

The 2008-2009 Financial Crisis: Risk Model Transparency and Incentives

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1. Introduction

In this Preface, we offer some analysis of the 2008-2009 financial crisis and its implications for financial industry reform and research. We primarily focus on issues relating to transparency and the measurement of risk and how these are affected by management incentives that are often misaligned with the incentives of those who are exposed in various ways to the risk being measured. In the aftermath of the crisis many have called for increased transparency, but as we will suggest below, while transparency is no doubt a desirable goal in many ways, increasing it in some contexts will be quite difficult.

Before considering issues related to transparency of the risk and valuation models used by financial institutions, we need to set the stage by very briefly summarizing our thinking on what caused the “financial crisis” and how it led to what has become known as the Great Recession. Unlike the stock market crash of 1987, for which there is still no consensus concerning what caused the sharp drop in stock prices, nearly everyone agrees that the current problems started to unfold after housing prices began to fall in late 2006 and early 2007 with a concomitant drop in sub-prime mortgage values. The problem spread beyond mortgage markets to a near breakdown in short-term funding markets in September and October 2008, while U.S. and global markets for longer-term corporate credit and equity securities continued to function relatively well.

Reinhardt and Rogoff (2008) point out that the 2007-2008 U.S. financial crisis has “stunning qualitative and quantitative parallels to 18 earlier post-war banking crises in industrialized countries,” and they observe that the majority of these historical crises were preceded by financial liberalization. These stylized facts seem to implicate the financial liberalization that occurred over the prior decade or so, which allowed the spectacular growth in the “parallel” or “non-bank banking” system. Among other things this parallel banking system helped meet the need to “recycle” the accumulating global capital imbalances with the U.S. At the beginning of 1980, securities funded roughly 33% of U.S. household, nonfinancial corporate and nonfarm business debt; by the third quarter of 2008, that percentage had risen to around 64%. In reality though, the traditional commercial and investment banking institutions, along with some insurance companies and money market mutual funds, themselves became significant

¹ Author bios follow the References.

players in the non-bank banking system, via lines of credit, off-balance sheet special purpose vehicles, short-term commercial paper and repos, senior CDO tranche insurance, etc.²

While financial liberalization undoubtedly played a role as an “enabling factor” in the financial crisis,³ no consensus has emerged concerning the precise channels through which the financial crisis in turn affected “Main Street” and the markets for real assets. On the one hand there is the distinct possibility that the additional risk-taking permitted in the liberal financial regime led in various ways to real assets being overvalued. After the financial crisis occurred these asset valuations were “corrected,” which of course meant a decline in value. On the other hand, the financial crisis and associated credit freeze almost certainly helped precipitate the recession, which of course resulted in a downward revision of cash flow projections and valuations. Determining how much of the fall in real assets values can be attributed to the first effect and how much to the second is a challenge that has yet to be met. What is clear is that the lively discussion five years ago about the extent to which financial liberalization contributed to global economic growth has now been replaced by the equally lively one of “how mistaken ideas helped to bring the economy down.” Numerous candidates for these mistaken ideas and potential feedback loops have been proposed, including Calvin Trillin’s humor-tinged suggestion⁴ that “the financial system nearly collapsed...because smart guys had started working on Wall Street.” Here, we focus on risk-taking incentives and the financial system – if those incentives have an ultimately

²As Geithner (2008) describes: “Banks could not fully absorb and offset the effects of the pullback in investor participation – or the “run” – on this non-bank system, in part because they themselves had sponsored many of these off-balance-sheet vehicles. They had written very large contingent commitments to provide liquidity support to many of the funding vehicles that were under pressure. They had retained substantial economic exposure to the risk of a deterioration in house prices and to a broader economic downturn, and as a result, many suffered a sharp increase in their cost of borrowing.

“The funding and balance sheet pressures on banks were intensified by the rapid breakdown of securitization and structured finance markets. Banks lost the capacity to move riskier assets off their balance sheets, at the same time they had to fund, or to prepare to fund, a range of contingent commitments over an uncertain time horizon. The combined effect of these factors was a financial system vulnerable to self-reinforcing asset price and credit cycles. The system appeared to be more stable across a broader range of circumstances and better able to withstand the effects of moderate stress, but it had become more vulnerable to more extreme events. And the change in the structure of the system made the crisis more difficult to manage with the traditional mix of instruments available to central banks and governments“ (p. 2).

