

The Role of Defective Mental Models in Generating the Global Financial Crisis¹

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Abstract

This paper argues that defective mental models or views of how the world works made an important contribution to the generation of the recent global crisis. While one of these views, that house prices always rise, has been clearly shattered by the crisis, two other false views have not been sufficiently taken into account in official reform discussions. These are competition in the financial sector is sufficient for it to regulate itself and that modern financial engineering has enabled risk to be substantially conquered. While in these bold terms these positions are no longer defended, in milder forms they still account for a number of inadequacies in the official agendas of financial reform.

1. Introduction

While the worst of the global financial crisis has passed, debate still rages about the most fundamental causes of the crisis and consequently about the nature of the reforms that should be implemented to reduce the probabilities and magnitudes of future crises. There is fairly widespread agreement that many factors contributed to the generation and severity of the crisis. Howard Davis (2010) has recently discussed over thirty factors that have been suggested. Where there is still considerable disagreement is over what factors were particularly important. This is reflected in the failure of the United States' official Financial Crisis Inquiry

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¹ Earlier versions of this paper were presented at conferences and seminars at Cornell University, Duke University, George Mason University, Seton Hall University, and National Chung-Hsing University. The author thanks the participants in these forums and in the Claremont Crisis Workshop for many helpful suggestions.

Commission (2011) to produce a report that would be signed by both the Democrats and Republicans on the Commission, thus leaving the huge volume produced open to being described as over 400 pages and still no conclusion. The debates over the main causes are particularly strong in the political area where many on the right try to force explanations into a framework of government being at fault, while many on the left are equally insistent that deregulation and market excesses were the primary culprits. The sharpness of such debate is given in an editorial in the Wall Street Journal (“Rewriting Fannie Mae History,” August 3, 2010) which asserts that political defenses of US housing financial institutions, Fannie Mae and Freddie Mac, and the failure to date of efforts to reform them, are “proof that the Washington establishment has learned nothing from the 2008 financial panic...” (p. A16)

Debate at the level of government versus the market is almost bound to be unproductive. As the members of the Warwick Commission on International Financial Reform put it, “Our primary objective is not more regulation but more effective regulation.” (2009, p. 2) Careful analysis of the origins of the crisis clearly establish that there were major failures on the parts of both government regulators [see Levine (2010)] and the private sector and that these interacted in ways that made the crisis much worse.

In terms of appropriate policy responses, it would be nice if it were true that the problem was simply too much deregulation as some argue. If this were the case, then we could simply re-regulate. It seems clear that some financial deregulation did go too far, but at the heart of the crisis were institutions over which governments

still had considerable regulatory authority. But the regulators in both Europe and the United States were simply not on top of the situation.

It seems clear that many regulators, especially in the United States, succumbed to the same overoptimistic views as a majority of market participants—that “this time it’s different”², and that high asset prices reflected fundamentals not bubbles and that modern financial engineering and risk management techniques have made financial systems much safer.

My argument in this paper is that **such** cognitive or intellectual capture of government officials and the private sector alike played a major role in generating the crisis. These were certainly not the only factor contributing importantly to the crisis, but correcting these defective mental models, or views of the world, could play an important role in making our financial systems safer. Although correcting such mistaken views is only a necessary, not a sufficient condition, for such improvements, but it is a necessary and an important one.

My criticisms of these defective mental models are not new. All had been raised by some economists and financial experts before the crisis, but these views were widely ignored. These criticisms have also been made in many of the recent books and studies on the crisis that have appeared. While some of the flaws of the mental models that contributed so much to generating the crisis have become widely acknowledged and **this has** been incorporated into official thinking and actions on financial reform, as I review in the concluding section, the deliberations of the G-20, the Financial Stability Board, the Basel Committee on Banking

² See Reinhart and Rogoff (2009).

Supervision, and the recently passed US financial reform bill still fail to take the dangers generated by these defective views sufficiently into account. This is similar to Mallaby's(2010) recent discussion of the limited learning that took place after the collapse of Long Term Capital Management in 1998. Thus I believe that it is useful for public debate [see Thirkill-White (2009)] to pull these criticisms together in one place and to discuss how they interacted with financial innovations and perverse incentives to contribute so importantly to the generation of the crisis.

Many economists and political scientists have been skeptical about the roles that ideas and ideology play in the formation of policy. Some argue that ideas and ideology are just used as masks for interests. And this is often true. But it surely cannot be the whole story, for it is only through our mental models of the world that we perceive our interests.

