

Mortgage Backed Securities¹

Warning: This topic has more to do with finance than economics. Not being a finance professor, I find the details of financial instruments such as mortgage backed securities and credit default to be extremely complicated. Our goal is to generally understand how these instruments allowed risk to pass from the housing sector to the general economy.

Consider the following illustrative example of a simple mortgage: a household obtains a loan from a commercial bank. That commercial bank seeks to profit by charging an interest rate that is above the risk free rate. The bank, however, assumes the risk that is associated with that mortgage. This risk may be broken down into two components:

1. Default risk. There is a chance that the borrower will be unable or unwilling to make their payments. In this case, the lender may seek to foreclose on the borrower by trying to seize the collateral behind the loan, almost always the property. Foreclosure is a costly process. It entails surprisingly high legal fees. Additionally, if the value of the property has declined, it may not be worth as much as the outstanding loan.² Default risk is thus increased by declining home prices. Finally, foreclosure can be a drawn out process. During this process, the lender is unlikely to receive payments on the property and runs the risk that the property is damaged.

Some estimates place the cost of foreclosure at about 25%, on average, of the home's worth.

2. Prepayment risk. With many mortgages, the borrower is free to make extra payments on their loan.³ Such prepayment represents lost profit to the lenders.

In this simple example, the *originator* of the loan assumes both types of risk. In reality, however, the years prior to 2007 saw a proliferation of complicated financial instruments that allowed this risk to pass from the originator to other agents in the economy. Crucially, these other agents include organizations such as investment banks and insurers that are not direct participants in the housing sector. We now discuss a few such instruments:

i. *Mortgage backed securities* (hereafter MBSs) bundle a set of mortgages together and then distribute the rights to the cashflow (the sum of mortgage payments) to the owners of the asset. MBSs exist for both commercial and residential real estate. They may be organized on a geographic basis, by the

¹These are undergraduate lecture notes. They do not represent academic work. Expect typos, sloppy formatting, and occasional (possibly stupefying) errors.

²There are also anecdotes of foreclosed households vandalizing the property. I doubt, however, that this is a major cost.

³Many states have enacted laws that forbid or limit prepayment penalties. They are legal in Maine.

relative riskiness of the mortgages (*e.g.* subprime vs. prime), or by the type of loan structure (*e.g.* fixed rate vs. interest only mortgages). Some bundles may be homogeneous, while others may include a diverse set of loan types.

Many MBSs distribute cash flow based on tranches. Suppose, for example, that a MBS consists of \$100,000,000 of cashflow from subprime mortgages. The MBS may be organized as follows:

1. Tranche 1 owns the rights to the first \$10,000,000 of cashflow from the pool of mortgages. This tranche will receive payment unless the default rate is extremely high. It thus represents a low risk asset.

2. Tranche 2 owns the rights to the second \$10,000,000 in cash flow. This tranche receives payment only if the obligations to the first tranche is fully satisfied. It is thus a riskier asset than the first tranche.

...

10. Tranche 10 owns the rights to the last \$10,000,000 in cashflow. This tranche receives payment only if the obligations to all the other tranches are satisfied. It is thus the riskiest of all tranches. Because of this, the price is low and the expected return is higher.

This is just an illustrative example. MBSs are organized in countless different ways. Often, there are tranches within tranches and other grisly details.

