PANEL STATEMENT

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ENDOGENOUS LEVERAGE AND DEFAULT

1 INTRODUCTION

In my view the fundamental missing ingredients in quantifiable macro models used by the Federal Reserve and the ECB are endogenous default and endogenous lending terms distinct from the interest rate. The models do not recognise that changes in the perception of potential defaults can radically alter lending conditions and therefore economic activity. This failure has prevented policy-makers from recognising asset bubbles, from understanding the source of debt crashes and from accurately gauging the severity and duration of their aftermath. It led to policy errors in ignoring the dangerous build-up of debt before this last crisis and to further policy errors after the crisis in not acting to restructure unpayable debts. In short, it has led to a faulty understanding of the nature of the debtor-creditor relationship and its impact on the macroeconomy.

For a long time now, maybe since Irving Fisher, we have come to believe that managing interest rates is the way to regulate lending and borrowing in the macroeconomy. Whenever anything goes wrong, people say "change the interest rate". Similarly, we have developed a phobia about forgiving debt. My view is that neither of these prejudices can be unambiguously derived from a proper general equilibrium model with endogenous default and lending. Collateral rates or leverage can be more important to economic activity and prices than interest rates, and more important to manage. And the only expeditious way out of a severe leverage cycle crash is to move quickly in writing down debts. The fact that we do not presently know how to compute the optimal leverage ratios, or the optimal amount of debt forgiveness, is not an argument against taking such actions, but rather further proof that we have been developing the wrong models.

The nature of promises and debt has been a preoccupation of philosophers for thousands of years. Keeping promises was Plato's first proposed definition of justice in the Republic (it was shown not to be always just). Nietzsche, in the "Genealogy of Morals", says the emergence of Conscience came from the repeated punishing of people who failed to honour their debts and the subsequent internalisation of that punishment. (Thus "schuld" is the root of the German word for debt and also for one version of Conscience.) The subtlest literary analysis of keeping promises can be found in Shakespeare's "Merchant of Venice".

The plot of the "Merchant of Venice" turns around the contract negotiated by Antonio to borrow money from Shylock to finance his friend Bassanio's courtship of the beautiful and rich Portia. In the central scene in the play, Antonio and

Shylock argue over the rate of interest on the loan. But Shakespeare understood the primary importance of collateral. How many of you can remember the interest rate Shylock charged Antonio and Bassanio? Yet, all of you remember the collateral agreed on in the contract – the pound of flesh. Obviously, Shakespeare thought the collateral was more important. When all the boats apparently sink and Antonio is unable to repay the loan, the Court alters the collateral, saying it should have been a pound of flesh, but not a drop of blood.

The theme of borrowing and default is repeated several times in the play with the story of the rings. Portia and her assistant lend Bassanio and his assistant their rings in exchange for the promise that they will never be taken off their fingers. Shylock has earlier made it clear that he would never break his promise about the ring his wife Leah gave him. Yet when faced with an urgent need, Bassanio and his assistant do give up their rings, and they expect forgiveness. "To do a great right, do a little wrong" is Bassanio's philosophy. Or as Portia describes forgiveness of debts, "The quality of mercy is not strain'd, ...It blesseth him that gives and him that takes."

Following Shakespeare's lead, I discuss models of collateral and debt forgiveness (or punishment for default). In the next section I argue for the necessity of collateral and leverage in macro models. I point out that, at present, leverage is absent from those models, even if lip service is paid to it now. I illustrate my view by describing the kinds of effects I have obtained in my models of leverage that cannot be reproduced by the more carefully calibrated macro models that guide central bank action. Next, I show that only by taking collateral seriously can one properly assess the effect on asset prices of new derivatives like credit default swaps. Finally, I talk about the optimal punishment for default and the current deplorable conditions of debt overhang much of the world finds itself in.

2 LEVERAGE AND ASSET PRICING

Just as with Shakespeare's Court, I believe today that the regulatory authority ought to be managing collateral rates in addition to interest rates. I have worked on the leverage cycle, as I call it, for over ten years – not quite as long as Shakespeare and with somewhat less attention than Shakespeare received. My oldest published papers on the subject are "Promises, Promises" in 1997, about collateral general equilibrium, "Liquidity Default and Crashes" in 2003, about the leverage cycle, and "Leverage Cycles and the Anxious Economy" in 2008 with Ana Fostel, about the spread of leverage cycles across markets. In those papers I showed that when leverage is high, asset prices tend to rise, and when leverage declines, asset prices fall, sometimes in a violent crash.

There have been other early papers on collateral. In fact, Ben Bernanke was one of the pioneers in emphasising collateral. However, he did not really write very much about leverage or changes in leverage. Instead he emphasised that when collateral goes down in value, the amount that can be borrowed goes down (as would be the case with a constant loan-to-value lending rule). What I emphasised is that the loan-to-value can change dramatically and it is the rapid

change in loan-to-value that is a crucial source of crashes. And as I shall argue, loan-to-value is a variable that can be regulated.