³There was much less growth in non-banking activity in countries like Japan, China, and Canada over the same period. Since there was (broadly) less financial liberalization in these countries and they experienced much less or zero direct financial crisis, we could add that as *a priori* evidence of an association between financial liberalization and financial crisis. At the same time, not all else was equal: Japan’s banks were still in recovery and merger mode; China was on the flip side of the U.S. capital inflows and its banks are still majority-owned by the State, which itself makes “free insurance” for banks from the Government somewhat moot.

⁴ Calvin Trillin, “Wall Street Smarts,” *New York Times*, October 15, 2009.

negative impact on the real economy, then the taxpayer potentially “pays” twice, once in any bail-out subsidies and once in the direct damage to the real economy.

Clearly the large investment losses that in part defined “the crisis” are not *per se* evidence that “economists got it so wrong”; nor are the losses necessarily evidence of problems either in the management of financial institutions or the quality of the financial models that they use. For example, an accurate risk model – accurate in the sense that it misses none of the “knowable unknowns” – permits financial managers to take well-calculated bets, but these are not sure bets. Pure arbitrage aside, fund managers and investors must decide which risks to insure against, and which risks are priced attractively enough to warrant the costs of exposure. For all but the most conservative strategies there will be some risk of a large loss. An accurate risk model simply means that, *ex post*, managers and investors are not blind-sided by risk exposures that should have been known.

As established economics tells us, and as we are reminded almost daily by the financial media, incentives to take on risk are magnified in “heads I win and tails someone else loses” situations. In particular, implicit government insurance (e.g., too-big-to-fail insurance) potentially leads financial institutions to take on socially undesirable levels of risk, unless the government can somehow magically and instantly adjust for the level of risk taken and perfectly price and charge upfront for the implicit insurance it provides. Financial liberalization permitted the financial sector to take on more leverage and more risk, and the incentives of managers and others all but guaranteed that would happen. There is certainly supporting anecdotal evidence of “risk-be-damned” behavior by large financial players prior to the crisis, e.g.: “[A former senior Lehman banker] recalls vividly the days in early 2007 at Lehman when his financial models began to throw up more warnings showing delinquencies and defaults, and he remembers colleagues on his desk raising questions about loan quality. But he said the firm’s ranking as the top loan originator on Wall Street, not to mention the pressures put on the desk by Lehman’s growth-obsessed leadership, made it difficult for even the most senior executives to raise questions” (New York Times, September 13, 2008 p. 7). Of course, different financial institutions have different cultures and compensation plans. All that economics can say is that implicit government insurance, among other things, creates incentives that can lead to more-than-otherwise prudent risk-taking. Management hubris or over-confidence undoubtedly played a role – the bail-out insurance simply lowers the downside costs of that behavior. The stunning magnitude of the bail-outs that did occur make it plausible that they played a major role in prior decision-making: Alessandri and Haldane (2009) calculate that “the scale of intervention to support the banks in the UK, US, and the euro-area during the current crisis...totals over \$14 trillion or almost a quarter of global GDP. It dwarfs any previous state support of the banking system” (p. 2).

2. Incentives and Risk Models

The “heads-I-win, tails-the-Government-or-investor-loses” moral hazard incentives in turn have an impact on the quality of risk and valuation models. To explain how, we must clarify who is developing the risk models and how they are being used. Assume that there are two parties to a transaction (or

ongoing economic relationship) and assume Party A has incentives to increase risk at the expense of Party B. In the case of implicit government insurance, the financial institution or bank is obviously Party A, and the government is Party B.⁵ Now if Party B protects itself by using a risk model that it develops and controls, there is no obvious problem. However, to the extent that Party B relies on a risk model developed and maintained by Party A, potential conflicts can arise. An obvious example is the case where capital requirements imposed by the government (Party B) are based on risk measures that are produced by risk models developed and maintained by the regulated financial institution (Party A). In those situations where the full cost of downside risk is not borne by Party A, then all else equal Party A would opt for a less-than-state-of-the-art risk model that underestimates risk. Among other things this means that Party A has an incentive to have fewer rather than more known unknowns in its models, since fewer known unknowns generally translates into lower risk measures like c-VaR. Moreover, the less transparent the risk model being used, the harder it is for Party B to detect the model's shortcomings, particularly when the risk model is applied in new areas and to complex new products. Since exploiting risk-shifting opportunities that benefit equity at the expense of others is in the interests of a financial entity's shareholders and its Board as well as management's, standard corporate governance can't be relied upon as a corrective. Lacking such a corrective, it seems particularly likely that the problems of model transparency for the more complex structured products will bedevil regulatory reforms involving capital requirements and leverage.