I do not claim that the defective mental models discussed here provide a complete explanation of the causes of the crisis. Recent studies have shown that a wide range of factors contributed to the breadth and depth of the crisis.³ Deficient mental models are only part of the story. But they are an important part. I do not attempt to identify all the faulty views that contributed to the crisis, but focus on three of the most important ones.

The first is a simple one: the belief that house prices never fall. This false belief has been largely shattered and almost certainly will not be the trigger for the

³ For book length studies by economists see Barth et al. (2009), Dowd and Hutchinson (2010), Gorton (2010), Johnson and Kwak (2010), Rajan (2010), Reinhart and Rogoff (2009), Roubini and Mihm (2010), and Zandi (2009).

next crisis. It is worth beginning, however, by reviewing how this perception drove much of the perverse behavior of the private sector.

A second faulty mental model was that market discipline would automatically lead to self-regulation of the financial markets, and as a result, little regulatory oversight was needed. This view was most famously associated with Alan Greenspan, chairman of the Federal Reserve. His golden reputation at the time of his position as Fed chairman gave his views great weight with legislators and other regulators.

The third defective view was generated by over-confidence in developments in the mathematical modeling of risk that led to a revolution in the financial engineering of complex financial instruments. This led to the view that these models would allow risk to be precisely measured and managed, and thus lead leading to a virtual conquering of financial risk. This view became widely accepted by regulators as well as financial institutions. While these models were often excellent for managing risk during good times, they were generally poorly equipped to deal with the bad times. By offering a false sense of security, these views facilitated the generation of excessive risk in the financial system.

2. Myth 1: The Whopper – House Prices Never Fall

This was likely the false mental model that caused the most severe damage. Had the old style structure of financing, that the lender keeps the mortgage, still been predominant, the damage would have been much less. Both the demand and supply for housing were heavily influenced by this belief which became increasingly

widespread as the housing bubble grew. Of course, it is not surprising that real estate agents would strongly disseminate this view, however, unfortunately officials, such as Alan Greenspan, supported this view as well. Post war period housing prices in the United States had never fallen in nominal terms on a nationwide basis. Nor were housing bubbles limited to the United States. The US, however, was the primary source of the mortgage-backed securities that were at the heart of the crisis, and almost half of these were sold to institutions in other countries, especially Europe.

If housing prices were indeed bound to keep going up then there was much less need for lenders to demand substantial down payments to ensure reasonable risk levels on mortgages. As long as the owners could meet their payments for the first few years, then even with a zero down mortgage they would soon have considerable equity in their home. Teaser rates could be justified by beliefs that by the time the higher interest rates kicked in, the owner would have enough equity to refinance. And even if default occurred, the value of the collateral would have likely appreciated enough to cover the various costs of foreclosure. As Gorton (2010) argues, the problem was not so much securitization per se, but the way that financing was structured, making it highly sensitive to a need for continued increases in housing prices.

Clearly there were a number of cases where aggressive salesmanship and speculative purchases went well beyond even the widest limits of appropriate behavior, but such abuses appear to have been of lesser importance than the general frenzy of buying and selling. It is fairly easy to see how real estate agents and

relatively uninformed buyers could get caught up in a mania of extrapolative expectations, but such views also spread to many supposedly cool headed analysts as well. This belief that at the national level housing prices could only go up became widespread. Many of the models used by the ratings agencies and large financial institutions had no provisions for dealing with price declines, and such possibilities were not sufficiently included in stress testing.

While some hedge funds and analysts challenged such rosy scenarios⁴, the possibility of a collapse of the real estate market was ignored by most of the participants in the financial markets that provided such a large share of mortgage financing through the purchase of mortgage-backed securities. There were some exceptions. A prime example is Kerry K. Killinger, chief executive of Washington Mutual. In 2005 he wrote to his chief risk officer that he had never seen “such a high risk housing market.” (Norris 2011). Unfortunately, he didn’t convert his views into actions to reduce risk. This was due in large part to the fear of losing market share to competitors as is discussed in section 4. (WaMu’s failure also provides a prime example of the regulatory failures discussed by Levine (2010)). It’s not hard to see why originators would substantially lower their standards since they collect their fees while passing on the risks to purchasers of the MBSs. But then the question becomes why investors would be willing to buy securities based on potentially toxic assets. Strong market discipline by purchases of MBSs would have forced the originators to keep up their standards.

⁴ See Lewis(2010) and Mallaby (2010).

Belief that such market discipline would be forthcoming, and that hence there would be little need for strong regulatory oversight, is a second major mistaken belief or false minded model that contributed importantly to the crisis, and to which we now turn.

