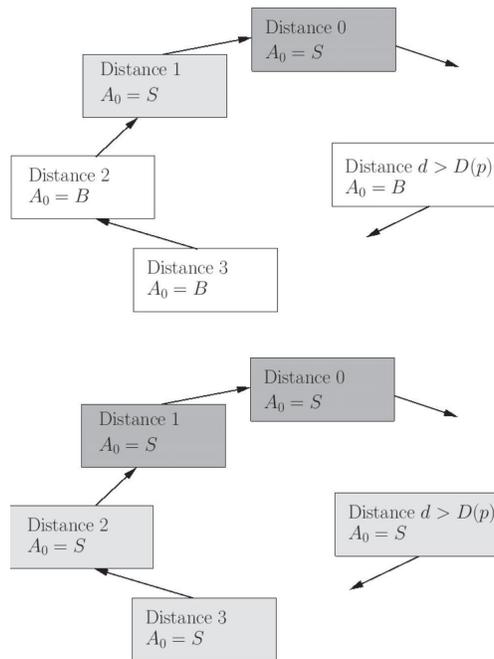


Figure 15: The partial domino effect and the precautionary actions with network uncertainty.

The international dimension adds yet another layer of complexity. As I already mentioned in the context of EMs, a well documented pattern is the tendency of capital flows to be fickle, with large reversals of capital inflows and retrenchment of outflows during risk-off episodes (Figure 16). In other work with Alp Simsek we show that Knightian uncertainty provides one plausible explanation

for such a pattern of fickleness and retrenchment.

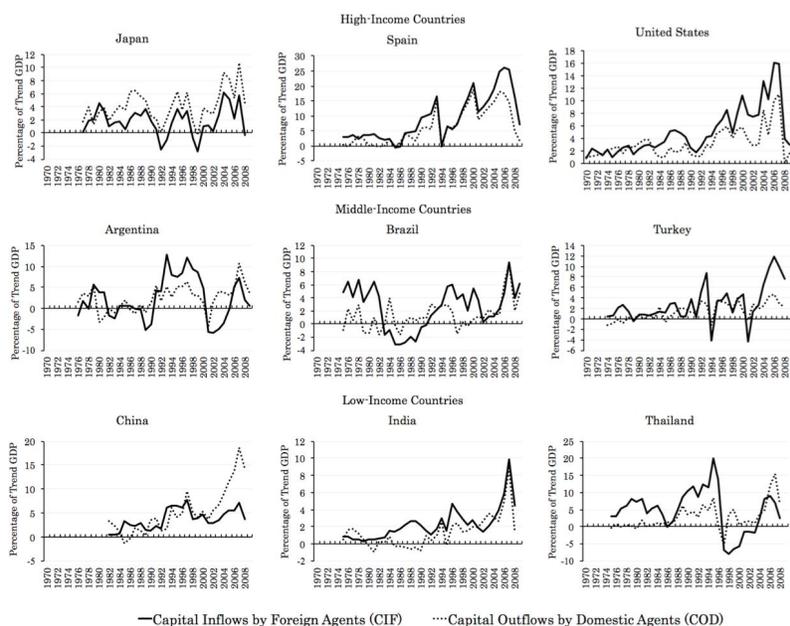


Figure 16: This figure from Broner et al. (2013a,b) shows the capital inflows and outflows for a sample of countries based on IMF’s Balance of Payments statistics. CIF is equal to the net purchases of domestic assets by non-residents, and COD is equal to the net purchases of foreign assets by domestic agents (including international reserves).

3.3.1. References

1. Caballero, Ricardo J., and Arvind Krishnamurthy. 2008. “Collective Risk Management in a Flight to Quality Episode.” *The Journal of Finance*, 63(5): 2195–2230.
2. Caballero, Ricardo J., and Alp Simsek. 2013. “Fire Sales in a Model of Complexity.” *The Journal of Finance*, 68(6): 2549–2587.
3. Caballero, Ricardo J., Arvind Krishnamurthy, et al. 2008. “Musical Chairs: A Comment on the Credit Crisis.” *Banque de France Financial Stability Review: Special Issue on Liquidity*, 11: 9–11.
4. Caballero, Ricardo J., and Alp Simsek, 2018, “A Model of Fickle Capital Flows and Retrenchment,” MIT mimeo.