In the next section, we look more closely at the meaning of transparency. In Section 4, we look briefly at evidence on how the crisis unfolded and how transparency of risk and valuation models looked to be a potential issue. In Section 5, we discuss various solutions to the problems of ensuring model fidelity when the models are not completely transparent; in particular, we note that it doesn't follow that it would be optimal to require complete transparency, even if that were somehow counterfactually feasible.

3. Meaning of Transparency

Transparency has a variety of meanings. From the post-crisis perspective of both retail and institutional investors, more transparency typically means getting a better grasp on what their investment advisors / wealth managers / structured product sales & trading desks are delivering to them; these investors now find that the crisis has laid bare – made transparent – the emperor's state of undress.⁶ The demand for

⁵ Alessandri and Haldane (2009) subdivide government insurance into *deposit insurance* (payouts to retail depositors), *liquidity insurance* (support to wholesale funders), and *capital insurance* (equity injections from the government). We lump these different insurance subsidies together in our discussion here.

⁶ "The economic crisis has presented client relationship managers with challenges that they have neither the experience nor the skills to deal with...[A] recent PricewaterhouseCoopers survey of 238 private banks and wealth management firms [found]. What is disturbing in the study's findings is that only now, after the crash, have wealth management firms realized they need to train advisers to do a better job" (*New York Times*, Friday, July 31, 2009).

what is essentially better stewardship is at its simplest a demand for better documentation and attribution. Such documentation transparency goes hand-in-hand with mandatory compliance procedures. The extent of documentation and compliance in the investment process had generally already been improving before the crisis, thanks in part to decreasing IT costs and the additional records needed to support public trading of all the newly-created credit instruments. However, documentation (and regulation and hence compliance) is always a catch-up game when financial innovation is rapid.⁷ There are at least three general cases where investors were vulnerable due to transparency and documentation problems. First and most obvious, lack of audit and trade verification was a necessary condition for the Ponzi schemes exposed by the “receding tide” in the crisis. Brown, Goetzman, Liang, and Schwartz (2009) examined a sample of due diligence reports on asset managers and found substantial misrepresentation of documentable facts by the managers, e.g. 10% of the time the AUM data was incorrect and 4.5% of the time measured performance disagreed between the fund and the administrator or the auditor. Second, Zimmerman (2007) and Rajan, Seru, and Vig (2008) suggest that default models for securitized subprime mortgage claims failed in large part because “...the models relied entirely on hard information variables such as borrower scores, and ignored changes in the incentives of lenders to collect soft information about borrowers.” Soft information “such as time since last bankruptcy, time on the job, length of time at same residence etc. are all important elements in mortgage credit, but these secondary attributes are not disclosed on a term sheet, and dealers, rating agencies, and investors seldom have access to that information” (Zimmerman, p. 12). These documentation transparency problems were complicated in the case of CDOs that held tranches of many different pools of mortgages, or CDOs that held tranches of CDOs that held various tranches of the mortgage pools, etc. Third, stewardship accounting is perhaps the most instrumental for documentation transparency. Yet during the financial crisis, pressured regulators relaxed accounting rules for consolidating special purpose vehicles onto balance sheets, for documentation of the “fair value” of positions in turbulent markets, and for loss provisioning and thus measurement of stated capital, arguably all of which decreased transparency. The bottom line is as important as it is obvious: transparency in a documentation sense is a *sine qua non* for high quality risk assessment, valuation, and enforcement of capital/leverage rules. Insofar as future research is concerned, issues concerning the most appropriate rules for “fair value” accounting that also provide an optimal level of transparency seem as pressing now as they ever were.

The term “transparency” as used in the introduction has to do with one’s understanding of the important drivers of investment returns and risk. Documentation transparency is an obvious pre-requisite for determining these “drivers.” One might think that complexity leads to reduced transparency in identifying these drivers of returns. But that is not necessarily the case. For example, a plan sponsor could enter into an agreement with an asset manager whereby the latter will run, as an

⁷ The current failure rate in settlements is a good illustration of catch-up problems in documentation in the trade process – 29% for OTC derivatives, 16% across all instruments (Source: Smartstream Technologies) – that can contribute to market breakdown in crisis conditions, though we don’t have evidence that about the mechanics of clearing and settlement was *per se* a major factor in September-October 2008.