3. Myth 2: Financial Markets are Self-Regulating

A key problem with the self-regulation view most famously associated with Alan Greenspan was that it was based more on faith in the market system than careful analysis of the incentive structures needed for the market to provide effective discipline over financial behavior. Financial innovations had led to an enormous change in incentive structures with respect to mortgage lending. With the development of the widespread use of securitization and the originate and distribute model of mortgage lending, the direct incentives for lenders to carefully monitor the quality of their loans were sharply diminished.

This in itself might not have presented serious problems if the prospective purchasers of the securities had been demanding about what they bought. Careful attention to quality by purchasers would have forced continued discipline by lenders in their originations in order to be able to distribute profitably. Unfortunately, buyers showed little discrimination. They relied heavily on certification by the ratings agencies and the herding instincts of following the crowd of supposedly sophisticated big investors.

The ratings agencies played a key role in the breakdown of market discipline by offering disgracefully high ratings on a high proportion of sub-prime and other

bad mortgages. What happened was that a potentially valuable innovation in financial engineering was taken and then drastically oversold. The good idea was that with the benefits of diversification and the slicing and dicing allowed by securitization, the top proportion of a large group of sub-prime securities genuinely deserved AAA ratings. But while this might have appropriately applied to 10 or 20 percent of the total package, the ratings agencies were convinced by mortgage securitizing clients to rate well over half of many of these bundles as AAA.

To some extent, this reflected the deficient models of risk that will be discussed in section 4. But also important were the gross conflicts of interest generated by the development of a market structure where the payments for ratings came from those being rated. It doesn't require one to be an advanced student of economics to see the conflict of interest problem that this generated. But the money was rolling in and neither the players nor apparently the regulators wanted to rock the boat. The regulators and politicians got what they wanted – increased home ownership by the poor with the ratings agencies, real estate firms, and financial institutions raking in huge profits. The problem was that this was a game that wasn't sustainable.

While the rating agencies had an oligopolistic structure favored by government-erected barriers to entry, on both the supply and demand side the market for securitized mortgages was highly competitive. The problem was that this is a market where information costs are high and knowledge is quite asymmetric. While we can fault buyers of these securities for being lazy and relying too much on the ratings agencies, a careful look at the information structure in this market

suggests why the ultimate purchasers did not provide strong oversight. The information costs of doing so were quite high.

It may be true, as advocates of the new financial alchemy argued, that securitization allowed risk to be transferred to those in better positions to bear it – but in many cases little attention was given to the problem of diminished incentives to obtain good information. In the old hold-to-maturity model of mortgage lending, the institutions that could most efficiently gather the relevant information and act on it had the incentives to do so. With widespread securitization, the initial lenders' incentives to obtain relevant information about the borrower decreased drastically, while diversified investors had little access to direct information. These investors relied heavily on middleman evaluations from the ratings agencies which turned out to be highly biased. As a result, the level of effective information with which the system operated deteriorated markedly.

Often we can count on the market to turn up its nose at investment opportunities about which there's little knowledge. This would have forced discipline back onto the lenders. But with the combination of misleadingly high ratings and fee-driven sales pushes from major financial institutions, mortgage backed securities became viewed as a smart thing to have in one's portfolio. The herd rushed in. A largely similar phenomenon developed with the booming market for credit default swaps. Little attention was paid to counterparty risks and institutions were allowed to, in effect, offer insurance without being required to have the reserves needed to meet potential obligations.

In many industries a reasonable degree of competition is all that is needed for market discipline to work well. However, where there are substantial differences between private and social costs and benefits, competition is not enough. This is easy to see with polluting industries, but in the banking sector the potentially important divergences between private and social costs and benefits aren't as readily apparent.

Two major functions of a productive banking system are liquidity transformation, and promotion of the effective allocation of investment. These two functions are mutually reinforcing. Securing longer term sources of financing are necessary for real investments. However, for day to day operations, both firms and individuals also have a need for liquidity, the quick availability of funds at low cost. Bank deposits have for centuries been a major source of such liquidity. Long ago, however, bankers discovered that seldom, if ever, will all depositors want their money at the same time. Thus under normal circumstances bankers could safely lend out a substantial fraction of their deposits longer term, thus facilitating real investment. This was one of the first major examples of financial alchemy. This process substantially lowered the cost and increased the availability of financing for longer-term investments in total. Furthermore, the desire to be repaid gave the bankers strong incentives to monitor carefully their loans and thus contribute to an efficient allocation of capital.