3.4. Put Policies and Financial Defibrillators

Conventional monetary policy, the quintessential tool for plain-vanilla cycles, has an important role to play in risk-based contractions, mostly by improving the (ex-ante) Sharpe ratio of risky assets. Figure 17 illustrates this mechanism, in which a lowering of interest rate expands the demand for risk.

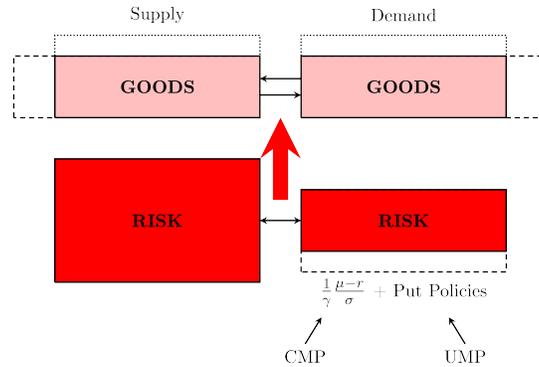


Figure 17

However, this channel is often insufficient, as interest rate adjustments are constrained by an effective lower bound, or by their impact on weak banks' profits, or by the need to defend a rapidly weakening exchange rate, and so on. In this context, unconventional “monetary” policies have a very significant role to play, and these are naturally, and mostly, risk-markets interventions, as it is in those markets where the source of all gaps lies. Again, EMs are at the short end of these scenarios. To them, unconventional policies are nearly conventional ones, since interest rate policy is often locked by equally urgent objectives, such as the exchange rate stabilization in a heavily dollarized economy, or the anchoring of potentially explosive inflation expectations. Still, given the proximity of DM's rates to their own effective lower bound, these policies have become crucial for them as well.

As I mentioned earlier, acute risk markets dislocations are messy and the degree of effective risk aversion can rise dramatically as financial complexity triggers Knightian uncertainty. In such an environment, unconventional policies that have a large anti-anxiety component are most powerful. Explicit and implicit insurance arrangements, put option type policies (such as private and sovereign credit markets support), are more powerful than call-option type policies (such as forward guidance), as financial markets shift their focus to the left tail of the distribution of risks during crises. Moreover, these policy actions have to be fast and anticipated by economic agents.

We have in the lender of last resort facility one such framework, but its scope is too narrow for full blown crises, especially those that destroy the asset side (and hence the collateral) of financial institutions, or that are concentrated outside of commercial banks. We need a broader *financial defibrillator* such that whenever a systemic crisis of uncertainty strikes, the government is able to provide access to reasonably priced balance-sheet insurance to financial institutions. Moreover, because it has to be fast, it should be managed by central banks, hopefully with a framework as close as possible to conventional monetary policy. We made one proposal of this kind with Pablo Kurlat at the Fed's Jackson Hole conference. Under our proposal, the central bank (CB) would issue *tradable insurance credits* (TICs):

- During a systemic crisis, each TIC entitles its holder to attach a CB guarantee to newly issued and legacy securities. The CB is the sole determiner of what constitutes a systemic crisis,

partially based on observable indicators.

- All regulated financial institutions are allowed to hold and use TICs, and possibly hedge funds, private equity funds, and corporations as well.
- The basic mechanism attaches TICs to assets, but variants include attaching them to liabilities and even equity, depending on particular needs of distressed institutions and markets. They could also operate as collateral-enhancers for discount window borrowing.
- During normal times, when TICs are *not* convertible, the CB can buy or sell TICs at a market price. Regulated financial institutions hold a minimum amount of TICs as a proportion of risk-weighted assets and systemic importance.

It is important to notice that the TIC policy is not a conventional insurance policy in the sense that the latter exchanges a fee during normal times for a cash injection during crises. Rather, the TIC policy is an “insurance-squared” policy: For a fee, it ensures that financial institutions will have *access* to insurance for their assets during a systemic crisis. This is a key feature to maximize the perceived size of the policy. In my work on flight to safety with Arvind Krishnamurthy (discussed in the previous section) we show that when Knightian uncertainty is at play, it is possible to find situations where there could be nearly free-policy-lunches, as collectively agents envision and fear scenarios that are impossible (for example, everyone thinks that they will be hit harder than the average). A powerful put policy framework builds on these features to gain leverage.