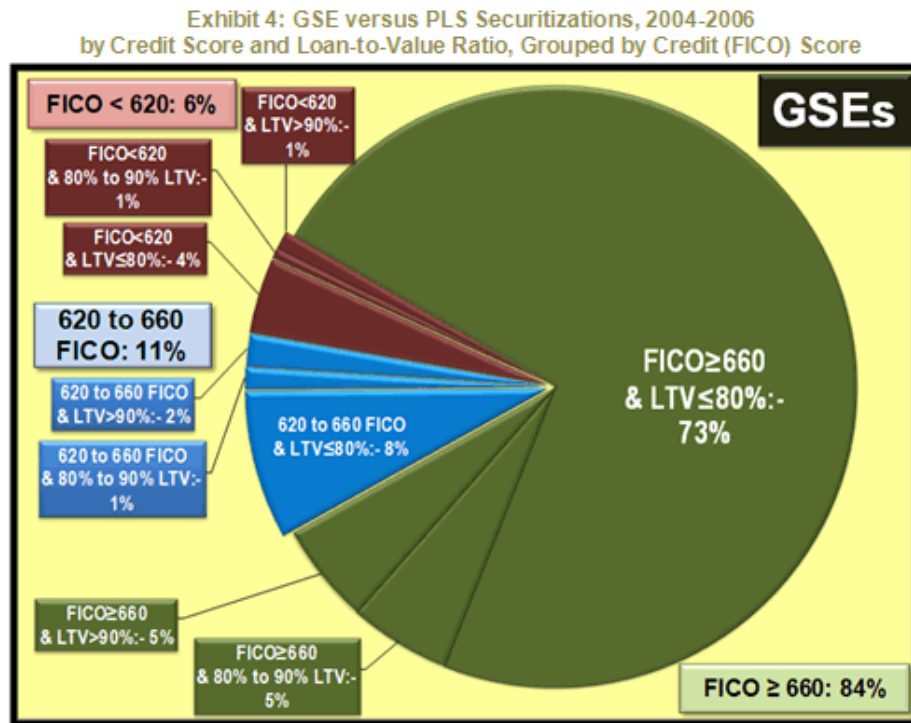
The original homebuyer is frequently unaware of the bundling, and often rebundling, of their mortgage. Usually, the originator of the loan continues to service it in exchange for a fee. If Fannie Mae or Freddie Mac purchases a home loan, for example, they send the borrower a letter making it clear that they should deal only with the originator of the loan, and not the agency. If the borrower makes their payments, then the pooling of their loan has almost no effect on their financial situation.

The pooling of mortgages does, however, cause complications if the the borrower goes into default. When a borrower becomes delinquent, the lender does not have to foreclose. They can instead choose forbearance where they seek to modify the terms of the loan, possibly accepting less or delayed payments in order to avoid the costs of foreclosure. If the originator of the loan continues to hold it, this process is straightforward. But if the loan is pooled, then it may be owned by many different agents and it can be very difficult to legally modify its terms.

MBSs can be further classified into two types:

1. Agency MBS are those created by Fannie, Freddie, or Ginny Mae. The third is a smaller GSE. Unlike Fannie and Freddie, Ginny Mae has always been explicitly backed by the government⁴ and is responsible for making loans through the Veterans Administration, the Federal Housing Authority, and other governmental programs. Agency MBSs consist of conforming loans, those that meet the standards set by the GSEs for them to guarantee that they will buy them from the originators of the loans.

One common definition of subprime mortgages are those issued to borrowers with FICO credit scores under 660. The following chart breaks down the MBSs securitized by Fannie and Freddie, and usually bundled into MBSs, between 2004 and 2006.⁵



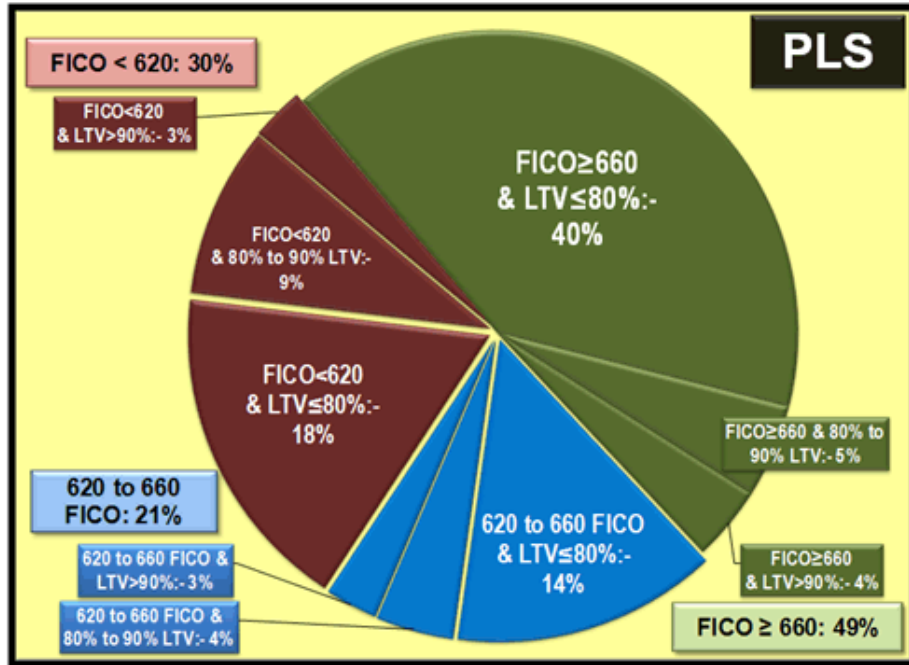
The chart also breaks the GSE loans down by loan to value ratios (LTV). Collectively, 84% of the GSE loans are to borrowers with 660 or better FICO scores. 85% have less than or equal to 80%.