The Achilles heel of this system was that in panics the typical depositor could not easily discover which banks were sound and which were not. Thus there were strong incentives among depositors for runs on all banks. Because of the

characteristics of liquidity transformation, even solidly solvent banks couldn't meet huge increases in demands for liquidity by their depositors. By their very nature longer term investments could only be liquidated quickly at huge discounts, if at all. As a result, most economists concluded that modern banking systems could not effectively manage themselves during a crisis, and thus there was a strong case for governments to act as a lender of last resort. This would allow the crucial function of liquidity transformation to continue to operate, while reducing the risks of financial crises. With the implementation of modern deposit insurance, depositor runs on banks are now quite infrequent (the run on Northern rock was a vivid exception). Nonetheless, the basic problem has not disappeared. With the development of heavy reliance on short-term borrowing by many financial institutions, the most serious form of modern bank runs, namely the drying up of short-term financing, can prove equally devastating as many investment and commercial banks have discovered during the most recent global financial crisis. See Gorton (2010).

As long as governments followed Bagehot's advice to lend only to solvent institutions, and only at penalty rates, no major problems of moral hazard were generated by this increased role of government in the economy. Often, however, solvency is not so easy to judge, and particularly with large institutions, governments may have strong political incentives to bias their judgments in terms of solvency or even to ignore this constraint all together. Hence the too big to fail moral hazard was generated. As a counter, governments tended to adopt capital requirements to offset the incentives for excessive risk taking generated by this moral hazard. This moral hazard is probably economists' favorite explanation for

excessive risk taking in financial sectors, and it has often been an important phenomena. It is not so clear, however, that this was the dominant factor in the crisis of 2007-2008.

The combination of defective mental models--internal management problems within financial firms, changes in the structure of financing, and perverse effects of competitive pressures—was to cause most of the problems without any need to involve moral hazard considerations generated by governments. The widespread bailouts and guarantees offered by governments during the recent crisis, combined with the increased size of many financial institutions means that the too big to fail problem has substantially increased since the crisis however. As partial evidence in support of this proposition, we can invoke the huge wealth losses that the crisis generated for most of the top managers of the large financial institutions. Although their creditors and institutions were generally bailed out, most top managers had considerable portions of their personal wealth tied up in the stock of their institutions, and these took huge hits. The enormous golden parachutes that several ousted leaders received were the results of private contracts, not government intervention.

Several accounts of the internal decision making within many of the large financial institutions that contributed to the crisis have now been published.⁵ These accounts strongly suggest that over the period in which most of the risky investments were made, many of the top management of the financial institutions

⁵ See for example, Cohan(2009), Bamber and Spencer (2008), Gilbert (2010), Faber (2009), Lowenstein (2010), Mallaby (2010), McLean and Nocera (2010), McDonald and Robertson (2009), Sorkin (2009), Tett (2009), and Tibman (2009).

had little conception of the true magnitude of the risks that were being taken. While many of these top managers can certainly be faulted for failing to exercise due diligence, and in some cases for being grossly out of touch with what was going on, many of them seem to have been just as misled about the safety of asset backed securities as the purchasers of the exotic instruments that these created. Many managers appear to have believed as strongly in the AAA ratings of mortgage-backed securities (MBSs) as ordinary investors.

Within the ratings agencies themselves a strong case can be made that the risk analyses performed was as much (or more) a mask for greed than a result of true beliefs in defective mental models. Certainly a number of examples have come to light of employees who had severe doubts about the adequacy of many of the risk assessments being offered. For many analysts, their technical analysis was likely as much a record for plausible deniability when things went wrong than a source of genuine errors. Some analysts did express concerns to higher ups, but perhaps blinded by all the money rolling in, top management typically overlooked these concerns. Indeed a number of officials from the ratings agencies have argued that they were marginalized, and in some cases, even fired for warning of dangers.

Even beyond the prospect of government bailouts, economists have analyzed dilemmas in which managers who fear that their institutions may be insolvent could be induced to gamble for redemption. However, as with the direct government-induced moral hazard, this doesn't appear to have played a major role in generating

the subprime crisis⁶. Over the period in which most investments were made, no evidence has surfaced of top-level internal concerns about solvency in any of the major financial institutions. By the time some insiders did begin to worry about this, it was likely already too late. A number of warnings about excessive riskiness were given to top management earlier on but these were generally ignored,

A stronger candidate for explanation is the competitive pressure in markets in which short-run returns are accurately measured and longer run risks are not. When it comes to decision making, there is a familiar tendency to over weigh what can be easily measured versus what can't. We also know that immediate effects tend to be weighed more heavily than future ones. As analysts such as Nassim Taleb (2007) have emphasized, when what is at issue is a perceived small probability of large future losses, short-run competitive pressures are likely to generate insufficient attention to such risks and consequently result in excessive risk taking. As a result, prudent investment managers who resist this pressure and abstain from such activities will be outperformed in the short-run, losing clients, substantial amounts of income and possibly their jobs.

