Lessons for the Current Financial Crisis from Catastrophe Reinsurance

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As this is being written, the US and world economies are experiencing the probably most intense contraction since the Great Depression. Instability in key intermediaries and markets prevails. There is much debate about the downturn’s underlying drivers and their respective primacy, but the discussion can be categorized under two main views.

One view is the “bubble-has-burst” hypothesis. It holds that excessive consumer demand fueled by lax borrowing standards, principally in the US, drove asset prices to high levels generally, and real estate in particular to levels not previously seen. These bubbles then popped. And, before they popped, upward price movements first stalled in mid 2007. The timing was driven by concerns that newly incurred and poorly-qualified sub-prime and Alt-A mortgage debt would be unserviceable by borrowers without continued price appreciation or interest rate decline. As borrowers began to feel pinched and housing values began to decline, consumption logically fell. Households needed to pay down their debts, without the benefits of continuing price appreciation. This recession is necessarily deep, this view holds, because asset prices have to fall a long way before reaching more normal multiples. And current and expected future consumption need to adjust downward to reach sustainable levels with more realistic assumptions about future growth. This bubble-has-burst hypothesis view emphasizes what I refer to as a “demand shock” -- it revolves around a boom and bust cycle of the demand for credit at its core.

The second view focuses on levered financial institutions and their role in morphing what was otherwise a garden-variety macroeconomic adjustment into an all-out crisis. This view holds that a relatively small perturbation – the excessive real estate borrowing of a small group homeowners – affected negatively financial intermediaries’ balance sheets. These intermediaries – banks and “shadow” banks who jointly fulfilled the function of credit extension to a wide universe of companies and investors – essentially cut back on lending to investors and to their market making desks. Investors who depended on credit to hold securities had to sell them. And the lack of dealer market-making funding made the situation worse, substantially undermining the liquidity of many dealer-centric markets.² So the deleveraging process, which by itself is the mechanical result of an initial reduction in asset values, had to take place in the context of increasingly illiquid and non-functioning dealer-centric markets. With liquidity low and falling, additional selling brought falling prices down even more dramatically than would have otherwise been the case. As a result, prices fell farther than the current fundamentals might have justified and credit became expensive and scarce. Unfortunately, the fear and

¹ Dedicated to Howard Kunreuther and written for the Festschrift in his honor.
² I modify markets by “dealer-centric” to indicate many dealer intermediated markets, and to contrast them from “exchange-centric” markets.
concern around these declining markets led to runs – both on markets and institutions, such as money market funds, and on consumption. This resulted in dramatic and precipitous declines in economic activity that ultimately, though unnecessarily, validated the low levels of asset prices. This financial-intermediaries view emphasizes what I refer to as a “supply shock” – a collapse of internal capital in financial intermediaries that greatly magnifies a small price change and turns it into a crisis in the macroeconomy.

These two versions of the current financial crisis can be seen most easily using Figure 1. It shows an equilibrium in the pricing and availability of intermediary-provided capital. This capital is used by households to gain access to mortgages and other forms of credit (such as automobile-purchase credits or credit card receivables), by corporations for borrowing from financial institutions, and by investors and traders who rely on dealers to help provide liquidity and who obtain financing in order to buy securities or other investments.

The bubble-has-burst hypothesis describes a leftward shock to the demand curve. A reduction in customers’ demand for credit is equivalent to a leftward shift in the demand curve. As expected, the quantity of intermediary-provided credit falls. So too does the cost of credit. At the original rates charged by intermediaries, there is excess supply of credit, so the shadow return on intermediary capital must decline.

The levered-intermediary view describes a supply shock – the leftward move in the supply curve shown in Figure 1b. Here too the amount of credit supplied in equilibrium falls. However, because the cause is a reduction in the capacity of intermediaries to lend, the shadow cost of intermediary capital rises.

There seems little controversy about what has happened in this financial crisis to the quantity of credit extended by intermediaries – it has fallen considerably. The critical – and decisive – issue between these two hypotheses is whether the shadow cost of intermediary capital has gone down or up. This is essentially the debate between these two different hypotheses.