2. Private label MBSs are those not issued by a GSE. The following chart breaks these down by type:⁶

⁴Ginny Mae is an agency within the Department of Housing and Urban Development

⁵Source: Fahey, Noel. 3/9/12. "The Two Phases of the Housing Bubble." available at <http://www.fanniemae.com/portal/about-us/media/commentary/030912-fahey.html>.

⁶Source: Fahey (2012).



Note that over half (51%) of private label MBSs are from borrowers with FICO scores less than 660. And 30% come from borrowers with FICO scores under 620 (compared to 6% from the GSEs); these are considered extremely risky loans. Fahey (2012) reports that the delinquency rate for these loans was 31% for private label and 22% for GSE. This is pretty solid evidence that the riskiest loans were being made by the private sector.

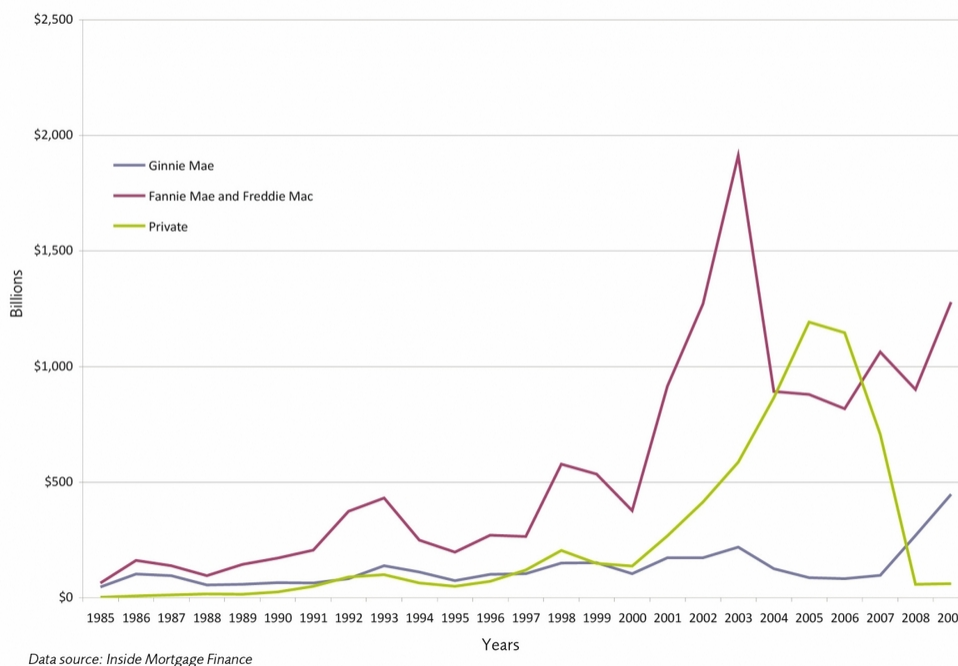
MBSs transfer the risk of mortgages from the originator to whoever owns the security. By pooling together loans, they were reasonably effective at aggregating away much of the prepayment risk associated with mortgages. As we will see, however, they did little to mitigate the default risk of these loans.⁷

The following table shows the recent history of MBSs by type:⁸

⁷You may hear about other types of financial instruments. *Asset Backed Securities (ABSs)* is a generic term that includes MBSs and many other assets that are collateralized. *Collateralized Debt Obligations* include MBS and other ABSs as well. These may pool together both mortgages and, for example, corporate bonds.

