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Uncertainty and the Financial Crisis

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Abstract

The majority of commentators, along with the public opinion, are inclined to identify the causes of the last financial crisis in a combination of traditional market and regulatory failures in the operation and regulation of financial markets. Whatever cannot be explained along these lines is interpreted as evidence of inability of individuals, including market professionals, to make rational choices. Without denying the importance of these factors in explaining the behavior of some of the players involved, this paper argues that the extraordinary proportions of the crisis we have experienced are better understood by looking at the specific dynamics of financial innovation through securitization of illiquid assets. Particularly, a perverse combination of Knightian uncertainty and externalities in banking seems to have been one major responsible of the financial crisis.

This paper investigates the role of uncertainty and externalities in the unfolding of events that determined the financial crisis. In this perspective, financial regulation has not been just too lax or too lenient. Rather, it has distorted the choices of financial intermediaries ex-ante (inducing them to rely too much and too quickly on liquidity for funding and profits) and it has turned out to be too rigid ex-post (failing to provide the banking system with incentive-compatible forms of resilience). The implications of this approach are discussed with regard to the regulation of credit rating agencies, the pro-cyclicality of capital adequacy regulation, and the corporate governance of banks.

Keywords: Securitization, Liquidity, Maturity Transformation, Externalities, Shadow Banking, Ratings, Capital Adequacy, Corporate Governance of Banks

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1. INTRODUCTION

Despite the extraordinary proportions of the financial crisis that developed economies have experienced worldwide, its explanation seems, at first glance, rather trivial. A lax monetary policy, misplaced incentives, and regulatory failures in the US and other countries of the Wealthy West are apparently responsible for what has happened (e.g. Posner 2009a). In hindsight, the failure to regulate adequately the market for subprime mortgages, their securitization, and the exposure of the banking system to it is reported as the main culprit. This triggered the downward spiral transforming a liquidity crisis in a credit crunch, a cyclical slowdown of the economy in a severe recession, underperformance of financial assets in banks' inability to fuel investments and growth.

Perhaps due to the absence of retrospection, the way out of this situation is still unclear. But received wisdom tells us that all this could have been avoided with more regulation and less reliance on individuals' ability to make rational choices (e.g. Schwarcz 2008). I am not denying the relevance of these arguments for a few factors that undoubtedly contributed to the subprime market meltdown and its dramatic consequences. However, this paper will argue that the main drivers of the financial crisis depended on rational choice under uncertainty and on a number of regulatory distortions that aggravated the negative (systemic) externalities of banking, instead of correcting them.

The paper is structured as follows. Section 2 critically reviews the standard explanations of the financial crisis based on opportunism, irrationality, and on various combinations thereof. It shows that these factors cannot be the whole story. The problems with choice under uncertainty, which underlie financial innovation, are introduced in Section 3. This section shows that the rational decision of banks to face the uncertainties of securitization generated important externalities through excessive use of funding liquidity for maturity transformation. The role of financial regulation in fueling, instead of countering, the production of these externalities is analyzed in Section 4. Regulatory reliance on ratings supported investors' demand for high-grade assets; pro-cyclicality of capital adequacy requirements sustained abuse of funding liquidity in good times, via regulatory arbitrage and otherwise, as it contributed to precipitating banking into liquidity spirals in bad times; insistence on market discipline in corporate governance (of banks) fostered short-termism in dealing with financial innovation. Before addressing old problems with new and potentially more distortive tools, a sensible overhaul of financial regulation should correct these distortions. Section 5 concludes.

2. A TALE OF SCAMS AND FOOLS

The story of subprime mortgage securitization is well known, and it will not be recounted in detail in this paper. Yet, in order to appreciate its bearing on the financial crisis, it is important to look at the market exchange of securitized mortgages. One influential view is that this exchange was severely tainted by conflicts of interest, asymmetric information, and irrationality (e.g. Akerlof & Shiller 2008). Falling short of addressing these market failures, (absence of) regulation bears the major responsibility of what happened (e.g. Avgouleas 2009). This line of reasoning has an immediate appeal, which I will initially try to follow in stylized terms. The resulting tale of 'scams and fools' fits, indeed, a few facts, but it leaves key questions unanswered and the big picture unclear. Taking stock of these open questions, I will try to articulate a different,

albeit complementary, explanation of the determinants of the last financial crisis in the following section.

2.1. Mortgage Origination

Subprime mortgages had to be 'sold' to household willing to bear their burden. There is evidence that, especially in the US, mortgages were increasingly offered – often with the aid of pressure sale tactics – to non-creditworthy households. Allegedly, they failed to appreciate the long-run implications of this engagement (Oren Bar-Gill 2009). How could that happen? In the years preceding the burst of the house market bubble, Americans were talked into using real estates as leveraged investments. So long as house prices are increasing, you do not need to repay a burdensome mortgage – you can refinance it based on the increased market value of the house. This outcome is profitable for both the borrower and the lender. Mortgage originators were thus eager to sell this scheme to as many people as possible. In spite of the decreasing quality of credit in the subprime mortgage market, the risk premia were decreasing between 2001 and 2006 (Hellwig 2008). This shows that the mechanism was entirely supply-driven and similar to the sale of financial investments, despite the fact that financial intermediaries were ultimately lending, not borrowing, money.

Two questions are in order. First, the leverage game can be as profitable in good times as disastrous in bad times – and good times do not last forever. How could this elementary circumstance be neglected by households? The second question is even more important. Mortgage defaults affect the lenders more than the borrowers. Why were then the former so insistent on offering mortgages to the latter, knowing that a downturn of the real-estate market would make most of them unable to repay the loan?

The first question seems to have an easy answer, fitting the 'scams and fools' paradigm. The risks of leveraged bets are not known to financially unsophisticated households. Retail investors have limited information and knowledge to appreciate whether and on what terms they should enter into a financial transaction, and their decisions are often subject to a number of behavioral biases. The two effects go in the same direction, suggesting that the retail sale of financial products (both investments and loans) should be regulated to account for the 'suitability' of the product for the buyer and for the conflicts of interest of the seller. This conclusion parallels the standard approach to the regulation of retail financial services (Pacces 2000), and it has been recently extended to the mortgage market (Macey, O'Hara, and Rosenberg 2009). Although the issue of consumer protection against excessive indebtedness has gained considerable momentum in the policy debate,[1] this part of the story plays a minor role in the development of subprime mortgages market. Regardless of whether consumer choice was flawed by ignorance, irrationality, or fraud, this choice was induced by suppliers of credit, not debit, instruments. But the problem of having loans paid back belongs to the lenders, not to the borrowers. The investigation of subprime market development thus points at the second question: why were mortgages offered, rather than purchased, on such terms?

The so-called 'originate-to-distribute' model of securitization apparently provides an easy answer to this question too. Individual mortgage deals were closed as they were pooled together with thousands of similar mortgages, securitized, and sold immediately to investors in different tranches of Mortgage-Backed Securities (MBS). In this way,

[1] See e.g. US Department of Treasury, "Financial Regulatory Reform: A New Foundation", 17 June 2009.

originators could earn their fees without bearing any risk. Mortgage originators did not have incentives to screen the quality of the credit being provided, for the simple reason they did not have sufficient (if any) 'skin in the game' (Hellwig 2008). To be sure, this circumstance is controversial. Originators could not avoid retaining a financial interest in the securitization; the vast majority of private originators were sponsored by the same banks underwriting the securitizations and keeping large parts of the output on their books or in their off-balance-sheet vehicles; and finally, the crisis has almost wiped out the mortgage origination business (Gorton 2009a).

The real problem with placing the blame on the 'originate-to-distribute' pattern is that misaligned incentives in origination do not necessarily result in deceit to be cured by regulation. In principle, agency problems between professional players are dealt with contractually (Jensen & Meckling 1976). The flaws in the 'originate-to-distribute' model tell nothing about who ultimately supplied credit to households and why. Here the 'scam story' starts getting problematic. MBS were not bought by unsophisticated investors, but by professional financial institutions. Most of them were banks, often operating through their affiliations in the less regulated sectors of the financial industry. By purchasing MBS, they did bear the risk of mortgage default. Indeed, they have been most severely hit by the meltdown of the market for these securities. Before assessing whether and how regulation could have prevented this meltdown and its dramatic repercussions, one should understand why MBS were so popular in spite of the problems with their origination.