3.4.1. References

1. Caballero, Ricardo J., and Pablo Kurlat. 2009. “The ”Surprising” Origin and Nature of Financial Crises: A Macroeconomic Policy Proposal.” *Financial Stability and Macroeconomic Policy*, Federal Reserve Bank of Kansas City.
2. Caballero, Ricardo J. 2009. “The ”Other” Imbalance and the Financial Crisis.” Prepared for the Bank of Italy’s Pablo Baffi Lecture.
3. Caballero, Ricardo J., and Pablo Kurlat. 2008. “Flight to Quality and Bailouts: Policy Remarks and a Literature Review.”
4. Caballero, Ricardo J., and Pablo Kurlat. 2009. “Public-Private Partnerships for Liquidity Provision.”
5. Caballero, Ricardo J., 2009. “Crisis and reform: Managing systemic risk.” *Rivista di Politica Economica*, 99(4): 9–64.
6. Caballero, Ricardo J. 2010. “Sudden Financial Arrest.” *IMF Economic Review*, 58(1): 6–36.
7. Caballero, Ricardo J. 1999. “Stock Market Interventions: “An Update”.”

4. Structural Safe Asset Shortages, Aggregate Demand Constraints, and Global Spillovers

With the collapse of the private production of safe assets and the loss of the safe status by a large share of the European sovereign debt, the acute scarcity of safe assets in EMs became an acute *global* scarcity. All of a sudden, the mostly benign decline in safe interest rates that preceded the GFC turned into a negative force that put most DM's interest rates against their effective lower bounds. Capital flows (now within DMs) spread the liquidity traps across the developed world, and created the potential for currency wars. By then, not only the crisis, but also the ability to recover from it, heavily depended on risk-perceptions and policies at the global level.

4.1. Safety Traps

Figure 18 shows that while initially the decline in safe interest rates also dragged down the expected return on risky assets, it eventually turned into accommodating a rising equity-risk-premium (ERP), until it hit the zero lower bound (ZLB). Figure 19 is a particular representation of the risk-imbalance portrayed in Figure 1b, that captures the safe asset shortage view.

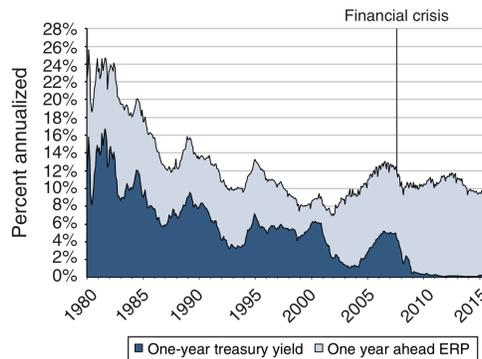


Figure 18: One-year Treasury yield from Federal Reserve H.15; equity risk premia (ERP) from Duarte and Rosa (2015).

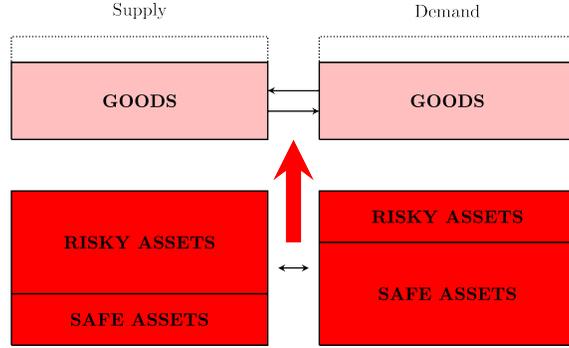


Figure 19

Emmanuel Farhi and I dubbed this situation a Safety Trap due to its origin in safe asset markets and because, unlike a conventional liquidity trap, it is responsive to put-policies but not to call-policies (such as forward guidance). To study this phenomenon we build a Keynesian model (sticky prices) with an endogenous risk premium. For this, we split economic agents between risk neutral and Knightians – the latter are only willing to hold safe assets, while the former have a limited (by endowment and financial frictions) capacity to issue these assets. In this environment, when the safe interest rate drops, resources are transferred from the Knightian to the Neutral agents, which restores equilibrium by depressing the demand for safe assets. A safety trap takes place when the imbalance in safe asset market is strong enough to bring the safe interest rate to its lower bound.

