

A Retrospective on the Subprime Mortgage Problem

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Looking back we can see that an asset price bubble started in the US in January 1995 when the S&P500 stock index started rising at a rate well in excess of 10% per year (see Figure 1). This was the dot-com bubble. The rising stock market was joined by rapidly rising housing prices in 1997 when US housing prices started to grow at a rate of 10% per year or more. The stock market bubble was over by 2002 and housing prices started to decline in August 2006. The end of the asset price bubble precipitated the financial crisis that started in the summer of 2007.

The causes of the asset bubble are hotly debated. Possible candidates include US monetary policy (low interest rates), US housing policy (attempting to make home ownership available to all), and US regulatory policy (failing to adequately regulate financial institutions). Export driven economies such as Japan, Germany and China also played a role since a fundamental rule of economics is that in order to run a trade surplus you must provide financing for your customer, in this case the US. This low cost financing stimulated consumption in the US contributing to rising asset prices. In addition to the possible causes listed above much criticism has been aimed at the alphabet soup of securitizations (RMBS – residential mortgage backed security, ABS – asset backed security, CDO – collateralized debt obligation, ABS-CDO, CDO-squared, and so on) and the role of the rating agencies in assigning AAA ratings to many of the securitizations.

What were the Subprime Securitizations?

A typical securitization consisted of a portfolio of about 1,000 mortgages. Investors were allowed to invest in these assets by buying securities called tranches whose interest and principal payments were based on the interest and principal payments made by the mortgage holders. The securities issued were differentiated in terms of their priority in receiving the mortgage cash flows. The mortgage interest payments were first used to pay the promised interest payments on the most senior tranche. Any remaining cash after making these payments was used to make

¹ It should be noted that Alan White is a member of Moody's Academic Advisory and Research Committee”.

interest payments on the next most senior class of security and so on. Principal payments were distributed in a similar fashion.

Defaults in the pool of mortgages reduced the amount of interest and principal available to be paid. Because of the sequence in which payments were made these reductions in principal were borne by the most junior tranche. If the principal amount lost due to defaults in the mortgage pool exceeded the investment of the most junior tranche-holders subsequent losses reduced the principal repayments to the next most junior tranche, and so on. The result of this sort of structure was that the most senior tranche constituted a very secure investment, almost certain to be paid, while the more junior tranches were progressively more risky investments.

The economic forces driving this style of securitization were twofold. First, there were many investors who preferred to invest in high quality debt. The most senior tranches provided the sort of high quality debt that these investors wanted. Second, the regulatory regime applied to banks allowed the bank to reduce the amount of capital held if the bank invested in the high quality tranches of the mortgage securitization rather than the mortgages themselves. As a result banks were motivated to take the mortgages that were on their balance sheet, create a securitization and then retain most of the tranches for themselves thereby reducing their regulatory capital. In order to satisfy these two groups it was necessary to have the tranches rated by a rating agency.

How were the Tranche Ratings Determined?

The traditional business of rating agencies is the rating of corporate and sovereign bonds. The rating is based on an examination of the revenues and expenses of the debt issuer among other things. The rating represents an opinion about the investment quality of the debt. Although the rating process is relatively subjective, rating agencies try to ensure that their ratings are consistent over time. To do this they gather statistics on the default experience of bonds with different ratings. For example, about 0.1% of AAA-rated companies default over the following five years; for a company rated AA, this default probability is about 0.2%; for a company rated A, it is about 0.5%; and so on. The rating agencies try to ensure that the assignment of ratings is such that these default rates remain fairly constant over time.

When asked to rate the new structured products that started to appear around 2000 the rating agencies settled on using the probability of incurring a loss due to default as the procedure for assigning ratings.² If the probability of a AAA-rated bond experiencing losses during a five-year period is 0.1%, a securitization tranche that has a probability of experiencing a loss over the next five years that is no greater than 0.1% will also be rated AAA.³ Tranches with higher probability of loss would be given lower ratings.

In a typical subprime securitization the size of the most senior tranche was about 80% of the size of the pool of mortgages.⁴ In order for this tranche to suffer losses due to default more than 20% of the mortgage pool principal would have to be lost due to defaults. The historical experience was that when a mortgage defaulted the loss was about 25% of the amount owed, the balance being recovered by foreclosing on the property and selling it. So if past experience was any guide about 80% of the portfolio would have to default in order to generate the 20% of losses required to impair the senior tranche.

The historical default rate for mortgages varies with the business cycle and with the quality of the mortgage. The historical experience with subprime mortgages were default rates between 2% and 7% per year. Given this range of experience, statistical methods⁵ were used to determine whether the worst case default rate was sufficiently low to ensure that the AAA-rated tranche would be impaired less than 0.1% of the time. Based on the historical information available at the time it appears that the AAA-rating was reasonable.⁶

What Happened?

Following the collapse of the asset bubble mortgage default rates rose sharply and recovery rates fell dramatically. Many of the tranches that had been rated AAA suffered losses due to default.

² In practice the methodology that each agency used evolved over time. Only S&P and Fitch use the probability of default approach. Moody's uses a slightly different approach.

³ The use of a 5-year time horizon is a simplification. In practice the rating agencies considered the possibility of default throughout the entire life of the securitization.

⁴ This was the case for early securitizations. As the quality of the mortgages being securitized worsened in 2005 and 2006 the rating agencies became more conservative in their assumptions and the size of the most senior tranches became smaller.

⁵ The procedures used are referred to as copulas. These statistical tools allow one to estimate the degree to which defaults will cluster together based on the average default rate and the variability of the default rate.

⁶ See "The Risk of Tranches Created from Residential Mortgages," John Hull and Alan White, *Financial Analysts Journal*, forthcoming.

Did the rating agencies get it wrong? Many people including the US Senate seem to think so. However, based on the information available at the time the ratings appear reasonable. Even if one were to go back and apply more stringent assumptions the ratings would have been lowered only by a small amount. As a result the defaulting tranches would have been rated AA perhaps rather than AAA.

A security rated AAA is not guaranteed not to default. In fact, our experience has been that about 0.1% of AAA-rated bonds default within five years. The surprising fact in this case is that so many AAA-rated tranches suffered losses. Part of the reason for this is all of the securitizations were the basically the same. They differed only in detail. As a result it was as though only one securitization with many guises was rated. When the US housing sector collapsed the securitization in all its guises suffered.

Did the securitizations and their ratings cause the collapse of the financial sector in 2007? Probably not. The securitizations did make it easier for mortgage arrangers to provide mortgages to unqualified borrowers. In this way they contributed to the problem. However, the most egregious problem loans represented a small fraction of the total pool. The main problem was tied to the collapse of the much more broadly based asset price bubble.

Figure 1

A US equity index and a US housing price index depicted on a logarithmic scale. The slope of the index lines shows the rate of return earned. A constant 9.5% rate of return is shown for reference purposes.