Robert Frank (2008) argues that the phenomenon described above is actually a general feature of situations in which performance is judged on a relative rather than absolute basis.⁷ Furthermore, this tendency is strengthened when the risk

⁶ In the United States, several forms of government encouragement for lending to low income and minority home buyers definitely contributed to the magnitude of the crisis, but much of the bad lending was for higher priced houses. While the first signs of the crisis showed up in the subprime market, Munchau (2009) is right to argue that it's a misnomer to refer to this crisis as the subprime crisis. For more on the US housing aspects of the crisis see Barth et al. (2009), Gorton (2010), Shiller (2008), and Sowell (2009).

⁷ That competition can generate pressures for excessive risk-taking in modern financial systems is also a theme in Brunnermeier et al (2009), Frank (2010), French et al (2010), Gibson (2010), Rajan (2010), and Turner (2009).

aspect of risk-return tradeoffs cannot be adequately measured at the time of the decision-making. Of course, as will be discussed in the following section, when the standard risk evaluation methods tend to understate the true risk, as the popular value-at-risk method did, then the problem becomes even more pronounced. Behavioral biases can also contribute to this issue⁸. We often see what we want to see and overlook what we don't want to see. Confirmation bias seems to have played a strong role within major institutions with many top executives not paying enough attention to warnings that high earnings were coming from excessive risk taking.

Easy money also played a considerable role, both in facilitating financing and in changing the incentives facing many financial decision makers. As rates of return fell in response to the flood of global liquidity, many investment managers felt strong competitive pressures to keep up returns. The easiest way to do this was to take on more risk, and one of the easiest ways to take on more risk without this being immediately apparent to one's bosses or clients was to increase leverage. Such increases in leverage in turn not only fueled the bubbles that resulted but also increased the damage to the economic system when the crash came.

There are also important principal-agent problems in the financial sector. Executive compensation is a prime example. Many large firms, and not just financial ones, have generally had cozy arrangements between top executives and directors, with relatively little effective oversight from the small number of outside directors and stockholders. These firms have typically faced a number of institutional

⁸ The new subfield of behavioral and neuro finance focuses on such possible biases. See, for example, Akerlof and Shiller (2009), Burnham (2005), Peterson (2007), Shefrin (2000), Shleifer (2001), and Zweig (2007).

impediments to effective oversight. Many analysts argue that this structure contributed importantly to high salaries of executives [see, for example, Posner (2009)]. However, while there is a push for reform in this area, there is little basis to believe that high salaries in themselves, as opposed to compensation structures that gave too little weight to risk relative to return, contributed importantly to the excessive risk taking.⁹ Given the difficulties of ascertaining “true” longer-term risk positions and the limited incentives for diversified investors to invest their time and resources in gathering and analyzing what information is publicly available, it seems likely that the majority of shareholders would have penalized rather than rewarded institutions that held back from increasing leverage and risk when others were increasing it and hence producing greater short-term returns. From this perspective, principal-agent problems between shareholders and the major financial institutions were likely not a major cause of the excessive risk these institutions undertook.

One indication that this is likely the case comes from the results of particular hedge fund managers during the dot.com era. There were managers who believed correctly that the rapid increases in the values of the dot.com companies were a bubble, and bet against it in the early and middle stages. However, as the bubble continued they underperformed in the short-run and lost many investors who focused on chasing returns. Some of these, like George Soros, took large losses and eventually gave up. See Mallaby(2010). The lesson from these managers was that

⁹ For discussion of proposals to reform compensation structures, see Acharya and Richardson (2009), Brunnermeier et al (2009), and French et al (2010).

being right in the long run isn't always an effective short run survival strategy in financial markets.

In summary, competitive markets can provide productive discipline only when good information is available and a sufficient number of actors have the right incentives to obtain, analyze, and act on this information. In the old days when banks kept their loans on their books and investment banks served in partnerships, these conditions were reasonably approximated. As the new financial structure based on widespread securitization took hold, such discipline broke down. A general faith in market discipline was no substitute for a careful analysis of market structure and incentives. There was little basis to believe that the financial system would be self-disciplining under the new conditions generated by financial innovation. As long time Wall Street economist Henry Kaufman (2009) puts it, "The structural changes in the financial markets encouraged participants to become short-term oriented...the fervor for profits from securitization...ushered in a host of ...institutional shifts. Senior managers at a growing number of leading financial institutions either lost control of risk management or became its captives... every institution... felt growing pressure to take risks in order to maintain market share" (p. 203) and "the glamour and profit of risk-taking ensured that the risk takers themselves gained more and more power within the structure of financial institutions." (p. 205) Thus neither internal disciplines from within the major

financial institutions nor external disciplines from the financial markets or from regulators were sufficient to counter these problems¹⁰.