Figure 20 provides a Keynesian cross / AS-AD representation and illustrates this mechanism. In it, the supply of safe assets, V^S , plays the role of an aggregate demand shifter. A drop in V^S causes a recession if not compensated by a lower safe interest rate r , which is the case at the ZLB. Once interest rates reach the ZLB, equilibrium in the safe asset market is achieved by a costly recession (or slow recovery), which depresses everyone’s income in the process of dragging down safe asset demand.

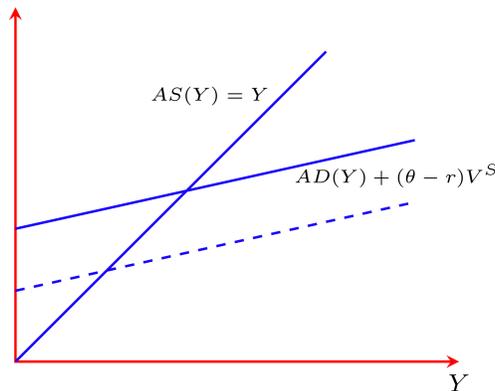


Figure 20: AS-AD representation and the Keynesian cross.

That is, when the imbalance in risk markets is severe, the economy is not only exposed to the standard (and important) supply side effects of balance sheet and collateral amplification mech-

anisms highlighted by the financial frictions literature, but also to the contractionary effects of a decline in aggregate demand.

In terms of policy interventions, safety traps are particularly responsive to QE type policies that absorb risky assets from private balance sheets in exchange for safe assets. Expansion of public debt is also useful as long as it does not compromise the safety of such debt or the private sector's ability to issue safe debt. In contrast, forward guidance type policies are ineffective as they do not relax the safe asset constraint, and for the same reason asset price bubbles have limited traction in expanding aggregate demand.

4.1.1. References

1. Caballero, Ricardo J., and Emmanuel Farhi. 2017. "The safety trap." *The Review of Economic Studies*, 85(1): 223–274.
2. Caballero, Ricardo J. 2011. "Asset Scarcity and Financial Crisis." In *Interview with Federal Reserve Bank of Minneapolis*, ed. Douglas Clement.
3. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2017. "Rents, technical change, and risk premia accounting for secular trends in interest rates, returns on capital, earning yields, and factor shares." *American Economic Review*, 107(5): 614–20.
4. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2017. "The safe asset shortage, the rise of mark-ups, and the decline in the labour share." *VOXEU.org*.

4.2. Global Spillovers and Policy Wars during the Recovery

In papers with Emmanuel Farhi and Pierre-Olivier Gourinchas, we show that in the international context, safety traps spread like wildfire across countries with structurally low interest rates and that, by the same token, put-policies anywhere are expansionary everywhere, which creates incentives for policy-free-riding, and, even worse, for currency wars.

Figure 21 illustrates the incentive to depreciate one own's currency by showing Home (y-axis) and Foreign (x-axis) output at the global ZLB, for different values of the exchange rate E (measured as units of domestic currency per unit of foreign currency). The red curve is a constant global output condition consistent with an equilibrium in the safe assets market at the global ZLB. Point A denotes the autarky equilibrium with both countries in a safety trap; full employment corresponds to output equal to one. When $E > E^a$, Home output increases and Foreign output decreases (point B). For a sufficiently high E Home escapes the ZLB and Foreign absorbs all the global output loss required to balance the safe asset markets (point C).