The modern calibrated macro models that pay any attention to collateral, such as those presented by Christiano at the American Federal Reserve meetings in Jackson Hole last August (Christiano et al. (2010)) and by Smets at the current ECB meetings in Frankfurt (Fahr et al. (2010)), derive from the foundational work of Bernanke, Gertler and Gilchrist and Kiyotaki and Moore. In that foundational work, leverage is barely mentioned and changes in leverage play no significant role. In Kiyotaki and Moore, for example, leverage actually rises after a bad shock, dampening any crisis. In the papers of Christiano and Smets, leverage is duly noted, though it is not clearly distinguished from credit, but again it does not play a central role. Both those models suggest the possibility of calibrating what happened in the current crisis. In the Smets paper, mysterious shocks started the crisis. No effort is made to identify what the shocks are or what they correspond to in reality; their existence is inferred from the fact that we had a crisis. Not even their properties are identified. In the leverage story I told in 2003 (and which is also told in Brunnermeier and Pedersen in 2009), it is crucial that the shocks are not only negative, but that they increase in volatility, as they did in reality. Moreover, I identify the first shocks as increases in mortgage delinquencies. In the Smets paper, there is no reason why his shocks should cause leverage to decrease rather than increase. In Christiano, the shocks are explicitly identified as changes in future productivity. But again there is no reason why such shocks should lower leverage. It is quite clear that in these models, leverage is not needed and changes in leverage do not play a vital role.

The foundational work of Bernanke, Gertler and Gilchrist, Kiyotaki and Moore and Holmstrom and Tirole is about credit cycles, not leverage cycles. In those papers, a drop in asset values or the wealth of entrepreneurs makes it more difficult to borrow, which in turn hampers productivity, which then lowers asset values, making it harder to borrow and so on. Their story is about levels of credit, not ratios. It could be told as if the ratio of loans to asset values were constant. The leverage cycle differs from the credit cycle insofar as it is about ratios of credit to asset values. In my view it is these ratios which played the crucial dynamic role.

What I mean by leverage is loan-to-value on *new* loans. If the loan-to-value is 80%, USD 20 down gets you a USD 100 house. The leverage is five because your cash downpayment of USD 20 has been multiplied by five in the USD 100 value of the asset. Loan-to-value and leverage describe the same thing. But let me emphasise it is on new loans. Debt-to-equity is essentially loan-to-value on old loans. Debt-to-equity is also an important ratio, but different from what I mean by leverage. And the two ratios often go in different directions. Historically, debt-to-equity typically increases for two or three years after a crisis and then starts a long slow decline stretching over years. But leverage on new loans drops abruptly *before* a crash. It is a cause, not a lagging result. How well things are going in the economy usually depends more on the leverage on new loans, not on what is happening to old loans, which often goes in the opposite direction. Of course, as we shall see, the duration of a crisis depends critically on the debt overhang, that is on the loan-to-value on old loans.

The point of my equilibrium theory of leverage is that supply and demand determine not just the interest rate, but leverage as well. Supply equals demand for a loan is apparently just one equation, which gives rise to a puzzle. How can one equation determine two variables: interest and leverage? That is part of the reason why leverage has received so little attention in economics. It is just awkward for economic theory. That is why, as an economic theorist, I began to think about the subject. I wanted an equilibrium theory of what influences leverage and what role leverage plays in the economy.

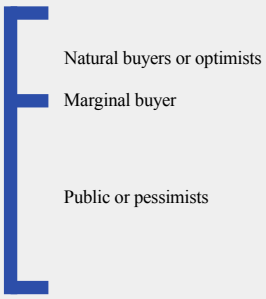
In my theory, supply and demand do determine both the interest rate and leverage. (The trick is that there is more than one supply equals demand equation, but I do not have time to discuss that here). What ends up influencing the interest rate in equilibrium is impatience; what influences leverage in equilibrium is volatility in the short run and, in the long run, innovation (because the economy is always looking for innovative ways to stretch scarce collateral).

Why are people now saying leverage is important? Every trader knows, if you are leveraged five to one and the asset goes up or down 1%, your wealth goes up or down 5%. You are more sensitive to changes. And the second thing they say is that since collateralised loans often turn out to be no recourse loans, people can walk away from their debts. "If we had only limited leverage, these banks would not have lost so much money when prices started to go down. And homeowners would not be walking away from their homes."

Of course, I believe those two things are very important and they played a crucial role in my theory. But there was a third aspect of leverage in my theory which I think is far more important. The real significance of leverage is that it allows fewer people to buy more assets and therefore raises the price of assets. Leverage causes bubbles.

In the leverage cycle, periods of high leverage produce higher asset prices, while periods of low leverage produce lower asset prices, provided there is no short selling. In Chart 1 below, you can see why that is. Imagine a continuum of people from top to bottom, who have different views about the value of assets. The people at the top think the assets are worth a lot. The people at the bottom do

Chart 1 Marginal buyer theory of price



not think they are worth very much. This heterogeneity is of crucial importance. Whatever the price is, there are going to be people at the top who think the price is cheap and they will be the buyers. The people lower down are going to think the price is too much and they will be sellers. The guy who thinks the price is just right, his valuation is equal to the price. You might say his valuation is determining the price.

When leverage goes up, the people at the top can borrow more. Fewer of them are required to hold all the assets, so the marginal buyer goes up and the price rises, not because there is any fundamental change in the economy, but because the marginal buyer is someone who has a higher opinion of the value of the asset. More leverage causes higher asset prices because it changes the marginal buyer. Most of modern finance basically assumes this heterogeneity away. I am not aware of a single finance or macro textbook that mentions endogenous leverage and its effect on asset pricing.

There are many reasons why agents in reality have heterogeneous valuations of assets. For example there are real differences in risk tolerance – risk-averse people value the assets less, even with the same information. There are also real differences in how people can use assets for production. There are also differences in utility from owning assets, like living in a house, for example. And some people maybe are just more optimistic about the assets than others.

3 THE LEVERAGE CYCLE IN THEORY

Over the leverage cycle, leverage gradually rises, as I said earlier, because of technological innovation stretching the available collateral and because volatility is low. After a big, bad shock that increases volatility, leverage abruptly plummets. The fall in asset prices can be much bigger than anybody thinks is justified by the news alone because it is coupled with a crash in leverage and the bankruptcy of the most optimistic buyers. There is too much leverage in normal times and therefore too-high asset prices, and too little leverage in bad times and therefore too-low asset prices.