4. Efficient Markets Theory, Financial Engineering, and the Myth that Risk Had Been Conquered

The rapid expansion of the use of complex financial instruments, so many of which eventually turned toxic, was made possible by a combination of advances in mathematical finance and computational power. These advances likewise revolutionized techniques of risk management.¹¹ As sophisticated as they were, however, such models for pricing derivatives, discovering speculative opportunities, and managing risk, still had to make a number of important simplifying assumptions in order to be computable.

These advances did bring a number of important benefits to society. A much greater array of derivative products allowed firms to hedge more types of risks. But as was true of the first financial derivative to become widely used, the forward contract in foreign exchange, it was also true with these new instruments, which could also be used to take risks, i.e. to speculate. This isn't necessarily bad, as speculators are often the source of supply for the demands of hedgers and increase market liquidity.

Most of the innovations in the mathematical modeling of risk in recent decades were based on the assumptions that markets were efficient, liquid, and

¹⁰ For discussion of proposals to improve market discipline by requiring the insurance of subordinated debt, see Acharya and Richardson (2009), Brunnermeier et al (2009), and French et al (2010).

¹¹ For discussion of these revolutions, see Bernstein (2007), Best (2010), Fox (2009), Triana (2009), and Lindsey and Schachter (2009).

subject to continuous trading. (Of course mathematical models were also used to try to discover profit-making inefficiencies in markets.) However in crisis periods, these assumptions proved false. In such cases standard risk models can generate spectacular failures of risk management strategies. This was illustrated in the stock market crash of 1987. Many investors had become sold on the benefits of so-called dynamic hedging, which under the assumptions noted above, would allow investors to limit their losses from stock market declines. These strategies were also based on the assumption that overall market behavior would not be affected by the adoption of such strategies. This seemed reasonable for a stock market in which each investor would normally be only a small part of the market. However what was overlooked was that if a large number of investors started following similar strategies, this could begin to significantly affect the very behavior of the market. On Black Monday, October 19, 1987, when the market began to plunge, the dynamic insurance programs began to sell. This generated a sharp discontinuity in the market with liquidity vanishing and prices plunging.

Despite this fiasco, other versions of profit seeking and risk management models based on the same underlying assumptions continued their spread. Even the collapse of Long Term Capital Management due in large part to model failures in 1998 was not sufficient to seriously dampen the rise of widespread faith in these models. A number of economists, financial analysts, and Wall Street quants did point

to serious problems with the reliability of these models¹² but these individuals were in a distinct minority, both among financial market participants and regulators.

Such blind beliefs in efficient market theory and in the idea that innovations in risk management had made financial systems significantly safer, contributed to the tendency to focus primarily on the idiosyncratic risks of individual institutions in isolation. Insufficient attention was being given to the danger of system wide shocks. This, in turn, led regulators to pay insufficient attention to macro prudential issues, and both public and private sector agents to pay insufficient attention to liquidity risks and the liability side of financial institutions' balance sheets. (These issues are discussed further in the concluding section.)

In general these new risk models and the derivative products based on them work well during normal periods. A case in point is the value-at-risk (VaR) model which came to dominate risk management strategies in large private financial institutions. These were heartily endorsed by many regulatory agencies. Part of their popularity was their collapsing of a complex set of considerations into a single number. This number represented the largest amount of money that could be lost on a portfolio over a relatively short period of time, often a day to a month, with a certain degree of statistical confidence (often 95 percent). Usually such models worked quite well. Furthermore, they had the important advantage of taking into account the risk reduction benefits of diversification by incorporating the correlations among different components of the portfolio. Unfortunately, however,

¹² See, for example, Das (2006), Taleb (2007), Triana (2009), Lindsey and Schachter (2009) and Willett et al (2005).

the precision of the calculations gave many traders and managers an exaggerated sense of confidence that risk was being adequately measured, and that with the benefits of diversification and the new array of hedging instruments, risk could be controlled to a high degree. As the Financial Times columnist Wolfgang Munchau (2009) notes, “Some believed that innovation in the financial markets had eliminated all risk for all time. This, of course, was an erroneous belief, but it does give a clear picture of what people were thinking at the time.” (p. 89)

The key problems with the VaR models were not only that they ignored liquidity, counterparty, and operational risks, but more importantly that they assumed financial market outcomes were normally distributed and that correlations over the recent past would be a good guide to their behavior in the future. Both of these latter assumptions were known to be invalid thanks to the results of massive amounts of empirical research. It was well known to financial economists and many financial analysts that the distributions of most financial market outcomes had “fat tails,” i.e. that large positive and negative changes occurred much more frequently than they would have if a normal distribution were the case. See, for example, Mandelbrot and Hudson (2004).

