

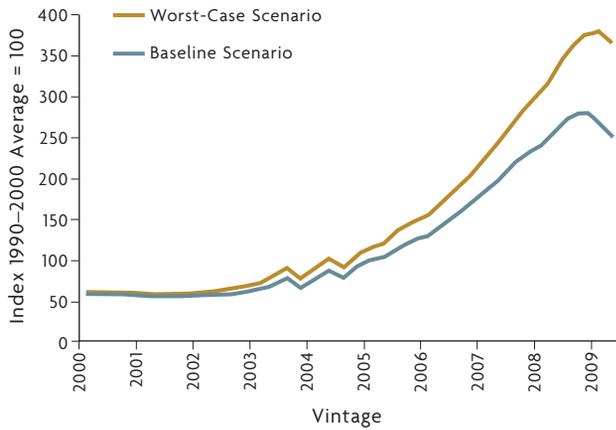
Dissecting Defaults

Historical trends in foreclosure activity are a function of both prevailing underwriting quality and economic conditions. This look back at foreclosures from 1979 through the present reveals how economic conditions and underwriting quality were about equally responsible for the spike in defaults from 2005 onward. A move away from fully documented loans was a key factor in the portion of defaults due to underwriting during that spike.

BY DENNIS CAPOZZA AND ROBERT VAN ORDER

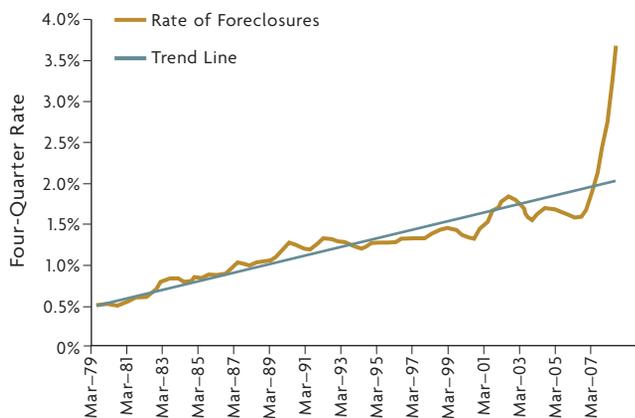
For lenders, investors and regulators, an important risk-management exercise is to understand possible worst-case scenarios. A worst-case scenario enables decision-makers to quantify the downside risk and prepare mitigation strategies if prudent. ■ Decision-makers can monitor the indicators (for example, house prices), determine ways to limit the worst risks and maybe even know when they are seeing the light at the end of the tunnel. ■ In this article, we will consider historical trends in mortgage foreclosures and house price values, and link those particular trends to trends in the economic environment—including local economic conditions at time of origination and developments in underwriting quality. ■ All of these factors can shed light on how the current crisis developed, and help us understand our worst-case scenario.

Figure 1 The UFA Default Risk Index (Constant-Quality Loan by Vintage)



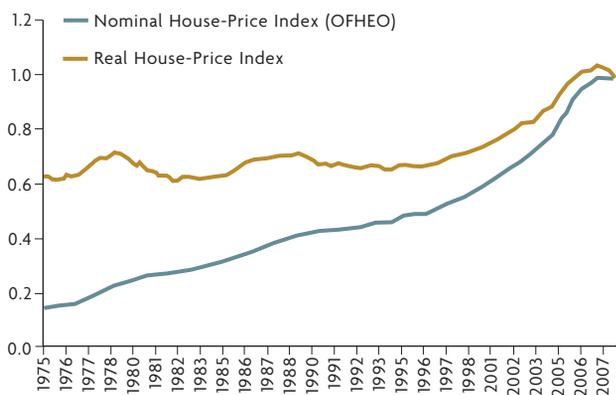
SOURCE: UNIVERSITY FINANCIAL ASSOCIATES LLC (UFA)

Figure 2 All Foreclosures Started: U.S. 1979–2008 Quarterly Data (Four-Quarter Averages Annualized)



SOURCE: MORTGAGE BANKERS ASSOCIATION (MBA) NATIONAL DELINQUENCY SURVEYS

Figure 3 Real and Nominal House-Price Indexes, 1975–2008 (2007 = 1.0)



SOURCE: OFFICE OF FEDERAL HOUSING ENTERPRISE OVERSIGHT (OFHEO)

Are the worst quality-adjusted vintages behind us?