Leverage cycle crashes always happen in exactly the same way. First, there is a period in which leverage becomes very high and the assets are concentrated in the hands of the natural buyers (optimists for short) who have borrowed large sums of money to get them, setting the stage for the crisis. Then there is bad news that causes asset prices to fall because every investor values the assets less. This price fall forces the leveraged natural buyers or optimists to sell assets to meet their margin calls, thus realising their losses. In Chart 2 below, I assume they all go bankrupt. Their departure causes asset prices to fall more because the assets fall into less optimistic hands. If the bad news is “scary”, then lenders demand more collateral. This means that the remaining less ebullient optimists each buy less, requiring more of them to hold all the assets. The new marginal buyer must be much further down the continuum and so much more pessimistic, and prices drop even further, reflecting the opinion of the lower marginal buyer.

Chart 2 Leverage cycle theory of crashes

Now what is "scary bad news"? It is not just bad news, but it is the kind that creates more uncertainty, more volatility. You are at an airport and they say the plane is going to be ten minutes late. That is bad, but ten minutes is really nothing. However, once you hear it is ten minutes late, you think, "My gosh, maybe it is going to be an hour late." That could be really bad.

It is the *uncertainty* the news creates that is critical, not how bad it is. Another example is subprime delinquencies going from 2% to 5% in January 2007. 5% is not catastrophic. However, once it has reached 5% and broken the old pattern, investors think maybe it will go to 30% or 40%. That is what causes people to get nervous. When the lenders get nervous, they ask for more collateral and they force deleveraging. That is the beginning of the crisis.

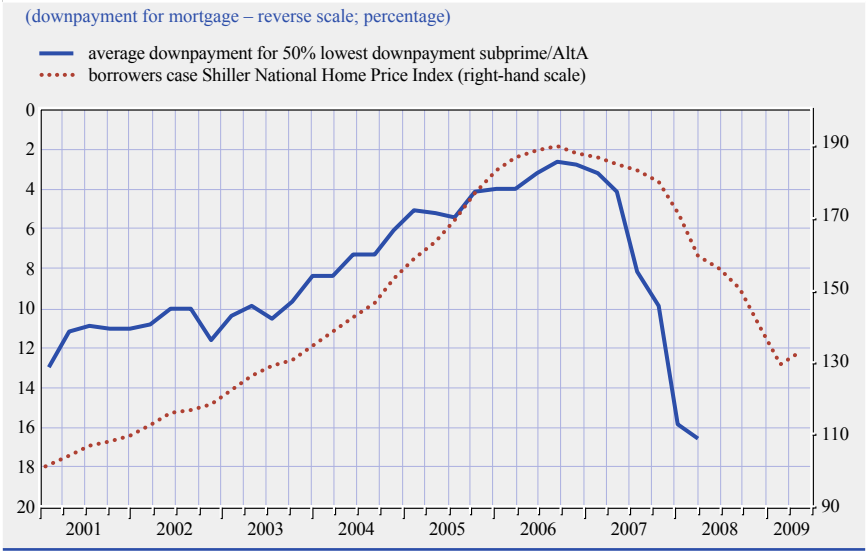
The leverage cycle would occur even with completely rational agents; it gets much worse with irrationality. For example, if, in the boom, irrational lenders thought prices could only go up, leverage would get absurdly high, or if, as bad times approached, panicked investors sold everything, prices would fall much faster.

4 LEVERAGE CYCLES IN HISTORY

I believe our financial history is full of recurring leverage cycles, during which leverage gradually builds up, creating a huge asset bubble, and then leverage and asset prices suddenly come crashing down. That is what happened in the Tulip mania of 1637 in Holland, in the great Florida land boom and bust just before the Great Depression, in the 1980s land bubble in Japan, in the Asian crisis of 1998 and in the subprime crisis of 2007-09. Of course, the data on historical collateral rates is spotty and needs assembling. There is a lot more work that could be done about this. We need to develop macro models that could calibrate the waste in the overbuilding that inevitably takes place in the ebullient stage when asset prices are too high and, even more importantly, that could calibrate the loss from the crisis stage and its aftermath.

The current crisis, I believe, is a clear example of a leverage cycle crash after a long leverage boom. And for this we do have some data. In Chart 3 below, the

Chart 3 Housing leverage cycle margins offered (downpayments required) and housing



Sources:

Notes: Observe that the downpayment axis has been reversed, because lower downpayment requirements are correlated with higher home prices. For every AltA or subprime first loan originated from Q1 2000 to Q1 2008, downpayment percentage was calculated as appraised value (or sale price if available) minus total mortgage debt, divided by appraised value. For each quarter, the downpayment percentages were ranked from highest to lowest, and the average of the bottom half of the list is shown in the chart. This number is an indicator of downpayment required: clearly, many homeowners put down more than they had to, and that is why the top half is dropped from the average. A 13% downpayment in Q1 2000 corresponds to leverage of about 7.7, and 2.7% downpayment in Q2 2006 corresponds to leverage of about 37. Subprime/AltA issuance stopped in Q1 2008.

dotted line is Shiller's famous housing index. In 2000, it was at 100 on the right-hand scale. By the second quarter of 2006, it hits 190, a 90% increase in six years. Then it goes down by 30% or so from there. Shiller famously said that it was irrational exuberance driving prices up. And, when the narrative changed because people decided things cannot go up forever, they started telling bad stories, so everyone got depressed and the prices went down.