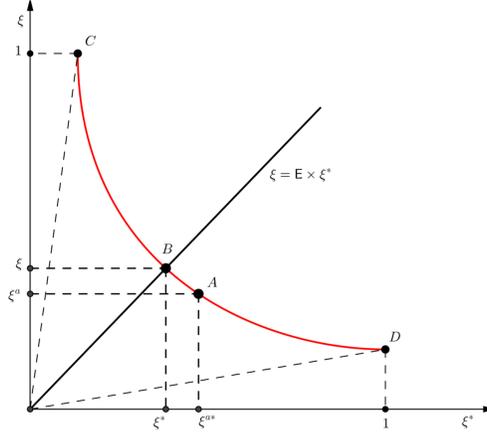


Figure 21: Home (y-axis) and Foreign (x-axis) output at the global ZLB, for different values of the exchange rate E .

4.2.1. References

1. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2017. “The Safe Assets Shortage Conundrum.” *Journal of Economic Perspectives*, 31(3): 29–46.
2. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2016. “Safe Asset Scarcity and Aggregate Demand.” *American Economic Review*, 106(5): 513–18.
3. Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2016. “Global Imbalances and Currency Wars at the ZLB.” mimeo.
4. Caballero, Ricardo J. 2016. “Global Safe Asset Shortage: The Role of Central Banks.” In *Progress and Confusion: The State of Macroeconomic Policy.*, ed. Olivier Blanchard, Raghuram Rajan, Kenneth Rogoff and Lawrence H. Summers, 261–266. International Monetary Fund and MIT Press.

5. Risk-centric Aggregate Demand Channels, Speculation, and Macroprudential Policy

The world economy finally has left the crisis behind, but the underlying structural asset market imbalances that took us there have not disappeared entirely, and we are in worse shape today in terms of our ability to respond to future risk-off shocks with conventional policies. In this context, risk-positions that may damage the capital of high-valuation levered financial institutions during a severe risk-off event acquire an extra layer of systemic risk, and may justify macroprudential policies even in the absence of EM style pecuniary externalities due to financial frictions.

In work with Alp Simsek we remove the market incompleteness behind the safe asset shortages mechanism but capture similar positive implications for aggregate demand recessions with a

complete markets model with risk averse agents. In this model severe risk-off episodes generate aggregate demand recessions with powerful amplification mechanisms even if there is no financial frictions. It also generates low-interest rates during the risk-on phase due to economic agent's concern with the economy's vulnerability to risk shocks.

We also show that when agents have heterogeneous valuations, financial transactions that increase the exposure of high valuation investors during the boom can be most damaging. The reason is that when interest rates are low, or are constrained by some other concern, then there is the possibility of an aggregate demand externality. This will be the case if high valuation investors (such as levered global banks) suffer severe losses in the event of a risk-off scenario, which further drags down asset prices, and aggregate demand, and so on.

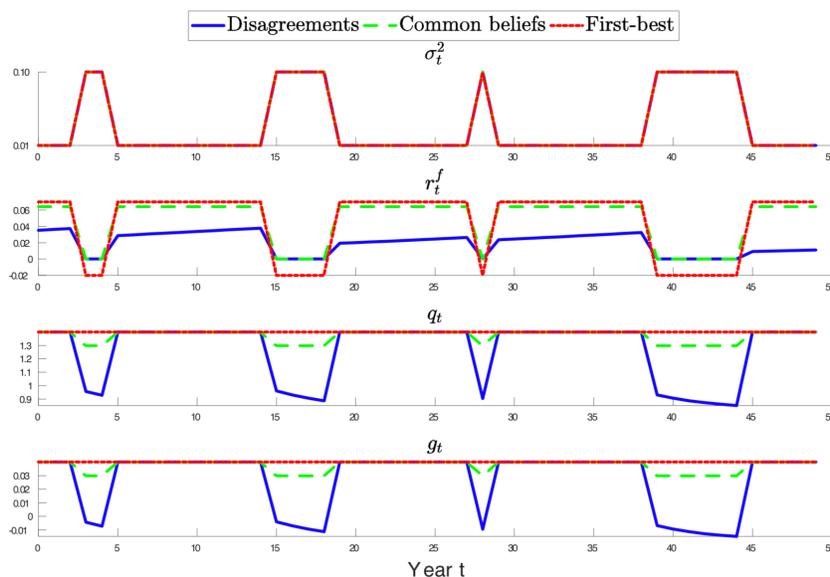


Figure 22: Evolution of the equilibrium variables (from top to bottom: risk, safe interest rate, asset prices, growth rate of output) with interest rate rigidities and belief disagreements (solid line), with rigidities and common beliefs (dashed line), and without rigidities (dotted line) over the medium run (50 years). The bottom two panels are in deviation from their diffusion component.

