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# **Regulatory Reform: Integrating Paradigms**

**Augusto de la Torre  
Alain Ize**

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# Regulatory Reform: Integrating Paradigms

*Augusto de la Torre*

*Alain Ize*

The World Bank  
Latin America and Caribbean Region  
Chief Economist Office  
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## Abstract

The Subprime crisis resulted from the interplay of information asymmetry and control problems with failures to internalize systemic risk and recognize the implications of Knightian uncertainty. A successful reform of prudential regulation will thus need to integrate more harmoniously the three paradigms of agency, externalities, and mood swings. This is a tall order because each paradigm has different and often inconsistent regulatory implications. Moreover, efforts to address problems under one paradigm can exacerbate problems under the others. To avoid regulatory arbitrage

and ensure that externalities are uniformly internalized, prudentially regulated intermediaries should be subjected to the same capital adequacy requirements and unregulated intermediaries should be financed only by regulated intermediaries. Reflecting the importance of uncertainty and mood swings, the new regulatory architecture will also need to rely less on spontaneous market discipline and more on “holistic” supervision, and incorporate countercyclical norms that can be adjusted in light of changing circumstances.

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## Regulatory Reform: Integrating Paradigms<sup>⊕</sup>

Augusto de la Torre, *World Bank*  
and  
Alain Ize, *World Bank*

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<sup>⊕</sup> Authors are Chief Economist for Latin America and the Caribbean ([adelatorre@worldbank.org](mailto:adelatorre@worldbank.org)) and Senior Consultant ([aize@worldbank.org](mailto:aize@worldbank.org)). The paper benefited from comments by Guillermo Calvo, Stijn Claessens, Paul de Grauwe, Eva Gutierrez, Asli Demirguc-Kunt, Marcelo Giugale, Miguel Kiguel, Michael Klein, Eduardo Ley, Eduardo Levy Yeyati, Giovanni Majnoni, Fernando Montes-Negret, Roberto Rigobon, Calvin Schnure, Constantinos Stephanou, and Carol Wambeke. The paper also benefited from stimulating conversations with Michael Dooley, Vincent Reinhart, Klaus Schmidt-Hebbel, and Sergio Schmukler, and from comments received at a conference organized by Columbia University's School of International and Public Affairs in New York; the XI Workshop in International Economics and Finance, which took place in Montevideo, Uruguay; and workshops organized by Casa das Garças in Rio de Janeiro, the Central Bank of Argentina in Buenos Aires, and financial sector authorities in Bogotá, Colombia. We thank Felipe Valencia Caicedo for research assistance. The views in this paper are entirely those of the authors and do not necessarily represent the views of the World Bank, its executive directors and the countries they represent.

## 1. Introduction

As in the case of the other two large financial crises in modern U.S. history, the Great Depression and the Savings & Loan (S&L) crisis, the Subprime crisis was triggered by the inability of financial intermediaries to withstand large macroeconomic price volatility.<sup>1</sup> In the Great Depression, banks started failing when the stock market crash induced losses on their equity investments or the loans they had given to investors towards the purchase of stocks. In the S&L crisis, the main trigger was the rise in deposit rates that accompanied the increase in inflation of the late 1970s and the subsequent, sharp tightening of monetary policy. For the Subprime crisis, the trigger was the decline in housing prices. In all three cases, the crisis resulted from a rapidly rising wedge between the underlying value of financial intermediaries' assets and liabilities, which prevented them from honoring the implicit insurance commitments they had made to their clients. High leverage and liquidity on demand, which limited the size of the buffers available against shocks, made these wedges lethal.

While the proximate triggers of these crises are fairly clear, the most interesting question is why financial intermediaries continue to contract such huge implicit insurance commitments while failing recurrently at honoring them, in the U.S. or elsewhere. Going back to the fundamentals of financial decision making, three possible explanations spring to mind: (i) managers of financial institutions understood the risks they were taking but made the bet because they thought they could capture the upside windfalls and leave the downside risks to others (*the agency paradigm*); (ii) managers understood the risks they were taking, yet went ahead because they did not internalize the social risks and costs of their actions (*the externalities paradigm*); and (iii) managers did not fully understand the risks they were running into; instead, they reacted emotionally to a constantly evolving, uncertain world of rapid financial innovation, with an excess of optimism on the way up and, once unexpected icebergs were spotted on the path, a gripping fear of the unknown on the way down (*the mood swings paradigm*).

These three paradigms reflect human condition in a nutshell. In the agency paradigm, the better informed are constantly tempted to take advantage of the less informed and, ultimately, the state. By contrast, in the externalities paradigm, financial intermediaries are free agents whose decisions do not necessarily coincide with the public good, or in the case of group coordination failures, with their own good. In the mood swings paradigm, like all market participants, managers of financial institutions have bounded capacity to deal with the genuine uncertainty lying ahead, which is naturally associated with bouts of risk euphoria (“this time around, things are really under control...”) followed by episodes of sudden alarm and deep risk retrenchment.

The next question that naturally comes to mind is why such similarly triggered crises have continued to recur notwithstanding the development over the last eighty years

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<sup>1</sup> Throughout this paper we use the term “Subprime crisis” to denote the current, broader crisis of structured securitization and its propagation across financial markets and borders.

or so of a formidable set of prudential regulations precisely designed to prevent systemic failures. Not only has regulation failed abysmally but attempts to seek a safer regulatory path ahead seem in some cases to have made matters subsequently worse. For example, a key piece of regulatory legislation coming out of the Great Depression was the Glass-Steagall Act that sought to shield commercial banks from stock market price fluctuations by barring them from investment banking. In turn, the S&L crisis launched the regulatory push towards securitization as a way to pass on to markets much of the risk associated with housing and other longer term finance. Yet, investment banks and securitization are precisely two ingredients at the epicenter of the Subprime crisis.

This paper argues that the failure of regulation largely resulted from a piecemeal approach to reform that looked at one paradigm at a time. In trying to address the central problem under one paradigm, they made the problems under the others worse. Thus, the creation of the Federal Reserve System in 1914 and introduction of deposit insurance after the Great Depression, which set the stage for the public lender-of-last-resort function and were meant to alleviate the instability resulting from recurring runs on the banking system (a problem of externalities), exacerbated the agency-moral hazard problem. In turn, the strengthening of prudential norms after the S&L crisis, meant to address the acute moral hazard manifestations observed during that crisis, indirectly exacerbated the externalities problem—it drove much of the intermediation outside the prudentially more tightly regulated sphere of commercial banking; once there, participants had less incentives (regulatory-induced or otherwise) to internalize the externality and hold systemic buffers (liquidity or capital). This last problem of course came back to haunt us in the Subprime crisis.

Moreover, while following this game of tag and run between moral hazard and externalities, regulation missed all along another central suspect: asset bubbles growing and bursting under the impact of rapidly shifting animal spirits. In the Great Depression, the bubble and crash were driven by stock prices; in the Subprime crisis, they were driven by housing prices and the weaknesses of subprime mortgage lending suddenly emerging from the fog. To reconcile theory and facts, the third, missing (or much less developed) paradigm—which puts Knightian uncertainty and the associated mood swings (more than incentive misalignments) at center stage—needs to be recognized and dealt with.

Looking ahead, regulatory reform is largely complicated by the fact that the internal logic of each of the three paradigms leads to different and often inconsistent regulatory implications. In the pure agency paradigm, the only task of the regulator is to mitigate principal-agent problems by fostering market discipline—mainly through the disclosure of ample, reliable information and by ensuring that financial intermediaries’ “skin in the game” is sufficient to maintain their incentives aligned in the right direction. A properly set regulatory framework should thus eliminate the risk of systemic crises.

By contrast, in the pure externalities paradigm, as markets of their own cannot close the wedge between private and social costs and benefits, the relevant regulation cannot be “market friendly” and the supervisor’s role becomes more central. Moreover,

because of the high cost associated with crisis-proofing, the system's exposure to some tail risk (akin to "one hundred year floods") is likely to remain. The ex-ante crowd coordination and control role of the supervisor needs therefore to double up, if a crisis materializes, with an ex-post fireman role.

Finally, in the pure mood swings paradigm there are no incentive distortions but market participants do not fully (and spontaneously) visualize the dynamic and systemic risk implications of market completion and innovation. Hence, markets on their own are unlikely to provide efficient pricing signals.<sup>2</sup> Unless effective safeguards can be put into place, this severely undermines the Basel II-type, risk-based regulatory architecture where every risk can presumably be assessed and translated into an efficient prudential norm. By the same token, the mood swings paradigm boosts the role (and responsibility) of the supervisor, who has to become a scout and a moderator, constantly looking for possible systemic trouble ahead and slowing down the system when uncertainty becomes too large.

To be successful, any reform of prudential regulation will need to integrate the key insights and sidestep the main pitfalls of all three paradigms in a way that limits inconsistencies and maintains a proper balance between financial stability and financial development. Overcoming these tensions will require a dialogue between researchers and policy makers whose perception of the world may be colored by different paradigms. One of the aims of this paper is to contribute to this dialogue.

The paper also proposes a set of basic objectives that any regulatory reform should seek to fulfill in a multi-paradigm world. Reflecting the main current pitfall of uninternalized externalities, the reform will need to improve the alignment of incentives by internalizing (at least partially) systemic liquidity risk, thereby lessening the likelihood of crises. However, it should do so in a way that ensures regulatory neutrality and leaves room for prudentially unregulated intermediaries to enter and innovation to thrive. At the same time, reflecting the pitfalls of uncertainty and mood swings, the reform will also need to pay more attention to the risks of financial innovation and rebalance the monitoring roles of markets and supervisors, with the latter acquiring more responsibilities but also more powers. Since in a world of externalities and uncertainty-driven mood swings even the best regulation and supervision are unlikely to fully eliminate the risk of systemic crises, improving the systemic features of the safety net will continue to be an essential objective.

Consistent with these objectives, we propose: (i) making prudential norms also a function of the maturity structure of the intermediary's liabilities; (ii) giving prudentially

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<sup>2</sup> Throughout the paper, we refer to market discipline as "spontaneous market discipline", i.e., as the monitoring that markets have a natural incentive to carry out provided that information is sufficient and there is a proper control infrastructure, including reliable contract enforcement and effective governance. However, market discipline can also be "induced" by government regulatory requirements—for example, compulsory private insurance—that reward market participants for their monitoring services. Whether there is scope for expanding induced market discipline in a multi-paradigm world is at this stage an open question to which the paper will allude only briefly in the concluding section.

unregulated intermediaries the choice between becoming regulated (with the same capital adequacy requirements as commercial banks) or remaining unregulated subject to the condition of not funding themselves in the capital markets (in other words, prudentially unregulated intermediaries could only borrow from regulated intermediaries);<sup>3</sup> (iii) giving the regulator more powers to authorize innovations and norm instruments; (iv) enabling the supervisor (through appropriate statutory powers, accountability, and tools) to play a more “holistic” role by focusing more on the system (its risks, evolution, links, etc.), and to set and calibrate (within bounds) countercyclical prudential requirements depending on changing circumstances, much as the interest rate is calibrated by monetary authorities; and (v) revisiting the deposit insurance to incorporate systemic risk, rethinking the LOLR as a risk absorber of last resort, and examining the feasibility of pairing them with a systemic insurance subscribed by all financial intermediaries.<sup>4</sup>

The rest of the paper is organized as follows. Section 2 goes back to the foundations and pitfalls of intermediary-based finance and briefly retraces the steps and objectives of modern regulation. Sections 3 to 5 present alternative interpretations of the Subprime crisis from the perspective of each of the three paradigms. Section 6 sums up the main failures of regulation and emphasizes the deep contrasts that exist between the three paradigms when one tries to address these failures. Section 7 concludes by laying down a minimum set of basic objectives that would need to be met in order to ensure a more harmonious integration of the three paradigms.

## 2. The Foundations of the Current Prudential Framework

Finance seeks to bridge three basic gaps (Chart 1). First, there is an *information and control gap* (a principal-agent problem) that reflects fund suppliers’ exposure to the idiosyncratic risks and costs involved in properly screening and monitoring fund users, and enforcing contracts with them. Second, there is a *price volatility-uncertainty gap* that reflects fund suppliers’ aversion to becoming exposed to aggregate risks (market-specific or systemic) over which they have no control. Third, there is a *liquidity-maturity gap* that reflects fund suppliers’ “opportunistic” desire to maintain access to their funds and a quick exit option at all times. This third motive responds both to idiosyncratic risks (a quick exit disciplines fund users and mitigates agency problems) and aggregate risks (liquid portfolios and flights to cash mitigate exposure to uncertainty and mood shifts). Each of the gaps is naturally associated with a paradigm: the information and control gap with the agency paradigm, the liquidity and maturity gap with the externalities paradigm, and the volatility and uncertainty gap with the mood swings paradigm.

The financial system helps investors bridge these gaps in different ways and through various channels, the choice of which depends in part on transaction costs and

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<sup>3</sup> The obvious complement to this approach would be to ensure that all the direct and indirect credit risk exposures (on- and off-balance sheet) of the regulated intermediaries are backed by capital (“skin-in-the-game”), at a level which ensures regulatory neutrality.