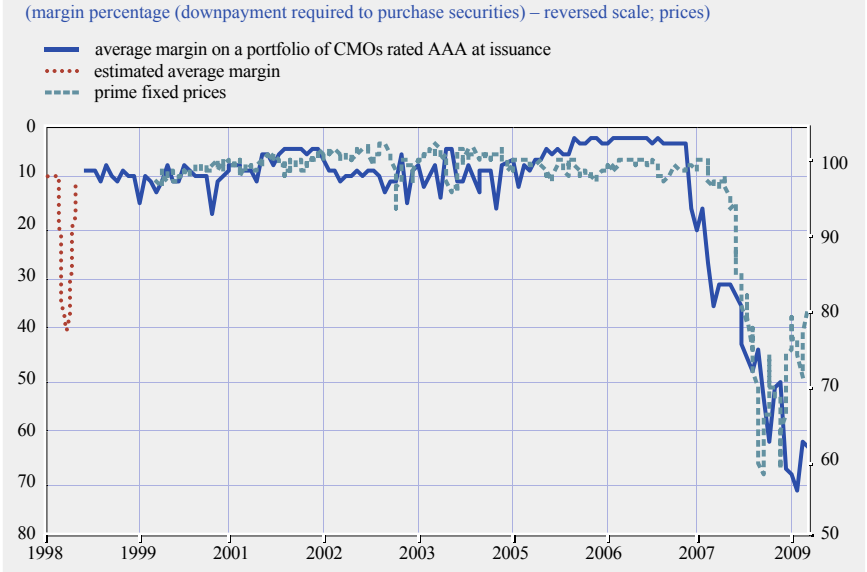
I believe the housing boom and bust was more a matter of leverage than of irrational exuberance. The solid line above gives the average loan-to-value for securitised subprime and Alt-A loans among the top 50% leveraged homeowners. The left vertical axis measures loan-to-value from 0% at the bottom to 100% at the top, or equivalently, the downpayment measured from 0% at the top to 100% at the bottom. You can see that the average downpayment goes from 14% (that is 86% loan-to-value) in 2000 to 2.7% in the second quarter of 2006. In exactly the same quarter that leverage hits its maximum – the second quarter of 2006 – so do home prices. It is not irrational exuberance, I say, but leverage that caused housing prices to go up and then go down.

In Chart 4, you see the analogous leverage-price diagram for prime mortgage-backed security bond prices. Measured along the right vertical axis, the prices in the dashed curve stay close to 100 until the beginning of 2008 when they start to

fall, eventually declining all the way to 70. Leverage is measured as in Chart 4 on the left vertical axis, and is given by the solid blue curve. These repo downpayments (margins) are data the Federal Reserve should be keeping, but apparently the Federal Reserve did not closely monitor repo margins before the crisis. The hedge fund Ellington Capital Management that I work with gave me the history of margins they were offered, averaged over a large portfolio of prime mortgages. You see that downpayments were at 10% in 1998, then in the 1998 leverage cycle crisis they jumped to 40%, then went back to 10% very quickly when the crisis subsided. Margins eventually went down to 5% in 2006 – so 20-to-1 leverage. Then in 2007 leverage began to collapse, and afterwards you see prices and leverage collapsing together. Leverage on these AAA bonds, measured properly as loan-to-value on new loans, starts to collapse before prices and is part of the reason for the collapse of prices. The deleveraging comes before the fact, not two years after the fact. Of course, much of the deleveraging in the diagram (and in other time series of security prices) comes simultaneously with the fall in prices. Falling prices make rational lenders demand more collateral, which in turn lowers prices, making lenders ask for still more collateral and so on.

What caused prices and leverage to go down? What was the scary bad news? To listen to the conventional accounts, the crisis began with housing prices

Chart 4 Securities leverage cycle margins offered and AAA securities prices



Notes: The chart represents the average margin required by dealers on a hypothetical portfolio of bonds subject to certain adjustments noted below. Observe that the margin % axis has been reversed, since lower margins are correlated with higher prices.

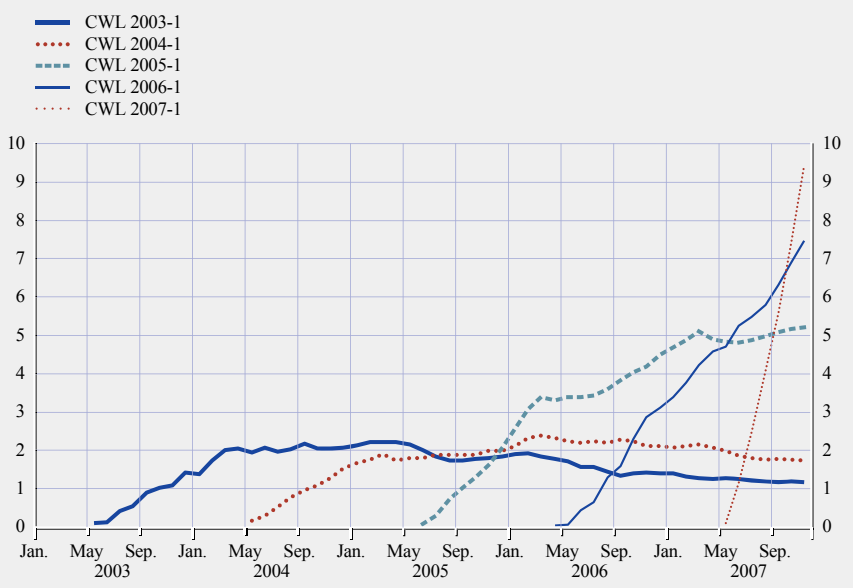
The portfolio evolved over time and changes in average margin reflect changes in composition as well as changes in margins of particular securities. In the period following August 2008, a substantial part of the increase in margins is due to bonds that could no longer be used as collateral after being downgraded, or for other reasons, and hence count as 100% margin.

suddenly plummeting, completely unexpectedly, out of the blue. In Chart 3, you see housing went down slowly. It is a nice slow curve. It goes up, it stops going up, and then it comes down slowly. That housing prices stopped going up is not really a surprise from the leverage cycle vantage point. Downpayments cannot go below 0%, so as housing downpayments approach their minimum, one would expect housing prices to stop increasing. What is surprising is how fast leverage comes down just after the second quarter of 2006. What happened? What was the scary bad news?