Each quarter, University Financial Associates LLC (UFA) calculates its Default Risk Index, which tracks the impact of local and national economic conditions on expected life-of-loan mortgage defaults by vintage. By holding borrower credit and loan terms constant, the index is able to isolate the effects of local and national economic conditions from the myriad other variables that affect loan performance.

The Default Risk Index is one of the simulations that UFA runs to help risk managers understand future economic risks. A simulation is a model of real economic conditions, in which key measures of the economic environment, such as gross domestic product (GDP), unemployment or house prices, are treated as variables whose interaction can be expressed in mathematical equations. With these tools, an economist can model what might occur if GDP growth falls to -5 percent, or if unemployment climbs to 15 percent in a given time period. Hypothetical numbers for GDP or unemployment are the input for the equation, and predictions—such as house prices or mortgage default levels—are the output. In a worst-case scenario, economists estimate what values the variables might reach if everything were to go wrong with the economy. A baseline scenario is business-as-usual; the variables are given values close to trends.

In UFA’s worst-case scenario, GDP will decline 5 percent for two years, followed by two more years of positive 1 percent growth before returning to trend growth. The worst-case scenario is much worse than any of the post-war recessions, but far better than the 1930s.

In such a worst-case scenario, the UFA Default Risk Index peaks at 376 in first-quarter 2009, while in the baseline scenario it peaks in fourth-quarter 2008 at 279 (see Figure 1). The index reading represents a comparison with the average of the 1990s (1990s = 100). For the worst vintage, first-quarter 2009, it is estimating the worst-case risk of default on newly originated nonprime mortgages at 2.76 times higher than the average of the 1990s. Compare this number for the baseline scenario, which peaks one quarter earlier at 2.79 times higher than the 1990s average. The index is telling us that the loans originated in fourth-quarter 2008 and first-quarter 2009 are likely to default at the highest rates after controlling for other risk factors such as loan-to-value (LTV) ratio and credit scores. In either scenario, the worst vintages are already behind us, in fourth-quarter 2008 and first-quarter 2009. This is an important result of our scenario experiment. It means that very likely we have already seen the worst economic environment for originating loans that this credit cycle has in store for us.

To understand the UFA Risk Index and the worst-case scenario results in a broader context, let us turn to an examination of trends in loan performance, collateral performance, economic conditions, underwriting quality and the relationships among these factors.

The long-run trend in foreclosures

Figure 2 shows the foreclosures started as a percent of outstanding number of loans from 1979 through 2008. There is a rising trend with an occasional leveling off. Between 1979 and 2002, foreclosure rates quadrupled, going from 0.48 percent to 1.96 percent annually. In an impressive surge from 2006 to 2008, foreclosure rates more than doubled again,

jumping from 1.88 percent to 4.32 percent.

Figure 2 includes a linear trend line. The actual rate of foreclosures rises above the trend line just after the recessions of 1981–1982, 1990–1991 and 2001. During the intervals of economic expansion, the rate dips below the trend line.

This evidence highlights the role of national and local economic conditions in the rate of foreclosures, which we discuss in more detail later. To the extent that increases in foreclosure rates are recession-induced, the spike from 2006 onward points to a very severe recession.

The trend in house prices

Modern theories of mortgage valuation treat the borrower's financial position in the mortgage contract as analogous to that of a buyer of a put option on a stock, where the house is the underlying asset instead of the stock. Like a put option, the buyer has the right, but not the obligation, to default and surrender the underlying asset (the house) at an agreed-upon price (the loan balance) within a specified time period (the mortgage term). One implication of this approach is that the put option should be sensitive to the value of the collateral.