2.2. Rating Agencies

What made securitization so popular is the risk assessment by credit rating agencies (CRAs), which apparently, could overcome the deficiencies in the origination process. Securitization of loans has two important advantages. It allows for diversification of the risk of individual loans and makes the latter marketable. The two aspects are related, most prominently through the division in tranches of the cash flow generated by the underlying pool of loans. This division allows concentrating the default risk of the pool (which is by definition lower than the sum of individual risks) in the junior tranches, while making the senior tranches relatively safe. The beauty of this mechanism would vanish in transaction costs in the absence of information intermediaries certifying the riskiness of each tranche. Thus, CRAs have been crucial for the development of the securitization business, including the securitization of subprime mortgages. With the appropriate securitization structure, they could certify the safety of certain tranches of Asset-Backed Securities (ABS) whatever the riskiness of the underlying assets (Fabozzi and Modigliani 2003). This risk was absorbed progressively by the junior tranches, so that – in essence – *all* the securities generated in this way offered a better risk/return combination than the underlying assets. In hindsight, we know that risk was seriously underestimated, and even more so its correlations within the pools of underlying assets. But ex-ante, these were investment opportunities too profitable to be refused (Posner 2009a).

The role of CRAs provides us with the answer we are looking for. Financial institutions were eager to fund the subprime mortgage business by purchasing MBS (and re-securitization thereof) that offered terrific earnings relative to default risk. However, it seems that, in making this judgment, financial intermediaries were fooled by overoptimistic assessments of risk by the CRAs. Bottom line: CRAs, whose central role in the financial industry is unaccompanied by adequate regulatory oversight, need a

substantial injection of regulation to cope with information asymmetry in financial intermediation.

Asymmetric information is a problem as old as the study of finance. Yet, anybody familiar with bankers, asset managers, and the big players in the financial industry will have reservations that these professionals can be fooled so easily. All the more so as CRAs have been operating the securitization business under well-known conflicts of interest (Pagano & Volpin 2009). Not only the major CRAs operate under the issuer-pays model. More importantly, they normally act as advisors of the same securitizations they rate. These circumstances, which are nowadays regarded as major calls for regulation, might be overlooked by unsophisticated investors; but they should have alerted the professional management of MBS purchasers. Once we add that the ability of CRAs to stay in business depends on their reputation with these professional investors (which rebounds to, but is not determined by, reputation with the issuers),[2] it is hard to believe that CRAs were certifying as good investments a "modern form of snake oil" (Akerlof & Shiller 2008: 37).

It is more likely that CRAs were just giving financial intermediaries what they wanted. This was investments earning more than traditional securities of comparable rating. The quest for such investments fueled both aggressive marketing of subprime mortgages (certainly piling risk) and their securitizations and re-securitizations (apparently shredding risk). Undoubtedly, originators and CRAs orchestrated the whole thing with a view to maximizing their profits (what else?). But, whatever motivated the alchemy (masked appetite for risk or a genuine attempt to square the risk/return circle), this must have been in the interest of financial intermediaries, not against it (Calomiris 2009b). This observation does not detract from the pivotal role and responsibilities of CRAs in the securitization business, only helps put these in the right perspective. More than preventing professional investors from being fooled by CRAs, regulation should worry that the two do not collude. As I will show in section 4, this is the opposite of what financial regulation has been doing.

2.3. Moral Hazard

If banks and other financial institutions have not been fooled by originators and CRAs, they must have chosen deliberately to flirt with bankruptcy. Rational actors take this strategy when they play the 'tail-I-win-head-you-lose' game, also known as moral hazard. Moral hazard of banks and asset managers is, with reason, one major explanation of the financial crisis (Calomiris 2009a). Banks have a tendency to engage in overly risky operations, since this may increase their profits while most of the downside risk is borne by their creditors. Banking regulation only makes things worse by providing a safety net that lowers creditors' incentives to monitor. Besides deposit insurance, governments and central banks are credibly committed not to let banks fail when this may lead to the collapse of the entire financial system. This is also a well-know problem, which is addressed by combining banking supervision, capital adequacy requirements, and residual market discipline by shareholders and uninsured creditors. In a sense, what went wrong here is rather trivial (Hellwig 2008). First, banks could circumvent regulation and supervision operating through highly leveraged off-balance-sheet affiliations with the unregulated segments of the industry. Second, managers could make shareholders happy with the higher returns of operating in MBS, their re-

[2] This proposition holds in a hypothetical world undistorted by regulation. For how regulatory distortions displaced the reputational incentives of CRAs, see *infra*, section 4.

securitizations, and credit derivatives on all these securities, while sharing in the profits via bonuses and stock options. No surprise that these two circumstances are now a major target of the regulatory response to come.

However, authentication of the moral hazard paradigm requires a further step: the risks of this game should have been effectively shifted to other players (de la Torre & Ize 2009). It is at least questionable that this has happened. One striking feature of this financial crisis is that it has hit virtually everybody in the financial industry. Not only did it penalize the banks that took leveraged bets on the mortgage market, but also their uninsured creditors and counterparties. Consistent with the moral hazard explanation is that both the former and the latter were relying on the implicit guarantee by the state that it would not let them go under. It is plausible that at least the largest banks and their financiers were playing this game, as financial institutions have always an incentive to become 'too big to fail.' But it must be foolish to believe that governments, however large, are politically and financially able to bail out the entire financial system. One piece of evidence against this belief is that wholesale short-term creditors (including the much-too-blamed hedge funds) were ready to run, and they did run at the first sign of trouble with MBS (Gorton 2009a).

Bank runs are a genuine instance of market discipline. Their occurrence shows that uninsured creditors were monitoring after all. However, after the US government let Lehman Brothers go bankrupt, liquidity drained across the board. Financial intermediaries just stopped lending to each other, triggering a downward liquidity spiral (Brunnermeier 2009) that spared nobody, whether or not still invested in what had become meanwhile the 'toxic assets.' Market discipline had simply come in too late, and it became unfocused (and thus useless) upon realization that the game had become bigger than the system could stand. How big, nobody really knew. This is the reason to dismiss the moral hazard paradigm as incomplete (de la Torre and Ize 2009), for it requires at least one player to know what the others do not know and to profit from it. The fact that no financial intermediary fully anticipated the systemic implications of operating the mortgage securitization business shows that this was not just 'the perfect scam.' That leaves us with the 'fools' side of the story, which, in spite of its intuitive appeal, is no more satisfactory.

2.4. Irrationality or Bounded Rationality?

The 'irrational investors' approach (Akerlof & Shiller 2008; Avgouleas 2009) contends that both financial intermediaries and CRAs did not exactly know what they were doing. They honestly thought, the argument runs, that securitization was an ideal way to separate default risk from the underlying assets and they irrationally underestimated the effects of correlations on the mortgage pools' exposure to systematic risk (i.e., the risk that the house market bubble bursts, eventually, across different geographic areas – which has happened at last).[3] To complicate the picture, securitization of increasingly riskier mortgages was just the beginning of this play. It concentrated risk in the lower tranches that became increasingly thinner, and yet they kept outperforming securities of comparable rating. These tranches were then re-securitized and re-securitized again until gains from trade were exhausted (Gorton 2009a). This pattern generated a bunch of AAA securities out of BBB or lower-grade MBS, through the notorious Collateralized Debt Obligations and re-securitizations thereof (CDO and CDO^2). Similar strategies

[3] The fact that CRAs made these mistakes is uncontroversial (Pagano & Volpin 2009; Calomiris 2009c). The point under discussion is whether this nurtured irrational behavior by professional investors.

were pursued through Credit Default Swaps (CDS), which allowed hedging the riskier positions while earning more than the risk-free return. What apparently supports the irrationality explanation is that the multiple layers of securitization, especially when combined with the swapping of default risk, were after all too difficult to understand also for market professionals.

