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Credit Crisis Lessons for Modelers

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DOES THE CREDIT CRISIS MEAN THE HERALDED AGE OF THE Quant has passed? Much of the blame for the current credit crisis is being laid at the feet of the analysts responsible for modeling and evaluating the innovative debt securities driving the massive losses for financial institutions. How was the modeling of these securities so wrong?

An article recently published by four Federal Reserve economists, "Making Sense of the Subprime Crisis,"¹ provides some insight into what information was available for analysts during 2005 and 2006, the time period of loan origination associated with the most toxic segment of the subprime securities. The falsely optimistic pitch to investors could have been based upon the following points:



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- 1. The subprime market fundamentals were considered to be strong.** Lending in this market had evolved toward subsidiaries of large, reputable financial services companies, replacing the small, thinly capitalized lenders of the 1990s. Lenders were increasing the use of quantitative models based on credit scores for loan underwriting, which were demonstrating an improvement in average FICO scores for subprime borrowers. Furthermore, the historical performance of subprime mortgage securities had shown them to have more stable credit ratings than similarly rated corporate bonds. With increased use of automated underwriting, improved credit score transparency and more reputable lenders, the performance of subprime securities was expected to remain strong.
- 2. Subprime securities were expected to have less interest rate risk than prime mortgage securities.** Prime mortgage borrowers had demonstrated a tendency to refinance their loan and pay off their existing loan when interest rates decreased. This correlation to interest rate changes was problematic for investors because it increased the interest rate risk for these securities. Subprime loans demonstrated a more stable prepayment rate, as their refinancing tended to be less

correlated with market interest rates, and more correlated with individual borrower financial difficulty. This source of prepayment was diversifiable for a large pool of independent borrowers. Furthermore, as much as 80 percent of subprime mortgages contained prepayment penalties,² further reducing the likelihood of the mortgages to be refinanced if interest rates decreased. These features reduced the perceived interest rate risk of subprime securities, making them arguably a safer investment than a prime mortgage security with the same credit rating.

- 3. The strong housing market was expected to minimize the downside risk of subprime loans.** The data typically used to evaluate these securities went back to 1998. Data prior to 1998 was not thought to be as relevant due to the changes in the industry regarding loan originators and the more automated underwriting process. Unfortunately, that time period did not contain a recession, nor did it contain a period of sustained home price declines. A Citigroup December 2005 report is quoted as stating:

"the risk of national decline in home prices appears remote. The annual HPA has never been negative in the United States going back to 1992."

Home price appreciation (aka HPA) all the way back to 1992 has not been negative. What could possibly go wrong?

The basics of this story look very familiar to what occurred in the P&C insurance industry during the depths of the soft market of the late 1990s. Underwriters and brokers were making assertions that the re-underwriting of books would mean that future results would be better than historical loss experience indicated. Changes in claim handling were also expected to reduce the future development that standard actuarial loss triangle methods were predicting. Management teams were proclaiming that the diversifying of their portfolios into new lines of business would reduce the risk of loss as well. Wall Street errors of the current crisis echo these soft market mistakes of the P&C industry. Both Wall Street and the insurance industry have demonstrated

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a propensity for underestimating risk, although the bankers seemed to have discovered a way to receive an extra zero or two at the end of their paychecks while doing so. Going forward, what can those who attempt to quantify risk for a living learn from these missteps? First, recognize that the accuracy of a model is limited to the accuracy of the input assumptions. Complex models can provide a false sense of security, hiding the evidence that the entire range of indications may hinge on one or two key assumptions. Use data-driven assumptions, making sure the time series includes stressed environments when possible. If a model of underwriting risk indicates that the probability of accident year combined ratios experienced from 1998 to 2000 is remote, it is not a realistic model.

Second, stress test key assumptions. In most insurance risk modeling exercises, the correlation assumptions between lines of business and between other risk elements drives the tail of the results. These correlation assumptions should be transparent, while the model needs to be able to stress test the impact of increased correlation between risk elements. Each new market crisis demonstrates that correlation in stressed environments is much higher than historical averages would indicate.

Finally, understand the limits of the data being used and acknowledge the resulting uncertainty. A model built on five to 10 years of data provides limited information about a 100-year PML. Many analysts of subprime securities recognized that using data since 1998 was less than ideal and not fully representative of all possible scenarios. Extrapolating beyond the historical data, they made reasonable estimates of the potential losses to securities backed by subprime loans if home prices were to decrease. However, their biggest mistake was to underestimate the probability of U.S. housing prices dropping nearly 20 percent from 2006 to 2008 in the largest metro areas. This error demonstrates that the quantification of remote probabilities is more difficult than the quantification of possibilities.

To further illustrate this point, Nassim Taleb presents the clever story of a turkey being raised on a farm in



his book *The Black Swan*. Every day of its life, when a turkey sees the farmer, it gets fed. Based upon that experience, when the turkey sees the farmer coming out of the farmhouse the day before Thanksgiving, it sees no reason to be concerned. This very big error in judgment regarding the risk posed by the farmer is driven by the fact that the turkey's prior experience period did not include a Thanksgiving.

To make sure the end users of model projections do not make the same errors in judgment as the turkey, modelers should maintain the humility to document the limits of the data underlying their model, providing transparent summaries of the key assumptions and their impact to the uncertainty of the estimates. Don't mistake modeled probabilities for real world results.

What Thanksgiving is your model potentially missing? What are you doing to address it? ■

END NOTES:

¹ K. Gerardi, A. Lehnert, S. Sherlund and P. Willen, "Making Sense of the Subprime Crisis," Sept. 5, 2008.

² G. Gorton, "The Panic of 2007," Aug. 4, 2008.