The scary bad news was that delinquencies on subprime loans started going up in 2006 and by the beginning of 2007 it was clear a dangerous trend was materialising. In Chart 5 we see that historical delinquencies as a percentage of original balances for Countrywide deals asymptote at 2%. But in January 2007 the delinquencies on 2005 and 2006 loans were already approaching 5%.

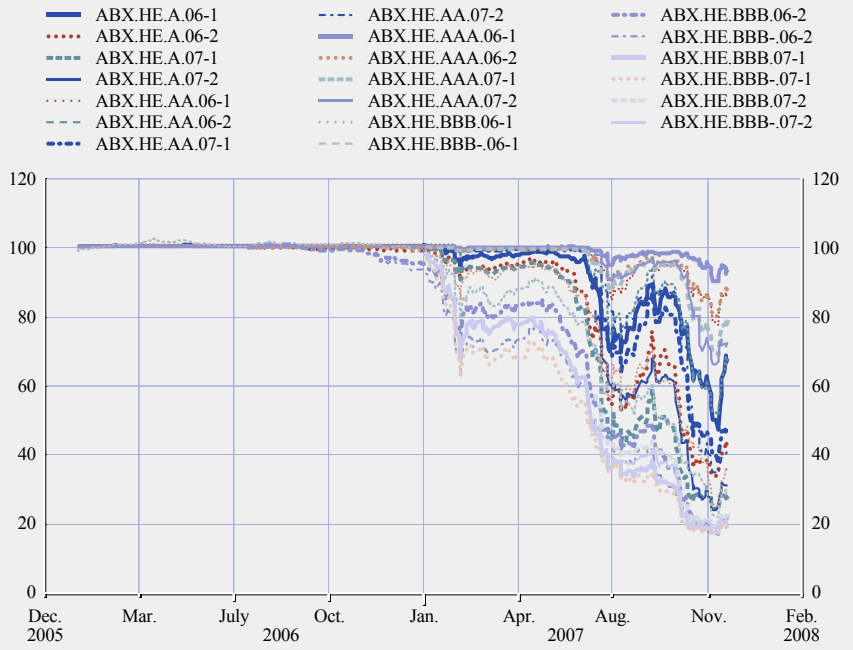
The result was that the subprime BBB ABX index collapsed in January and Feburary of 2007, as we see in Chart 6.

Chart 5 Delinquencies as a percentage of original balances



Notes: The result was that the subprime BBB ABX index collapsed in January and Feburary of 2007, as we see in Chart 6.

Chart 6 BBB prices crash before big drop in housing

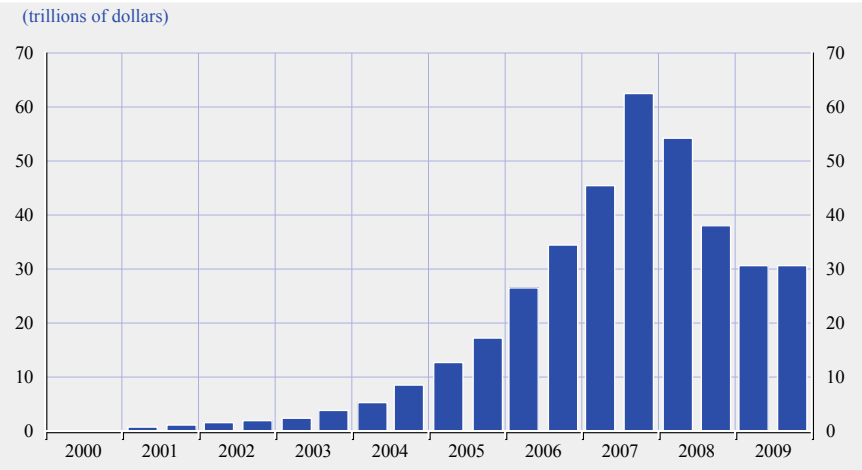


It may seem surprising that an increase in delinquencies from 2% to 5% could cause such a drop in the subprime security index. I argued earlier this should not be surprising because of a sharp decline in leverage on subprime securities as nervous lenders ask for more collateral. I do not have the data on subprime security collateral, but I have the next best thing. As buyers of subprime securities get more nervous, one would expect them to prefer pools with subprime loans that have bigger downpayments. And that is just what we see in Chart 3. Leverage on subprime loans collapses just after January 2007. And I believe that is what led to the housing price collapse.

5 THE LEVERAGE CYCLE AND DERIVATIVES

The role of derivatives in the financial crisis has not been well understood. In my opinion the introduction of credit default swaps (CDSs) played a vital role in the subprime crash. Before their introduction, a pessimist could not leverage his views. CDSs did not become standardised for mortgages until the end of 2005. Only then you could easily leverage your position as a pessimist. All those guys at the bottom of the continuum in Chart 1, who earlier just had to stand by and shake their heads at the high subprime prices, could thereafter weigh in with money behind their opinion. This was bound to push the marginal buyer lower and to have a big effect on asset prices. Chart 7 shows the dramatic increase in CDSs in general (data is not available for mortgage CDSs in particular).

Chart 7 Volume of Credit Default Swaps



Source: "ISDA market survey: historical data."