⁸Taken from <http://www.intellectualltakeout.org/library/chart-graph/issuance-mortgage-backed-securities-1989%E2%80%932009-billions-dollars>.

FIGURE 3: ISSUANCE OF MORTGAGE-BACKED SECURITIES, 1989-2009 (BILLIONS OF DOLLARS)



The volume of MBSs takes off around 2000. Initially, Fannie and Freddie are clearly driving the increase, a fact often noted by those who feel that the GSEs deserve much of the blame for the housing bubble. Around 2003, the GSEs begin to lose market share to the private sector. Note that once the housing bubble bursts, the private sector almost entirely ceases to issue MBSs. To this day, almost all new MBSs are created by a GSE. This final point is often noted by the defenders of the GSE bailout. They take it as evidence that, if the GSEs failed, then the mortgage market would have dried up even worse than it did.

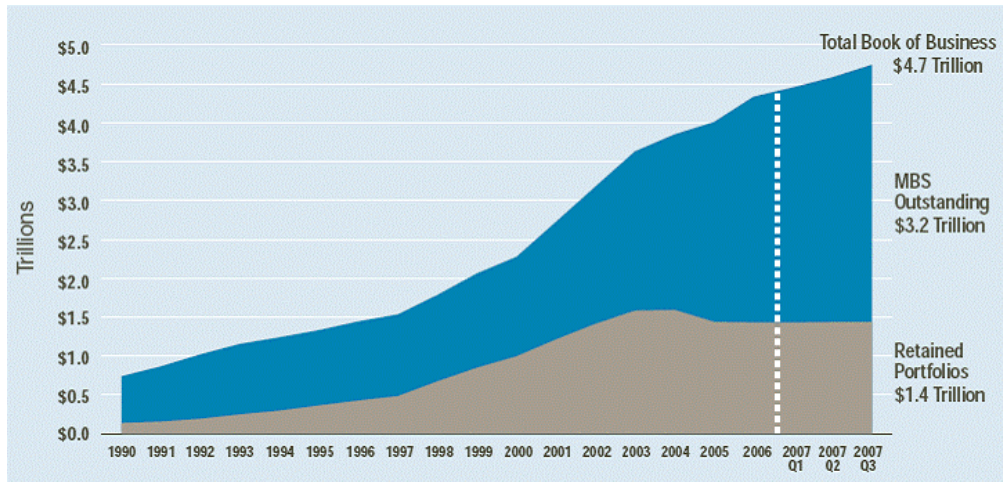
Often, the risk from the underlying mortgages was again transferred away from the owner of the MBS. The next two financial instruments offer the means of doing so.

ii. GSE Guarantees of Payment:

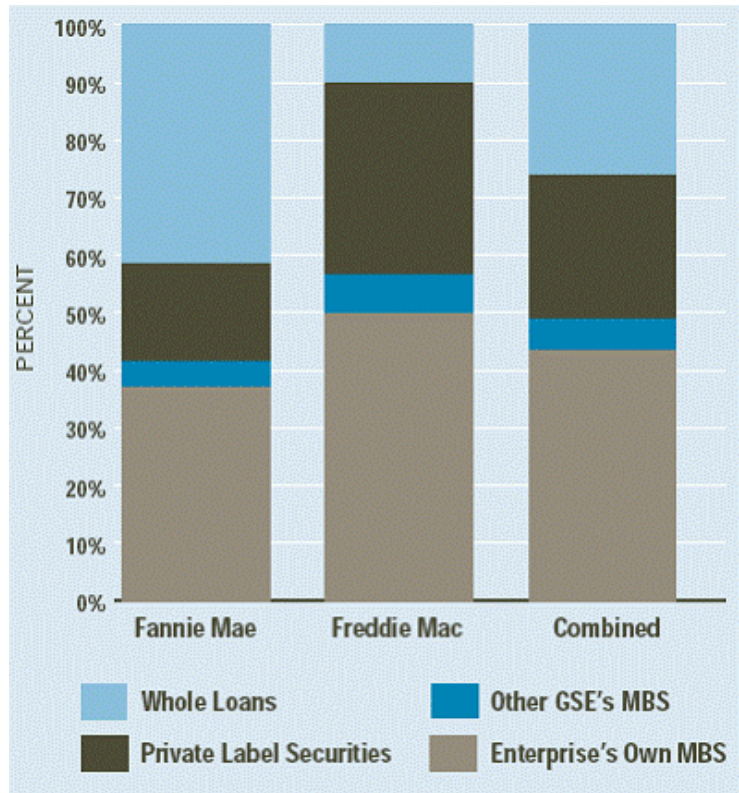
The GSEs held a large portfolio of MBSs by 2007, including those they created and some purchased private label MBSs. In doing so, they assumed the default risk of the underlying mortgages. In addition, however, for a fee they guaranteed payment on many of the MBSs that they created.