As often in behavioral analyses (e.g. Thaler & Sunstein 2008), this approach equates bounded rationality (i.e., decision-making under limited knowledge – e.g. Williamson 1985) with outright irrationality. However, investing without knowing does not imply irrationality. For one, this perspective confuses being irrational with being wrong (Posner 2009b), neglecting that the latter judgment is performed ex-post while most of the decisions of rational actors are taken ex-ante under uncertainty about future states of the world. I will return to this crucial point in the next section. What suffices to dismiss the irrationality argument is that, differently from stock markets, markets for fixed-income assets are normally 'information-insensitive' and operate on trust that financial commitments will be honored as stated (Gorton 2009b). Trading complex debt securities without meticulously assessing creditworthiness is as rational as buying wholesale diamonds in sealed packets (Holmstrom 2008). Both are markets for liquidity. As such, these markets are rationally operated with limited information, provided that it stays symmetric.

There is plenty of evidence that both rating agencies and the analysts of banks as of other institutional investors *knew* that the house prices appreciation sustaining mortgage securitization could not last forever.[4] In this perspective, information was as symmetric as incomplete. What professionals failed to appreciate, which became evident only in hindsight, were the magnitude of the shock in the real-estate market and, more importantly, the repercussions of this on the new features of the banking business (Gerardi et al. 2008). As hinted before, rating agencies had an incentive to provide investors with what they wanted. But why investors should have been content with ratings highly suspected of being inflated if they were not irrational? Should not rational investors rather question such an illusion of safety, or even better, sell short the overpriced securities instead of ending up deeply invested in them? The answers to these questions illustrate how the build up of the financial crisis depended on entirely rational profit maximization.

Relative to more traditional investments, securitization is attractive as it generates investments earning more than other securities with the same rating. Of course the former are riskier than the latter. But that does not matter for professional investors so long as the securities are marketable. When this is the case, investors can profit from the earnings spread in a simple way: posting the securities as collateral for short-term funding. As the collateral can be rehypothecated and the credit default risk can be swapped, in principle this mechanism allows for optimal risk allocation (Gorton 2009b). Financial intermediaries maximize the profits from engineering this market through short-term financing, which is particularly cheap in situations of low interest rates. In

[4] See, most extremely, US House of Representatives Committee on Government Oversight and Reform (22 October 2008), "Committee Holds Hearings on the Credit Rating Agencies and the Financial Crisis": "Rating agencies continue to create and [sic] even bigger monster – the CDO market. Let's hope we are all wealthy and retired by the time this house of cards falters" (internal email correspondence in Standards & Poor's). In a similar vein, see the report on the employees of AIG (the major counterparty to CDS, which had to be rescued by the US government) by Michael Lewis, "The Man Who Crashed the World", *Vanity Fair* (US edition), August 2009. Calomiris (2009c) and Gerardi et al. (2008) likewise report pieces of evidence on the knowledge of the downside of securitizations by rating agencies and investment banks.

the absence of regulation, the only constraints on leverage are the margins or 'haircuts' demanded by financiers as a fraction of the securities' market value (Gorton & Metrick 2009). When financiers trust the quality of collateral, as when the securities enjoy high ratings, haircuts can be very low (actually even close to zero). Short-term financing is cheap exactly because haircuts are easy to adjust to market conditions (e.g. rating downgrade).

Therefore, securitization created a profitable, and apparently not too risky, opportunity to finance long-term assets with short-term liabilities. That is the essence of the so-called "shadow banking." Shadow banking can be simply described as maturity transformation operated through liabilities contingent on the same assets being financed. This kind of banking is workable so long as the liabilities of banks as of other intermediaries carrying out similar operations are information-insensitive, namely there is no asymmetric information on the value of the collateral backing them (Gorton 2009b). Otherwise, shadow banking is effectively banking: asymmetric information on the value of a bank's liability triggers a run by short-term creditors. In the absence of extreme moral hazard (which, as we have seen, can be safely assumed), banks cannot be expected to rationally expose themselves to runs. In fact, banks had no reason to fear that the eventual downturn of real-estate market could generate asymmetric information as long as CRAs continued to certify the quality of collateral. In the event of a downgrade, margin calls by financiers would have forced banks to liquidate part of their holdings at a loss. However, Shleifer and Vishny (2010) have recently demonstrated that when the price of the securities is not expected to fall too much, it is entirely rational for a bank to profit from leveraged investments in securitization despite the (lower) losses that will be incurred at a later stage. Of course, when the price drops dramatically more than expected, the bank goes bankrupt and the whole system is at jeopardy. This circumstance was considered simply too unlikely to be worth considering; and yet, this is exactly what happened.

How could markets get the price of the new financial instruments so wrong? In principle, the quality of market prices is protected by a powerful mechanism: arbitrage. If MBS and CDO are overpriced, it should be profitable for 'smart traders' to sell them short until the price incorporates all available information. Unfortunately, this mechanism does not work when wealth-constrained arbitrageurs need to wait too long for realizing their profits (Shleifer & Vishny 1997). Until 2006, MBS and CDO were not exchanged on any market rewarding informed trading. Their liquidity relied on their being accepted as collateral (funding liquidity) and priced according to their rating (market liquidity) (Brunnermeier 2009). Both kinds of liquidity depend on the information-insensitive character of the assets and thus of the banks' liabilities they were backing. As no market platform was available to question the ratings, banks could continue making their profits assuming that, when the real-estate prices started to fall, there would have been always sufficient liquidity to unwind their positions at a moderate loss.[5]

That assumption turned out to be incorrect. In the beginning of 2007, the newly established ABX-CDS index of subprime risk suddenly anticipated the effects of the house market downturn on (initially) the junior tranches of MBS (Gorton 2009a). The

[5] As late as on July 10, 2007, Chuck Prince – former CEO of Citigroup – famously stated: "When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you've got to get up and dance. We're still dancing."
Apparently, he had not realized that the music had already stopped (Posner 2009a).

index, which for the first time allowed second-guessing the assessment by CRAs, precipitated rapidly forcing the massive downgrade of mezzanine MBS and CDO based on them. Shortly afterwards, also the price of top-rated MBS fell so much as to make further downgrades inevitable. This circumstance not only triggered increasing margin calls and fire sales trapping the prices of these securities in a downward spiral. It also injected asymmetric information in the ABS markets altogether, because all of them were relying on ratings suddenly turning out to be inflated. Eventually, financial intermediaries became unwilling to accept any asset-backed security as collateral, and they ran on each other until the liquidity of the interbank market dried up (Brunnermeier 2009). Trying to avoid losses in this fashion was no more irrational than maximizing the profits of securitization in the first place. Events too unlikely to be worth contemplating prompted financial intermediaries to rely too much on securitization on the way up (until markets unexpectedly stopped functioning), and too little on the way down (when asymmetric information had transformed also mortgage-unrelated ABS in 'lemons' *à la* Akerlof 1970).

2.5. Summing Up

The development of the MBS market and of its appendices provides compelling evidence that market players were not irrational altogether. Market professionals could appreciate the riskiness of the new products, albeit not its systemic implications. Translating this assessment into coherent market prices took quite some time; eventually, it resulted in over-reaction. Similarly, a significant proportion of wholesale investors did not play the moral hazard card. They were ready to run, and so they did as soon as the market made this strategy more profitable than financing or engaging in shadow banking. This shows that market forces were less tainted by irrationality and conflicts of interest than is commonly understood. Yet the functionality of the market itself was extremely fragile: it worked pretty well under a simple setting, which failed to appreciate the full implications of structured finance; it suddenly stopped working in the face of complexities that market pricing was unprepared to handle smoothly.

I have reviewed what are considered the major determinants of the financial crisis exactly with the purpose of showing how their role was, at best, ancillary to this dynamics. The market dynamics was driven mainly by two factors, which I have intentionally neglected so far: uncertainty and externalities.