Before I turn to some direct evidence on this, I want to draw some parallels with the catastrophe risk market. This is the marketplace in which the risks of large, damaging natural perils, such as hurricanes or earthquakes, is transferred from insurers toward those who can diversify these cat risks better, most often reinsurers. The catastrophe risk market has in the past witnessed dislocations that are similar to that of the current credit crisis. Yet it is in many ways a far more simple and easy to interpret marketplace.

There are several reasons that the cat marketplace is makes for an easily interpreted analogy. First, catastrophic events are exogenous. Outside of some fringe apocalypsists, not many people worry that these events are caused by prior human behavior. In the case of the credit crisis, we know that the housing and commodity price bubbles have burst. But, rather than worry about what exactly caused it, the cat risk example suggests we can and should move on to see what the were the effects on capital provided financial intermediaries. Second, cat risks and the damages they cause are physical phenomena which can be scientifically modeled. The likelihood of a given dollar amount of hurricane
damage is much more objective and transparent than the likelihood of a deep recession, or, more accurately, of AAA securities trading at only pennies on the dollar. We can objectively simulate storm frequency, severity, and trajectory based on our knowledge of physical systems. We cannot objectively simulate the "madness of crowds" – by which I mean shifts in sentiment, so-called 'animal spirits', or runs on banks, runs on markets, or runs on consumption. Finally, cat risk is not systematic – it is not correlated with the risks of major financial markets. This means that we have a good idea of how what the "fair market" price of cat risk should be. Specifically, because cat risk is diversifiable, the fair-value premium for a reinsurance contract that incurs no losses 99% of the time and incurs losses up to a given limit 1% of the time is 1%. That is, fair-value premiums are just equal to expected losses. And since expected losses can be reasonably accurately and scientifically modeled, fair-value premiums can consequently be readily observed. This is far better and simpler than in the financial world – while the market may try, no one has any real knowledge of what most underlying financial securities are worth. The same applied to real estate – who can say convincingly that houses are too cheap or too expensive or neither in 2009? Indeed, it is the lack of reliable markers of fair valuation that allow for enormous swings in the values of financial securities. In the most extreme bubbles we have witnessed (and there have been many over the past decade alone), there have been pundits arguing compellingly both that the bubbly and the bubble-has-burst prices are fair.

So what happened in the catastrophe markets in the aftermath of an event? As with the current crisis, some argue that immediately following an hurricane is the best time to be selling insurance (and reinsurance) because the demand for protection is high. Those who bought plenty of insurance see its value, and those who didn’t feel once-burned, and, going forward, twice shy. With demand high prices should be high. This is just the demand-shock view. And there are those who argue that, after an event, capital is depleted in the relevant financial intermediaries – reinsurers in the case of cat risk – so that supply is low. Both arguments suggest that prices should be high after the event. And indeed they are. However, they have opposite implications for what happens to quantities of intermediary risk sharing supplied.

Figure 2a shows the behavior of cat reinsurance prices in the aftermath of events, first from Hurricane Andrew in 1993 and, in the second panel, from the three large hurricanes of 2005. It makes several points. First, both panels demonstrate that, in the aftermath of these events, the price of reinsurance rose substantially relative to actuarial, or fair, values. Prices on hurricane insurance jumped to be over 6 times actuarial value in 1994 and to 5 or so in 2006. There is little question that the reinsurance was expensive and that writing cat reinsurance was an attractive proposition after these events. This brings us to the second point – that, while the cat risk was badly mispriced, and while the cat risk market is fairly transparent and simple, it still required YEARS after hurricane Andrew for prices to return to normal. Capital did flow into this sector to take advantage of the attractive opportunities, and eventually brought rates down. However, it required a long time. Competition among capital providers exists, but it is far from instantaneous. Capital arrives slowly when the opportunities arise and the early arrivers earn excess returns for a period before they are essentially competed away.

Figure 2b then makes the point that this cycle is a predominantly a supply shock story – the depleted capital of reinsurance intermediaries requires prices to rises AND quantities of reinsurance
transacted to fall. This result cannot be driven by a demand shock, because higher demand after an event should result in both high prices and high quantities of reinsurance provided. In fact, the amount of reinsurance fell considerably, tracing out the negative correlated between price and quantity suggested by supply shocks.