The following two chart show Fannie and Freddie's portfolio up to September 2007. It includes MBSs held and guaranteed. It peaks at \$4.7 trillion.⁹

⁹Taken from Menzie Chen and James Hamiltons' blog *Econbrowser*. See post "Freddie Mac and Fannie Mae back in the news," 11/21/07, available at: www.econbrowser.com/archives/2007/11/freddie_mac_and.html.



The next chart breaks this portfolio by origination type for September 2007. It clearly shows that the GSEs were purchasing significant quantities of private label MBS. This was a fairly recent development, until about 2005 they held very few of these.



iii. Credit Default Swaps

Credit default swaps are essentially a type of insurance where one party agrees to compensate another in the case of default. The global market for these is in the tens of \$ trillions. They apply to all types of debt including MBSs, corporate bonds, and government bonds. Our focus, however, is on the use of these swaps to insure private label MBSs.

The GSEs generally do not guarantee payment on private label MBSs. Private insurance firms, such as the American Insurance Group (AIG), do. During the housing bubble, many such insurance firms assumed large amounts of risk by doing so.

These three financial instruments allowed risk to escape from the housing sector to the overall economy. The groups that held MBSs, including GSEs and investment banks, were exposed. So were the groups that insured payment on MBSs, including GSEs (again) and private insurers. Investment banks, of course, are responsible for facilitating credit in areas largely unrelated to housing. Insurers also obviously insure many things besides MBSs. Anyone using the services of investment banks or insurers therefore became indirectly linked to the potential for a collapse of the housing bubble.

NINJAs

The most egregious type of subprime loan is known as the NINJA loan – No Income, No Job or Assets. Exact data are not available¹⁰, but they do seem to have been a small but significant part of the subprime mortgage market. Unsurprisingly, these loans exhibited a very high default rate.

It is difficult to explain why a profit maximizing lender would make such a loan. We conclude this topic by considering three, non-exclusive and non-exhaustive, explanations:

1. Increasing home prices.

If housing prices are increasing rapidly enough, then it is possible for a NINJA to avoid default. As long as they are able to borrow against their increased equity in order to make payments and pay related costs (*e.g.* property taxes), this can continue as long as housing prices are rising fast enough. It is thus possible, for the reasons discussed earlier in the class¹¹ that the originators of NINJA loans genuinely expected home prices to continue to increase, and default rates to therefore remain low.

2. Informational Failures.

A profit maximizing lender may be perfectly happy to make a loan that will default with probability one if it knows that it can sell that loan to someone else at a desirable price. And this was often

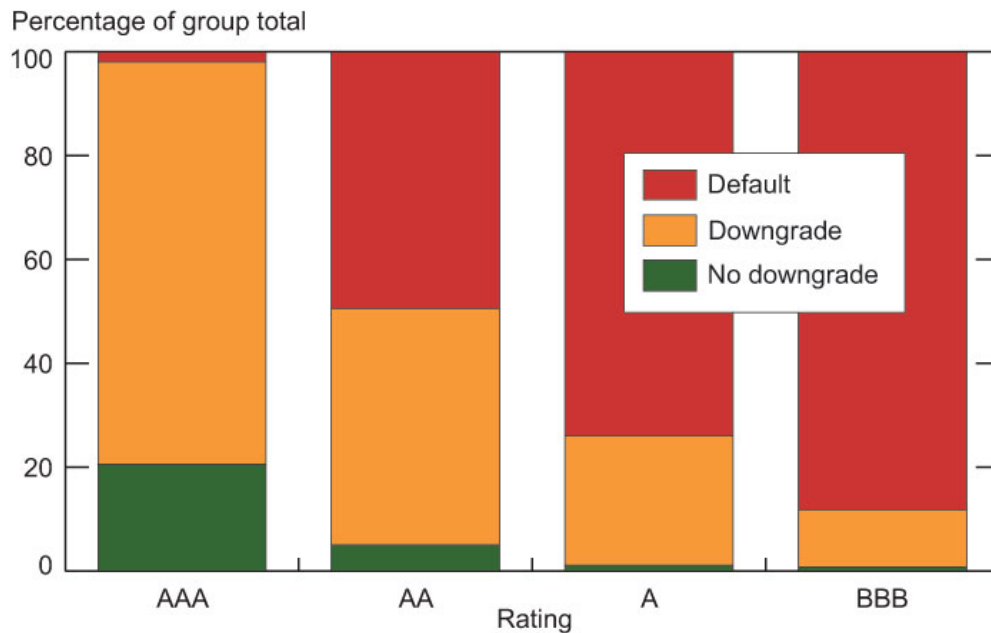
¹⁰Well, I couldn't find them.