Figure 22 is a simulation from our model. The model has diffusion productivity shocks (removed from the figure) and risk-premium jumps. Heterogeneous valuations are generated via heterogeneous beliefs with respect to the likelihood of risk-premia shocks (that is, we use speculation as a catchall for financial transactions between high and low valuation agents). The top panel illustrates a randomly chosen path of the risk-premium driver. The next panels show the path of interest rates, asset prices, and the rate of growth of output, respectively. The red lines represent the path of the economy when there is no ZLB. The green dashed lines represent the path of the economy with homogeneous beliefs about the process driving the ERP shocks when the ZLB binds during ERP spikes. Finally, the blue lines represent the paths of the economy with the same average beliefs as the homogeneous economy but with disagreement (and hence speculation).

The figure is a proof of concept of how destabilizing it can be for a low-interest rate economy to have high valuation investors' balance sheets exposed to risk-off shocks. Note also that the severity of recessions significantly reduces the level of interest rates during the boom phase, which is due to a fear mechanism similar to that behind the safety traps described in the previous section.

The reason for this amplification in our framework is distinct from the standard and highly relevant balance sheet mechanism. In our model the feedback between aggregate demand and asset prices is a strongly destabilizing force that can only be contained by the expected capital gains from a recovery. That is, average optimism is a crucial state variable in this environment. However, average optimism is driven by the degree of speculation in financial markets. When speculation is high, the economy becomes effectively extrapolative, since the distribution of capital gains favors optimists during booms and pessimists during recessions. This extrapolative feature raises the possibility of a disaster path during recessions where optimists wealth is depleted. In turn, this possibility feeds into expectations and hence makes risk-off events much more severe.

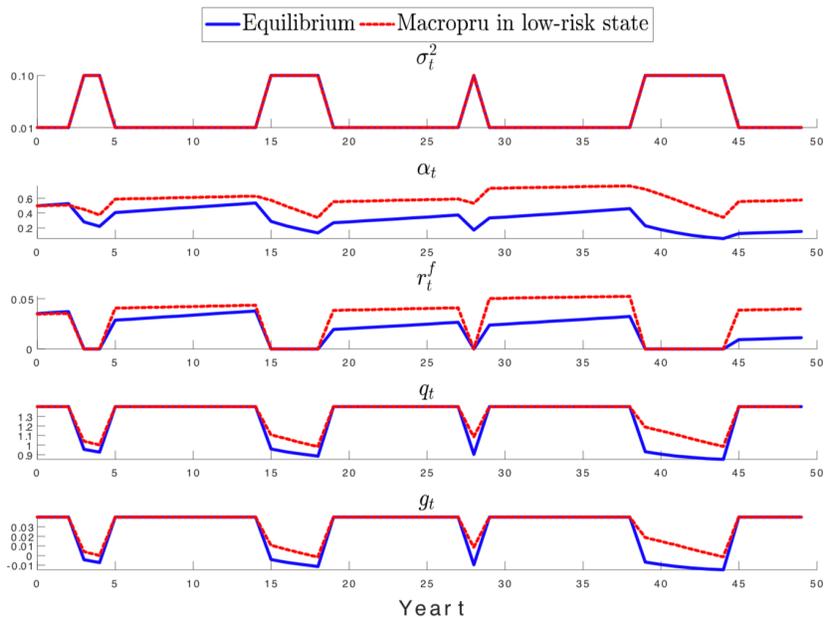


Figure 23: Evolution of the equilibrium variables without macroprudential policy (solid line) and with macroprudential policy in the boom state (dotted line) over the medium run (50 years). The bottom two panels are in deviation from their diffusion component.