<sup>4</sup> Needless to say, to avoid exacerbating cross-border arbitrage, any such reform would require broad international agreement on the essence of the reforms and their modalities of implementation across borders.

borrower size (Table 1). At the one extreme, markets bridge the principal-agent gap through hard public information (arms-length lending), the liquidity gap through the ability to trade financial contracts easily in deep markets, and the volatility gap through derivative contracts. Asset managers (mutual funds, pension funds, brokers, etc.) cover the middle ground. They help fund suppliers fill the agency gap through expert screening and continuous monitoring (including through direct board room participation), the liquidity gap through pooling, and the volatility gap through diversification. At the other extreme are financial intermediaries that engage in leverage. Commercial banks—the prototypical financial intermediaries—bridge the agency gap through soft private information (relationship lending), debt contracts (a disciplining device), and capital (skin-in-the-game). They help investors deal with the volatility and liquidity gaps by offering them deposits (debt contracts) redeemable at par and on demand, and absorb the ensuing risks through capital and liquidity buffers.<sup>5</sup> Remarkably, debt and capital (hence leverage) play a key role in intermediaries’ ability to deal with each of the three gaps.

By interposing their balance sheet between borrowers (through assets whose underlying value fluctuates with economic conditions) and investors (through liabilities whose value is fixed by contract), financial intermediaries become exposed to systemic risk. They may fail to address this risk in a socially optimal way, reflecting market failures that also map all three gaps and paradigms portrayed in this paper. While we will describe these failures more fully in each of the three subsequent sections, a brief preview here will help establish the historic setting and rationale for the current regulatory framework.

Principal-agent problems give rise to a variety of malfeasance manifestations, most importantly moral hazard.<sup>6</sup> Should all depositors be well informed, banks could eliminate moral hazard to the satisfaction of depositors by holding capital.<sup>7</sup> But the mix of small uninformed depositors and larger, better informed investors can lead to inefficient equilibria in which banks and wholesale investors benefit at the expense of the retail depositors (or their deposit insurance).<sup>8</sup> Governance issues compound the problem by

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<sup>5</sup> In addition, intermediaries, unlike markets, can offer “incomplete” contracts that provide more ex-post flexibility in adjusting to unforeseen circumstances that can lead to failures in honoring the contracts. See Boot et al. (1993) and Rajan (1998).

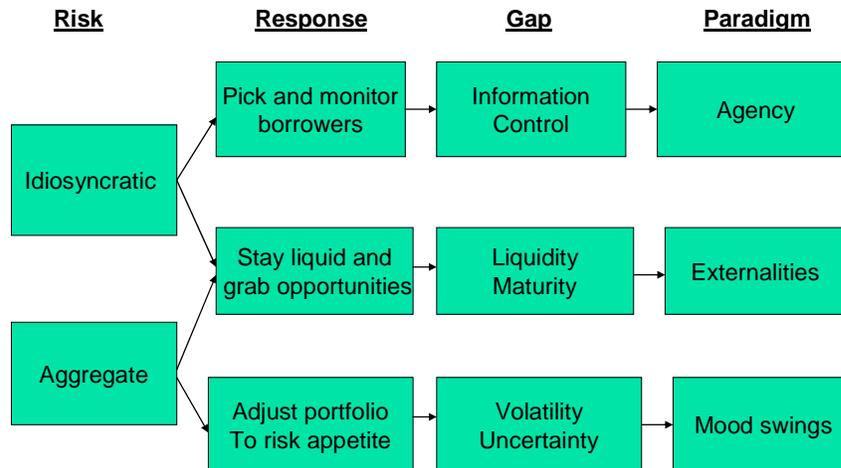
<sup>6</sup> The list of malfeasance manifestations with which bankers and other financial intermediaries have been associated over the ages also includes adverse selection, predatory lending, outright fraud and pyramid schemes (Ponzi finance). In this paper, we will broadly lump together all forms of malfeasance within the agency paradigm but focus primarily on moral hazard because it is the only one that raises “prudential” issues, i.e., issues of risk management.

<sup>7</sup> Moral hazard is a reflection of limited liability (limited capital). There is an important literature that questions the need for (and optimality of) capital requirements imposed from the outside. See in particular Kim and Santomero (1988), Berger, Herring, and Szego (1995), Diamond and Rajan (2000), and Allen and Gale (2005).

<sup>8</sup> The literature has mostly stressed the “bright side” of wholesale finance, where small depositors free ride on the monitoring and disciplining services of larger investors (see for example Calomiris and Khan, 1991). However, Huang and Ratnovski (2008) recently showed that there is also a “dark side” to wholesale finance. In the presence of a noisy public signal on the state of the bank, wholesale investors may relax their monitoring and rely instead on an early exit as soon as there is any adverse change in the public signal, whether warranted or not. The fact that the smaller investors will stay put (which in their model reflects the

superposing additional layers of moral hazard. In particular, bank managers may take decisions that benefit them in the upside but leave the downside mostly to the shareholders or investors.

**Chart 1. The gaps finance seeks to bridge and the pitfalls it encounters**



7

<b>Channel of finance</b>	<b>Gap</b>		
	<b>Information/Control</b>	<b>Liquidity/Maturity</b>	<b>Volatility/Uncertainty</b>
<b>Markets</b>	<i>Hard information and governance standards</i>	<i>Deep, liquid secondary markets</i>	<i>Derivative markets</i>
<b>Asset Managers</b>	<i>Expert screening, direct board participation and monitoring the monitors</i>	<i>Pooling</i>	<i>Diversification</i>
<b>Intermediaries</b>	<i>Relationship lending, debt and capital (skin in game)</i>	<i>Pooling, demandable debt and capital/liquidity (buffers)</i>	<i>Diversification, debt and capital (buffer)</i>

presence of deposit insurance) facilitates the exit of the large investors. In this context, it is indeed surprising that the inherent tension within the deposit insurance as currently conceived—meant to cover only small depositors in non systemic events but de facto exposed to systemic losses resulting from early runs by the large depositors—has not received more attention.

The opportunistic behavior of fund suppliers or intermediaries faces an externalities problem. Financial intermediaries are exposed to runs by their depositors or lenders, triggered by self-fulfilling panics or suspicions of intermediary insolvency. Even if they could limit this risk by holding sufficient capital and liquidity, their incentive to do so is limited by the fact that they do not internalize the social costs of a run, i.e., by the existence of externalities.<sup>9</sup>

The attitude of financial intermediaries (as well as that of other agents) towards price volatility also gives rise to a market failure in that their decisions in the face of uncertainty are influenced by mood swings. They incur bouts of excessive optimism (exuberance) during the upwards phase of financial expansions and excessive pessimism (extreme uncertainty aversion) during contractions. In either case, this compounds price volatility and can lead to sharp deviations from underlying fundamentals (bubbles).

Regulation has been designed to help intermediaries overcome the two first pitfalls, albeit not the third. The current regime rests on three key pillars: (i) prudential norms that seek to align incentives ex-ante; (ii) an ex-post safety net (deposit insurance and lender-of-last-resort) aimed at enticing small depositors to join the banking system and forestalling contagious runs on otherwise solvent institutions; and (iii) a “*line-in-the-sand*” separating the world of the prudentially regulated (mainly commercial banking) from that of the unregulated.

In turn, the line-in-the-sand rests on at least three key arguments. First, regulation is costly and can produce unintended distortions. It can limit innovation and competition, and it needs to be accompanied by good, hence inherently costly, supervision. Second, extending bad oversight (oversight on the cheap) beyond commercial banking can exacerbate moral hazard—it can give poorly regulated intermediaries an undeserved “quality” label (hence an edge in the market place) and an easy scapegoat (blame the regulator if there is a problem). Third, investors outside the realm of the small depositor are well informed and fully responsible for their investments. As a result, they should monitor adequately the unregulated financial intermediaries, making sure their capital is sufficient to eliminate moral hazard.

Consistent with this line-in-the-sand rationale, only deposit-taking intermediaries are prudentially fully regulated and supervised under the current regulatory architecture. In exchange, and reflecting their systemic importance, they benefit from a safety net. Other financial intermediaries (and all other capital markets players) neither enjoy the safety net nor are burdened by full-blown prudential norms. Instead, they are mostly (if not only) subject to market discipline, enhanced by well known securities markets regulations focused on transparency, governance, investor protection, market integrity, etc.

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<sup>9</sup> There is a vast and rapidly expanding literature on the underpinnings of the demand for liquidity and the drivers of liquidity crises. In all cases there is a basic externality at the core of the respective models: liquidity has public good features which liquidity providers cannot fully appropriate. See: Diamond and Dybvig (1983), Holmstrom and Tirole (1998), Diamond and Rajan (2000), and Kahn and Santos (2008).

Interestingly, the early history of regulatory intervention, which was marked by the introduction of the safety net, was more closely linked to externalities than to agency problems. However, subsequent regulatory developments came to be dominated by concerns about principal-agent frictions, particularly moral hazard, which the safety net itself exacerbated. But at this point the logic of the line-in-the-sand completely missed the obvious facts that, even if free markets take care of principal-agent problems, they will (nearly by definition) neither internalize externalities spontaneously, nor temper mood swings and price risk appropriately where genuine uncertainty exists. Thus, the regulatory architecture that is in place today became seriously unbalanced.<sup>10</sup>

In fact, the line-in-the-sand became porous and was widely breached during the build-up to the Subprime crisis, as highly-leveraged intermediation developed outside the confines of traditional banking—in what has now become known as the world of “shadow-banking”—and the safety net had to be eventually sharply expanded, from the regulated to the unregulated.<sup>11</sup> The explosive growth of “shadow banking”—driven by the originate-to-distribute model, which relied on the securitization of credit risk, off-balance sheet transactions and vehicles, and fast expansion highly-leveraged intermediation by investment banks, insurance companies, and hedge funds—has been so well documented elsewhere that it is not necessary to reiterate the details here.<sup>12</sup> It is only worth stressing that, by radically expanding the *interface between markets and intermediaries*, the process brought a variety of new problems and issues. However, the same underlying pitfalls of agency problems, liquidity runs, and mood-driven cycles reappeared with a vengeance.

In what follows, we interpret the story behind this shift to “shadow banking”—its roots, dynamics, and implications—from the vantage point of each of the three paradigms. As many of the observed features of the Subprime crisis can be consistent with more than one of the three paradigms, attribution is inherently problematic and conclusive proofs are virtually impossible. Hence, the strategy is to work out the internal logic of each paradigm *taken by itself*, so as to illustrate its potential explanatory power as well as highlight its internal limitations. We will also refer to structural factors such as financial innovation, competition, and regulatory arbitrage when useful to illustrate the inner workings of a particular paradigm, albeit such factors affect all paradigms. On the other hand, although we certainly recognize the importance of macroeconomic impulses such as the savings glut (and related macroeconomic imbalances) and the “Greenspan factor” (the long period of

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<sup>10</sup> In modern terms, the prudential framework can be seen as a “line of defense” or “buffer” that partially shields public funds from bank losses by reinforcing market discipline and putting a positive price on the safety net. While focusing on capital, the existing prudential framework clearly goes beyond capital—it includes liquidity requirements, loan-loss provisioning, fit and proper rules, loan concentration limits, prompt corrective actions, bank failure resolution procedures, etc.

<sup>11</sup> Key players in the Subprime meltdown included commercial banks (the prototypical financial intermediaries) and other intermediaries that blossomed outside the banking system and became hyper-leveraged (mainly investment banks but also insurance companies, hedge funds, as well as commercial banks themselves trespassing into securities markets through off-balance sheet special investment vehicles—SIVs).

<sup>12</sup> See for example Adrian and Shin (2008), Brunnermeier (2008), Gorton (2008), and Greenlaw et al. (2008).

low interest rates), we restrict our attention to prudential failures because they are the ones that matter for regulatory reform.

### 3. The Agency Paradigm

The moral hazard-agency story of the Subprime crisis is arguably the most popular.<sup>13</sup> It posits that incentive distortions arising from unchecked principal-agent problems (the heads-I-win-tails-you-lose syndrome) are *the* source of trouble, inducing market participants to either pass on risks deceptively to the less informed or take on too much risk themselves with the expectation of capturing the upside or exiting on time and leaving the downside with someone else. The perversion of incentives can happen at one or several points of the credit chain between the borrower and ultimate investor, passing through the various intermediate links.

However, for moral hazard to start driving the show, it must be the case that the expected upside benefits come to dominate the expected downside costs (i.e., losing one's capital or reputation). This can occur under two plausible scenarios: (i) an innovation (perhaps facilitated by deregulation) opens a world of new opportunities (the upside widens), or (ii) a macro systemic shock suddenly wipes out a large part of the intermediaries' capital (the downside shrinks).<sup>14</sup> Indeed, one can argue that in the case of the Subprime crisis it was the discovery of new instruments and intermediation schemes (securitization and shadow-banking) which set the process in motion.<sup>15</sup> The expansion of upside opportunities led to a moral hazard-induced under-pricing of risk, encouraging participants to make the bet and take the plunge.<sup>16</sup> This process, which Basel I regulation encouraged, can be explained in part by regulatory arbitrage.<sup>17</sup> However, poor regulation (that did not sufficiently align the incentives of principals and agents, whether the risk was acquired off or on balance sheet) can no doubt also be blamed.

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<sup>13</sup> See for example Caprio et al. (2008) and Calomiris (2008).