3. UNCERTAINTY AND EXTERNALITIES IN BANKING

John M. Keynes' *General Theory of Employment, Interest and Money* (1936) has regained enormous popularity in the wake of the financial crisis. While leaving to the specialists the discussion on the best way to get out of its macroeconomic consequences (and the related controversy about Keynesian policies in this regard), there is one short passage of the *General Theory* which is especially pertinent to the subject of the present inquiry. I quote it below (Keynes 1936: 104-105):

> "Even apart from the instability due to speculation, there is the instability due to the characteristic of human nature that a large proportion of our positive activities depend on spontaneous optimism rather than on a mathematical expectation, whether moral or hedonistic or economic. Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits — of a spontaneous urge to action rather than inaction, and not as the

> outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities. Enterprise only pretends to itself to be mainly actuated by the statements in its own prospectus, however candid and sincere. Only a little more than an expedition to the South Pole, is it based on an exact calculation of benefits to come. Thus if the animal spirits are dimmed and the spontaneous optimism falters, leaving us to depend on nothing but a mathematical expectation, enterprise will fade and die; – though fears of loss may have a basis no more reasonable than hopes of profit had before."

Not differently from other parts of the *General Theory*, Keynes' notion of "animal spirits" is open to interpretation. Stressing the emotional component of the animal spirits, two authoritative economists (Akerlof & Shiller 2008) have recently argued that Keynes was a behavioral economist *ante litteram*. They have attempted to revisit macroeconomics and to interpret the financial crisis on this basis. They might be right, but if we put Keynes' words in context, and in a historical perspective, the interpretation changes considerably. As Posner (2009b) correctly points out, Keynes was building on the work of Frank Knight (1921) a few years back – most notably on his distinction between risk and uncertainty. According to Knight, risk is a future event that can be assigned a probability, whereas uncertainty cannot be quantified objectively. Neoclassical economic theory, including financial modeling, has traditionally neglected this distinction due to its mathematical intractability – which is exactly one of the points stressed by Keynes. Irrational behavior is likewise intractable, but the major difference from that approach is Keynes' reference to the enterprise. He might have been praising irrational entrepreneurial endeavors, but this is implausible given how Keynes criticizes irrationality of speculation in the preceding pages of his treaty (Keynes 1936: 103-104).

Most likely, both Keynes and Knight were seeing entrepreneurs as major actors in a capitalist economy. Entrepreneurs do not act only on mathematical expectations, but on unique circumstances determining "a spontaneous urge to action rather than inaction." In Knightian terms, entrepreneurs face uncertainty, not risk. What Keynes adds to this framework is that, like speculation, the exercise of entrepreneurship in this fashion is a source of "instability." We are getting closer to the bearing of this digression on the determinants of the financial crisis.

Mortgage securitization was a financial innovation, and as such, the result of an entrepreneurial process in the financial industry. Financial institutions had a lot of cash and cash-equivalent to manage and they could only extract competitive earnings by taking more risk. Given the trend of the US house market, subprime mortgages were an attractive option. But there are limits to a bank's ability to offer mortgages to borrowers who will only be able to sustain them out of appreciation of the collateral. Without overly complicating things, these limits are concentration of risk that collateral is devalued, long maturity of contracts, and the costs of individual monitoring. Securitization could solve all these problems. Risk was diversified geographically (house prices *usually* do not move in the same direction across the US) and the costs of individual monitoring was replaced by the securitization structure with the aid of CRAs certifying its soundness. More importantly, securitization allowed tackling a crucial issue in banking: maturity mismatch. As we have seen, banks could profit from expanding mortgage credit (as many other forms of credit to firms and households) because, differently from traditional loans, ABS and MBS were widely accepted as collateral for short-term funding.

The important advantage of securitization was that it *completed* the credit market by improving risk allocation. However, as any developing technology, securitization had a

downside: it was not known how much of the underlying resource – liquidity – the credit market could guarantee in case of distress unaccounted for in risk modeling. Facing this uncertainty (and implicitly disregarding it) was the only way to implement this innovation in banking.

Securitization thus changed the approach to maturity transformation, exposing banking to the liquidity uncertainties generated thereby and the financial system to the consequent instability. Banks borrow short(-term) and lend long(-term), and this is what makes them so fragile in a systemic perspective. Traditionally, the safety net protects banks from runs by insuring their liquid liabilities (deposits) and providing lender-of-last resort facilities. In return, with the purpose of containing moral hazard, governments prevent banks from exceeding with leverage. This paradigm was considered outdated and the capital adequacy requirements unnecessarily binding (Hellwig 2008). The liquidity properties of securitized loans allowed banks to borrow more and better against assets perceived as safe. These advantages were reflected in lower risk-weighted capital ratios for high-grade securities (20% as opposed to 50% of mortgage loans and 100% of commercial loans). But securitization had more potential. Apparently, re-securitization could shred risk further and generate high-grade securities out of much riskier ones (with the latter still fueling higher returns). Moreover, lower-grade securities could be hedged with a CDS and still generate a positive spread (Gorton 2009a). All that the system needed in order to exploit this potential is access to higher leverage. Some institutions (hedge funds, investment banks) had that, and thus they could outperform commercial banks whose leverage was more tightly regulated. To keep up with this competitive pressure, banks set up off-balance-sheet vehicles (e.g. Special Investment Vehicles operating under an implicit or explicit bank's guarantee). This strategy allowed banks to perform as much maturity transformation as their financiers allowed.

The ultimate question is *why* financiers allowed banks to perform so much maturity transformation in this fashion. As we have seen, the literature does not provide clear-cut answers other than moral hazard and/or irrationality, which are at best incomplete explanations. I posit that wholesale investors accepted to finance banks dealing with securitization because they disregarded the *uncertainty*, not the quantifiable *risks*, of the liquidity they were generating. And they did that because no financial intermediary internalizes the effects of uncertainty on liquidity. Knowing the risks of leveraged banking, financiers kept their exposure short-term counting that margin calls on liquid collateral would suffice to absorb shocks (and protect their investment) even in the worst-case scenario. Some of the securities involved could be devalued by the sudden downturn of real-estate prices, but the vast majority of them were safe and marketable, which would allow the necessary price adjustments and the smooth settlement of CDS. Banks would only make moderate losses in this scenario, so who could think of bank runs? A similar belief animated the inaugural sail of the Titanic. 'Unsinkable' – they all thought – for the ship could withstand the burst of up to four watertight compartments. The most famous iceberg in history hit six of them, pretty much as what will be remembered as the largest house market bubble burst in the US flooded the safest compartments of the securitization industry. They both sank.

Errors of judgment are present in both stories. But that is the least interesting part of dealing with uncertainty, as mistakes only prove such in hindsight. For instance, one major mistake in the design of mortgage securitization was the failure to account for a nation-wide synchronized decline in real-estate prices, which had never happened in the

US since the Great Depression (Coval et al. 2009). It is now easy to say that, in the absence of this mistake, the market for MBS and CDO would have not overreacted to the downturn in the housing market. However, it was not this mistake to determine excessive exposure of the banking system to securitization *in general*, including assets other than mortgages. Financial intermediaries were in the position to carry out virtually unlimited maturity transformation via the new markets for liquidity established by securitization, without worrying that the uncertainties in securitization design could adversely affect the liquidity everybody was relying upon. More conservative ratings would not have changed this outcome provided that it remained possible to generate investment-grade securities out of risky long-term assets. Moreover, the mistakes in securitization design could have been timely corrected by CRAs. As long as rating agencies had preserved symmetry of information, investors would have made losses on securitized mortgages, but the general panic on banks' short-term funding could have been avoided. Although CRAs were aware of the necessity to revise downwards their mortgage risk assessments well before the ABS-CDX index started falling (Calomiris 2009c), they followed, instead of anticipating, the market panic. CRAs had no incentive to compromise their reputation with investors so long as the assets they rated remained liquid.

This dynamics of financial innovation shows that the main players were not internalizing the effects of uncertainty, as innovators normally do. This finding is more important than the mistakes uncovered by the unfolding of events. Mistakes cannot be avoided when dealing with uncertainty. However, the effects of these mistakes are amplified by externalities, which are the major problem with old and new forms of banking. The key issue for policymaking is not preventing mistakes in the innovation process, for new and old ones will never be alike and the only way to avoid them is to stifle innovation altogether. A sensible overhaul of financial regulation should rather focus on the externalities of financial innovation.