But this raises an interesting puzzle. The growth of derivatives, for example, as tranches in the collateralised mortgage obligation market or as separate bonds in subprime securitisations, long predated the spectacular expansion of the CDS market. In this prior stage, the growth in derivatives seemed to raise asset prices. Indeed, one of the major reasons the government sponsored securitisation and encouraged tranching was because it was believed to raise the underlying mortgage price, thereby making it cheaper for homeowners to borrow money to buy homes. But why should the creation of a derivative inside a mortgage securitisation increase the value of the mortgage, whereas the creation of a similar derivative like a CDS outside the tranche reduces the value of the mortgage?

The answer that Ana Fostel and I gave in a recent paper is that the collateralised mortgage obligation tranches obviously make the underlying mortgage more valuable relative to cash because the mortgage pay-offs can be divided in ways that appeal to heterogeneous investors. The mortgage acts as collateral for the tranches (and in fact is literally called collateral in the deal). On the other hand, when trading a CDS one has to put up cash as collateral to guarantee the payment. In effect, the CDS tranches the cash, making the cash more valuable relative to the mortgage.

6 MANAGING THE LEVERAGE CYCLE

Let me conclude my discussion of the 2000-10 leverage cycle by briefly mentioning four reasons why this last leverage cycle was worse than its predecessor cycles. First, leverage reached levels never seen before in previous cycles. There is a variety of reasons for this, including the great and long moderation in volatility. Another is the aforementioned securitisation and tranching. Yet another is that the government effectively guaranteed the debt of Fannie and Freddie, and perhaps even implicitly for the big banks, letting them all leverage with

no market discipline. Still another reason is that the banks hid their leverage from regulators who might have turned a blind eye to them anyway. Lastly, low rates might have encouraged more leverage from investors searching for yield. The second reason this last leverage cycle was so bad is that it was really a double leverage cycle – in securities on the repo market and on homes in the mortgage market. These cycles fed off each other and, as we saw, as security prices fell and leverage collapsed there, leverage then went down in the housing mortgage market. Third, CDSs played a huge role and had been absent from previous cycles. CDSs helped optimists leverage at the end of the boom, making them more vulnerable, but most importantly, it provided an opportunity for pessimists to leverage and so made the crash much faster than it would have been without them. Lastly, because leverage got so high and then prices fell so far, a huge number of people and businesses ended up underwater, including 14 million homeowners. This debt overhang is playing a big role in our current malaise.

What should be done about the leverage cycle? Something to prevent it from getting too high, and then something to get out of the acute crisis once there is a crash, and, lastly, something to shorten the costly aftermath.

To prevent leverage from building up, we have to monitor it by collecting not only debt-to-equity ratios on a large variety of institutions, but also loan-to-value leverage data on all kinds of securities and assets. We have to put derivatives like CDSs on an exchange or something similar. I do not have time now to explain it, but CDSs are just another way of leveraging. So you have to monitor the leverage of derivatives just like you would monitor the leverage of asset purchases. During normal times, loan-to-value leverage should be regulated. The Federal Reserve or another body that is given the authority should simply say, "You cannot loan at 2% down on houses. You cannot make repo loans with 0.5% down. You cannot write CDS insurance unless your initial margin is comparable to the margin on buying the security. And if you want to buy CDS insurance, you also have to put comparable margins down."

Allow me to mention four of the six reasons I have given elsewhere why monitoring and regulating leverage should be based at least partly on loan-to-value ratios on new loans (asset-based leverage) for all borrowers and lenders, rather than solely according to debt-equity ratios of entire institutions (investor leverage). First, leverage in the system can move away from regulated institutions. Second, limiting the overall leverage of an institution can sometimes incentivise it to choose riskier investments that are leveraged less. Third, as we have seen, investor leverage and asset leverage often move in the opposite direction. Fourth, it is harder to lie about asset-based leverage because separate reports will be obtained from both the borrower and the lender.

If, despite efforts to curtail leverage, the crisis begins anyway, the only way to get out is to reverse the three standard causes of leverage cycle crises: reduce the uncertainty, re-leverage the system (to moderate levels), and inject optimistic capital to make up for the lost demand from the suddenly bankrupt or insolvent optimists. In the acute stage of the crisis we always see the same thing. There are a huge number of people who have gone bankrupt, but a much bigger group that

are teetering on the edge of bankruptcy. Partly because of counterparty worries, a number of markets freeze up and liquidity disappears. Regulatory controls may suddenly be triggered. So there is a new kind of uncertainty, quite distinct from the volatile shock that triggered the crisis. The government must step in to quell this uncertainty and to keep markets transparent.

During the crisis and its aftermath, what looks like a demand problem – no one is borrowing at the going low interest rate – is really a collateral problem. Lenders are asking for so much collateral that investors cannot borrow because they do not have the collateral. What the Federal Reserve has to do is to go around the banks and lend directly on less collateral, not at lower interest rates. In fact, that is one of the things the Federal Reserve and the Treasury did (in the TALF and PPIP programmes) that helped get the United States out of the depths of the crisis. It could have been done on a much broader scale. But the bravery to do something that had never been done before played a critical role in helping avoid a worse catastrophe.

Let me close this section by challenging the false separation between interest and collateral that has been maintained by some monetary authorities. It has been suggested that the Federal Reserve or the ECB should deal exclusively with interest in normal times, perhaps managing collateral in crises as "non-standard" policies. Of course, it has now been recognised that leverage must be systemically curtailed. But the idea is that in normal times the central bank worries about interest, while collateral management is left to the macro-prudential regulator. This reminds me of the old Soviet separation: one bureau was put in charge of prices, another in charge of quantities. A crisis is a window into the soul of the economy, like Plato's republic was the soul writ large. If non-standard policies saved the economy during the crisis, they surely should play a role in normal times.