<sup>14</sup> The sudden opening of profitable new business opportunities that set the cycle's upswing into motion is what Fisher (1933) called a "displacement".

<sup>15</sup> By contrast, the S&L crisis can be viewed as driven by deregulation and the rise in interest rates that effectively de-capitalized the system (a reduction of downside risks), unleashing the subsequent rounds of "betting for survival". The process was exacerbated by the lack of fair value accounting (which aggravated information asymmetry problems while allowing insolvent institutions to continue operating normally) and generous regulatory forbearance.

<sup>16</sup> There is a body of literature emphasizing moral hazard-caused deviations of asset prices from their fundamental values. See for example Allen and Gale (1998). While these deviations may be interpreted as "bubbles", the underlying models are typically static.

<sup>17</sup> Basel I prudential standards encouraged securitization through differential risk weights (a mortgage held on a bank's balance sheet is charged with a 50 percent risk weight, against only 20 percent if securitized). At the same time, although Basel I did incorporate some off-balance sheet commitments, conversion factors limited their impact on capital. Banks could also circumvent regulation through innovations such as tranching and indirect credit enhancements, the use of the trading book rather than the banking book, and other balance sheet adjustments. See Tarullo (2008).

Indeed, the build-up phase of the crisis provided plenty of opportunities for principal-agent problems to expand and deepen. The multiplication of actors (borrowers, loan originators, servicers, securitization arrangers, rating agencies, asset managers, final investors) involved in the originate-to-distribute model not only reflected the increased sophistication and complexity of intermediation but also boosted the scope for accompanying agency frictions, not just moral hazard but also predatory lending, mortgage fraud, and adverse selection.<sup>18</sup> The widespread preference of unregulated intermediaries to lever up on the basis of mainly short-term funds can also be interpreted as driven by moral hazard. Managers (particularly, but not only, asset managers) also seemed to have danced eagerly to the moral hazard tune. While enjoying the high returns of the good times, they let their shareholders and investors deal with the losses in the bad times under the convenient excuse that everybody shared the same miseries.<sup>19</sup>

A good case can also be made that the state promoted moral hazard on the way up. Some argue, for example, that the widespread subsidies and guarantees provided to the housing financing sector in an effort to boost access (exacerbated by Fannie Mae's and Freddie Mac's "quasi-mandated" foray into the sub-prime sector) can be blamed for launching the ball and boosting its moral hazard momentum once in play.<sup>20</sup> The failure to control the build-up phase can then be attributed to the regulator's inability to win the cat-and-mouse game of regulatory arbitrage. Banks managed to stay on top by swiftly moving to the shadow-banking world, with regulators hardly able to keep up.<sup>21</sup> The extreme fragmentation and overlapping mandates of agencies that comprise the U.S. supervisory system was of course the final blow. Had the regulators been aware and statutorily able to do something, the necessary coordination was just too much to handle.

The agency paradigm is self-contained in that it carries the seeds of its own demise. Once participants have taken the plunge, they have little or nothing more to lose by taking on additional risk. A dynamic could be thus unleashed that pushed bets higher and higher as less risky investment opportunities became gradually exhausted. Indeed, there is good evidence that risk taking by mortgage originators mushroomed over the cycle as less and

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<sup>18</sup> Ashcraft and Schuerman (2008) analyze the "seven deadly frictions of asymmetric information" that unfolded with a vengeance in the originate-to-distribute world.

<sup>19</sup> The managers masquerading their excessive tail-risk taking as clever investment moves are dubbed by Rajan (2008a) as "fake-alphas". The perfect excuse for the bad times is defined by Calomiris (2008) as "plausible deniability". Reflecting their greater concern for the short-term bottom line than for the potential longer term risks (perhaps reflecting mostly backward looking compensation schemes), operational managers seem to have paid insufficient attention to the concerns of risk managers. On issues of managerial compensation and the scope for managerial "abuse", see also Dewatripont and Tirole (1994), Brunnermeier (2008), and Gorton and Winston (2008).

<sup>20</sup> Fannie Mae and Freddie Mac—the giant mortgage government-sponsored enterprises—could meet their mandated social housing goals by buying eligible subprime mortgages. For a summary of public policy actions to promote housing finance see Calomiris (2008).

<sup>21</sup> For good narratives along these lines, see Caprio et al. (2008), and Calomiris (2008).

less creditworthy borrowers were gradually let in.<sup>22</sup> Such dynamics should be naturally unstable and eventually collapse on their own weight.<sup>23</sup>

Once the crisis hit, the liberal unfolding of the safety net under the gun of systemic contagion (lender-of-last-resort by the Fed and bail outs by the Treasury) clearly validated any moral hazard incentives that might have led to the crisis. In particular, it facilitated the early exit of at least some of the well-informed large investors, rewarding those who had lent imprudently (and allegedly knowingly). Another moral hazard booster in the ex-post unfolding of the safety net was that, for the most part, large institutions were not closed and, perhaps more importantly, managers were allowed to stay in charge.<sup>24</sup>

In sum, the moral hazard tune does ring true in many respects. However, important questions remain. First, for shadow banking to be explainable by moral hazard, it must have allowed commercial banks to pile on more risk. However, whether, on balance, commercial banks ended up shedding or piling risk through securitization is not entirely clear, albeit some evidence seems to militate in favor of the latter.<sup>25</sup> As intended by the early promoters of securitization, the sale of mortgage-backed securities to investment banks should in and of itself, have reduced (not increased) commercial banks' riskiness. In reality, however, much of the risk was not divested away. Instead, commercial banks repurchased good chunks of the instruments they sold, for reputational as well as business continuity reasons, and remained committed to support investment banks through their back-stop liquidity facilities (they were lenders of first resort to capital markets players). Moreover, they generally retained the more risky assets (or the more risky tranches) while shedding away the less risky ones.<sup>26</sup> At the same time, they moved down the credit market to take on new and arguably higher risks associated with consumer, mortgage, and SME lending. They also accumulated more risk by engaging in widespread rating arbitrage (shopping for the most favorable ratings).<sup>27</sup>

Moreover, even if one believes that banks did accumulate more risk, it does not necessarily follow that this was induced by moral hazard. Indeed, commercial banks could have genuinely bought the risk under the presumption that it was safe for them to store it (they perceived the regulations to be too tight and their capital more than enough to cover

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<sup>22</sup> On the propensity for increased risk taking, see Dell' Ariccia et al. (2008), and Keys et al. (2008). Leamer (2008) goes further to argue that there was a gradual shift from hedge finance to speculative finance and then to outright Ponzi finance during the recent housing cycle.

<sup>23</sup> In the end, the trigger for the crisis under the pure agency paradigm should still be a stochastic event (moral hazard would cease to operate if there was no longer a possible upside, as unlikely as it might be). That event, however, can be so small that it ceases to be relevant.

<sup>24</sup> Curiously, while deposit insurance fully protected the small depositor, much less was done to protect the small borrower (that has been an important asymmetry as regards consumer protection).

<sup>25</sup> Rajan (2005) presents evidence that suggests some increase in overall banking risk, as indicators of banks' distance to default have not risen in many developed countries and bank earnings variability has not fallen in the United States. Instead, the risk premium implicit in bank stocks appears to have risen.

<sup>26</sup> See for example Ambrose et al. (2005).

<sup>27</sup> See Brunnermeier (2008).

the associated risks). Under this interpretation, to which we will come back under the externalities paradigm, commercial banks ventured into new markets and new instruments simply because they had a comparative advantage in doing so.

Perhaps more importantly, the main piece of the puzzle that does not quite fit this paradigm is the blatant asymmetry between the smart ones who are alleged to have consciously caused havoc and all the rest of the financial market participants who were not paying attention. In particular, why did the markets (informed investors and shareholders) fail to discipline financial intermediaries? In the end, many investors surely got it wrong and lost tons of money; a multitude of bank shareholders got wiped out; and many managers likely have had second thoughts about having played so eagerly the alpha card. In this context, supervisors must surely also be thinking that it is unfair to treat them as if they were the only ones asleep at the wheel.

The moral hazard story inherently requires a strong agency problem, caused either by high enforcement costs or deep crevices of information asymmetry. Arguably, principals (shareholders and large investors) lacked the incentives or regulatory tools that might have helped them, collectively, to align the actions of their agents (managers). However, it is difficult to believe that principals would not have taken early disciplinary action on their own, if only by voting with their feet, had they really understood the risks agents were taking. Thus, setting aside the problem faced by the regulators as regards the growth of the unregulated sector, enforcement costs are not really consistent with the lengthy gestation of the build-up to the crisis nor with the short-term nature of the financing that supported that build-up. A better case can perhaps be made for the intensification of information asymmetry resulting from the opacity, complexity, and interconnectedness of the new age housing finance market.<sup>28</sup> Arguably, this could have provided a cover under which the ones at the top of the pack could have hidden their operations. Yet, it still remains hard to fathom that this “scam” would take place for such a long period, during which the asymmetry between those who were “in” and those who were “out” would linger unabated, and that this would happen in a market place where tips, news, and information are produced by the ton every minute.

#### **4. The Externalities Paradigm**

Externalities, the mirror image of individual opportunism, clearly play a major role in the collapsing phase of any crisis. Seeking to save oneself by running for the exits puts the others at increased risk of a major meltdown with extreme social costs, thereby exacerbating the *violence* of the downturn. But externalities also play a key role during the build up stage, making the system inherently more *fragile*. The failure to internalize the costs of a systemic crisis is at the core of the insufficient demand for prudential buffers, including in particular liquidity, which has features of a public good. Externalities can also induce bubble-type deviations of asset prices from their fundamentals.<sup>29</sup> They can also

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<sup>28</sup> See for example Gorton (2008).

<sup>29</sup> Because individual agents do not internalize the general equilibrium impact on asset prices of fire sales under financial distress, they can bid up the price of these assets in excess of their socially optimal value.

result in under-production of information and monitoring (free-riding) and over-extension of credit during upswings, over-contraction during downswings (in both cases, the marginal lender can “sour the market”, increasing the vulnerability of other lenders to a default). Last but not least, coordination failures (a form of un-internalized externalities) can also play an important role in lengthening and aggravating the upwards phase of the cycle. Market participants may know it is in their best interest to prevent an asset bubble yet fail to do so because doing the right thing would only be optimal if everybody else in the group did it too. Supervisors, both across agencies and across countries, are similarly vulnerable to such coordination failures. For example, tightening regulation in isolation has a high cost, as business will quickly flow to the less regulated sectors or countries.

The lack of sufficient buffers was indeed at the core of the severity of the collapse. As in the case of traditional banking, shadow banking was financed mostly through short-term obligations (and largely perceived to be redeemable at par), much of it through overnight repos. The potential for a bank-type run was therefore there from the outset. But two additional factors made for a much more explosive situation. First, the financing came mainly from ready-to-run wholesale investors, thereby introducing a new, more unstable layer to the intermediation process. Second, the capital and liquidity buffers held by most shadow-banking intermediaries to protect their short-term liabilities from price fluctuations in the final asset (housing) were much smaller than in traditional commercial banking. This reflected the high leverage of self-standing investment banks and (to a less extent) hedge funds, as well as the lack of capital put in by the final borrowers who benefited from high loan-to-value ratios and second mortgages. Thus, as documented elsewhere in detail, once a tail-risk event materialized and pressures to sell started to build up, the devastating downward spiral quickly dried up liquidity and brought markets to a standstill.<sup>30</sup>

In the shadow banking world, the externality pitfall of traditional banking operated with a vengeance, as everyone counted on everyone else’s for support but no one adequately internalized the systemic risks of such cross-support. Investment banks counted on commercial banks (both for liquidity and for asset repurchases);<sup>31</sup> commercial banks counted on market liquidity (why hold liquid backing against assets which you can sell at any time in the market place?); and leveraged intermediaries counted on credit default swaps and other forms of insurance issued by other leveraged institutions. In the process, a great fallacy of composition developed—leading market players (and supervisors) wrongly to believe that risk protections at the individual level would add up to systemic risk

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Lorenzoni (2007) develops a model along these lines and shows that competitive financial contracts can result in excessive borrowing ex-ante and excessive volatility ex-post. As in Holmstrom and Tirole (1998), agents cannot insure themselves against aggregate liquidity shocks due to a limited ability to commit to future repayments (this in turn reflects agency frictions). Korinek (2008) develops a paper along the same lines but applied to capital flows rather than domestic intermediation (in his model, agents borrow too much because they do not internalize the potential impact of an exchange rate move on a systemically-induced need for sudden repayment).

<sup>30</sup> See Greenlaw et al. (2008), Adrian and Shin (2007 and 2008), and Brunnermeier (2008).

<sup>31</sup> Yet, there were no capital charges for such “reputational” credit lines (see Brunnermeier, 2008).

protection. Yet, markets for individual risk protection instruments could only continue functioning if some intermediary was willing to continue “making the market”.<sup>32</sup>

The extreme systemic fragility of such interconnectedness has by now become obvious.<sup>33</sup> By unloading (selling) risk—for example through credit default swaps—to other financial institutions such as insurance companies, intermediaries further intensified the negative systemic externalities.<sup>34</sup> Such transactions might have reduced the exposure of institutions individually but increased the exposure of the system as a whole. Yet, this move was openly encouraged by regulators (insured assets had a low or zero risk weight), who viewed it as a way to reinforce market discipline (again, an example where moral hazard and externality containment directly collided). The possible systemic costs of trading credit derivatives over the counter (without a central clearing counterparty or protocols for multilateral netting), rather than on an exchange, were not internalized either.