agent, a very complex strategy for the sponsor. So long as the sponsor is able to verify that the manager is performing every step in the agreed-upon, complex algorithm, the drivers of the investment return will be fully transparent to the sponsor. Indeed, if the asset management contract can specify all the steps in the process and these steps can be audited for compliance, the principal-agent problem has again been reduced to a “check the boxes” task, consistent with what we’ve just termed documentation transparency. Consider now the case where the manager’s investment process is not given by mechanical rules that can be audited, but instead has many elements that are subject to the discretion of the manager. When decisions are delegated to the manager, the sponsor is not expecting complete transparency. How can the investor be assured that the manager is delivering a product that has the expected risk and return characteristics? In the case of everyday consumer products that involve complex technology, we typically see Underwriters’ Laboratories certification and expert guides. In the financial management industry, due diligence consulting firms like Albourne, and perhaps ratings firms such as Moody’s, S&P, and Fitch, are very rough analogs to UL certification. The more severe the model (and documentation) transparency problem, the more due diligence that we’d expect to see, and the more critical become the fund consultants, ratings agencies or their successors. While our examples concern asset management, the point easily generalizes to large financial institutions carrying on a broad cross-section of complex activities.

If non-transparent risk models help managers exploit risk-taking incentives, then all things considered, are the best models those that maximize transparency? One example of transparent risk modeling is the Basel Committee’s first set of “risk bucketing” rules for minimum capital requirements. These rules essentially reduced the transparency-of-models problem to one of documentation transparency, i.e. verify that an asset is in category X, and if so it gets weight Y%. Alas, the buckets were so broadly defined that the same bucket could potentially contain assets with quite different risks, e.g., a bucket containing all first-lien residential mortgages or a bucket containing all OECD countries lumped together. As is well-known, Basel I also missed altogether anything other than default risk, including, most critically, the market risk⁸ of securities on a financial institution’s balance sheet. Misclassification of assets by risk creates obvious opportunities for “regulatory arbitrage.” The unregulated parallel banking system seems to have exploited many such opportunities to arbitrage institutional rigidities, inappropriate risk weights, and inaccurate ratings.⁹

The type of problems encountered with the risk bucketing approach would logically lead us toward a more “functional” approach to risk and valuation, and indeed that is the direction that Basel II took. In that functional approach, the objective is to define assets as having similar risk when their payoff

⁸ The BIS defines market risk factors as: “the market rates and prices that affect the value of the trading positions” (July 2009).

⁹ This is hardly an “Anglo-Saxon business model” problem, as some European critics have argued. Witness the Credit Lyonnais problems over a decade ago that are eerily reminiscent of Fannie Mae, but where the pressures were to make poor decisions about credit risk for political ends, while the push on Fannie Mae appears to have been for explicit monetary ends. At the end of the day, these were in many ways differences without distinction.

profiles are similar.¹⁰ The wrinkle, however, is that the functional approach typically involves a concomitant shift away from a check-list-like transparency-in-documentation to the generally lower transparency involved in identifying and assessing the quality of risk models.

4. *Transparency and Market Stress*

In the previous section, we suggested that one of the ways in which financial entities can take on more-than-prudent risk when they don't fully bear their downside losses is to have poorer quality risk models. We have been using too-big-to-fail banks as examples of such financial entities, but the skewed incentives would also be present for say hedge funds with nonlinear performance fees on one side and less sophisticated investors on the other. Because of a lack of transparency into these institutions, it is difficult to gather systematic evidence across them concerning the quality of their risk models going into the crisis. Of course, as we have repeatedly argued above, it is precisely this lack transparency along with potentially misaligned incentives that creates the possibility that low quality models may have been used.

Lapses in risk control have certainly been implicated in some of the major "blow-ups" in Q4 2008. For example, former AIG CEO Hank Greenberg testified to Congress that: "There is no question that management took their eye off the ball and that risk management was not getting the right instructions, and that's what led to the downfall" (Teitelbaum and Son (2009, p. 36). Of course, this testimony is anecdotal evidence of a failure of risk management, not necessarily of a failure of the models. However, AIG had been writing insurance on the senior securitized CDO tranches at 15 bps, and at the same time a senior AIGFP official famously contended in an August 2007 conference call that "it is hard for us...to even see a scenario within any kind of realm of reason that would see us losing a dollar in any of those transactions."¹¹ It was widely claimed at the time that AIG was effectively "arbitraging" the fact that it was an insurance company and not subject to Federal Reserve, FDIC, or SEC rules and supervision. Note that a case could be made that the clients of AIGFP and the senior management of AIGFP and AIG were all acting quite rationally, if they anticipated there was a good chance that Government assistance would be provided in those negative fat tail scenarios evidently "ignored" by AIGFP.