7 THE AFTERMATH: GETTING OUT FROM UNDERWATER

After a major crisis has stabilised, the most important uncertainty becomes who else will go bankrupt and how will they behave while they are underwater? The depth and length of the crisis and its aftermath depends on how much leverage there was to begin with and on how effective government policy is in reducing value-destroying bankruptcies and debt overhang.

Debt overhang causes terrible deadweight losses. Once a homeowner is far enough underwater, he is not going to spend money to fix his house in order to raise its value when he knows he will probably lose it eventually anyway. Even if he wanted to fix his house, nobody would lend him the money to finance the repairs anyway. The underwater homeowner might continue to make his mortgage payments if he feels it would be more expensive to move and rent another house and live with a diminished credit rating, or if he thinks there is a chance his house might eventually recover enough value to be worth more than the debt. However, once he becomes far enough underwater it becomes too expensive *not* to default.

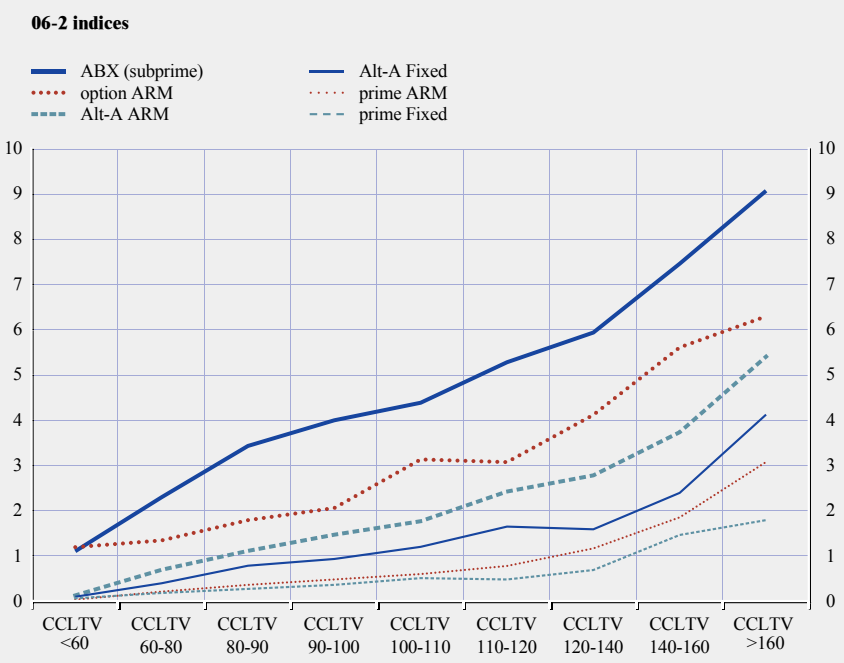
A major reason many homeowners stopped paying in this crisis has been that they are underwater. Chart 8 indicates that homeowners with current loan-to-values well below 100% rarely default, whereas subprime borrowers with loan-to-value at 160% were defaulting at the rate of 8% per month in 2009. Default rates are steeply monotonic in how far underwater the homeowner is.

Throwing a homeowner out of the house for defaulting also incurs huge costs. Subprime lenders on average recover less than 25% of their loan from foreclosing. It takes 18 months to 3 years nowadays to throw somebody out of his house, during which time the mortgage is not paid, taxes are not paid, the house is not fixed, the house is often vandalised and realtor expenses are incurred.

By writing down principal on subprime loans so that the homeowners are above water, lenders and borrowers can both gain. For example, the lender can expect less than USD 40 back on a USD 160 loan if the house has a market value of USD 100 at the time of the default. If the lender cut the principal to USD 80, the homeowner would probably pay. If not, he would fix up the house and sell it. Either way the lender would get USD 80 instead of USD 40. The biggest policy mistake of the Obama administration in the current crisis was entrusting

Chart 8 Net monthly flow (excluding mods) from <60 days to ≥60 days DQ

(6-month average as of January 2009; percentages)



mortgage modifications to the servicers and the banks. The servicers do not own the mortgages and thus do not have the same incentives as the bondholders or the homeowners to write down principal. On the contrary, their incentives lie in not writing down principal. And the big bank lenders are afraid of taking an immediate loss on their books, even though they will incur a bigger loss down the road by foreclosing. I wrote about this over two years ago in two op-eds with Susan Koniak in the *New York Times*, predicting a foreclosure fiasco if the government did not act.

The same logic can be applied to the many underwater businesses in America today. What appears to be a lack of demand for investment may instead be an inability to borrow either because of debt hangover (as Myers pointed out in 1977) or because lenders now require too much collateral. Macro models that do not capture such effects cannot possibly predict the effect of a stimulus or the period of time until normal employment levels are restored. Reducing interest, which in the conventional historical times used to calibrate the standard macro models can be relied on to generate more activity, may be completely ineffective in the aftermath of a leverage cycle crash.

What applies to homeowners and businesses applies even more so to sovereign debts. After every leverage cycle crash, the government assumes some private debts and borrows to stimulate the economy. If the government debt was large before the crisis, it can become almost unmanageable after the crisis. In the United States, cities and states are beginning to cut back on vital services like policemen, firemen and teachers because they feel they can no longer increase their debt. When we add on top all the pension and medical obligations many western governments took on before the crisis, it is difficult to honestly maintain that any of them are solvent. This brief discussion is surely not the place to document my claim, but in my opinion many western governments will be obliged to scale down their promises, that is, they will have to find ways to write down their debts or default on them.