¹¹See the notes for "Speculative Bubbles."

the case for subprime loans; the originator was often easily able to bundle the loans into a MBS and offload that risk to another party. This, however, raises an obvious question: why would anyone have purchased such an asset?

There are three major credit rating agencies in the United States (Standard & Poors, Moody’s, and Fitch). These agencies make assessments of risk on all types of assets, including MBSs. Prior to the financial crisis, these agencies consistently gave indefensibly strong ratings to many subprime MBSs. The following graph shows investment grade (BBB or better) MBS ratings and their subsequent performance.¹²

Downgrades and Defaults on Investment-Grade Subprime MBS Issued in 2005-07



Source: Author's calculations, based on Intex and ABSNet data.

Critically, the bulk of the securities end up in default or at least downgraded.¹³ This is not definitive proof that the ratings were bad. Hypothetically, the ex-ante default risk could have been 1 in a million

¹²Source: Vickery, J. 2/15/2012. “The Dodd-Frank Act’s Potential Effects on the Credit Ratings Agency.” *Federal Reserve Bank of New York’s Liberty Street Economics*.

¹³93% of AAA rated subprime MBSs from 2006 have been downgraded to junk status. See Krugman, Paul. 4/25/2010. “Berating The Raters.” *New York Times*.

and the owners were then just unlikely. Few observers believe this, however, it seems far more likely that the ratings were indefensible all along.

It is harder to explain why the CROs performed so badly. One suggestion is that they were simply stupid, believing in specious logic such as:



Others have suggested that they ratings agencies were aware that their risk assessments were off base, but did not care due to competitive pressures or manipulation from the creators of the MBSs. The *investor pays* model has been cited by many as part of the problem. Here, the issuer of the security pays the ratings agency to issue the rating. If reputational concerns are too weak, they may thus be incentivized to issue ratings that are too good, which yield more profits for the issuer, and more future business for the rating agency.

Another possibility is that the rating agencies were aware of the weakness of their ratings but that individual employees didn't care because they expected to have left their firms before problems emerged. Controversy erupted when an email chain about CDO ratings emerged where one S&P executive wrote about their ratings:¹⁴

Let's hope that we all all wealthy and retired by the time that this house of cards falters.

The performance of the ratings agencies is important because, having often been rebundled several times, it is difficult for an investor to see exactly which loans comprise a MBS. Many purchasers of MBSs thus relied on these ratings and were therefore willing to purchase very risky assets.

The ratings agencies seem to have survived the financial crisis intact. Interesting, they seem to be relied on much as before.¹⁵

¹⁴12/15/2006 email from Chris Meyer to Belinda Ghetti and Nicole Billick.

¹⁵Many financial contracts require that an asset receive a certain grade from a Nationally Recognized Statistical Rating Organization (NRSRO). The Securities and Exchange Commission determines which firms qualify as NRSROs and it is a fairly small set. This designation probably helped the rating agencies survive their debacle because their role in the financial system had become formalized by this system. The number of NRSROs has, however, grown from 3 since the crisis.