One scenario that should have been within the "realm of reason" of AIG's risk models is a stress scenario in which so-called contagion or "network" effects cause reverberations across institutions. The worry is that these network effects amplify the transparency issues that we discuss here. Note that the entities that are most likely to explicitly or implicitly consider themselves too-big-to-fail are the ones that have

¹⁰ That is, the assets are "functionally similar" in the same sense that Robert Merton classifies financial institutions as similar if they perform the same function.

¹¹ "What brought the company down, [wind-up head Gerry] Pasciucco says, was its exposure to fewer than 200 insurance contracts that were sensitive to AIG's credit ratings and the value of the underlying CDOs" (p. 29). Presumably this would be the place to start with forensics; we don't have the information to assess the relative importance of these 200 contracts, but the evidence seems to be that they were substantial, e.g. AIG reportedly needed \$40 billion in cash as of the weekend before the Lehman bankruptcy filing (Stewart (2009, p. 66)).

the largest number of network connections. Of course, if systemic risk is an important factor that can result in losses for some or all the interconnected institutions, each of those firms would ideally have an incentive to take the systemic network effects into account in each one of their in-house models. However our point is that if those same too-big-to-fail institutions want to downplay known unknowns in their risk controls, the network effects are certainly not transparent and *ipso facto* they are easy to ignore.

The less transparent the asset values and risk models of counter-parties in “the network,” the more the collateral that will be demanded, and the shorter the term will be funding against that collateral. As is well known, when transparency problems become too substantial, even short-term funding breaks down and without complete certainty of Government bail-outs in the bad scenario, we have a classic bank run. Up to September 2008, AIG had been providing the CDS insurance on senior tranches of securitized debt, and this insurance was a key feature in having those tranche bonds play the wholesale funding AAA “equivalent” of demand deposits, albeit with AIG’s backing rather than the FDIC’s.

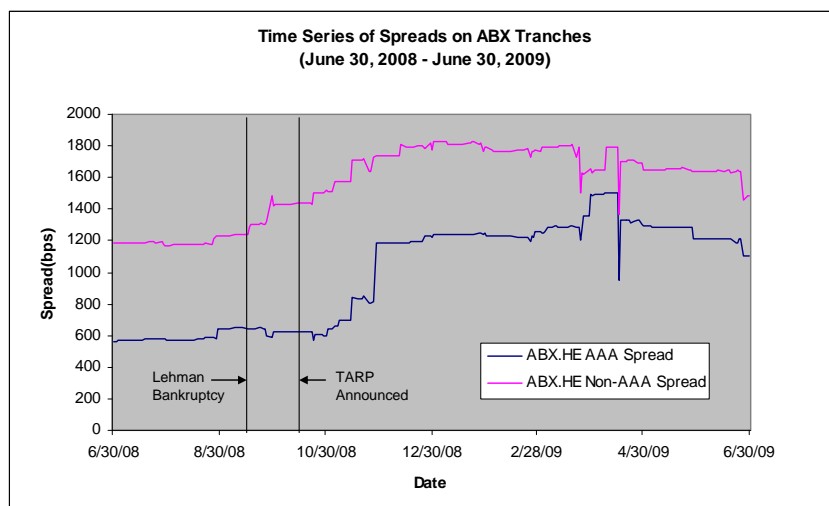
Liquidity or market network effects are more likely to occur when a financial entity’s balance sheet is more complex and risk and valuation models less transparent, all else equal. One reason for this became clear in the thick of the financial crisis, when institutions by-and-large tried to sell off assets rather than deleverage by substituting equity for debt. Structured mortgage credit instruments, like the swaps on CDO bonds that AIGFP was writing, trade in an OTC dealer market, so “selling off” those assets is difficult. We think that this illiquidity and the contagion it engendered should have been a “knowable unknown” factor in risk and valuation models; even in normal times, that OTC market was relatively narrow, with around ten serious dealers and further specialization among them. Trading was relatively opaque, e.g. only the counter-parties to trades, one of whom was typically the dealer, knew prices. Moreover, in the case of CDOs with their complicated hierarchical structuring,¹² the dealers arguably not only possessed better price information, they were also better informed about deal structures than most counter-parties; many of these counter-parties post-2004 were relatively new to the market and were inexperienced, in some cases lacking good information about how much sub-prime exposure was even in the underlying the CDO tranche bonds (which itself would be consistent with our thesis that parties didn’t particularly want to know these risks given their downside loss protection and, in the case of entities subject to BIS, didn’t want to in any way jeopardize the zero risk weight applied to these securities.)