One of the standard methods for governments to write down their nominal debt is to inflate it away. A 20% inflation over four years would reduce US government debt by 20% and bring millions of homeowners out from underwater. As the need for debt reduction becomes more acute and as the money supply created by the government to stimulate demand via low interest becomes larger, the private sector will begin to expect inflation. Central bankers will declare that they will not allow inflation to start, presumably for fear that once started it may spiral out of control. However, such protestations will not stop the private sector from hedging by moving money into commodities, which will be where inflation begins. With unemployment high and activity low, central bankers will be reluctant to put on the brakes and the inflation will start to spread. The surest way for inflation to spiral out of control is if the central bankers vow it will never start and it does. Then people will really believe it is out of control.

It is generally believed that forgiving debt might start a chain reaction of defaults because the lender might then be unable to keep his promises, or that a default in one sector will lead lenders to expect a default in another sector and so kill lending there, or that debt forgiveness will create a moral hazard, encouraging future borrowers to take on too much debt and to strategically default. Most importantly, it is believed that default is immoral, that the defaulter deserves blame and that if one man's debt is forgiven, everyone's should be.

I believe that much of this viewpoint derives from the primitive creation of Conscience described by Nietzsche following centuries of punishment. Collateral is a much more sophisticated guarantor of delivery than punishment. It should spread the stigma of default to the lender. If the collateral falls so far in value that it no longer covers the loan, who is more to blame – the borrower or the lender? If a grocer goes bankrupt because he sells below cost (like the lender who asked for too little collateral), is the buyer to blame for purchasing on such absurd terms?

The Law recognises the difference between deception before the fact and default. A tort case and a contract case are treated differently. It may, in fact, be more blameworthy of governments to claim that all debts will be paid, say by entities they are bailing out or by programmes started many years before during boom times, even after they realise they will not than it was to make those promises in the first place when it was thought they could be paid. As Plato said, it is not always just to keep promises when unexpected or unusual circumstances arise.

My point, of course, is not that ancient philosophers understood default better than modern economists, but that we must change our models to incorporate default and lending terms in order to understand the macroeconomy in ways the ancient philosophers could not dream of doing.

Consider for a moment an example presented in Dubey, Geanakoplos and Shubik (2005). Each investor would like to borrow money because he is almost always much richer in the future, but each has a state in the future in which he will be quite poor. Suppose the government can set ex ante a penalty per dollar of default (say how long one goes to jail, or how long one's credit rating is destroyed). One might also think of the penalty as a pang of Conscience. How high should the penalty be set?

If the penalty is infinite, nobody will default and lenders can be sure to get their money back and so will lend at low interest. If the penalty is set lower, even for some people, then people will start to default, especially in the state they are poor. Lenders will then want a higher interest rate and even the borrowers who do not plan to default (but who cannot be distinguished from the low conscience borrowers by the lender) will face high interest rates. Moreover, the people who default will pay the penalty which is a pure deadweight loss for society. There seem to be several compelling reasons to eliminate default by setting high penalties.

Yet it is Pareto superior to set an intermediate level of penalty, allowing for some defaults, the resulting higher interest rates and the deadweight losses of paying the penalties. An infinite default would force people to repay even in their bad state, which, with diminishing marginal utility, would be extremely painful. Foreseeing this, they would not borrow much, even at low interest rates, and everyone would be worse off. Notice that the optimal default penalty allows agents in bad circumstances to default (in exchange for paying the penalty) not because they cannot repay, for in fact they could, but because it would be so painful to repay.

This story includes almost all the elements of default that are so scary to central bankers: lenders demand higher interest rates, even completely reliable borrowers must pay the higher rates, defaults occur, and the defaults are messy and incur deadweight losses. Yet it is socially optimal to have them!

Moreover, if the government could intervene and declare a situation a crisis ex post and mandate debt forgiveness, then there would be yet another Pareto gain because the messy losses from default would be reduced. Ex ante, the lenders would of course anticipate that they would be forced to forgive debt in some circumstances. But the point is that they would not have been paid in those circumstances with the ex ante optimal default penalty either.

One could ask a further question. Can the market set the default penalties? The answer, as shown in Dubey, Geanakoplos and Shubik is yes, just like the market sets leverage ratios. In some circumstances, the market will set the correct levels of penalties, in some not. But these penalties will have a profound effect on the levels of aggregate borrowing and lending and therefore on macroeconomic activity.

To the best of my knowledge, these kinds of considerations are completely absent from the calibrated models that guide macroeconomic policy. The ECB needs a macroeconomic model in which the anticipation of some sovereign default raises interest rates and then work out all the likely direct and indirect effects of an actual default. My guess is that the spectre of such an event makes modellers shrink from doing the labour to create the models.

9 PENSION PLAN DEFAULT

One of the principal sources of default is pension obligations. Firms, cities and states alike seem to promise more for future retirees than they can actually deliver. One important reason for this is the lack of regulatory guidelines. There does not appear to be a consensus on how much money should be required in the trust fund to back those promises, or how it should be invested, or even on how to compute the present value of the pension obligations. Discounting expected benefits at the risk-free rate gives astronomical numbers that would put most pension funds deeply underwater. Discounting at an equity return makes the liabilities seem manageable. I believe the reason for the lack of models and clear guidelines for pension plans is that regulators do not want to think seriously about default.

If they got rigorous about default and wanted to ensure that it never happened, they would need to force pension managers to cut all the risk out of their portfolios. But regulators and managers alike seem to agree that it is sensible to hold a large stake in equities because their expected returns are so much higher. Inevitably, that leads to scenarios where the pension fund defaults. This probability must be quantified and the consequences of default systematically investigated.

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