The externality problem in the financial crisis was generated by banks' reliance on the liquidity of securitized assets, notwithstanding uncertainty made this liquidity inherently fragile. As I am going to show in the next section, this partly depended on regulation making it comparatively more profitable for financial intermediaries to invest in rated securities. This generated demand for shadow banking and for the ratings that made it viable. Otherwise, what allowed banks to become over-dependent on securitization was the inability of markets for liquidity to charge the costs of uncertainty to society.

Markets for liquidity are unable to process uncertainty: either they disregard it or they are killed by it (Holmstrom 2008). Markets for MBS (and ABS in general) were prompted to hastily disregard uncertainty because there was no opportunity for arbitrage on the underlying assets' fundamentals, which originally made ratings the only available source of information. This created two complementary forms of liquidity of securitized assets: funding liquidity and market liquidity (Brunnermeier 2009). In the absence of asymmetric information, banks could fund their investments in MBS through contingent short-term liabilities and make profits from selling MBS on a bullish market; market liquidity also sustained funding liquidity by allowing selling at a moderate loss in the event that lower prices resulted in increased margin calls. This leverage pattern makes both shadow banking and the markets it relies upon unstable (Shleifer & Vishny 2010). Instability materializes the moment arbitrageurs find it profitable to short the securities so that their price drops well below expectations. This is what happened with the ABX-CDS index. Any event turning uncertainty into asymmetric information would

have produced the same result. A liquidity spiral is created by the sudden injection of asymmetric information in securities prices: financiers increase haircuts because of adverse selection of collateral; its value also declines because of fire sales, until the margin calls become too large for banks to sustain; ultimately, the securities stop trading and funding liquidity is withdrawn through a bank run. None of these effects is fully internalized by individual intermediaries dealing with the uncertainties of shadow banking (Brunnermeier et al. 2009).

Shall we blame banks for placing on the market a heavier burden than it could stand? Yes and no. It should be clear by now that banks have been acting rationally in the pursuit of profit opportunities made available by financial innovation, and that moral hazard played no larger role than in the performance of more traditional banking. In this perspective, blaming bankers for maximizing profits in spite of the dangers for the financial system sounds like blaming a lion for eating a zebra (Posner 2009a). A lion is not supposed to spare a zebra based on concern that zebras are eaten faster than they can reproduce. Similarly, it cannot be expected that market players internalize the systemic risk of massive leveraged bets on MBS so long as liquidity is there. Neither the extinction of zebras nor the collapse of the financial system is socially optimal though. Here is the crucial point. The strategy of banks was implemented taking liquidity for granted. But liquidity is a positive externality, which turns into a negative systemic externality when it is withdrawn through a bank run. The fundamental rationale of banking regulation is preventing and correcting collective action problems that may turn liquidity externalities upside down.

Then it is true that the financial crisis was ultimately a regulatory failure. However, the uncertainty perspective allows qualifying regulatory failure in important respects. Regulation could have not prevented the mistakes that resulted in the crisis. Focusing now on these mistakes would be like closing the barn after the horses have escaped: it will not help in the next crisis. What regulation failed to address are the *amplifying* mechanisms of these mistakes, which are due to the problem of externalities in banking. In a similar vein, regulation is not neutral to financial innovation. As it constraints only the forms of financial intermediation that are known, it implicitly induces banks to take advantage of existing rules for profiting from unregulated intermediation. Here again, regulation should focus on the ultimate source of systemic externalities, which is maturity transformation carried out in whatever form. Instead, regulation has incentivized banks to engage in maturity transformation through fragile markets; and it has made it more difficult for banks to cope with the sudden illiquidity of those markets. Less but more focused regulation would not only avoid these distortions. It could also induce more caution in financial innovation without hampering it more than necessary.

4. REGULATORY DISTORTIONS: A WAY FORWARD

Despite the standard view that financial regulation has been too lax in the last few decades (allowing 'unbridled innovation' and 'reckless appetites for risk'), the attractiveness of mortgages securitization for banks depended considerably on the existing regulatory framework. A few factors seem to have been particularly relevant in motivating intermediaries to engage in shadow banking in the quest for more favorable risk/return combinations. With no pretence of being exhaustive, these include most prominently: a) supply of 'regulatory licenses' by otherwise unregulated credit rating agencies; b) loopholes in the regulation of capital adequacy; c) regulatory insistence on

market discipline. The combination of these factors induced banks to depend increasingly on securities markets, for profits in good time as well as for survival in bad times. In the absence of firm knowledge of how bank assets could be marketed smoothly, this amplified banks' exposure to swings between euphoria and panic.

This perspective partly connects with others advanced by authoritative commentators. Posner (2009a) identifies in the excesses of a 'free-market' ideology the main cause of regulatory failure (albeit stressing as more worrisome the combination of market failure with uncertainty). Calomiris (2009b) blames governments and central banks for "errors of commission" rather than for "errors of omission." Hellwig (2008) suggests that, especially in a systemic perspective, "errors of governance" may have been more important than "errors of judgment." What I argue, as a synthesis of all this, is that regulation has mistakenly supported the ideal of a market governance of the banking enterprise. Had it not done so, banks could have avoided relying immediately on a shaky market mechanism for cashing in the profits of financial innovation. In what follows, I will try to illustrate the above-mentioned regulatory distortions with a view to the general dynamics (and to how it should be avoided in the future) more than to the specific details that sustained it in this crisis.

4.1. Credit Rating Agencies

On both sides of the Atlantic, CRAs are a major target of regulatory reform.[6] The argument, attracting widespread consensus, is that they have failed to do their job for lack of transparency, of rules preventing conflicts of interest, and of public oversight. This debate misses one crucial point. CRAs have been indeed very lightly regulated, but regulation is not neutral to them. Regulation of banks and of other major financial institutions (e.g. pension funds) provides CRAs with substantial regulatory rents. Banks can economize on equity capital (and engage in higher leverage) when their marketable assets are rated high enough. Pension funds and some mutual funds are prevented from, or contractually committed to, investing only in top rated securities. The assumption by regulators (which proved wrong only in hindsight) is that high-grade securities are safer. Investors have therefore a strong interest in purchasing high-grade securities, and the whole purpose of subprime market securitization was to combine this regulatory incentive (or outright obligation) with the higher earnings of shadow banking.

In this perspective, the celebrated conflicts of interest of CRAs in dealing with issuers are of secondary importance. In most cases, CRAs are paid by issuers, but for what? Mainly for certifying that their securities qualify for minimizing the *investors*' costs of compliance with financial regulation (Calomiris 2009c). This is how, in the securitization business, the role of issuers became merely instrumental to the investors' strategy. Securitizations were conceived with the double purpose of marketing illiquid assets and reducing the amount of banks' capital to be booked against those assets. CRAs were asked to devise with issuers the appropriate securitization structures for this purpose. That ratings turned out to be inflated is thus no surprise.

The question is, rather, why ratings were not *more* inflated. Besides managing "regulatory licenses" (Partnoy 2009), CRAs do also a more traditional job. They help

[6] See Jacques de Larosière (Chairman), "Report of the High-Level Group on Financial Supervision in the EU", 25 February 2009; US Department of Treasury, "Financial Regulatory Reform: A New Foundation", 17 June 2009; EC Regulation No. 1060/2009 on credit rating agencies of 16 September 2009 (OJ L 302, 17.11.2009, pp. 1-31).

overcome asymmetric information in trading fixed-income securities by staking their reputation on the ratings they provide. The oligopolistic structure of the ratings market supports reputational rents constraining CRAs' incentives to inflate ratings, for this strategy would reduce their rents in the long run. Had they been not credible in rating securitization tranches, there would have been no market for MBS and CDO (in fact, those markets disappeared when CRAs lost their credibility) and much less business to extract rents from.

The supply of regulatory licenses generates a substitution effect (Opp & Opp 2010). CRAs may afford to be less strict with ratings inasmuch as their prospective loss in reputation is compensated by regulatory rents. There is evidence that they ended up providing securitization ratings without having sufficient resources to handle the increased size of the business.[7] This gave market players the illusion that the new financial products were as safe as regulation wanted them to be, with the dramatic consequences that we have seen when this turned out not to be the case. Surprisingly, regulation continues to reward this strategy by maintaining the CRAs' role as providers of regulatory licenses and focusing, instead, on how to make their judgment independent from issuers. CRAs would hardly have any incentive to collude with investors, and consequently to provide issuers with inflated ratings, in the absence of regulatory distortions of their incentives.