3. Misjudging the Nature of the Housing Market

Another explanation is that agents misunderstood the relationship between different housing markets. On one extreme, we can suppose a single housing market where housing prices in all locations are perfectly correlated. On the other, we can imagine a very large number of unrelated markets. It isn't obvious which is closer to the truth.

There is anecdotal evidence that many people believed that housing prices across locations were only weakly correlated. We now set up a simple model to illustrate why this question is important. Start with the following assumptions:

1. An individual subprime borrower obtains income ranging between \$0 and \$100.
2. An individual subprime lender must obtain income equal to X or he will default on his mortgage, be evicted from his home, and end up being eaten by a bear.
3. If a fraction of borrowers, Z default on their loans, then all subprime lenders end up going bankrupt, and the executives will be evicted from their homes and eventually end up being eaten by mountain lions.
4. The income for any individual borrower i equals: $Y_{i,t} = e_{i,t} + u_t$. $e_{i,t}$ represents the household specific shock to the borrower's income and ranges between \$0 and A with all values being equally likely. u_t is an economy wide shock that ranges between \$0 and $(100-A)$ with all values being equally likely. If A is large, then the model assumes that a borrower's income is largely determined by personal matters and has little to do with the entire macroeconomy. If A is small, however, then the macroeconomy largely determines the borrower's income and individual issues are not as important.

Many lenders seem to have taken the view that a national housing market did not exist, but housing instead consisted of fairly independent markets. As a result, they were fairly unconcerned with the possibility of dramatic increases in default occurring nationwide. We can model this outlook by setting A close to \$100.

Suppose that $A = \$100$, $X = \$20$, and $Z = \frac{1}{2}$. For a sufficiently large number of borrowers, 20% of borrowers will default and there is thus no chance of lenders failing and hence no mountain lion mauling risk.

Suppose, however, that lenders are mistaken and that the national housing market is highly sensitive to national macroeconomic shocks. We can model an extreme case by setting $A = \$0$. In this case, all borrowers obtain the same income and there is a 20% chance that all borrowers default.

Therefore, a 20% chance exists that all lenders will fail. By underestimating the integration of the all housing markets to nationwide shocks, lenders have underestimated the risk involved with subprime lending. A strong negative shock may then cause a financial crisis.



By bundling mortgages together, lenders are able to aggregate away the individual riskiness ($e_{i,t}$) of loans. There are unable, however, to fully protect themselves against aggregate risk (u_t). [Note: This is similar to how holding a diverse portfolio of stocks protects the holder against firm specific risk but does not protect against the probability of downturn in the general market.] Several macroeconomic factors may be interpreted as representing low values of u_t in this basic model. Later in the course, we will formally model credit effects. For now, however, we will briefly list them:

1. Declining home prices. Most analysts felt, prior to the bursting of the bubble, that real estate prices might level off, but that a dramatic decline was unlikely. There are a number of ways that declining home prices can harm those owning the cash flow on mortgages: i) if a home's value is increasing, borrowers can refinance their loans and use the cashed out equity to make their mortgage payments. Declining home prices prevent this. ii) when borrowers default, the creditor is able to take possession of the home which is now worth less, and iii) if borrowers are underwater, owing more than the value of the home, they may have an incentive to default, even if they could make their payments. Most states do not allow mortgage holders to pursue the assets of a borrower in default beyond the underlying property. The housing bubble did not affect all parts of the country equally and declining home prices were therefore not perfectly correlated in all markets. The bubble was vast enough, however, so that home prices in different markets were significantly, if not perfectly correlated.

It is clear that declining housing prices have increased default rates. This includes both voluntary defaults (able to pay but choosing not to, as in the case of an underwater mortgage), and involuntary defaults.

2. Higher unemployment. Clearly workers who lose their jobs are more likely to default. Also, almost all states have seen their unemployment rate rise since 2007, suggesting a strong correlation across markets. Higher unemployment also introduces positive feedback into the economy. As home prices fall, unemployment in the construction industry increases, further reducing home prices, etc.

3. Lower wages. As with higher unemployment, this also introduces positive feedback that further depresses home prices and wages.

4. Higher interest rates. Higher interest rates increase the user cost of housing. It follows that more households will be unable to make their payments. Many of the early foreclosures were caused by higher interest rates on adjustable rate mortgages. Since interest rates have fallen, however, this has become less of a factor.