Within the mortgage-backed securities markets, network or liquidity risk turned out to be less severe for the ABX Index market than it was for the individual CDO constituents of that Index. The ABX Indices, introduced at the beginning of 2006, consisted of a series of equally weighted, static portfolios of CDSs referencing twenty subprime MBS transactions. As Gorton (2008) suggested, these ABX Indices were already important pre-crisis in aggregating and revealing market information about subprime values and

¹²Most CDOs had some structured product tranches as collateral, but it was not easy to even figure out where the sub-prime exposure was.

risks. In Figure 1, we show the spreads on the ABX.HE Index AAA tranche and non-AAA tranche from June 30, 2008 through June 30, 2009.

Figure 1: Time Series of Spreads on ABX-AAA and ABX-non AAA Tranche Bonds (June 30, 2008 – June 30, 2009)



The spread on the junior (non-AAA) tranche begins to increase in the second half of 2008 around mid-September, the time of the Lehman bankruptcy and AIG bailout (the spread had already increased substantially in 2007 and H1 2008). This increasing spread is consistent with the deterioration in the value of the junior claims. Notice, however, that the senior tranche spread doesn't itself start to increase until mid-November, well after the TARP announcement. In mid-November, the VIX index for equities peaked out at 88.86%. This VIX index is often used by traders as a gauge for the correlation of the values of the assets (here, mortgages and mortgage derivatives) in the underlying pool. The thinking appears to be that the higher the VIX, the higher the correlation within the pool – another item for more research. Granting for the moment that the assumption about correlation is correct, we would *expect* to see spreads on the senior tranches rise relative to those on junior tranches as the VIX peaks, since it is only with many simultaneous defaults that loss rates would “reach up” to the senior and super-senior levels. This is by no means a complete analysis of these spreads, but it does suggest that they were in step with fundamentals.

If we broaden our scope of analysis still further from the MBS Indices to the markets for longer-term corporate credit instruments and equities, the evidence is still stronger that price behavior there was dominated by fundamentals. In the corporate bond and equity markets, there were more data available

that could be used to calibrate risk and valuation models,¹³ and thus our thesis would say there was less scope for opportunistically tweaking the specification and parameters for those models. Broker-dealers and banks also hold only a small fraction of (cash market) U.S. corporate bonds and equities, e.g. less than two percent of equities outstanding are held directly by broker-dealers and banks, reducing even further the likelihood that misaligned incentives would have an impact there. Consistent with our reasoning, the market for longer-term corporate credit risk appeared to have continued functioning relatively normally during the crisis, insofar as corporate credit spreads moved roughly in line with the predictions of structural models for credit risk. Our evidence for the normal functioning of the corporate credit market is partly anecdotal, based on discussions with traders, and partly drawn from Coval, Jurek, and Stafford (2009), who present evidence showing that “...changes in fundamentals, as reflected in the equity market, account for a large portion of the re-pricing of [corporate] credit that...occurred.” Three comments are warranted: (i) The shifts in the variance-covariance of the values of assets of companies that have issued debt results in “multivariate fat tails” in default risk for pooled debt securities, but these are picked up in models like Quantal’s and in the procedure used in Coval, Jurek, and Stafford (2009), if not in the notorious Gaussian copula modeling; (ii) it is true that the basis difference between corporate credit spreads and their respective CDS spreads did generally widen through much of the last quarter of 2008, but we would expect to see this given the increase in perceived counter-party risk; and (iii) short-term corporate commercial paper demand dried up, not surprisingly given the quasi-bank-run in other parallel banking short-term funding.

Finally, while equity prices fell sharply and volatility increased sharply, the price discovery process for equities also continued to function, albeit with controversial restrictions on the shorting of financial stocks in 2008. In particular, there was no repetition of the problems of October 1987 where it seems that market transparency problems may have contributed to the 22% drop in the Dow Jones Index on October 19th, e.g. Grossman (1988), Gennotte and Leland (1990) and Jacklin, Kleidon and Pfleiderer (1992) who hypothesize that investors may not have been able to differentiate portfolio-insurance-generated trading from information-motivated equity trading. Moreover, not only did equity markets not freeze up, but also volume remained roughly constant in the U.S. during the crisis, and fell off only slightly in Europe and Asia; activity in after-hours trading in S&P cash and futures markets seems to have remained at its normal level during the crisis (Avramonic (2009)) – we didn’t see panicked after-hours activity like the large “unusual” EFP trades after-hours in October 1987.