Imagining a world without regulatory distortions is 'nirvana economics' (Demsetz 1969). The hypothesis that financial regulation does without ratings would be quite unrealistic nowadays, so rethinking the legal discipline of CRAs is the only option to cope with the existing distortions. The insistence of reform proposals on transparency of ratings procedures, registration and supervision of CRAs, and severe rules on conflicts of interest, addresses (sometimes mistakenly) a number of relatively unimportant issues (Sy 2009). For instance, although authoritatively supported (Pagano & Volpin 2009; Posner 2009a), the idea of prohibiting the issuer-pays model has little bearing to the problem. Switching to any investor-pays model would be irrelevant (Calomiris 2009c). The structure of remuneration does not tackle regulation-induced incentives to rate anything that can result in lower compliance costs (and thus in higher profits) for financial intermediaries. Similarly, the proposal to increase transparency by mandating publication of detailed information on the probability of default and on the loss given default (Pagano & Volpin 2009; Calomiris 2009c) are unlikely to help. As this solution produces higher adverse selection in otherwise information-insensitive markets (Holmstrom 2008), it makes the collateral backing short-term funding more volatile thereby increasing the externalities of funding liquidity.

The real problem is how to stop CRAs from certifying marketability and safety of financial innovations before they are proved such by a sound market mechanism. Two solutions seem to be apt to achieving this goal (Partnoy 2009). One is legal liability, from which American CRAs have been traditionally insulated thanks to a broad interpretation of the First Amendment (right to free speech). The other is competition with comparable sources of credit risk assessment.

If we take the uncertainty problem seriously, it is at least doubtful that either of these solutions would work alone. Imposing liability on CRAs brings about the problem of setting the right standard: it should be neither too lenient to stop reckless behavior nor

[7] Partnoy (2009: 3) reports from a SEC investigation of the three major CRAs the increasingly loose policies for rating. Famously, one analyst declared, "It could be structured by cows and we would rate it."

so strict to prevent financial innovation for fear of hindsight bias in adjudication. Uncertainty also makes competition of ratings with other market indicators of credit risk is difficult to establish. In order to enjoy the regulatory benefits of investing in new financial products, investors would always choose the most optimistic risk assessment. As long as CRAs do not put their money where their mouth is, they will always outperform markets in providing less conservative assessments. Yet, the comparison of ratings with market indicators such as CDS spreads or risk premia over Treasury Bonds (suggested, for regulatory purposes, by Calomiris 2009b) becomes very useful with a view to administering a liability standard for CRAs. To escape liability, CRAs should demonstrate that departure from market assessment in their ratings was justified ex-ante by superior expertise and access to information. When they fail this test to justify departure of their assessment from e.g. CDS spreads, they would be liable. One such standard would provide CRAs with sufficient market challenge while protecting their judgment from hindsight bias. This solution is better than punishing CRAs simply when market indicators prove them wrong in hindsight (e.g. Calomiris 2009c). Both approaches hit the key point though: how to make CRAs more cautious in allowing marketing of financial innovations.

4.2. The Limits of Capital Adequacy Regulation

Regulation of bank's capital adequacy has two main purposes (Heremans 2010). One is to provide banks and their shareholders with sufficient 'skin in the game' in screening and monitoring the quality of the credit they provide. The other is protecting bank stability through sufficient equity buffers against shocks that may compromise its solvency. The first goal is linked with the issue of market discipline, which is one major 'pillar' of modern banking regulation.[8] I will discuss it in the next subsection. Here I focus on the buffering function of capital adequacy (CA) requirements.

Undoubtedly, CA requirements have failed to shield banks from the liquidity crisis. In combination with a few other regulatory items, CA requirements have also contributed to precipitating banks on the verge of insolvency after markets stopped trading mortgage securitizations. CA requirements have not protected banks for they are ill suited to deal with liquidity problems. In addition, these requirements vary significantly across different sectors of the financial industry, which reflects different exposure to systemic risk without corresponding with real differences in operation capacity. Therefore, in order to compete with less regulated intermediaries on their more profitable turf (Hellwig 2008), banks embarked upon leveraged investments in MBS and CDO through off-balance-sheet vehicles. This concealed the build up of systemic danger. Similarly, CA regulations did not help banks to cope with the systemic crisis when it materialized.

When liquidity dried up, banks faced two problems. Not only their equity cushions were insufficient to back up the leverage of their off-balance-sheet vehicles, which banks were committed to doing anyhow (Gorton 2009a). More importantly, the sudden depreciation of all securitized assets forced banks to acknowledge huge losses making both shareholders and creditors unwilling to recapitalize them.[9] As a result, banks could only meet the CA requirements by liquidating their assets at fire-sale prices. Those that

[8] See Basel Committee on Banking Supervision, "International Convergence of Capital Measurement and Capital Standards: A Revised Framework", November 2005 (*Basel II*), available at www.bis.org.
[9] This effect is due to the well-known problems of debt overhang (Myers 1977) and adverse selection in equity funding (Myers and Majluf 1984).

were too deeply invested in MBS and CDO did not have that option, and thus they became technically insolvent in no time. Some could be recapitalized through acquisition or otherwise, some others were bailed out by governments. The remainder went under, like Lehman Brothers, triggering (the fear of) a 'daisy chain' effect on the intermediaries having survived the first wave of panic. The surviving banks had to hoard cash, as cash was the only real buffer available against materialization of counterparty risks and/or further depreciation of their assets. This combination of externalities was aggravated, instead of coped with, by CA requirements. They forced banks to liquidate marketable assets at a loss in the absence of financiers willing to support holding of illiquid assets to maturity.

Had bank leverage been contained at the outset, this crisis could have been avoided simply by holding MBS and CDO to maturity (Hellwig 2008). All uncertainties about sensitivity to mortgage default risk are cleared upon termination of each tranche's cash flow. But liquidity of these securities is exactly what made mortgage securitizations so attractive to induce more leverage and maturity transformation than the system could stand. Excessive reliance on short-term funding was the very source of systemic externalities, and therefore regulation should have countered it. CA requirements did the opposite. Not only did they fail to prevent banks from abusing abundant liquidity in good times; they also precipitated them in a scramble for scarce cash in bad times.

This paradox of financial regulation applies to other related features. Ratings similarly make innovative financial products a blessing in good times and a curse in bad times. High-grade products are a 'must-buy' as long as they offer better risk/return combinations than comparable assets, but as soon as they are downgraded, institutional investors must sell them and banks are forced to recapitalize or deleverage due more demanding CA requirements (Sy 2009). The effects of fair-value accounting go in the same direction. Marking-to-market frees resources for increasing leverage in good times (appreciations accrue to the regulatory capital) and it strangles banks in bad times (depreciations are booked against regulatory capital).

In the regulatory debate, the sensitivity of banking regulation to asset bubbles and their bursts is known as "pro-cyclicality" (e.g. Hellwig 2008). The incentives to engage in regulatory arbitrage are also pro-cyclical, but circumvention of CA requirements is not necessary to determine this perverse situation. The pro-cyclical design of CA requirements was sufficient for banks to book less and less capital against securitizations (Calomiris 2009b). The fact that regulation also allowed banks to operate with unconstrained leverage through off-balance-sheet vehicles only amplified the volume of resources intermediated by shadow banking. A thorough discussion of asymmetries and pro-cyclicality in CA regulation is outside the scope of the present work (see extensively Brunnermeier et al. 2009). However, with a special view to countering the recurrent dynamics of uncertainty and externalities in financial innovation, a few points are in order.