In addition, many studies have shown that correlations among financial variables can vary a great deal over time. These measures are heavily influenced not only by structural relationships but also by patterns of shocks, which can vary considerably over time. Thus, for example, if interest rates rise because monetary policy is tightened we would expect the country’s currency to strengthen, but if

interest rates rise because of expectations of higher inflation or perceptions of greater risk, we would expect the currency to fall.

Furthermore the VaR methods are essentially backward looking. They ignore many types of warning signs that a crisis could be brewing. This was clearly the case in the Asian crisis. Using the VaR model, risk was measured by past volatility. Since the Thai baht had been basically pegged to the dollar for over a decade it had displayed little variability. As a result, the VaR approach could not pick up the increased riskiness of the baht as the crisis approached. [See Lindo (2008).]

All of these problems were well known to some academics and practitioners but were nonetheless ignored by many others. Even the real world examples of these problems such as the Asian and Russian-LTCM crises did not succeed in convincing many market participants of the dangers of believing that risk could now be precisely measured and managed.

5. Concluding Comments

In considering financial reforms for both the public and private sectors, the global financial crisis highlights a number of important lessons. The crisis tells a dismal tale of greed, hubris, stupidity, false assumptions, defective mental models, and regulatory inattention, fortunately we can end on a more positive note. If my analysis is correct, many of the problems that led to this crisis can be substantially mitigated by taking a more serious economic approach to financial regulation and correcting the defective mental models discussed above.

Of course, even with correct mental models conflicts of interest will remain and, major financial institutions and ratings agencies lobby for legislation that puts

their interests ahead of that of the overall economy. In general, however, the use of less faulty mental models is likely to reduce some of these conflicts of interest, especially those resulting from market actors taking on more risk than they realize. Likewise, even without new legislation, more widespread recognition of the fact that housing prices can fall as well as rise should promote more prudent behavior in the real estate market.

While the ideology or mental model that the financial sector needed little regulatory oversight was a key factor in the cause of crisis, “cognitive capture” of regulators by those being regulated also likely played a major role. This phenomenon will be difficult to overcome, but efforts should be made.

From the standpoint of private risk management, the principal lesson is that the behavioral relationships among different financial assets and liabilities are not physical constants such as those with which civil engineers deal. These relationships reflect a combination of direct economic and financial interdependencies and the patterns of shocks that hit the system. While most of the developments in mathematical modeling and product innovations that can be categorized under the heading of financial engineering can have productive uses in financial markets, they can lead to disaster when combined with bad incentive structures and false beliefs in the stability of historical correlations. It would be a shame to overreact and abolish all the recently developed programs in financial engineering. There is a strong need, however, for the risk management business to be re-engineered to put a stronger focus on financial economics, rather than just financial mathematics.

This change will help both to deflate hubris about the degree of predictability in financial relationships and also to focus more attention both within private sector institutions and regulatory agencies on incentive structures. One does not need to get into a debate about whether greed is good or bad to recognize that it is a widespread attribute of the human condition. While we can hope that most people would refuse to engage in some of the most predatory of the practices that have been uncovered in segments of the subprime mortgage industry, a central premise of the economic approach is that we need to design incentive structures that minimize the need for people to behave like saints. This should also be a central focus of regulatory reforms.

Critics of regulation such as Alan Greenspan put great stock in their judgments that on average we cannot expect financial regulators to match the resources and sophistication of the institutions they are supposed to regulate. This is a judgment with which I concur, but from which I draw a quite different conclusion than Greenspan's that regulation should be virtually eliminated. While much has been made of the laissez-faire attitude toward financial regulation adopted by American regulators, the recent financial crisis was far from just being an example of American free-market extremism. The whole set of regulatory principles developed by the Basel group of international regulators had deep flaws. These principles relied heavily on the outsourcing of risk analysis to ratings agencies and the large banks' internal models. Although these models were indeed highly sophisticated, they were also deeply flawed. Furthermore, regulators largely overlooked the strong incentives to misuse such analyses to game the system to

reduce capital requirements and increase leverage. To discover these perverse incentives one does not need a high-priced lawyer or a Ph.D. in mathematics. Any run-of-the-mill economist worth their salt would have spied many of these conflicts of interest immediately, and others after some study.