¹³ The National Association of Securities Dealers (NASD) has required, since July 1, 2002, that dealers report all OTC corporate bond transactions in the U.S. (with a phase-in through February 2004 for BBB-rated bonds). This is done through the NASD TRACE (Trade Reporting and Compliance Engine) bond price reporting system.

5. Discussion

The 2008-2009 financial crisis has focused concern on the risk-taking incentives of financial entities. This is especially true for the too-big-to-fail institutions where the “heads I win, tails the Government loses” problem looms large. Investors in privately managed funds are also concerned that their contracts with managers containing performance fees might contain the same misaligned management incentives. In the case of the funds, investors sometimes try to ameliorate the potential misalignment by including contractual terms like high-water-marks, and by limiting their investments to managers who have a substantial fraction of their own capital at risk. If a financial institution has virtually complete transparency so that the principals – the regulator or the sophisticated investors – can effectively monitor and control their investment risk from the outside, then the misaligned incentives have limited consequences. The necessary level of transparency would require, at a minimum, a high level of documentation transparency. It would also presumably require that the financial entity’s investment book and strategies be quite straightforward. In the case of a large financial institution, these two conditions might at best be fulfilled for a version of “utility” banks¹⁴ that take in deposits and carry out a conventional loan business¹⁴ – we say “might” here because it is hard to claim that the conventional loan business was itself ever very transparent. For funds, a “utility” strategy that closely tracks an index, or is designed to closely replicate a basket of hedge fund returns using a prescribed set of rules, could be transparent.

However, it may be impractical to split off the “utility” operations of large banks from the decidedly non-transparent “casino operations.” In the case of hedge funds, if they run sophisticated strategies, it will generally not be feasible for an outsider – regulator or investor – to perfectly observe risk-taking, or observe the quality and internal usage of risk models. As discussed earlier, there is ample evidence from the financial crisis to suggest that the risk models for complex securitized products turned out to be an example *par excellence*. Moreover, even if transparency into the quality of models being used were feasible at a point in time, the models themselves need to evolve over time as conditions change, as an entity’s business and products change, and as the most important stress scenarios change. Indeed, even documentation transparency needs to be in real-time if positions change quickly. This transparency of the banks’ or funds’ risk and valuation models is where the “rubber hits the road” in terms of potential problems of alignment of incentives. There may be perfectly legitimate reasons for the principal to not want to make the internal risk and valuation models completely transparent – after all, these models are part and parcel of the entity’s charter to identify risks and keep those that have the best reward-to-

¹⁴We are borrowing this “utility bank” terminology from a September 29 *Financial Times* column by Martin Wolf, “Why Narrow Banking is Not the Finance Solution.” In one rendition, the term “utility” bank refers to a deposit-taking institution with 100% of its liabilities backed by “genuinely safe liquid assets”, i.e. essentially a money market mutual fund. We are using the term in a slightly broader and arguably more practical sense. The “casino” consists of all other financial activities, for which we speculate that the pressures for implicit guarantee would be as strong as we see today for the financial sector.

(accurately measured) risk ratio, and insure against other known unknowns by efficiently hedging them; indeed, it is the improved reward-to-accurate risk ratio that provides the incentive to develop and deploy state-of-the-art models from both the manager's and investor's point of view. This is similarly true for process-driven trading where both the risk and also the perceived proprietary information involve knowing the "reservoirs of liquidity."

More stringent capital and margin requirements can in principle dampen some of the incentives of large financial institutions to increase risk, since reductions in leverage generally reduce opportunities for risk shifting gains. But modest changes in capital requirements cannot make the problem go away. Further, if managers are in part focused on achieving target levels of ROE (return on equity), enforced reductions in leverage can create additional incentives for managers to seek out higher return—*higher risk* activities, cloaking the latter in ultimately misleading risk models, parameterized to include fewer known unknowns.