When collateral prices are rising, a financially stressed borrower with equity will rationally choose to sell his or her house rather than default. Correspondingly, when house prices are falling and equity becomes negative, stressed borrowers are more likely to rationally choose default. Therefore, it is important to understand both collateral prices and financial stress as they relate to foreclosures.

Figure 3 plots real and nominal house prices since 1975. There is a cyclical pattern to real house prices from 1975 to 1997 within a narrow range. However, during the boom years from 1997 to 2007, real house prices rose about 40 percent above what had been the long-run level until that time.

Such steep increases should be expected to greatly reduce the need for stressed borrowers to default. Because many lenders develop underwriting models by evaluating recent loan performance data, looking back only two to three years, any underwriting models created using data from this boom period would underestimate the risks to lenders in more average times.

Separating underwriting from economic conditions

Figures 2 and 3 highlight the historical effects of economic conditions on foreclosures. One of the goals of our recent research has been to decompose the rate of foreclosures started in the national serviced portfolio, as reported by the Mortgage Bankers Association (MBA), into an underwriting component (both observable and unobservable) and a component arising from economic conditions.

For a detailed technical discussion of how we separated the effects of economic conditions from the effects of underwriting quality in the data, and how we fitted the forward-looking (predictive) Default Risk Index to the backward-looking (reported) rates of foreclosure in the MBA data, see the May 2009 research paper co-authored with Charles Anderson, *Deconstructing a Mortgage Meltdown: A Methodology for Decomposing Underwriting Quality*, pages 12–17, available at www.ufanet.com.

Figure 4 presents results of our data analysis for all loans. In Figure 4, one can see that defaults due to underwriting (i.e., of default rates after controlling for economic

conditions) went up as defaults due to local economic conditions went down; in other words, a strong economy was covering for poor underwriting quality.

The estimated variations by prime and subprime tell a similar story. For this story we focus on “All” foreclosures started, which have the longest time series and deepest data.

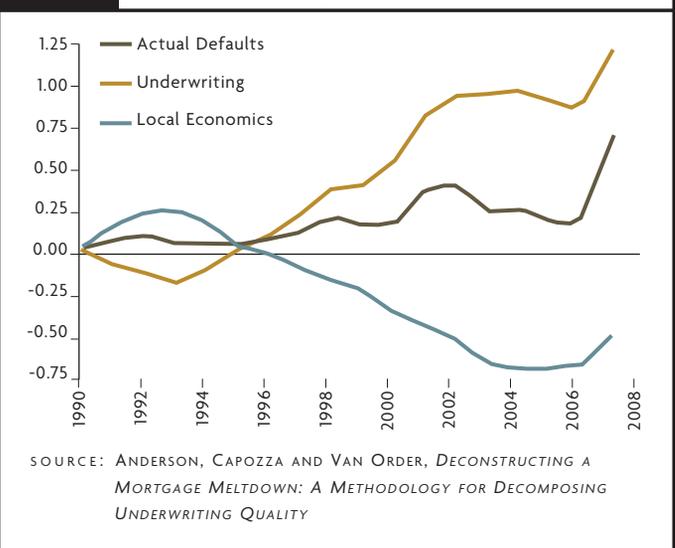
The line labeled “Actual Defaults” in Figure 4 gives actual foreclosures started relative to the 1999 baseline. The line labeled “Local Economics” identifies the part played by economic conditions (how foreclosures would have moved had underwriting not changed), which promoted declining foreclosures until 2004. And the line labeled “Underwriting” shows the contribution of underwriting quality to foreclosures started (or how foreclosures would have changed had economic conditions not changed). The contribution of underwriting quality was positive (more defaults) early in the period, negative later and sharply positive in 2006 to 2007.