While the fragility brought about by externalities has received much attention in the crisis literature, an equally important consequence of un-internalized externalities that has received much less attention is their implication for regulatory arbitrage. As in the case of moral hazard, the growth of shadow banking can also be explained as externality-induced incentives to circumvent regulation. The key difference is one of intent. From an externality viewpoint, intermediaries were “doing nothing wrong” by finding new ways to take on more risk. Instead of seeking to take one-sided bets with someone else’s money, as in the agency paradigm, the intermediaries engaged in regulatory arbitrage under the externalities parading were just searching for ways to match more closely their risk taking with their risk appetite, and they were doing so in a way which, from their own (limited) perspective, was sufficiently safe. From their individual viewpoint, regulations were “unnecessarily binding”.

In this sense, the intent of the Glass-Steagall Act—to shift risk away from regulated intermediaries to capital markets and unregulated intermediaries—was fundamentally misguided. While it could have solved the agency problem (by shifting risks to the land of the well informed) if it had been done cleanly enough (i.e., without dragging the banking system into the mud and the safety net over the line-in-the-sand), it exacerbated the externalities problem. Well-informed investors can monitor the intermediaries to make sure they do not “cheat them” (play the moral hazard card). However, they have no incentives to “internalize” the liquidity and other externalities.<sup>35</sup> Instead, their incentive is to play it safe by investing very short and running at the first signal of trouble and to increase leverage by as much as is privately (*not socially*) optimal.

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<sup>32</sup> The linkages between securities market liquidity and funding liquidity, and the resulting increased scope for liquidity spirals are analyzed by Brunnermeier and Pedersen (2008).

<sup>33</sup> The fact that most intermediaries traveled along the same path on both the way up and the way down, driven by similar incentives and risk management models, further boosted the systemic impact of these externalities. See Brunnermeier (2008).

<sup>34</sup> Allen and Gale (2005) discuss the possible implications for systemic risk of such transfers.

<sup>35</sup> A similar point was made by Bernanke (2006).

To be sure, reflecting regulatory shortcomings in the internalization of systemic liquidity risk (see below), incentives were not much better aligned for the regulated intermediaries. Nonetheless, capital ratios in the regulated sector substantially exceeded those in the unregulated sector, reflecting systemic concerns of regulators for the commercial banking sector.<sup>36</sup> Thus, the side-by-side existence of a regulated sector—where systemic concerns were partially factored in—and an unregulated sector—where externalities were not at all internalized—created a wedge in returns between the two worlds, giving rise to a *fundamentally unstable construct*. Investors left in droves the regulated intermediaries to join the world of the less regulated, highly leveraged and short funded intermediaries, rapidly raising their relative size and boosting systemic risk in the process. Moreover, because it involved sophisticated *and* unsophisticated investors, the exodus spread moral hazard throughout the presumably moral-hazard free unregulated (or less regulated) world.

The resulting competitive pressures on commercial banks ultimately motivated the repeal of the Glass-Steagall Act.<sup>37</sup> However, by challenging commercial banks to compete head-on with the blown-up investment banks—on the latter’s turf but under much stricter regulations—the repeal induced commercial banks to find creative ways to shed their regulatory burden outside their balance sheet. Thus, oddly enough, the Glass-Steagall Act resulted in a one-two punch on the soundness of financial intermediaries. Its introduction boosted systemic risk outside commercial banking. Once this was done, its repeal boosted systemic risk within it.

As in the agency paradigm, supervisors come out severely bruised. They did not realize that their own well-meaning regulation was setting into motion a deadly process of regulatory arbitrage that shifted intermediation to a field where inducements to internalize externalities were weaker or nonexistent, thereby contributing to asset over-pricing and spreading liquidity risk all over the financial system. And even when supervisors caught up, they were unable to do much because in the cat-and-mouse game of regulatory arbitrage the mouse had trespassed over the line-in-the-sand to a territory where prudential regulation was not unreasonably reluctant to enter. Investment banks, hedge funds, and the

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<sup>36</sup> For example, investment banks’ leverage of around 25—compared to commercial banks’ leverage of only about 10—gave the former an obvious advantage. Although the SEC, as lead regulator, applied to investment banks the same Basel capital rules as for commercial banks, the differences in leverages resulted from the much lower capital requirements on “trading books” than on “banking books” and the fact that limits on gross leverage ratios only applied to commercial banks.

<sup>37</sup> Pushed by the forces of competition and deregulation, commercial and investment banks seemed to have met somewhere in the “regulatory middle”. As the repeal of the Glass-Steagall Act allowed commercial banks to encroach more directly on investment banks’ traditional fee-based business, the former took on more fees in order to offset losses in intermediation margins. Also, and partly as a result of the deregulation of commissions for stock trading in the 1970s (that allowed low-cost brokers to encroach on investment banks’ brokerage activities), self-standing investment banks gradually shed their fee-based business in favor of a highly-leveraged margin-based business. See Eichengreen (2008).

like were thus simply left out of reach.<sup>38</sup> Moreover, even within the regulated world, the Basel-inspired wave of prudential regulation focused little on liquidity. And when the norms addressed liquidity issues, they did so from a purely idiosyncratic perspective.<sup>39</sup> To his defense, however, the externality-conscious supervisor may argue that systemic events such as the Subprime crisis are akin to “one-hundred year floods”. They are too rare and unpredictable to be usefully internalized in prudential regulations. The *social* cost of doing so (note here the italics) would simply exceed the *social* benefits. Hence, a better option is to have a prompt correction regime and an efficient public rescue system.

The missing piece in this paradigm, which is otherwise convincing enough, relates to its dynamics. To be sure, the lack of sufficient internalization of systemic risks can lead as easily as moral hazard-based incentives to a more fragile and vulnerable system. Yet, unlike in the agency case, the externalities paradigm in and of itself lacks inherent dynamics that gradually increase the precariousness of the equilibrium over time and eventually bring the system so close to the edge that the tiniest exogenous shock would throw it over.<sup>40</sup> In the pure externalities paradigm, intermediaries continue to “manage” their risk, adjusting it to what is privately optimal and then *just staying there*. The large shock that eventually sent the financial system over the edge must have therefore come out of “left field”—an exogenous act of god, whose probability was independent of the degree of vulnerability of the system. However, as far as one can see, there was no such shock in the case of the Subprime crisis.

One could argue that, instead of an exogenous shock, the engine driving the financial system to its eventual collapse was a real sector-driven business cycle. However, prudential norms are supposedly designed to allow financial systems to navigate unscathed through the ups and downs of the regular business cycle. Hence, this could only be a satisfactory explanation if the magnitude of the downturn was unprecedented and truly unexpected. Again, however, this does not seem likely. The financial crisis was unleashed in full force much before there was a marked real sector decline, with causality going mostly in the opposite direction.

Alternatively, one could tease out some endogenous dynamics within the externalities paradigm by associating the externalities driving the system to a prisoner’s dilemma. What market participants do individually (i.e., join the feast in the boom and the

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<sup>38</sup> The move towards consolidated supervision of financial conglomerates was as far as prudential regulators were willing to extend their reach to protect the core banking system from capital market risks.

<sup>39</sup> For example, liquidity norms generally advocate minimum ratio of liquid assets to liabilities to limit maturity mismatches. But this is simply not good enough from a systemic viewpoint where even short-maturity assets can become illiquid. Norms have failed to focus on systemic rollover risk, which is at the core of intermediaries’ vulnerability to runs.

<sup>40</sup> Some recent analysis of the unfolding of the Subprime crisis stresses the extreme market fragility resulting from an unexpected market realignment in a context where all the large traders have similar underlying risk models and objectives (Khandani and Lo, 2008). However, it is not obvious that traders would have continued to operate so close to the edge if they had understood the true fragility of the environment in which they were operating and the huge potential costs of a meltdown.

stampede in the bust) is clearly harmful to themselves and the group, but each participant would stop only if everyone else in the group did the same. That this type of coordination failure can generate some cyclical fluctuation stands to reason.<sup>41</sup> That it can lead to a catastrophic *and* expected systemic collapse is more difficult to accept. In the absence of a non-externalities related factor—either moral hazard (perhaps boosted by managers’ short incentive horizon) or a truly unexpected unfolding of events (a much bigger or much sooner meltdown than anyone could reasonably have expected)—one would think that at some point the downside risk to each individual participant of remaining in the game should dominate the upside risk. At that point, self-preservation should de facto force coordination, keeping the group some distance away from the edge of the cliff.

## 5. The Mood Swings Paradigm

The starting point of the mood swings paradigm is the endogeneity of financial innovation within a broad process of financial development. The shift from traditional banking to shadow banking can be interpreted as the natural evolution of a rapidly deepening financial system in which markets and intermediaries increasingly complemented each other.<sup>42</sup> Banks commoditized credit risk through the originate-to-distribute model and retained some credit risk to overcome agency problems.<sup>43</sup> At the same time, they used their ability to provide first resort liquidity to help markets overcome the remaining liquidity gap associated with the yet nascent and still overly heterogeneous instruments. The pressures of competition, boosted by the steady entry and rapid growth of unregulated (or less regulated) brokers and intermediaries (particularly investment banks), were clearly at the heart of such a remarkable process of financial deepening and market completion.

However, the creation of new instruments and forms of intermediation went faster than the ability of market participants and supervisors to fully comprehend their implications and handle the risks and uncertainty associated with such a rapidly changing world. The opacity, complexity, and hidden interconnectedness of the Subprime world can thus be seen in the mood swings paradigm as bad side effects of an innovative process, but side effects that were either not intended or, if intended, not necessarily maliciously pursued.<sup>44</sup> The inability to think through the potential systemic implications and fragilities of the new universe was the fundamental and critical failure.

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<sup>41</sup> For example, Abreu and Brunnermeier (2003) develop a model in which asset bubbles persist despite the presence of rational arbitrageurs because the latter cannot temporarily coordinate their selling strategies due to a dispersion of opinions.

<sup>42</sup> Through securitization, markets benefit from the screening done by intermediaries and the latter benefit from the more efficient parceling and tailoring of risk carried out through the markets. See Gorton and Winston (2002), and Song and Thakor (2008).

<sup>43</sup> This was certainly not a minor achievement—it involved standardizing the credit risk screening (through scoring and rating), breaking it up (through stripping and tranching) and dispersing it (by selling it to a wider base of investors and spreading it around through a new breed of credit risk derivatives).

<sup>44</sup> Information got lost through the “chain of complexity” and banks became exposed in the process to heavy “pipeline risk”. See Brunnermeier (2008) and Gorton (2008).

This problem was compounded by a failure to fully comprehend the links between financial sector dynamics and the underlying asset price dynamics, and to adequately understand the feedback loop between rising asset prices and expanding credit. The possibility of a large *and* nation-wide synchronized decline in housing prices (and the devastating implications this would have for the risk correlation assumptions underlying the presumed safety of credit default protections) was unthinkable because it had never happened since the Great Depression.<sup>45</sup> Moreover, when delinquency rates on mortgages started to rise during the mini-recession of 2002, the losses on mortgages were minimal because the housing market continued to boom.<sup>46</sup> From this perspective, falling housing prices and their implications for the housing finance market appear not as “tail risk” but as a “black swan” event, a new reality that could not be anticipated from historical series.<sup>47</sup>

Faced with the world of the new and unknown, market participants involved in the Subprime process no longer had a steady frame of reference. *On the way up*, they found themselves in a truly new and wonderful territory which fueled a mood of optimism and exuberance. This was reinforced by the decline in observed macro-financial volatility, predictable pricing and deep market liquidity, which further fed risk appetites and gave rise to pro-cyclical leveraging.<sup>48</sup> The low volatility environment not only had the immediate mechanical effect of reducing values at risk but also, the more it persisted, the more it fed the feeling that “this time around, things are different and the good times are here to stay”. New forms of macro-financial management and oversight, including the ever more sophisticated risk modeling, widespread divestment of risk through risk derivatives, and more effective and successful monetary management, were all major contributors to this optimistic picture.<sup>49</sup> Feelings such as “everything is being taken care of”, “good men are now in charge”, and “systemic volatility is a memory of the past which has now been vanquished even by the Mexicos and Brazils of this world” became so prevalent that few really questioned them.

*On the way down*, the brutal downward swing in the prevalent market mood also fed the collapse. A significant dissonance would be enough to initiate the mood swing. In the Subprime crisis, the swing was arguably triggered when the CBX credit swap index on sub-prime based instruments started going south, colliding with the still rosy assessments of the rating agencies.<sup>50</sup> As long as there was widespread market agreement on a price vector, ensuring that instruments could continue to be unloaded on short notice, markets

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<sup>45</sup> See Gorton (2008) and Coval, Jurek, and Stafford (2008).

<sup>46</sup> See Calomiris (2008).

<sup>47</sup> See Taleb (2007).

<sup>48</sup> Unlike commercial banks that targeted a constant leverage throughout the cycle, investment banks’ leverage was heavily pro-cyclical. See Adrian and Shin (2007 and 2008).