In this context, we show that limiting the exposure of high valuation investors during the boom can significantly reduce the severity of crises (and safety traps). One prominent recent example of the kind of bets that needs to be limited is the holding of AAA tranches of securitized subprime loans by highly levered investment banks. The blue line in Figure 23 reproduces the path of the heterogeneous beliefs economy in the previous figure, and the red line shows the path with macroprudential policy (risk limits during the boom). The policy reduces the severity of recessions and, by backward induction, raises equilibrium interest rates during the boom.

5.1. References

1. Caballero, Ricardo J., and Alp Simsek. 2017. “A Risk-centric Model of Demand Recessions and Macroprudential Policy.” MIT mimeo
2. Caballero, Ricardo J., and Alp Simsek. 2018. “Destabilizing Speculation and Policy Puts in a Low Interest Rate Environment.” MIT mimeo (in progress)

6. Capital Flows Taxation in a Low Interest Rate Environment

If macroprudential policy may be justified, should we also tax capital flows? After all, they are inherently fickle and are a source of sudden stops and contagion.

In my work with Alp Simsek we show that local policymakers worried about the negative impact of fickle capital flows on domestic financial stability, indeed have an incentive to tax capital inflows. However, if everyone does the same, the policy backfires in equilibrium as global liquidity is reduced, which is detrimental for financial stability when there is a scarcity of safe assets.

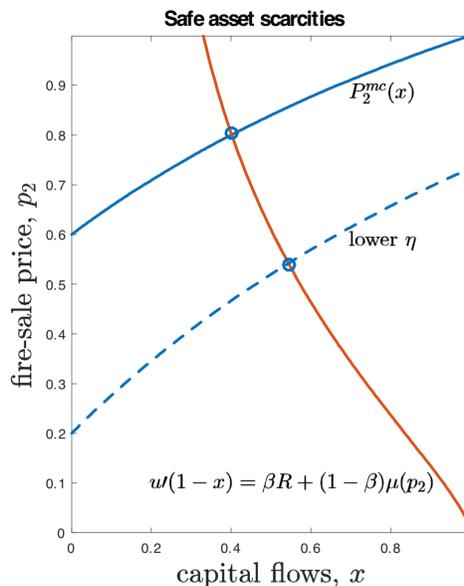


Figure 24: Comparative statics of equilibrium fire-sale price and capital flows with respect to changes in the supply of safe assets η .

Figure 24 illustrates this point. The blue lines represent the market clearing fire sale prices for an average economy experiencing a liquidity shock as a function of (symmetric) capital flows. It is an increasing function because the retrenchment of previous capital outflows dominates the fickleness of previous capital inflows, which are withdrawn at fire-sale prices. That is, other things equal, higher gross flows increase liquidity during crises. The downward sloping red line is the saving decision of a representative agent, which is decreasing because a worse fire sale price leads to more precautionary savings abroad. The important point is that a reduction in the availability

of safe assets (the parameter η in our model) shifts the equilibrium fire sales function downward, which leads agents to increase capital flows as a partial (and imperfect) substitute for the lost safe assets. In this environment, if all countries tax capital flows, it amounts to shifting the red line downward, which reinforces the negative effect of reduced safe assets on fire sale prices.

Of course there are exceptions to the argument against taxing capital flows, and I have already mentioned one: excessive reach for yield flows. However, the point is that there is a public good aspect to capital flows that is typically ignored when considered from the point of view of the financial stability of an individual country, and that this public good aspect is particularly valuable in a world with a scarcity of safe assets.

6.1. References

1. Caballero, Ricardo J., and Alp Simsek, 2018, “A Model of Fickle Capital Flows and Retrenchment,” MIT mimeo.

7. Final Remarks

Somewhat paradoxically, as EMs have become more prudent with respect to sudden stops, together with their growth success, the world economy has become more EM-like, in the sense of experiencing a chronic shortage of assets, especially safe ones. The downward pressure on safe interest rates resulting from this process has introduced new sources of fragility to the global economy, which has become exposed to risk-off shocks in particular. In this sense, too, the global economy has become more EM-like, as conventional monetary policy cannot be expected to become the main policy tool to fight large risk-off events.

When thinking about preventive economic policies in this context, a useful metric for their effectiveness is their likely effect on equilibrium safe interest rates. From this perspective, and since fear and Knightian concerns are a central feature of the environment, policy-put frameworks are particularly useful, as is a macroprudential framework that limits speculation by high valuation agents during the risk-on phase.