For example, in 2004 the line labeled “Underwriting” shows the curve for underwriting is 1 while actual defaults are 0.25 and the economic conditions index is -0.75. This means that while actual default rates rose 25 percent from 1990 to 2004, if economic conditions had not been so favorable, foreclosures started would have risen by 100 percent instead of 25 percent. Underwriting quality eroded enough to double the level of foreclosures started by 2004; but only a 25 percent increase was realized because favorable economic conditions offset three-fourths of the potential increase. During this period, house prices appreciated steadily in most of the country.

The recessions of the early 1990s and of 2001–2002, when unemployment was rising, are visible in the line showing local economic conditions curves of Figure 4, but they are dominated by the other very favorable economic effects such as rising house prices. Both recessions were accompanied by brief periods when underwriting standards tightened, as reflected by declines in the line showing underwriting curves, confirming that lenders do respond to recent loan performance by adjusting underwriting standards.

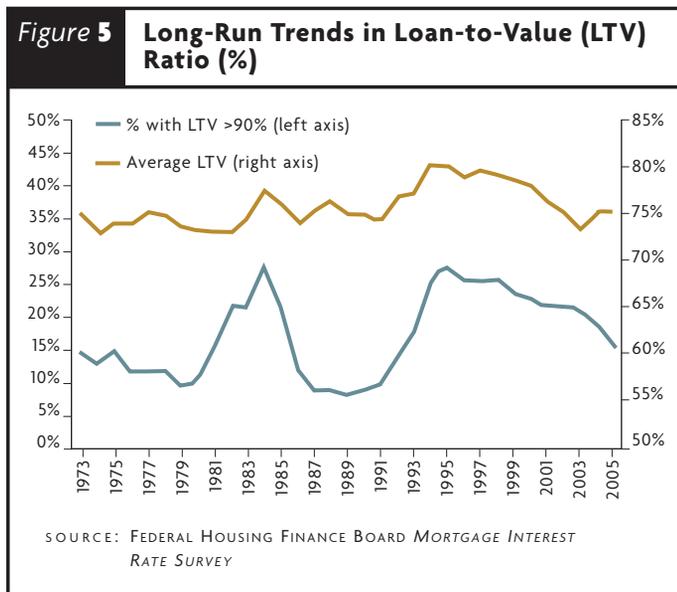
The spectacular increase in foreclosures after 2005 is unprecedented in the data. Economic conditions and underwriting quality typically moved in opposite directions in

Figure 4 All Foreclosures Started: Four-Year Distributed Lag



the 1990s. This negative correlation is consistent with lenders becoming more conservative when economic conditions are weak.

However, after 2002–2005, economic conditions and underwriting quality both deteriorated at the same time, instead of balancing each other out as they had tended to do in the past. Figure 4 shows an explosive break with the earlier pattern after 2005, and suggests a structural failure or regime shift in this market that is consistent with a moral-hazard story. Moral hazard is the possibility that a party protected from risk in a transaction might behave differently from the way it would behave if it were fully exposed to the risk. Usually, the party with the potential for inappropriate behavior has more information about its intentions and actions than the party suffering the negative consequences of the risk. We will discuss later what might have contributed to the regime shift, and summarize available evidence that moral hazard was at work.



Underwriting quality: Observables or unobservables?

The results discussed in the previous section attribute about half of the recent explosion in foreclosures to changes in underwriting. In the following section we present indirect evidence that suggests that the most important observable underwriting-risk factors (e.g., LTV ratios, credit bureau scores and cash-out refinances) actually improved since 2005. This implies that much of the increase in defaults in recent vintages may have arisen in factors that may be unobservable to investors in securitizations, although they may be known to the originator—such as appraisal quality, borrower assets and liabilities, occupancy intent and second liens.

Underwriting and moral hazard: Changes in loan characteristics

Figure 5 shows average LTV and share of loans with LTV greater than or equal to 90 percent for all loans originated from 1973 through 2005.

There have been cycles in LTV since the 1970s. The LTV distribution worsened in the first half of the 1990s. The average LTV rose from 75 percent to 80 percent and the proportion of loans with LTV above 90 percent reversed its earlier slide, but actually improved subsequently.

Figure 6 presents data on characteristics of non-agency loans combined by origination year.