<sup>49</sup> As Greenspan (1998) famously declared, the “management of systemic risk is properly the job of central banks” and “banks should not be required to hold capital against the possibility of an overall financial breakdown”.

<sup>50</sup> See Gorton (2008).

could go on functioning unperturbed (whether prices actually matched fundamentals was not that important as long as they were uncontested). However, by questioning the uniformity of market assessments, the drop in the CBX index suddenly raised the specter of “hidden icebergs lying ahead”. From euphoria, the mood shifted into acute Knightian uncertainty, where risk aversion swelled, driven by the fear of the unknown.<sup>51</sup> The frenzied recoiling of investors was compounded by general market opacity—including the knowledge that intermediaries were deeply interconnected coupled with utter ignorance on the nature and specific details of this interconnectedness. Opacity thus intensified the massive sell out of securities and simultaneous flight to cash, with the resulting market collapse and evaporation of price signals further accentuating the downward spiral.<sup>52</sup>

In this paradigm, well-meaning public policy also played a central role, both on the way up and on the way down. *On the way up*, a key and justifiable role for policy is to promote market completion within an evolutionary financial development process.<sup>53</sup> Indeed, the set of policies designed to promote housing finance by jump-starting the markets for new instruments such as securitization through guarantees and subsidies can be viewed as sowing the earliest seeds of the crisis. The Subprime crisis grew, in effect, in the “shadow” of the guaranteed world of Fannie Mae and Freddie Mac. While such policies can help overcome natural impediments to market development—particularly where collective action is difficult and network and scale effects are significant—they can also help promote the illusion that risk has been reduced to a point where it ceases to be a predominant concern. Public intervention also played (and continues to do so) a critical role *on the way down*. In a world of uncertainty and acute swings in risk aversion, only the State has the shoulders needed to function as the *risk-absorber-of-last-resort* during episodes of acute, systemic failure.<sup>54</sup> In this view, the ex-post unfolding of unprecedented Fed’s lender-of-last-resort activity and the U.S. Treasury’s bail out operations can be interpreted as a way to drain away from the system sufficient systemic risk so as to allow markets to spring back up to life and intermediaries to continue operating.

All in all, the mood swings paradigm presents a more rounded overall story than the other two paradigms, and a story with far-reaching implications at that. Unlike the agency paradigm, it does not require a gigantic and unyielding asymmetry of information between market participants that are in-the-know and those that are out. Rather, it is a

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<sup>51</sup> Uncertainty aversion came on top of (and interacted with) increased volatility. See Brunnermeier (2008).

<sup>52</sup> Panics end when information recomposes and becomes available. Intermediary-based finance is in this sense much more vulnerable than market-based finance, since prices are less likely to vanish in markets that do not rely on market-making institutions.

<sup>53</sup> A theoretical justification for government intervention in a context of incomplete markets can be found in Geneakoplos and Polemarchakis (1986). Gale (2004) shows that in the presence of incomplete markets there exists an implicit pecuniary externality that generally requires the imposition of capital requirements.

<sup>54</sup> The seminal contribution as regards the role of the State as the residual absorber of risk is that of Arrow and Lind (1970). See also Caballero (2009) for a recent reinterpretation of the insurance role of the State in systemic crisis conditions. An intriguing argument can however also be made that instead of spreading risk over taxpayers (current and future), risk might be more efficiently spread over existing debt holders by using debt equity swaps as an alternative to unconditional bail outs (see Veronesi and Zingales, 2008).

democratic paradigm where everybody was fooled. And unlike the externalities paradigm, it does not require a vengeful god to intervene exogenously with tail-risk events to unleash the dynamics of a downward spiral. Instead, it has its own fully endogenous dynamics, with favorable returns and optimism feeding each other on the way up, adverse returns and pessimism on the way down. The dynamics are akin to Schumpeter's creative destruction, where cycles are a natural part of the evolutionary process. However, unlike the traditional Schumpeterian process, where some do well while others perish at every point in the cycle, the dynamics in the mood swings paradigm are more like "Schumpeter on steroids", as financial innovation cycles can have a devastating systemic impact because everyone follows the same path, up the bubble and down the abyss.

The mood swings paradigm, however, is not free of puzzles and difficulties. In particular, uncertainty-driven mood swings are easy to invoke but harder to model.<sup>55</sup> To be sure, one would expect rationality (even if bounded) and path dependence to constrain feasible outcomes. However, modeling options range widely, from rationally updated priors in a world of imperfect information to heuristically updated beliefs stemming from biased perceptions (personal or group-based) of an excessively complex reality. Thus, unlike incentive distortions under the moral hazard and externalities paradigms, which are firmly grounded in traditional economic theory, modeling mood swings may require some departure from orthodox theory. In any event, it is also rather surprising that market participants were seemingly oblivious to the risks underlying the process of financial innovation. Did such obliviousness simply reflect a difficulty to look outside the box and connect the dots? Did such difficulty reflect the fact that markets do not reward systemic risk gazing (a theme to which we will come back in the next section)? Or was something more sinister at play, either moral hazard or non internalized externalities? In particular, absent externalities, one wonders whether uncertainty alone could pack so much punch, particularly on the way down.

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<sup>55</sup> The importance of mood swings for financial bubbles and panics has been widely recognized. It finds its roots in Keynes' animal spirits and Hyman Minsky's writings on financial crises (see Minsky, 1975). More recently, it was popularized by Kindleberger (1996) and Shiller (2006). While many attempts have been made to model mood driven-cycles within the traditional world of rational expectations with full information (see the seminal contribution of Azariadis, 1981), the conditions for such rational bubbles to exist have been shown to be rather limited (Santos and Woodford, 1997). However, moods play a much more important role once one assumes problems with the information (imprecision or uncertainty) or the way one deals with it, which, in turn, may (or may not) require abandoning the assumption of full rationality. Epstein and Wang (1994), and more recently Fostel and Geneakoplos (2008), showed that multiple priors can lead to models where beliefs influence asset prices in a fully rational world. In addition, Geweke (2001) and Weitzman (2007) showed that, when there is too much uncertainty, fully rational human behavior may not conform to the precepts of traditional economic theory as defined by the standard expected-utility framework. Abandoning the assumption of full rationality opens up the scope for innate biases in the way economic agents process information and make decisions (see the recent surveys of behavioral finance in Barberis and Thaler, 2003, and Della Vigna, 2007). Attempts to explore the implications of such limitations for finance and credit cycles are making some headway. For example, Shleifer and Vishny (1997) showed that inefficient asset pricing driven by noise traders can persist despite the presence of rational arbitrageurs. Lo (2004) proposed an evolutionary approach to economic interactions. De Grauwe (2008) showed that it is possible to generate endogenous cycles when agents use simple heuristic rules to interpret the dynamics of a model they do not fully comprehend.

In sum, the overall picture one gets from systematically reviewing the three paradigms is that they all provide broadly plausible stories. Hence, they must all contain important grains of truth. Moreover, the paradigms seem to interact and feedback on each other in complex ways, one triggering the other or becoming more predominant at different stages of the cycle. Hence, a fully rounded story—one that does not leave key questions unanswered and fully accounts for the complexity of real life—requires combining the paradigms. However, multi-dimensionality makes the challenges of policy reform that much more difficult. To these issues we now turn.

## 6. Paradigms and Regulation

In this section, we will briefly summarize what we perceive to have been the main failures of regulation and illustrate in broad terms how policy prescriptions to fix them will often not be independent of the paradigm of choice.

The great failures of prudential regulation evidenced by the Subprime crisis can be classified into: i) failures of scope; ii) failures of focus; and iii) failures of dynamics. Take the *failures of scope* first. The “line-in-the-sand” philosophy simply did not work. The prevailing thinking was that opening a wide room for unregulated intermediaries to thrive was of little consequence to systemic stability. Knowledgeable investors would maintain them in line. Moreover, they were too small to be systemically important. Both assumptions turned out to be deadly wrong. The failure to internalize externalities in the unregulated world created a bias in favor of unregulated intermediaries that drew in unsophisticated investors in droves and made them grow explosively. In turn, this competitive bias induced banks to elude regulation by pushing risk outside their balance sheet and turn a somewhat blind eye to the risks taken by their borrowers. Thus, not only was risk not adequately internalized ex-ante but also the prudentially less regulated intermediaries quickly grew to the point where they became systemically relevant players and, hence, had to be admitted ex-post to the safety net, no questions asked.

Consider next the *failures of focus*. First, the prevailing regulatory framework established a neatly dividing line between the ex-ante prudential norms and the ex-post safety net. The ex-ante regulatory framework focused on maintaining the soundness of assets, the ex-post safety net on maintaining the liquidity of liabilities. The obvious loose end was the lack of ex-ante internalization of systemic liquidity risk. Second, prudential regulation focused on the soundness of each institution under the assumption that the sum of sound institutions was equivalent to a sound system. However, as noted earlier, the Subprime crisis showed that this approach constituted a major fallacy of composition. It turned instead the approach on its head: the system is what matters most to the soundness of each institution.<sup>56</sup> Third, traditional regulation focused on statistically observable risks

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<sup>56</sup> Basel-style regulation rewarded those institutions that covered their risks with products and services offered by other institutions. Yet, the Subprime crisis showed those atomized protections to be not only irrelevant (they provided a false sense of security, unraveling when most needed) but possibly counterproductive as well (they exacerbated contagion and the risk of overall systemic failure).

and made much out of the sophisticated and complex risk modeling techniques that fed on these statistics. Yet, the Subprime crisis demonstrated that what you do not see is what will kill you (tail risks, black swans, and endogenous risk).<sup>57</sup>

Finally, consider the *failures of dynamics*. Basel-style regulation was essentially static. Norms were time invariant (cycle independent) and the mandated capital buffers were assumed to be sufficient to carry the system through the business cycle.<sup>58</sup> The Subprime crisis proved that approach wrong: static norms turned out to be pro-cyclical, too loose on the way up, too tight on the way down. Last but not least, Basel-style regulation failed to adequately incorporate the dynamic links between monetary and prudential policies. The central bank's job adhered to ensuring macro stability and providing lender-of-last-resort services, the supervisor's to ensure financial prudence, and the two did not need to interact much. Yet, the insufficient attention of monetary authorities to the implications of their actions on financial developments, coupled with the insufficient attention of the supervisors to macro dynamics, deeply contributed to the crisis.<sup>59</sup>

A major problem when seeking to address these regulatory failures is that the best fix will most often depend on the paradigm. How one sees reform is thus essentially a function of the lens one uses. Table 2 synthesizes this discussion. The first questions in the table (under “foundations”) refer to the objectives of regulation. Although both the aims (reducing principal-agent frictions or internalizing social costs) and the means (see below) differ, the need to align incentives through ex-ante prudential norms is clear and uncontroversial under either the agency paradigm or the externalities paradigm. Instead, in the mood swings paradigm, the aim is to temper moods and maintain innovation under control. While there is no obvious inconsistency between the two, aligning incentives and tempering moods are clearly of a different nature.

In either case, the key question as regards the respective roles of markets and supervisors in achieving the mentioned objectives of regulation is whether risk can be priced (which in turn largely depends on whether systemic crises can be avoided). The answer is “yes” in the agency paradigm. Anyone who has enough “skin” invested in his own game will have incentives to maintain risk taking within socially acceptable bounds. Similarly, anyone with enough skin invested in somebody else's game (and this can also be mandated by regulation) will have an incentive to look for the earliest signs of malfeasance. Markets can thus deliver efficient signals and function as early smoke detectors. Once principal-agent problems are kept under control, systemic crises should not

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<sup>57</sup> While the regulatory framework has attempted to reduce the gap between risk and regulation (by upgrading from Basel I to Basel II), the Subprime crisis has brought into evidence severe issues of opacity, excessive complexity, and a misleading sense of control. See Tarullo (2008).

<sup>58</sup> Spanish regulators were the only ones in the developed world that explicitly dealt with cyclical dynamics by introducing the so-called “statistical provisions”—i.e., provisions that are built out of income during the upswing of the credit cycle and can be converted into specific provisions in the downward part of the cycle. This commendable approach was never embraced as part of the Basel creed, however.

<sup>59</sup> Borio (2003), Goodhart et al. (2004), Rajan (2005), and White (2006) were among the few providing early forewarnings of the dangers of this approach.

occur and historical statistics can become the bread-and-butter of day-to-day micro-prudential risk management (i.e., help price risk across borrowers, institutions, and instruments). Accordingly, the main role of the agency supervisor is to put in place the necessary apparatus for markets to conduct their monitoring role effectively. Once this is done, his only residual role is one of compliance checking and crime policing (misrepresentation, fraud, looting, etc.)