First, regulation should not incentivize marketing of financial assets as a way to reduce the burden of capital adequacy. At the same time, restricting marketing of new financial products between professional investors would undermine financial innovation. One solution identified in the literature is allowing different operations for intermediaries subject to different regulatory burdens (de la Torre and Ize 2009; Avgouleas 2009). Shadow banking is effectively banking as it involves borrowing short and lending long (Gorton 2009b). Banks should thus have *exclusive* access to short-term borrowing and

to the governments' safety net, but under a very simple discipline of leverage allowing for no regulatory arbitrage. The same restrictions should apply to banks' off-balance-sheet vehicles. This solution would simultaneously mark out the boundaries of systemic risk and protect banks from it, by limiting their involvement in financial innovation. On the contrary, non-banks would face no limits in financial innovation (and no CA requirements), but they would have no direct access to funding liquidity as they must borrow it from banks. In this way, "systemic externalities would be evenly internalized across all possible paths of financial intermediation" (de la Torre and Ize 2009: 28). Non-banks would freely deal with uncertainty, leverage, and their consequences on profits and solvency. However, their funding would be intermediated by banks, making sure that leverage and maturity transformation in the system does not exceeds certain limits.

Second, the triggers of CA requirements should anticipate, not follow, the swings between market reliance on innovation and fear of the unknown. This is very difficult since such swings are not predictable with precision. However, economic theory has identified a number of market predictors of both individual and systemic trouble, which would allow regulation to lean timely against the wind. For instance, experience tells us that bubbles are preceded by certain patterns of credit growth and/or asset price appreciation (Calomiris 2009b). Similarly, systemic danger can be alerted by aggregate measures of leverage, maturity mismatch, and their co-variances across banking (Brunnermeier et al. 2009). In the presence of these warning signs, regulation should require banks to book a higher proportion of capital against their assets, thereby building up a real buffer for the event of asset prices downturn, when the extra capital requirements would be lifted (Calomiris 2009). Unfortunately, uncertainty makes such mechanisms inevitably imperfect: nobody can be sure it is a bubble until it bursts (Posner 2009a). However, the social cost of false positives is likely to be low as banks face little difficulty in raising equity during booms. The opposite holds after bursts, which makes false negatives more worrisome. To cope with this problem, counter-cyclical CA could be nicely combined with a solution recently identified by Hart and Zingales (2009): dynamic adjustment of CA requirements to CDS spreads. This would work as a margin call on a bank's equity, triggered in those situations in which uninsured creditors appreciate the thinness of capital buffers but have not yet started running on the bank's liabilities. As this mechanism copes with the difficulties of recapitalizing banks in bad times, it corrects potential failures of counter-cyclical CA. But as CDS spreads are themselves pro-cyclical, this solution cannot work independently from the establishment of counter-cyclical CA in the first place.

Third, the whole discussion of uncertainty might suggest that CA requirements should be managed with more discretion by the supervisory authorities. This is wrong for at least two reasons. First, uncertainty affects regulators no less (and possibly more) than market players. Second, regulators and politicians are time-inconsistent. They tend to favor strict policies against externalities in the aftermath of a crisis, but they are ready to give banks slack in both making profits and postponing losses for sake of their own popularity. Therefore, regulatory discretion simply cannot be trusted as a remedy against pro-cyclicality of financial regulation (Brunnermeier et al. 2009). An important application of this is marking-to-market of banks' assets.

Marking-to-market is undoubtedly pro-cyclical. In good times, it allows banks to realize short-term profits and to increase leverage; in bad times, it forces banks to recognize losses and to deleverage regardless of the long-term values. The first effect is not

avoided by historical accounting, which only forces banks to sell and repurchase the assets in order to book profits. But the worst downside of historical accounting is that it conceals long-term losses (Laux & Leuz 2009), which induces behaviors increasing systemic risk like 'gambling for resurrection.' Still, it seems that allowing regulators to suspend marking-to-market in times of crisis would produce beneficial "forbearance" (Epstein & Anderson 2009). Both CA regulations and private creditors could avoid imposing mechanical margin calls that fuel liquidity spirals. Although this solution apparently tempers the adverse effects of uncertainty ex-post, it has high costs ex-ante. First, regulatory forbearance generates moral hazard, giving banks an additional reason to be less cautious with maturity transformation. Second, banks have as much incentive to agree to marking-to-market in good times, in order to reduce haircuts, as to renege on this agreement in times of distress, in order to postpone acknowledgement of losses (Shleifer & Vishny 2010); both circumstances increase bank instability. A better solution, which copes with both banks' opportunism and regulators' time-inconsistency, is allowing banks to depart from marking-to-market *only* to the extent they have sources of long-term funding credibly supporting a hold-to-maturity strategy. As this "marking-to-maturity" rule (Brunnermeier et al. 2009) would be established at the outset, ex-post resilience would not come at the price of higher instability ex-ante.

4.3. Corporate Governance of Banks

We have seen two ways in which regulation concurred to determining the financial crisis. Regulatory reliance on ratings supported a demand for information-insensitive securities that were in fact subject to the uncertainties of securitization. Pro-cyclicality of CA requirements created the scope for externalities in generation (and withdrawal) of funding liquidity. These factors explain how shadow banking could become so big, but they do not tell why it grew at such a furious rate. The reason why banks increasingly invested in securitizations making use of as much funding liquidity as they had access to is realization of short-term profits, which could be shown to stockholders. In doing so, banks generated the more externalities the more they were exposing their long-term profits to the adverse consequences of uncertainty. More responsible ratings and counter-cyclical banking regulation would not eliminate this effect. As short-termism in banks' dealing with uncertainty can lead to bankruptcy, this is itself a source of systemic externalities.

Short-termism in banking is correctly perceived as a problem highlighted by the financial crisis. However, it is often overlooked that uncertainty fueling heterogeneous expectations on the stock markets is a necessary condition for long-term and short-term value maximization to diverge (Bratton & Wachter 2009). In models where bank(ers) know the future price of ABS, there is no difference between short-term and long-term profit maximization: it is privately optimal, but socially inefficient, to expand securitization so long as the price is not expected to fall too much (Shleifer & Vishny 2010). In the real world, nobody knows anything for sure. In addition, separation of ownership and control implies that managers' incentives are imperfectly aligned with the interest of shareholders. These are two reasons why short-termism in banking can lead to even more instability than long-term value maximization. On the one hand, shareholders may have overly optimistic expectations on the prospects of financial innovation and push managers to embark on it beyond their own judgment. On the other hand, managers may be in the position to cash in their short-term rewards before the long-term uncertainties adversely affect shareholders. Let us consider them in turn.

Shareholders who care about their quarterly results are normally in the position to steer managerial choice towards realization of short-term profits. In this perspective, short-termism depends on the traditional mantra of corporate governance, which enjoys particular regulatory support in banking: market discipline. Market discipline is supposed to foster stability of banking through the empowerment of dispersed shareholders, which prompts managers to maximize the value of the banks' equity given the CA requirements. Only a few commentators (e.g. Hellwig 2008) have noted the fragility of this construction, which only works under the assumption that stock markets care of long-term values. This assumption is certainly incorrect whenever uncertainty is involved. Markets, including stock markets, are unprepared to handle uncertainty and they react to signals that do not account for it. One of these signals is quarterly announcements of profits. These tell both shareholders and creditors that bankers are doing well. And they may easily induce shareholders to ask for more. Managers who are accountable to diversified shareholders have no way to talk them into making less profit in the short run with a view to maximizing long-term values. Even if managers have less optimistic expectations on the future price of ABS, dispersed shareholders would not be sufficiently committed to the long run to endorse shrinking of the securitization business. Rather, they would force a temporarily underperforming management to resign.

This is not the perspective from which the problem of short-termism in banking is analyzed. Commentators and policymakers prefer to focus on the agency problems that impair market discipline rather than on its being the very source of short-termism in the presence of uncertainty. From an agency perspective, the problem is that bankers have the upper hand in setting the structure and the levels of their compensation. Although, in the aftermath of the financial crisis, the perceived high *levels* of bankers' pay generated widespread discomfort in the public opinion, the economic problem is the *structure* of remuneration (Bebchuk and Spamann 2009). Bankers rewarded through performance-contingent bonuses and/or stock options plans have an incentive to generate short-term profits no matter of the repercussions on long-term values. The solution identified by authoritative commentators (Posner 2009a; Bhagat & Romano 2009) is mandating backload of stock-based compensation as to force bank managers to bear the future consequences of their investment decisions. Correctly, Bebchuk and Spamann (2009) observe that this would not be sufficient to cope with the problem of excessive risk-taking by bank managers, as the limited liability of equity induces both its current and prospective holders to disregard the effects of bank leverage on creditors and taxpayers. Therefore, remuneration of bankers should also be linked to the wealth of other stakeholders (creditors and governments as preferred shareholders).