The new Basel II set of rules, which in the U.S. require large financial institutions to use internal ratings based models as a part of determining capital requirements, can be expected to correct the problems of crude (credit) risk bucketing in the Basel I calculation of risk-weighted capital discussed earlier: presumably these internal models are better customized to the institution's products and strategies. But, as pointed out earlier, that same customization is likely to "up the ante" with respect to ensuring the adequacy of these internal models when transparency is an issue. Schwarcz (2009) also reminds us that agency conflicts between top management and middle-level management within a large institution are especially severe for financial firms where products and models are complex. In the Basel II rules, these middle-management conflicts in incentives are largely rolled into operational risk, and problems of transparency into the models used by middle managers become a part of operational risk.

One concern with monitoring the internal ratings based systems is that it is virtually impossible to do it properly without transactions and holdings data, especially when stress-testing an entity's risk. Rather than have the regulatory body periodically review systems and models, it seems worth investigating whether securities clearing and settlement corporations could be enlisted to do real-time auditing and risk assessment. These clearing corporations already have market and holdings and transactions data; they also have a good deal of experience in netting counter-claims and in using a portfolio approach to risk; and they could in principle monitor risk on at the same frequency as the entities' risks can change. Of course, in those cases in which the financial entities' balance sheets includes non-traded credit lines, loans, etc. outstanding, the relevant databases would have to be separately loaded.

There are many subtle underlying questions. For example, would a "clearing corporation as auditor" or similar solution require all OTC contracts to be standardized and possibly exchange-traded and cleared by the same clearing corporation? Presumably not, but any monitoring system (be it operated by a clearing house or, say, a Federal regulator) will presumably be cheaper to operate with some level of standardization that facilitates documentation transparency. Moreover, the marginal cost of auditing risk measurement is low if the transactions are already being cleared through the system. Presumably entities that trade both standardized exchange-traded-and-cleared instruments and OTC traded

contracts could be audited by the clearinghouse; the audit would simply be more expensive for the non-standardized and non-exchange-traded contracts.

One obvious caveat is that all these potential solutions for monitoring the risk and valuation models of financial entities are potentially costly. Whilst one might reply that “so is another financial crisis,” we need to be persuaded that the reforms would indeed help prevent another crisis, when they haven’t necessarily done so in the past. Indeed, some well-intentioned reforms may have even helped exacerbate problems when they engendered large scale regulatory arbitrage. If risk-taking incentives remain, as we think they almost surely will, then the details of trying to ensure risk and valuation model transparency matter crucially – improving transparency in some areas but not in others runs the danger of leaving things worse off, not better off. Moreover, unintended incentive problems aside, disclosing more data obviously does not necessarily mean better transparency. Lessig (2009) has recently claimed that all-out transparency in the political arena that involves simply providing “lots of data” won’t be optimal if users of data don’t have the bandwidth or skill to put the data in context and interpret it correctly.¹⁵ The same point would undoubtedly be true here if lots of data about risk and valuation models is just shoveled over to regulators or investors without carefully thinking about how it is useful in evaluating the models. Risk models, which as abstractions necessarily contain assumptions and parameters, can’t simply be “crash tested” to evaluate the parameterization, even in a market crash scenario, since the models involve the *probabilities* of gains and losses on portfolios of assets.

For the dwindling few who haven’t lost faith in the markets (or at least haven’t found a better alternative), a possible alternative to outside audits of risk systems would be shift to more reliance on market pricing of financial entity risk. Indeed, Basel II previously suggested that market calibration supplement its system of capital guidelines. For example, CDS contracts on a financial institution reflect the market’s evaluation of the risk of that CDS insurance. Of course, market pricing of any risk is only as good as the information available to the parties to the contracts being priced, so in the case of these CDS contracts, the market participants would presumably need a basis on which to adjust for misaligned incentives that potentially lead to biased usage of risk and valuation models within the respective entities. Moreover, there is a potential problem in looking at the pricing of CDS insurance on, say, Citigroup. CDS traders would logically account for the probability of government bailout in their expectations of default losses. This will make it more difficult for the government to use market pricing to infer the risk that it (the government) faces.

A final measure, one that undoubtedly deserves as much consideration as anything else that has been proposed, is to appoint more women to the Boards of financial institutions: “Far from focusing on traditionally ‘soft’ areas, boards with more women surpass all-male boards in their attention to audit and risk oversight and control” (Brown, Brown, and Anastasopoulos, *Conference Board of Canada Report*, 2002)!

¹⁵ Lessig’s discussion largely concerns data on the political process, but he points out that Justice Brandeis’ famous 1914 statement on transparency, that “sunlight is the best disinfectant”, was published in a book entitled “*Other People’s Money*” that was highly critical of bankers’ limited disclosures.

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