		<b>Paradigm</b>		
<i>Dimensions</i>	<i>Issue</i>	<b>Agency</b>	<b>Externalities</b>	<b>Mood Swings</b>
<b><i>Foundations</i></b>	<i>What is the market failure?</i>	Betting with someone's else money	Opportunistic behavior that conflicts with the social good	Acting upon weak information or biased perceptions
	<i>What should ex-ante prudential norms do?</i>	Align incentives through skin in the game	Align incentives through internalizing externalities	Temper moods and domesticate creativity
	<i>Can risk be priced?</i>	Yes	Probably not fully (one hundred year floods)	Probably not (unless Moses-like supervisor)
	<i>How effective is market discipline?</i>	Potentially very effective	Ineffective (inability to estimate or withstand systemic risk)	Ineffective (inability to comprehend or withstand systemic risk)
	<i>What is the role of the supervisor?</i>	Enhancer of market discipline-crime police	Crowd manager-fireman	Scout-moderator-fireman
<b><i>Scope</i></b>	<i>Should the line in the sand be redefined?</i>	No	Yes	Not necessarily
<b><i>Focus</i></b>	<i>Does fair value accounting help?</i>	Yes, it is fundamental	No, it exacerbates externalities	No, it exacerbates mood swings
	<i>Are systemic liquidity norms needed?</i>	No	Perhaps Yes	Probably Yes
	<i>How important to look at the system?</i>	Not important	Very important	Fundamental
<b><i>Dynamics</i></b>	<i>Should prudential and monetary authorities coordinate?</i>	Not really	Tightly	Very tightly
	<i>Are dynamic, macro-prudential norms needed?</i>	No	Yes, rule-based	Yes, judgment-based

By contrast, the scope for spontaneous market help is marginal at best in the externalities paradigm, where the key dimension of risk is dynamic rather than cross sectional. It is likely to be socially too expensive to put in place fully crisis-proof prudential buffers. If so, risks of one hundred year floods (truly extraordinary events) will persist and markets can only help internalize externalities (i.e., provide systemic insurance) if they are able to calibrate the risks and costs of such events, and to withstand their strains. Neither is likely, however. For one thing, tail risks are unlikely to be estimated with precision, even when a sufficiently long statistical history is available. For another, given the contrast between the huge scale of a systemic crisis and its low probability, this is an aggravated case of catastrophe insurance. In view of the difficulties that the latter has faced, it is dubious that full-blown, market-based systemic insurance will see the light of day any time soon.<sup>60</sup>

The scope for market assistance is limited even further in the mood swings paradigm. As in the externalities paradigm, risk is systemic and dynamic. However, rather than tail risks that can be ultimately modeled, exceptional bumps ahead are more in the nature of “black swans” (observations that cannot be inferred from previous data series) or “endogenous risk” (risk endogenously created by market participants).<sup>61</sup> Hence, risk pricing becomes inherently difficult, not only because statistical history provides few clues as to what might be popping up ahead, but also because markets that are shaped by alternative bouts of euphoria and despair are unlikely to provide efficient, fundamentals-based pricing signals. Thus, absent an effective oversight to prevent such financial system drifts (which, as argued below, will need to rely on greatly expanded supervisory skills and powers), Basel II’s aspiration to make regulation rest on internal risk management models, bolstered by risk-rating agencies and market valuations, crumbles. This aspiration presupposes that risk dominates uncertainty and markets are efficient, two premises that an unbridled mood swings paradigm debunks.<sup>62</sup>

The only scope for markets to play a role in the mood swings paradigm would be taking bets on whether the system as a whole is headed in the right direction or likely to crash. While a good case can be made that dedicated and well trained observers should be able to detect incoming icebergs through the fog, grasping how the system is wired and understanding the possible cracks is not an easy task. It is likely to require hefty investments and sophisticated skills. Hence, “systemic risk gazing” is unlikely to arise spontaneously as a profitable market activity. Instead, it should be viewed mostly as a public good.<sup>63</sup> Upgrading the role of the supervisor to provide or promote such “*holistic*

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<sup>60</sup> However, as proposed by Kashyap, Rajan, and Stein (2008), it might be feasible to set up private partial insurance schemes in the form of additional capital becoming available under stressful systemic events. We briefly come back to the issue of induced market discipline in the concluding section of the paper.

<sup>61</sup> See Danielsson and Shin (2002).

<sup>62</sup> De Grauwe (2008) and Haldane (2009) make closely related points.

<sup>63</sup> However, it might be possible to outsource part of the systemic monitoring activity through mandatory insurance arrangements. This issue is briefly revisited below.

*monitoring*” should therefore become a key component of reform. However, as discussed below, this will require, in addition to sound judgment and vision, sufficient independence and accountability—a tall order indeed.

Consider next some of the key implications for the nature of prudential regulation. As regards the scope of regulation (the “line in the sand”), the discrepancies between the three sides are obvious. A supervisor grounded in the agency paradigm would insist that allowing unregulated intermediaries to operate freely is the proper thing to do. Informed investors will naturally migrate to the unregulated world where innovation can thrive, risks and returns will likely be higher, and—as long as information is timely and reliable—users of funds will be appropriately disciplined. However, for the reasons already noted above, his externalities colleague would be dead set against the idea of allowing prudentially unregulated intermediaries to operate side by side with the regulated sector. The mood swings supervisor would be of a more mixed mind. Unregulated intermediaries could make his life more difficult as uncontrolled innovation, pushed along by the forces of competition and regulatory arbitrage, could set eventually the system on the wrong track. However, provided all innovation is regulated, he might find this to be manageable.

As regards the focus of regulation, the discrepancies across paradigms as regards the scope for market discipline have profound implications for the way risk is both reported and managed. Consider accounting issues first. In the agency paradigm, fair value accounting is clearly the superior alternative. Ensuring that changes in market values are immediately reflected in balance sheets is essential to contain the risk of a moral hazard-driven bubble where undercapitalized intermediaries are allowed to continue operating normally. However, fair value accounting can be problematic under the other two paradigms. By enhancing the impact of one intermediary’s actions on the balance sheets of other intermediaries, it exacerbates externalities. At the same time, and perhaps more importantly, it magnifies the impact of liquidity or mood swing-induced deviations in asset prices from their longer run fundamentals.

Consider risk management issues next. Are systemic liquidity norms needed? Clearly “no” under moral hazard (this is not a relevant problem), “perhaps” under externalities (as long as the ex-ante social benefits exceed the ex-ante social costs), and “probably yes” under mood swings. In the latter case, because crises are endogenous events rather than acts of god, they are likely to be more recurrent. Hence, unless the supervisor is convinced that he will be able to always navigate the ship around the icebergs, taking the proper systemic precautions is a good idea (multiple layers of steel against water inroads will better protect the keel).

How important is it to look at the system as a whole? In the agency case, this is not the proper way to look at the problem. Systemic events arise from individual malfeasance and this is where the emphasis should stay. Instead, in the externalities paradigm, a systemic perspective is naturally called for. Indeed, this is exactly what one does when one “internalizes the externalities”. In the mood swings paradigm, the focus on the whole is perhaps even more fundamental. Crises are manifestations of collective excesses and it is

impossible to understand the dynamics of the whole by summing up the idiosyncratic risks and dynamic paths of individual institutions.

In this context, the answer to the question “how tightly should the prudential and monetary authorities coordinate?” is rather self-evident. In the agency case, not much coordination is needed, if at all. Instead, the Greenspan doctrine seems to apply: let the prudential authority make sure that incentives are properly aligned and the monetary authorities make sure that the ship is sailing at the proper speed (i.e., take care of the cycle). In the externalities paradigm, the two authorities should instead closely consult each other to make sure that intermediaries are not unduly vulnerable to tail-risk events and that the supervisor is sufficiently aware of where the cycle might go. In the mood swings paradigm, there should be very tight coordination between the two authorities and possibly even no major differentiation between them. By contributing to mood swings, monetary policy becomes an integral part of the prudential story. And the prudential risks ahead become a key dimension of monetary policy decision making. Hence, prudential and monetary adjustments are joined at the hip.

Along similar lines, are macro-prudential, dynamically adjusted norms needed? In the stationary moral hazard world, the answer is clearly negative. Instead, in the externalities paradigm, the exposure to exogenous shocks and fluctuations provides a good basis for cycle-adjusted norms because it allows prudential buffers to be real buffers, i.e., to be built up during the good times and used up during the bad times. In addition, these norms can help coordinate the actions of individual agents and thus overcome the prisoner’s dilemmas-type situations. Given that the externalities are known (or knowable); this militates in favor of rules over discretion. The mood swings paradigm also makes a strong case for anti-cyclical prudential norms but for a different reason. Rather than systematically limiting the ship’s speed under clear weather, the main motive in this case is to lift up the yellow flag when, under foggy weather, “icebergs may possibly be lying ahead”. Hence, mood swings provide a rationale for a judgment-based anti-cyclical framework, much as the one in effect for monetary policy—a framework where an independent body would have the discretion to calibrate the anti-cyclical prudential instrument in light of evolving circumstances.

Consider finally the need for (and purpose of) a safety net (Table 3). To a large extent, this question relates to the scope for learning. In a system where learning is possible, it may be preferable to let agents face the hardships of financial crises and learn from experience.<sup>64</sup> In the agency paradigm the system is *not* dominated by uncertainty and mood swings and, hence, should be broadly stationary (even if subjected to innovation). Therefore, agents should eventually learn. This might take a few crises and significant bruises (which in turn require that the ex-post safety net *not* systematically validate the ex-

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<sup>64</sup> The scope for learning is crucial for determining the need for any regulation, not just the safety net. Indeed, a good case can be made that even without a regulatory reform crises should convince principals (shareholders and investors) that they need to improve their control on agents (managers).

ante expectation of bailouts) but wisdom should eventually arise from the pain.<sup>65</sup> Correspondingly, it would be better if the lender-of-last-resort (LOLR) function did not exist. Bank runs are healthy manifestations of market discipline. Stopping runs unnecessarily protects banks that should fail and aggravates the misalignment of incentives for all other banks. Similarly, deposit insurance can only be justified by consumer protection but, given its adverse moral hazard implications, a pure agency supervisor would probably conclude that, on balance, the world would be a better place without it.<sup>66</sup>

By contrast, in the externalities paradigm, the nature of the problem makes learning irrelevant. As long as externalities are not internalized, participants only see their side of the story, no matter what. Moreover, there is no possible learning from exogenous and random acts of god or from self-fulfilling runs in a multiple equilibrium world. Thus, to the extent that it is too expensive for society to prevent runs through large ex-ante buffer requirements, an efficient LOLR becomes a socially superior solution and the cornerstone of the regulatory edifice. Also, as his forebears after the Great Depression, an externalities supervisor would conclude that deposit insurance is needed to induce the small uninformed depositors to join the banking system while preventing them from crying wolf and causing systemic havoc without justification. Again, however, having fire safety only a 911 call away hardly promotes incentives for keeping a fire extinguisher at home, another good example of regulatory collision between the paradigms.

<i>Issue</i>	<b>Paradigm</b>		
	<b>Agency</b>	<b>Externalities</b>	<b>Mood Swings</b>
<i>Can players learn on their own?</i>	Probably Yes	No	Apparently not
<i>Is an ex-post LOLR needed?</i>	No, it is Counterproductive	Yes, to provide systemic liquidity	Yes, to absorb systemic risk
<i>Is a deposit insurance needed?</i>	Probably not	Yes, to limit risks of “wrong” runs	Yes, to limit impact of mood swings

Interestingly, as regards the scope for learning, the mood swings paradigm lies somewhere in the middle. The constantly evolving environment makes some learning possible but tricky. One would think that agents should learn to be more cautious and eventually come to realize that, even if the scope for the truly new is constrained by path dependence, nasty surprises can emerge and that “not all that glitters is gold”. History has

<sup>65</sup> The remaining question, of course, is whether such a system would be “fair” to the smaller and less educated consumers who might be scared away and remain forever on the fringes but in the end this is likely to be an issue of consumer protection more than systemic stability.

<sup>66</sup> Indeed, from a pure moral hazard perspective, the expansion of the safety net (particularly the creation of deposit insurance) can be seen as a mistaken knee-jerk reaction that has come back to haunt the current regulatory architecture and the goal should be to get rid of it. See for example Herring and Santomero (2000), Gale (2004), and Calomiris (2008).

amply demonstrated that this is not the case, however. Moreover, learning in this paradigm is somewhat of an oxymoron. Believing that one has finally “learned the lesson” can boost over-confidence in one’s ability to navigate through the obstacles, thereby setting in motion a mood swings-induced bubble. The uncertainty conscious supervisor would thus agree with his externalities colleague as to the core importance of the LOLR. However, as already noted, he would expect the LOLR mainly to absorb systemic risk rather than provide liquidity. Similarly, he would agree that a deposit insurance is needed to “calm down” the frayed nerves of investors when moods start to turn ugly.

## 7. Towards a New Regulatory Framework

The discussion in the previous sections suggests that the design of a proper regulatory architecture faces two major challenges.<sup>67</sup> The first is to build a regulatory framework that takes into account all three paradigms and avoids solving problems in one paradigm at the cost of making matters sharply worse in another. The second challenge is to find an adequate balance between financial stability and financial development. Extreme solutions—a crisis-proof system that hardly intermediates or a thriving system that frequently collapses of its own weight—are of course to be avoided.

A fully specified reform proposal that meets these challenges lies much beyond the scope of this paper (even more so since the devil is in the implementation details). There is however a minimum set of basic objectives that, in our view, any new prudential architecture should seek to fulfill, either because they cut across paradigms or they are absolutely central to one of the paradigms. Given the popularity of the agency paradigm, the reform agenda will likely be strong in addressing principal-agent issues (including through governance improvements, changes in management compensation schemes, and increased skin-in-the-game requirements). Hence, we focus in this section mainly on the objectives of the regulatory reform needed to address central issues under the externalities and mood swings paradigms.