Curiously enough, the above proposals do not aim at improving the alignment of managerial incentives with shareholder interest. Rather, the idea is to drive a wedge between the two (Bratton & Wachter 2009). This is a Copernican revolution in corporate governance, which implicitly acknowledges that managerial accountability to dispersed shareholders is a part of the short-termism problem, not a part of the solution. Arguably, this result could be confined to banking due to the special features of maturity transformation and to the regulatory distortions (especially moral hazard) that the fragility of the banking business unavoidably implies. There are three reasons for being skeptical of this conclusion.

First, we do not yet have a theory on how the specialty of banks affects corporate governance both positively and normatively (Mülbert 2009). Second, what is 'good' in

the corporate governance of banks as opposed to non-financial companies is empirically unclear. Banks whose managers were more accountable to dispersed shareholders performed worse in the crisis (Adams 2009; Beltratti & Stulz 2009). However, bank CEOs reinvested (and lost) significant parts of their performance-based compensation (Fahlenbrach & Stulz 2009). This suggests that alignment of financial incentives fostered neither short-termism nor moral hazard, as managers cashed in less than they could do. Third, executive pay could be just the tip of the corporate governance iceberg uncovered by the financial crisis. Assuming that managers dealing with uncertainty know more than their shareholders, the main problem for the maximization of long-term firm value is how to secure managerial autonomy from shareholder interference (Bratton & Wachter 2009). In the absence of such autonomy, bankers could not but ask to be compensated according to the short-term horizon of their accountability to shareholders. In banks as in non-financial firms, backloading of performance-pay (which, at least in part, bank managers chose voluntarily) is unlikely to foster long-term orientations without tenure of corporate control.

The basic advantage of tenure, which is well known to academics, is that it allows you to take your time for cashing in the proceeds of your most uncertain activities. On the contrary, without tenure, you are accountable to your principals on a regular basis, and this prevents you from pursuing any long-term strategy that is not in their interest or understanding. Untenured managers are naturally inclined to short-termism because their salary depends on being reappointed (or not ousted), which in turn requires that shareholders be happy with the return they receive on their investment. Tenured managers have incentives to take more long-term strategies, but they may fail to maximize shareholder value because they extract private benefits of control. The whole debate on corporate governance is centered on this tradeoff. For some time, performance-based compensation seemed to have squared the circle – at least in theory, for the practice has always exhibited significant conflicts of interest (Bebchuk & Fried 2004). With the appropriate vesting mechanisms and severance payments, stock options plans could protect management from the adverse consequences of loss of office while aligning their incentives with the interest of shareholders (Kahan & Rock 2002). The logic of this arrangement is entirely based on optimal risk bearing. Managerial investments are less diversified than those of shareholders, and thus management should be protected from downside risk and motivated by high upside potential. This is no less true for banks than for non-financial firms. In both situations, however, this logic neglects the role of entrepreneurs' dealing with uncertainty in corporate governance (Pacces 2007).

Financial markets cannot value innovations whose odds are highly uncertain, and thus shareholders can neither reward nor punish managers for dealing with them. However, when uncertainty is attached to events considered too unlikely to materialize, financial markets will simply disregard it. In this situation, managers accountable to diversified shareholders do not have a choice. If they refuse to be involved in an innovative business in spite of the easy money that it generates, they would be replaced by others willing to do it. On the contrary, if they go for it, their can demand a remuneration scheme protecting them from the downside of uncertainty. Ex-ante, prohibiting this protection will result either in higher salaries or in a lower quality of management (Kaplan 2009). But it is unlikely to curtail short-termism so long as shareholders are empowered to request competitive quarterly results from managers and the latter are indifferent between being fired for bankruptcy or underperformance. This perverse combination of incentives is avoided when managers are tenured, which allows them to

set the time horizon of dealing with uncertainty as entrepreneurs typically do. As I have argued elsewhere (Pacces 2009), control tenure allows idiosyncratic managerial investments under uncertainty to be rewarded in the form of private benefits of control. Cashing in of these benefits is postponed until stock markets are fully able to appreciate the consequences of innovation and they can compensate it in the form of a control premium. Since this compensation is lost in case of bankruptcy, one such mechanism naturally induces a long-term orientation in marketing financial innovations. This is exactly what the market for mortgage securitizations would have needed.

In conclusion, it may be true that the externalities of this financial crisis have been nurtured by malfunctioning in the corporate governance of banks. However, this may not depend on the pursuit of shareholder value or on executive compensation being too closely linked to it. There is anecdotal evidence that financial institutions controlled by large owners, who are more committed to long-term values than bank managers and their diversified shareholders, performed better in this crisis (Posner 2009a; Calomiris 2009a). This suggests that tenure of corporate control can be privately *and* socially efficient for banks too, at least when they are dealing with uncertainty. A misguided notion of managerial discipline by stock markets, supported by regulation, has induced banks' executives to seek immediate realization of high earnings, thereby amplifying the externalities of investing in uncertain assets. In this perspective, how to coordinate pay-per-performance with deferred compensation of bank managers in the form of private benefits of control is an interesting issue for future research.

5. CONCLUSION

In this paper, I have argued that the last financial crisis cannot be explained exclusively as the result of moral hazard and irrationality in financial markets. First, the crisis was determined by the behaviors of lenders, not of borrowers. Lenders were banks, their unregulated affiliations, or financial intermediaries operating leveraged maturity transformation in the same fashion as banks ('shadow banking'). Moral hazard and irrationality are at odds with the circumstances that the ultimate financiers of securitization ran on the intermediaries' short-term liabilities and that shadow banking is a rational pattern of profit maximization in which the risk of future, albeit moderate, losses is accounted for.

I have then shown that the key determinant of the financial crisis was rational choice under uncertainty. As often in financial and non-financial innovation, market players did not account for events too unlikely to be worth contemplating. In banking, however, this circumstance dangerously interacts with the production of systemic externalities. In this perspective, the specific mistakes underlying over-optimistic securitization are less important than the externalities generated by this mechanism. Externalities were amplified by the mistakes, but the former did not depend on the latter. Particularly, the very attractiveness of securitization depended on the ability to fund provision of credit with virtually unlimited short-term leverage. The uncertainty surrounding securitization made its funding liquidity inherently fragile, but individual players (financial intermediaries and credit rating agencies) had no incentives to care for the systemic implications of this fragility.

Not only did regulation fail to cope with the externalities of financial innovation. In a number of respects, regulation incentivized the financial industry to rely on unstable

liquidity for maximizing profits. I have reviewed three areas in which regulation has supported the production of externalities by shadow banking: the role of rating agency in financial regulation; capital adequacy requirements; and the corporate governance of banks. The uncertainty perspective suggests how these regulatory distortions could be corrected with a few adjustments to the proposals already made by other commentators. Regulatory reliance on ratings could be maintained when rating agencies are made liable for knowingly inflating their grades, but not just for making mistakes that only prove such in hindsight. Ideally, capital adequacy regulation should be counter-cyclical. However, as uncertainty cast doubts on regulators' ability to lean timely against the wind, this goal should be pursued through a number of complementary measures accounting for regulatory arbitrage, errors in detecting bubbles, and time-inconsistency of policymakers. Finally, regulation should be less insistent on market discipline in the corporate governance of banks. As short-termism in pursuing financial innovation is both privately and socially inefficient, regulation should at least allow (if not promote) contractual solutions supporting bankers' autonomy from diversified shareholders.

These considerations only identify the direction in which financial regulation should go. I discuss the current initiatives for reforming financial regulation in the aftermath of the crisis in a companion paper (Pacces 2010). The main lesson from analyzing the crisis in the perspective of uncertainty is that regulation may end up fostering the very externalities it is intended to prevent. Bearing this in mind could help significantly to avoid the next crisis.

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