This is very similar to what we have seen on a broad scale in the current crises. Much has been made about the fact that credit extension by financial intermediaries has fallen considerably as the crisis has worsened. The evidence on overall bank lending during the second half of 2008 and early 2009 is highlighted, for example, by Ivanisha and Scharfstein (2009). There is also evidence of this behavior in the securities markets.

At the point when Lehman brothers collapsed many financial intermediaries faced real difficulties financing themselves – balance sheets were overleveraged and there was substantial risk that counterparties would not get paid in time. This virtually destroyed lending markets to major banks, where overnight rates spiked to extraordinary levels, high not only in absolute terms, but also high relative to longer term borrowing to the same institutions. In other words, the market seemed to sense that either banks would fail, then and there, or, if the survived, would go on to operate more normally in the future. Intermediaries had difficulty tapping external markets for capital and so the initial reaction was a decline in the quantity of intermediary capital.

Figure 3 makes this point by showing the LIBOR OIS spread (which compares overnight to 3 month LIBOR rates) and its behavior beginning in 2007 and though the end of Q1 2007. While the onset of the problems in mortgage markets in the summer of 2007 shows up, it is dwarfed by the shock that occurred around the time the Lehman Brothers failed. In September, intermediary capital was clearly constrained – no one was going to put funds into additional intermediation at that time.

But this is only the first part of the story. The authorities at the major central banks, and most strongly Federal Reserve, understood that this was a potentially catastrophic threat to the financial system. Through series of programs and facilities they quickly moved to help provide capital to intermediaries, both directly and through indirect federal guarantees. This brought the chaotic situation of bank capital under control relatively quickly. While the long run health of these intermediaries remained in question, they were receiving sufficient funding over the short and medium term so as to allow them to access capital at more normal prices. LIBOR OIS decline precipitously.

However, the shortage of capital in banks also resulted in very high shadow rates for use of intermediary capital. This is shown in Figure 3 with the black line – the bond-cds basis, which is the difference between the spreads on corporate bonds and the derivative contracts that insure them, credit default swaps (CDS). Why the bond-cds spread, and what does it tell us? CDS contracts are relatively liquidly traded contracts that measure the credit risk on bonds. In theory, this basis, the difference between bond and CDS yields, should be near zero, since the cost of insurance against a bond’s default should be about the same as the additional yield demanded by bondholders to compensate them against this same default. Thus, in terms of credit risk, bonds and CDS are approximately the same. However, in terms of liquidity, they are dramatically different. Intermediaries
allow customers to write CDS insurance by putting up only a small amount of collateral relative to what they must put up to buy a bond. Moreover, bonds generally, even before the crisis, trade far less frequently, and with considerably higher bid-ask spreads than CDS. All of this makes bonds “riskier” in terms of liquidity, though no different in terms of credit risk.

In September 2009, the bond-CDS basis exploded to levels never previously seen. Intermediaries, who faced real capital shortages, called in capital everywhere they could. The bond-CDS liquidity differences was an indication that their clients’ bond positions were far more collateral intensive than were their CDS positions. So effectively it, as intermediaries called in their capital, it became impossible (or inordinately expensive) to finance bond positions. Many investors were forced to sell their bonds – to deleverage because leverage was no longer available. Others who retained access to leverage sold voluntarily because of the fear that the last one out of the bond market would be left to shut off the lights. Some were also forced to liquidate CDS positions. Yet bond liquidation predominated – it released more collateral than CDS liqation, and, in any case liquidation of CDS positions acted only to reduce the bond-CDS basis. By both cause and effect, liquidity disappeared from bond markets: the uncertainty around what bonds would actually fetch became further magnified. Bonds therefore rapidly became much cheaper than their associated CDS. The magnitude is stunning: the 400 basis point bond-CDS spread represents an undervaluation of bonds relative to CDS of between 20% and 25%.³

The behavior of LIBOR OIS suggests that intermediaries quickly regained access to capital after the seizure of markets in September 2008. Intermediaries could then fund themselves in debt markets. But they were willing do to the same for their clients because of the scarcity of equity capital. In essence, the shadow required return on intermediary risk capital rose to very high levels, so high that intermediaries would not lend capital out at anything like normal lending rates. This is the analog of the relative increase in bond rates – and relative decline in bond prices. This cycle of intermediary capital shortages, so pronounced in this recent financial crisis, is the same pattern we saw above in the catastrophe risk market – a decline in the supply of intermediary capital along with an increase in the price at which intermediary capital is available. This is powerful evidence that a supply shock –not a demand shock – was the predominant operative factor in both cases.