The *first objective*, which is particularly relevant to the externalities paradigm but applies to all, is full regulatory neutrality. If regulation is not applied uniformly, financial flows will sooner or later find the line of least resistance, giving unregulated financial institutions a competitive advantage and making them grow to the point where they become systemic behemoths. There are two possible solutions to this quandary. One is to make all financial intermediaries fit within the universal banking mode. This solution, however, would limit entry unduly and promote the preponderance of very large, too-big-to-fail, financial conglomerates with limited creativity and large non-competitive rents.

The alternative—which we find to be superior—is to maintain a distinction between commercial banks and other non-deposit taking financial intermediaries, but make

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<sup>67</sup> A number of important and detailed proposals to fix the regulatory framework have already seen the light of day. See for example Financial Stability Forum (2008), Basel Committee on Banking Supervision (2008 a, and b, and 2009), Institute for International Finance (2008), Goldstein (2008), FSA (2009), and the November 2008 and April 2009 Declarations of the G-20 Summits.

the latter choose between being prudentially regulated or being unregulated. All regulated intermediaries would need to satisfy the same prudential requirements (capital adequacy in particular) as commercial banks and in exchange benefit from LOLR services.<sup>68</sup> However, reflecting their reduced responsibilities towards retail investors and the payment system, regulated non-bank intermediaries would be subject to a lower entry capital (i.e., the minimum capital needed to open) and less cumbersome fit-and-proper tests than those applicable to commercial banks (otherwise all non-bank intermediaries would become universal banks). The unregulated intermediaries, by contrast, would not need to satisfy capital adequacy requirements nor be subjected to an entry capital threshold. In exchange, however, they would be restricted to funding themselves only from regulated intermediaries, banks or non-banks (i.e., *they could not borrow directly from—or acquire contingent liabilities with—the market*).<sup>69</sup>

This proposal has many benefits. As in the case of universal banking, it would comply with regulatory neutrality. Because unregulated intermediaries could only fund themselves from regulated intermediaries, a dollar lent to a final borrower through an unregulated intermediary would end up paying the same capital charge (systemic tax) as a dollar lent through a regulated intermediary. Hence, systemic risk would be evenly internalized across all possible paths of financial intermediation, whether they involve regulated intermediaries or not.<sup>70</sup>

At the same time, in contrast with universal banking, the proposed scheme would favor innovation and competition. Because they would not need to meet any entry capital requirements, unregulated intermediaries could start from scratch. This would facilitate the entry of the smaller players, possibly into “niche” or “boutique” intermediation. The most innovative and successful would eventually grow to become regulated and gain direct access to the capital markets. In turn, the most successful of the regulated non-bank intermediaries could grow further to become universal banks, thereby authorized to tap

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<sup>68</sup> Following the same logic of regulatory neutrality, all asset-backed securities issued with some form of recourse (including reputational) to the regulated intermediary, or purchased by a regulated intermediary, should carry an equity tranche retained by the issuer at least equivalent to the uniform capital adequacy requirement imposed on the intermediation system.

<sup>69</sup> Thus, hedge funds that wish to remain unregulated would be allowed to borrow only from banks or other regulated intermediaries. In addition, they (as well as all other prudentially unregulated financial institutions) would not be permitted to engage as counterparties in credit derivatives transactions and other forms of default hedging and insurance (these give rise to contingent liabilities whose payment at the time they fall due may exert systemic stress by requiring asset fire sales). At the same time, a clear dividing line would also need to be established between financial and non-financial corporations, with the latter not being allowed to engage in finance operations beyond basic trade credit.

<sup>70</sup> Some regulatory bias between intermediated debt and direct debt issues would persist, since systemic risk would be internalized only in the former case. However, because it would not involve leveraged intermediation or expose financial intermediaries, this residual bias should be much less problematic and more manageable. Notice also that our proposal is only meant to address the systemic risks associated with debt-funded intermediation, but not those attached to unleveraged asset managers such as mutual funds, whose contribution to downward liquidity spirals is tempered (albeit not eliminated, particularly under conditions of structural or temporary asset market illiquidity) by the marking-to-market of their liabilities.

deposits and take on full payment system responsibilities.<sup>71</sup> The cost of oversight would remain low, however, as the activities of the unregulated would be monitored on a contractual basis by the regulated intermediaries that lend to them.<sup>72</sup> This would effectively “delegate” supervision to the regulated intermediaries, creating a two-tiered “nursery” system in which the start-ups could prosper and grow under the watchful eye of the better-established (and more experienced) institutions.

Most importantly, this proposal does not rely on artificial boundaries set up by the regulator between “systemically important” and “systemically unimportant” financial intermediaries, based on size, activity, or some risk-based measure of systemic impact (such as the recently proposed CoVar).<sup>73</sup> Such distinctions may promote regulatory arbitrage in ever more complex and opaque ways or be very difficult to implement.<sup>74</sup> Instead, by treating all intermediaries equally subject only to a simple choice by the intermediary itself, our proposal is much simpler and operationally easier to implement.<sup>75</sup>

The *second objective*, particularly relevant to the externalities paradigm but also consistent with all three paradigms, is to keep the system reasonably close to a stable path (hence enhancing the scope for prices to reflect fundamentals) through a better alignment of incentives. In this regard, a key missing piece in the current framework is the internalization of systemic liquidity risk. Proposals have been made to penalize maturity mismatches between assets and liabilities. However, since short assets are likely to become as illiquid as long assets under systemic events, it seems preferable to focus on the maturity of the funding structure, *irrespective of that of assets*.<sup>76</sup> By inducing final

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<sup>71</sup> In this scheme, development banks could play a particularly important and relatively novel role. They could nurture innovation and promote competition and access by financing unregulated intermediaries and helping them grow. Their lower aversion to risk (supported by the State’s higher risk sharing capacity) would give them a natural edge over private regulated intermediaries.

<sup>72</sup> Kambhu, Schuermann, and Stiroh (2007) discuss the benefits (and limitations) of such indirect monitoring of hedge funds by regulated entities and conclude that it is a preferable alternative to direct regulation.

<sup>73</sup> See Brunnermeier et al. (2009).

<sup>74</sup> If the distinction is based on a simple objective criterion, such as size, unregulated intermediaries could multiply in numbers and engage in “systemic herding”. They would individually benefit from the lighter regulation by staying just below the size threshold but become just as systemically important *as a whole* as in the case where unregulated intermediaries of any size were allowed to operate. On the other hand, risk-based distinctions, even if based on meaningful and uncontested models (by no means an obvious proposition), could create grey zones with an uneven playing field as regards both the intensity of regulation and access to the safety net. Reclassifying institutions around the grey zones, in and out of the systemic list, could easily become an operational and political conundrum.

<sup>75</sup> Our proposal on the scope of prudential regulation only deals with pure market externalities. Hence, it does not address the too-big-to-fail or too-interconnected-to-fail problems. These problems do not invalidate our proposal but call for different instruments, particularly a suitable failure resolution framework—with powers to close, intervene, unwind positions, restructure, separate the “good” and “bad” parts of the balance sheet, etc.

<sup>76</sup> Penalizing maturity mismatches could encourage intermediaries to lend short. This would push liquidity risk on to borrowers but would not eliminate it from the system as it would increase the risk of defaults under systemic stress. Moreover, when several banks lend to the same borrower, it could encourage run-like loan recalls by banks that could further exacerbate systemic stress.

investors to hold at least part of the liquidity risk instead of pushing it on to the system, this should reduce systemic exposure to liquidity events. In any case, a liquidity-related norm would need to be properly calibrated to reflect social costs and benefits, could take alternative forms (e.g., a special capital charge, a risk-adjusted insurance premium), and would need to reconcile the pro-cyclicality of nearly any norm based on contemporaneous risk with the need for counter-cyclical adjustments.<sup>77</sup> None of the above is trivial.<sup>78</sup>

The *third (and closely related) objective* is to continue improving the safety net, reflecting its centrality to the externalities and mood swings paradigms. (Even with vigilant supervision and sufficient internalization of externalities, the high social costs of crisis-proof systems and the uncertain turns taken by continually evolving financial systems render the full elimination of crisis a socially undesirable endeavor.) The objective of improving the safety net calls for: (i) reviewing the pricing of deposit insurance schemes to better reflect their de facto systemic exposure; (ii) examining whether access to the LOLR should be paired with a systemic insurance that all prudentially regulated intermediaries (whether deposit-taking or not) should subscribe to; and (iii) rethinking the LOLR from a mood swings perspective, i.e., as a risk absorber of last resort. As noted, under our proposal for the scope of prudential regulation, all regulated intermediaries would have equal access to the LOLR. In contrast, unregulated intermediaries would be allowed to fail under an efficient bankruptcy code (this would allow the less successful intermediaries to exit promptly, thereby maintaining the vitality of the system).

The *fourth objective* relates to the importance of keeping a tighter rein on the possible downstream risks of financial innovation, particularly (but not only) from a mood swings perspective. This would require giving the regulator more powers to regulate, standardize, and authorize all forms of innovation (whether in instruments, institutions, or markets) and to subject them to much more rigorous pre-approval and road-testing, much as in the case of new drugs for the FDA.<sup>79</sup>

The *fifth objective* is realigning the respective monitoring roles of markets and supervisors to address the underlying weaknesses of spontaneous market discipline under both the externalities and mood swings paradigms. Markets should no doubt continue to play a key *ex-ante* role in allocating resources and helping align incentives in the agency paradigm. However, it would be foolish to expect spontaneous market discipline to prevent

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<sup>77</sup> The challenge for counter-cyclical norms largely stems from the fact that the direction towards which incentives need to be aligned (and moods tempered) shifts abruptly depending on the phase of the cycle: dampening the upward phase requires that intermediaries take less risk and accumulate more capital; dampening the downward phase requires that intermediaries take more risk and use up capital.

<sup>78</sup> Additional ways to better internalize systemic liquidity risk might also include limits on gross leverage, an in-depth review of the differentiated capital requirements on trading books versus banking books, and some form of liquidity buffer (i.e., a prudential norm encouraging the holding of systemically safe assets). On the latter, see Morris and Shin (2008).

<sup>79</sup> A very similar recommendation can be found in Buiter (2008). By the same token, the tight linkages between financial innovation and deregulation also call for special attention to the potentially destabilizing market implications of regulatory reform (unduly exuberance or moral hazard-induced dynamics).

externality- or mood swings-induced systemic crises. Moreover, imposing market discipline *ex-post*, once the system is deeply out of equilibrium and a crisis is unfolding, is fraught with danger.<sup>80</sup>

By contrast, in the multi-paradigm world, the supervisor would be naturally expected to have such a tough and complex responsibility that reasonable doubts exist as to whether its implementation lies in the feasible range. Unlike in the pure agency paradigm, he can no longer relax and concentrate on relatively simpler policing tasks once he has built the necessary informational and contractual environment to promote market discipline (hence, self-regulation). Instead, the “holistic” supervisor of the mood swings paradigm provides a valuable scouting, moderating, and coordination service to society that markets cannot spontaneously provide. To this end, he should be able to connect the dots, understand the forest beyond the trees, and look ahead for possible systemic trouble. He would need the means and the clout to help coordinate expectations around systemically sustainable paths. This in turn calls for a deeper informational role—i.e., to provide systemically oriented information and benchmarks to help intermediaries think systemically and fashion their risk assessments accordingly.

However, in a world of bounded rationality and sentiment-driven noise traders, information and analysis are unlikely to suffice. Adding deeds to words will require boosting the supervisor’s capacity (and skills) to exert judgment-based discretionary interventions to slow down credit cycles, or restrict specific forms of intermediation that may become riskier as they develop. Given evolutionary uncertainty, macro-prudential regulation cannot be entirely rule-based. Instead, counter-cyclical prudential norms may have to be at least in part judgment-based, calibrated discretionally in view of changing circumstances, much as the interest rate is calibrated by monetary authorities.<sup>81</sup> Of course, what shape and form such an instrument could take is hardly a trivial issue.

The stronger powers of the “holistic” supervisor would also be accompanied by a tougher responsibility and, with it, a risk of calamitous failure. If things go well, financial market participants will reap the benefits and the supervisor would be an unsung hero. If things go wrong, moral hazard will have a field day: “it was the regulator’s fault, hence the state’s responsibility to pay for damages.” Moreover, initial success in stirring the system may breed complacency and irrational exuberance leading to a crash down the line. Avoiding these pitfalls will require combining hard-wired rules (that maintain the system within reasonable bounds) with an institutional reform that is commensurate with the supervisor’s new terms of reference (including his enhanced powers and responsibilities), and sufficiently strong to overcome the multiple difficulties associated with the use of discretion. Finding the right implementation modalities and regulatory mix between rules

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<sup>80</sup> The failure of Lehman Brothers provides a vivid recent illustration of the risks attached to 11<sup>th</sup> hour attempts to limit moral hazard by restricting access to the safety net.