In contrast, the benefit of taxation of capital flows is more ambiguous, as it may exacerbate the scarcity of safe assets problem. What seems unambiguous, nonetheless, is that creating a global policy-put infrastructure akin to those existing for domestic risk-off shocks would reduce the undesirable fickleness of these flows (by reducing one of the sources of Knightian uncertainty) and expand the effective diversification benefits of capital flows. This would directly alleviate the sudden stops problem and reduce the structural asset shortage deficit that is behind much of the observed fragility of the global economy in recent decades.

7.1. An Active Research Area: A Sample of Recent References

1. Acharya, Viral V. and Arvind Krishnamurthy, 2018. “Capital Flow Management with Multiple Instruments.” mimeo.
2. Bocola, Luigi and Guido Lorenzoni, 2017. “Financial Crises and Lending of Last Resort in Open Economies” mimeo.
3. Brunnermeier, Markus K., Sam Langfield, Marco Pagano, Ricardo Reis, Stijn Van Nieuwerburgh, and Dimitri Vayanos, 2017. “ESBies: safety in the tranches” *Economic Policy*, 32(90): 175–219.
4. Brunnermeier, Markus K, and Yuliy Sannikov, 2016. “The I Theory of Money,” Princeton mimeo.
5. Cieslak, Anna, and Annette Vissing-Jorgensen, 2017, “The Economics of the Fed Put,” Berkeley mimeo
6. Coeurdacier, Nicolas, Stephane Guibaud, and Keyu Jin, 2015. “Credit Constraints and Growth in a Global Economy ” *American Economic Review*, 105(9): 2838–81.
7. Davila, Eduardo and Anton Korinek, 2018. “Pecuniary Externalities in Economies with Financial Frictions” *Review of Economic Studies*, 85(1): 352–395.
8. Farhi, Emmanuel and Matteo Maggiori, 2018. “A Model of the International Monetary System.” *The Quarterly Journal of Economics*, 133(1): 295–355.
9. Farhi, Emmanuel and Ivan Werning, 2016. “A Theory of Macroprudential Policies in the Presence of Nominal Rigidities.” *Econometrica* 84(5): 1645–1704.
10. Fostel, Ana, John Geanakoplos, and Gregory Phelan, 2017. “Global Collateral: How Financial Innovation Drives Capital Flows and Increases Financial Instability.” mimeo.
11. Gorton, Gary B., and Toomas Laarits, 2018, “Collateral Damage,” Yale mimeo
12. Gorton, Gary B., 2016, “The History and Economics of Safe Assets,” NBER WP 22210
13. Gabaix, Xavier and Matteo Maggiori, 2015. “International Liquidity and Exchange Rate Dynamics.” *The Quarterly Journal of Economics*, 130(1): 1369–1420.
14. Gopinath, Gita and Jeremy C. Stein, 2018 “Banking, Trade, and the Making of a Dominant Currency.” mimeo.
15. Gourinchas, Pierre-Olivier and Helene Rey, 2016. “Real Interest Rates, Imbalances and the Curse of Regional Safe Asset Providers at the Zero Lower Bound.” ECB Forum on Central Banking.

16. He, Zihuo, Arvind Krishnamurthy, and Konstantin Milbradt, 2018. “A Model of Safe Asset Determination.” forthcoming in *American Economic Review*.
17. Iachan, Felipe S., Plamen T. Nenov, and Alp Simsek, 2017. “The Choice Channel of Financial Innovation.” mimeo.
18. Jeanne, Olivier, and Damiano Sandri, 2017. “Global Financial Cycle and Liquidity Management.” mimeo.
19. Korinek, Anton and Damiano Sandri, 2016. “Capital Controls or Macroprudential Regulation?” *Journal of International Economics*, 99(1): 27–42.
20. Martin, Alberto and Jaume Ventura, 2016 “Managing Credit Bubbles.” *Journal of the European Economic Association*, 14 (3), 753–789.
21. Miranda-Agrippino, Silvia and Helene Rey, 2018. “U.S. Monetary Policy and The Global Financial Cycle.” mimeo.