What are the lessons, then, that we can draw for the current crisis from our experience with natural catastrophe reinsurance? First, is the fact that when the intermediary sector’s capital is damaged, replacement capital does not arrive quickly. Instead, it is as though the intermediaries essentially try to self heal – they charge a lot for access to their capital. Over time this helps them repair their balance sheets, along with capital inflows. But no cavalry of additional capital arrives to ensure that there is sufficient liquidity or capital to keep prices fair. Prices may be distorted for some period of time while intermediaries remain broken or weak. The system is sensitive – systemically sensitive – to shocks to the supply of intermediary capital.

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³ The average duration of the corporate bonds and CDS is about 7 and 5 years, respectively.
The second lesson we can draw during the healing process is that this return toward fair pricing is going to be even more painful and slow in banking that it has been, repeatedly, in reinsurance. Why? Remember that the shocks to reinsurance capital are essentially flips of a coin – they are chance outcomes whose ex ante probabilities are unaffected by the ex post occurrence. In the current crisis, the risk of lending is endogenous to the system. Now that we are in the crisis, lending is more risky. Indeed, the worse the breakage of bond markets and the more bond underpricing we experience, the more stressed are intermediary capital levels. Markets that break therefore make the crisis worse and make the prospect of ongoing lending even more risky. So the sensitivity of intermediary capital to supply shocks affects, in turn, both the severity and the duration of the downturn.

The final lesson is that the concentrated risks of intermediary capital are both systemically dangerous and preventable. In reinsurance, traditional reinsurers are giving way to a diffuse set of agents who manage dedicated but reinsurance exposures for many investors – hedge funds, mutual funds, and so forth. Reinsurance can be, and increasingly is being, written in small pieces by many portfolio managers acting as agents for their beneficial investors. This allows for far wider sharing of reinsurance risk and less concern with “too big to fail.” The current crisis has been made worse by the mistake of allowing intermediaries to accumulate large portfolios of the securities whose markets the dealers were supposed to support. When those security values fell, intermediaries’ stressed capital levels made it impossible for them to support these markets. And when intermediaries support of these markets waned, the public-good of liquidity declined, allowing for even less funding and even lower security values.

This vicious cycle was an important, but unnecessary magnifier of the current crisis. We have begun to make reinsurance markets more competitive by reducing intermediary concentration and by encouraging intermediaries to compete with investors directly. We need to do the same for bond markets – make them less reliant on exposed intermediary dealers, both by making the markets more competitive and by using regulation to prohibit substantial dealer warehousing of risk. The cost and protracted nature of this crisis is a direct result of preventable problems that we allowed to emerge in the regulation and organization of bond markets.
Figure 1
Equilibrium in the market for intermediary-supplied capital

Figure 1a
A negative shock to the demand for intermediary capital
Figure 1b
A negative shock to the supply of intermediary capital

![Graph showing demand and supply of intermediary capital]

Figure 2a
Prices of US property reinsurance relative to actuarial value following hurricane Andrew

![Graph showing prices of US property reinsurance]

5/10/2009
Figure 2a, continued
Prices of US property reinsurance relative to actuarial value following the hurricanes of 2005, Katrina, Rita and Wilma

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<td>$50B</td>
<td>2.5%</td>
<td>1.4x</td>
<td>6x*</td>
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Pricing shown as a spread to risk-free (typically 3m UST)

Expected losses shown as market standard model output (not NCL estimates)

Figure 2b
Transaction prices and quantities of US property reinsurance relative to actuarial value
Figure 3

Difficulties in bank financing were coincident with underpricing in corporate bonds relative to CDS, but dissipated faster

CDS Bond Basis vs. Libor OIS
January 2007 to March 2009

Source: Froot (2001)