<sup>81</sup> Indeed, reflecting more tenuous and complex links between the instrument and the final objective, a pure rule-based macro-prudential policy could be even more elusive than a pure Taylor rule-based monetary policy. Instead, having to explain and justify decisions could help promote progress on macro-systemic prudential analysis, much as has been the case with inflation targeting for monetary policy.

and discretion is likely to be one of the toughest yet most central challenges of prudential regulatory reform in the years ahead.<sup>82</sup>

A key additional question to be tackled in the years ahead is whether the supervisor's task might be eased through an expansion of *induced market discipline*. In effect, policy initiatives could create incentives for private participants to provide some form of insurance against systemic risks and this might further the supervisor's capacity to look ahead and facilitate his use of discretion.<sup>83</sup> However, whether it will be possible in practice to reliably outsource systemic monitoring in a cost-efficient manner to the private sector is a widely open question at this stage.

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<sup>82</sup> In this context, to avoid regulatory capture, a particularly hard look will need to be given to the political economy of regulation (see Demirguc-Kunt and Serven, 2009). This problem can become trickier when the supervisor needs to round off his views partly based on those who are closer to the market, including financial intermediaries. At the same time, however, players should realize that systemic adjustments should affect all players equally (provided regulation is truly neutral) and are for the common good, which should ease the way for fruitful coordination, much as in the case of monetary policy.

<sup>83</sup> In view of the large risks involved and the private sector's higher risk aversion, such policy initiatives may require some risk sharing between the public and private sectors.

## References

- Abreu, Dilip and Markus Brunnermeier, 2003, “Bubbles and Crashes”, *Econometrica*, 71-1, pp 173-204.
- Adrian, Tobias and Hyun Song Shin, 2007, “Liquidity and Leverage”, Mimeo, Federal Reserve Bank of New York and Princeton University.
- Adrian, Tobias, and Hyun Song Shin, 2008, “Financial Intermediaries, Financial Stability, and Monetary Policy”, Federal Reserve Bank of New York Staff Report 346.
- Allen, Franklin and Douglas Gale, 1998, “Bubbles and Crises”, Wharton School Working Paper 98-01.
- Allen, Franklin, and Douglas Gale, 2003, “Capital Adequacy Regulation: In Search of a Rationale”, in *Economics for an Imperfect World* by Joseph E. Stiglitz, Richard Arnott, Bruce Greenwald, and Ravi Kanvur. MIT Press.
- Allen, Franklin, and Douglas Gale, 2005, “Systemic Risk and Regulation”, Wharton Financial Institutions Center Working Paper No. 95-24.
- Ambrose, Brett, Michael Lacour-Little, and Anthony Sanders, 2005, “Does Regulatory Arbitrage of Asymmetric Information Drive Securitization?”, *Journal of Financial Services Research*.
- Arrow, Kenneth, and Robert Lind, 1970, “Uncertainty and the Evaluation of Public Investment Decisions”, *American Economic Review* 60, pp 364-378.
- Ashcraft, Adam, and Til Schuermann, 2008, “The Seven Deadly Frictions of Subprime Mortgage Credit Securitization”, Mimeo, Federal Reserve Bank of New York.
- Azariadis, Costas, 1981, “Self-Fulfilling Prophecies”, *Journal of Economic Theory*, 25, 380-96.
- Barberis, Nicholas, and Richard Thaler, 2003, “A Survey of Behavioral Finance”, in Handbook of the Economics of Finance, George Constantinides, Milton Harris and Rene Stulz, editors, Elsevier.
- Basel Committee on Banking Supervision, 2008a, “Principles for Sound Liquidity Risk Management and Supervision”, Bank for International Settlements, June.
- Basel Committee on Banking Supervision, 2008b, “Proposed Revisions to the Basel II Market Risk Framework”, Bank for International Settlements, July.

Basel Committee on Banking Supervision, 2009, "Proposed Enhancements to the Basel II Framework", Bank for International Settlements, January.

Berger, Allen, Richard Herring, and Giorgio Szego, 1995, "The Role of Capital in Financial Institutions", Wharton School Working Paper 95-01.

Boot, Arnoud, Stuart Greenbaum, and Anjan Thakor, 1993, "Reputation and Discretion in Financial Contracting", *American Economic Review*, 83, pp 1165-1183.

Borio, Claudio, 2003, "Towards a Macroprudential Framework for Financial Supervision and Regulation?", BIS Working Paper 128.

Brunnermeier, Markus, 2008, "Deciphering the 2007-2008 Liquidity and Credit Crunch", *Journal of Economic Perspectives*, (forthcoming).

Brunnermeier, Markus, Andrew Crockett, Charles Goodhart, Avinash Persaud, and Hyun Shin, 2009, *The Fundamental Principles of Financial Regulation: 11<sup>th</sup> Geneva Report on the World Economy*

Brunnermeier, Markus, and Lasse Pedersen, 2008, "Market Liquidity and Funding Liquidity", NBER Working Paper 12939.

Buiter, Willem, 2008, "Lessons from the Global Credit Crisis for Social Democrats", Mimeo, European Institute (December).

Caballero, Ricardo, 2009, "A Global Perspective on the Great Financial Insurance Run: Causes, Consequences, and Solutions", Vox, January 23.

Calomiris, Charles, 2008, "The Subprime Turmoil: What's Old, What's New, and What's Next", Mimeo, Columbia University.

Calomiris, Charles, and Charles Khan, 1991, "The Role of Demandable Debt in Structuring Optimal Banking Arrangements", *American Economic Review* 81, pp 497-513.

Caprio, Gerard, Asli Demirguc-Kunt, and Edward Kane, 2008, "The 2007 Meltdown in Structured Securitization", World Bank Working Paper 4756.

Coval, Joshua, Jakub Jurek, and Erik Stafford, 2008, "The Economics of Structured Finance", Harvard Business School Working Paper 09-060.

Danielsson, Jon, and Hyun Song Shin, 2002, "Endogenous Risk", Mimeo, London School of Economics.

De Grauwe, Paul, 2008, "Lessons from the Banking Crisis" A Return to Narrow Banking", Mimeo, University of Leuven.

De Grauwe, Paul, 2008, "Animal Spirits and Monetary Policy", Mimeo, University of Leuven

Dell' Ariccia, Giovanni, Deniz Igan, and Luc Laeven, 2008, "The US subprime mortgage crisis: A Credit Boom Gone Bad?" Vox, February 4.

Della Vigna, Stefano, 2007, "Psychology and Economics: Evidence from the Field", NBER Working Paper 13420

Demirguc-Kunt, Asli, and Luis Servén, 2009, "Are All the Sacred Cows Dead?" World Bank Working Paper 4807.

Dewatripont, Mathias, and Jean Tirole, 1994, *The Prudential Regulation of Banks*, MIT Press.

Diamond, Douglas, and Phillip Dybvig, 1983, "Bank Runs, Deposit Insurance, and Liquidity", *Journal of Political Economy* 109, pp 287-327.

Diamond, Douglas, and Raghuram Rajan, 2000, "A Theory of Bank Capital", *Journal of Finance* 55, pp 2431-2465.

Eichengreen, Barry, 2008, "Origins and Responses to the Crisis", Mimeo, University of California, Berkeley.

Epstein, Larry, and Tan Wang, 1994, "Intertemporal Asset Pricing under Knightian Uncertainty", *Econometrica*, 62:2, pp 283-322.

Financial Services Authority, 2009, "The Turner Review: A Regulatory Response to the Global Banking Crisis", London (March)

Financial Stability Forum, 2008, "Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience", Basel (April).

Fisher, Irvin, 1933, "The Debt Deflation Theory of Great Depressions", *Econometrica* Vol 1, pp 337-57.

Fostel, Ana and John Geneakoplos, 2008, "Leverage Cycles and the Anxious Economy", *American Economic Review* 98:4, pp 1211-1244.

Gale, Douglas, 2004, "Notes on Optimal Capital Regulation", New York University, mimeo.

Geneakoplos, John, and Heracles Polemarchakis, 1986, "Existence, Regularity and Constrained Sub-optimality of Competitive Allocations when the Asset Market is

Incomplete”, in *Essays in Honour of K. J. Arrow*, vol 3, Heller, W., Starret, D. and Starr, R. (Cambridge).

Geweke, John, 2001, “A Note on Some Limitations of CRRA Utility”, *Economic Letters*, 71 (3): 341-345

Goldstein, Morris, 2008, “Addressing the Financial Crisis”, Peterson Institute for International Economics, Washington D.C.

Goodhart, Charles, Boris Hofman, and Miguel Segoviano, 2004, “Bank Regulation and Macroeconomic Fluctuations”, *Oxford Review of Economic Policy* 20(4), pp 591-615.

Gorton, Gary, 2008, “The Subprime Panic”, NBER Working Paper 14398.

Gorton, Gary and Andrew Winston, 2002, “Financial Intermediation”, Wharton School Working Paper 02-28.

Greenlaw, David, Jan Hatzius, Anil Kashyap, and Hyun Song Shin, 2008, “Leveraged Losses: Lessons from the Mortgage Market Meltdown”, *US Monetary Policy Forum Report No. 2*, Rosenberg Institute, Brandeis International Business School and Initiative on Global Markets, University of Chicago Graduate School of Business.

Greenspan, Alan, 1998, “The Role of Capital in Optimal Banking Supervision and Regulation”, *Federal Reserve Bank of New York Economic Policy Review* 4-3, pp 163-68.

Haldane, Andrew, 2009, “Why Banks Failed the Stress Test”, Speech given at the Marcus-Evans Conference on Stress Testing, Bank of England (February).

Herring, Richard, and Anthony Santomero, 2000, “What is Optimal Financial Regulation?”, Center for Financial Institutions Working Paper 00-34, Wharton School.

Holmstrom, Bengt, and Jean Tirole, 1998, “Private and Public Supply of Liquidity”, NBER Working Paper 5817.

Huang, Rocco, and Lev Ratnovski, 2008, “The Dark Side of Bank Wholesale Funding”, Risk Analysis and Management Conference, World Bank and IMF.

Institute for International Finance, 2008, “Final Report of the IIF Committee on Market Best Practices: Principles of Conduct and Best Practice Recommendations” July.

Kashiap, Anil, Raghuram Rajan, and Jeremy Stein, 2008, “Rethinking Capital Regulation”, Mimeo, University of Chicago and Harvard University.

Khan, Charles, and Joao Santos, 2008, “Liquidity, Payment and Endogenous Financial Fragility”, Conference on Liquidity: Concepts and Risks.

Keys, Benjamin, Mukherjee Tanmoy, Amit Seru, and Vikrant Vig, 2008, "Did Securitization Lead to Lax Screening: Evidence from Subprime Loans 2001-2006", EFA 2008 Athens Meeting Paper.

Khandani, Amir, and Andrew Lo, 2008, "What Happened to the Quants in August 2007: Evidence from Factors and Transactions Data", NBER Working Paper 14465.

Kim, Deasik, and Anthony Santomero, 1988, "Risk in Banking and Capital Regulation", *Journal of Finance* 43, pp 1219-33.

Kindleberger, Charles, and Robert Aliber, 1996, *Manias, Panics, and Crashes: A History of Financial Crises*, Wiley Investment Classics.

Korinek, Anton, 2008, "Regulating Capital Flows to Emerging Markets", University of Maryland, Mimeo.

Leamer, Edgard, 2008, "Housing is the Business Cycle", NBER Working Paper 13428.

Lo, Andrew, 2004, "The Adaptive Markets Hypothesis", *The Journal of Portfolio Management*, 30<sup>th</sup> Anniversary Issue.

Lorenzoni, Guido, 2007, "Inefficient Credit Booms", NBER Working Paper 13639.

Minsky, Hyman, 1975, *John Maynard Keynes*, Columbia University Press

Morris, Stephen, and Hyun Song Shin, 2008, "Financial Regulation in a System Context", *Brooking Papers on Economic Activity*, Fall 2008 Conference Draft

Rajan, Raghuram, 1998, "The Past and Future of Commercial Banking Viewed Through an Incomplete Contract Lens", *Journal of Money, Credit and Banking* 30, pp 524-550.

Rajan, Raghuram, 2005, "Has Financial Development Made the World Riskier?" NBER Working Paper 11728 (November).

Rajan, Raghuram, 2008a, "Bankers' Pay is Deeply Flawed", *Financial Times*, January 8.

Rajan, Raghuram, 2008b, "A View of the Liquidity Crisis", mimeo, University of Chicago.

Santos, Manuel, and Michael Woodford, 1997, "Rational Asset Pricing Bubbles", *Econometrica*, 65:19-57.

Schumpeter, Joseph, 1934, *The Theory of Economic Development*, Harvard University Press.

Shiller, Robert, 2006, *Irrational Exuberance*, Princeton University Press.

Shleifer, Andre, and Robert Vishny, 1997, “The Limits of Arbitrage”, *Journal of Finance*, 52:35-55

Song, Fengshua, and Anjan Thakor, 2008, “Financial System Architecture and the Co-evolution of Banks and Capital Markets”, Pennsylvania State University and Washington University (Mimeo).

Taleb, Nassim Nicholas, 2007, *The Black Swan: The Impact of the Highly Improbable*, Random House.

Tarullo, Daniel, 2008, *Banking on Basel*, Peterson Institute for International Economics.

Veronesi, Pietro, and Luigi Zingales, 2008, “Paulson’s Gift”, Mimeo, University of Chicago.

Weitzman, Martin, 2007, “Subjective Expectations and Asset-Return Puzzles”, *American Economic Review*, 97(4): 1102-1130.

White, William, 2006, “Is Price Stability Enough?”, BIS Working Paper 205 (April).