The Securities and Exchange Commission in the United States is not unusual in being peopled largely by lawyers who tend to give insufficient attention to basic economic analysis. This situation could be easily improved if the political will is present. Of course it's not sufficient just to identify perverse incentives, they must also be corrected. Although in many cases the discovery of optimal incentive structures is well beyond our current capabilities, great gains can be made just by devising and implementing less bad ones. We should also pay careful heed to the call of Richard Bookstaber in his important book, *A Demon of Our Own Design* (2007), which predicted the current crisis as the outcome of excessive complexity in our financial structure. **Bookstaber's** analysis offers a most convincing warning of the danger of devising complex arrangements that optimize for a particular environment but which may fail badly in others. He stresses the evolutionary advantages of simpler but more robust arrangements which are optimal in no one environment, but perform decently in a wide range of situations. As the current crisis vividly – and painfully – illustrates, the financial landscape can be quite variable. This reality suggests that at least initially regulatory reform should focus on fairly simple regulations such as limitations on leverage for different types of activities. This should not require financial wizards to implement and should not discourage the development of useful financial innovations. Furthermore in lacking

the look of sophistication it would be much more difficult to game. However, this approach does require an important ingredient that is often in short supply – political will.

Unfortunately, despite the widespread recognition of the problems with standard risk modeling, it appears that the Basle Committee has been making little effort for reforms on this front, focusing primarily instead on strengthening capital requirements and tightening the definitions of what is counted as capital. While these go in the right direction, there appears to have been little official attention paid to the problems associated with the standard methods of risk-weighting capital requirements that contributed to allowing banks to engage in excessive leverage. Nor has much been done to reduce the conflicts of interest faced by rating agencies.¹³

Already as economies improve, we are seeing considerable official backtracking from positions taken in the depth of the crisis. One valuable proposal put forward in 2009 by the Basel Committee was the use of a simple leverage ratio. While crude, this approach is quite consistent with the lessons from Bookstaber’s analysis discussed above. Unfortunately in the latest version of these proposals, the leverage ratio was extremely weak. It’s now set at the extremely generous level of three percent while its implementation is set to be delayed for a number of years.

One of the most significant failures of the old Basel approach was its almost exclusive focus on micro-prudential issues, i.e. the soundness of each institution in isolation. Not enough focus was placed on macro prudential supervision of risks to

¹³ On issues concerning the ratings agencies, see Acharya and Richardson (2009).

the financial systems as a whole, especially with how financial institutions interact within the system. [See Brunnermeier et al (2009), Turner (2009), and the Warwick Commission (2009).] Consequently the standard risk measures failed to account sufficiently for the interconnectedness among institutions and the potential for contagion across the overall system. Risk management strategies that would be highly effective if adopted by one or a few institutions in isolation can act to substantially worsen a crisis if adopted simultaneously by a large number of institutions.

Since the standard risk measures were backwards looking they could be as much the source of herd behavior as psychological panic. Thus, the Basel Committee's risk weighted capital requirements were pro cyclical. Instead of dampening the tendency of the financial system to be subject to booms and busts, this aspect of the regulatory system helped contribute to the problem. (see Brunnermeier et al (2009) and the Warwick Commission (2009).] It appears that the need to make capital requirements counter cyclical has been generally accepted. But again, in its latest proposal the Basel Committee has backed away, saying the question needs more study. Nor has sufficient progress been made on dealing with the international aspects of crisis prevention and management. .¹⁴

¹⁴ Of course there are some important spillover aspects of regulation but as several studies have recently argued, concerns with level playing fields have been used in the past by multinational financial institutions to gain favorable regulatory actions. A move from home to host country responsibility for regulation would have strong advantages from the standpoint of the public as opposed to banking interests. See Brunnermeier et al (2009), Levinson (2010), Persaud (2010) (2010), and the Warwick Commission (2009). While there are of course gains from international harmonization of regulations, there are also costs as a diversity of strategies is likely to make a system less crisis prone. See Bookstaber (2009) and Levinson (2010).

Thus while some progress has been made on regulatory reform we are still far short of all that is needed. Mental models influence how actors see their interests. Unfortunately public officials and the leaders of the major financial institutions still have more to learn than they seem to realize.

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