The data are paradoxical. The steeply rising level of defaults after 2005, even after controlling for local and national economic conditions, would lead us to expect erosion in the most important credit variables—LTVs and credit bureau scores—in advance of the spike; but we do not see it. Nor do we see an increase in the percentage of cash-out refinances.

The only credit variable in Figure 6 that suggests lower credit standards is the decrease in full documentation. Notice that both initial interest rates and the margin on adjustable-rate mortgages (ARMs) are falling through most of this period. This also suggests that the loans should perform better than earlier vintages because lower interest

Figure 6 Loan Characteristics at Origination by Vintage (Non-Agency Mortgages)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Loan-to-Value (LTV) Ratio	77%	76%	75%	74%	77%	77%	77%	76%	73%
Credit Score	629	672	663	679	666	668	664	682	750
Cash-Out Refi Share	42%	32%	41%	38%	39%	41%	40%	44%	20%
Full Documentation Share	57%	62%	64%	57%	56%	47%	41%	38%	59%
Initial Interest Rate	9.9%	8.2%	7.5%	6.5%	6.5%	6.8%	7.7%	7.5%	6.5%
Margin* for ARM and Hybrid** Loans	5.6%	5.2%	5.2%	4.6%	4.5%	4.8%	4.8%	4.0%	2.3%
Index of Default Quality	100%	51%	45%	34%	39%	43%	54%	44%	17%
Number of Loans	126	213	470	958	1,601	2,441	2,222	732	1

* "Margin" is spread of rate on the loan over index to which the adjustable-rate mortgage (ARM) rate is indexed. Most ARMs have fixed initial rates for a year or more, so the loan only attains fully index rate over time. For instance, for subprime loans the initial rate might be 6.6 percent (see 2005) and fixed for two years, but after that sets at the London interbank offered rate (LIBOR) plus 5 percent.

** "Hybrid" refers to ARMs with first adjustments happening after one year. "Balloon" refers to loans that have to be paid off before they are fully amortized (e.g., a loan amortizing fully over 30 years, but with the outstanding balance required to be paid off after five years).

NOTE: This table summarizes selected loan characteristics of a large database of most (70 percent–80 percent) securitized, non-agency mortgages originated from 2000 to 2008. It includes only first mortgages on residential properties. The mortgages are a combination of subprime, alternative-A and loans above the limit allowed for purchase by Fannie Mae or Freddie Mac.

SOURCES: UNIVERSITY FINANCIAL ASSOCIATES AND APPLIED FINANCIAL TECHNOLOGIES

rates reduce the payment burdens for homeowners.

While we do not have direct evidence of moral hazard in originations during this period, we do know that borrowers with unverifiable or non-existent income or assets would naturally gravitate toward low- or no-documentation loans. Dropping the important verification step from the underwriting process opens the window to large numbers of borrowers who would not qualify ordinarily. Unobservable borrower quality could drop precipitously and investors would be unaware for months or years before worsening performance became significant enough to reveal that a significant change in borrower quality had occurred.

In their 2007 paper, *Securitization and Screening: Evidence from Subprime Mortgage Backed Securities*, Benjamin J. Keys, Tanmoy Mukherjee, Amit Seru and Vikrant Vig present indirect evidence of moral hazard. It appears that 620 is a special credit score threshold because loans with scores higher than 620 are more likely to be eligible for agency purchase.

Historically, credit scores have been a good predictor of default. Keys *et al* looked at loans with scores just above and below 620. They controlled for a range of other factors, but found that the loans with scores just slightly higher than 620 actually performed worse than those with scores just lower than 620. Investors in pools can observe the hard data such as credit score or LTV, but not the soft data. They conclude that the soft data were treated differently for borrowers with credit scores just above 620 in order to keep loans eligible for agency pools. It appears that some individuals working for mortgage originators, riding the bubble of sky-high house prices, may have manipulated data to make loans look better than they really were. Systemically, they were able to do this because there were no negative consequences for them individually or for the institutions that employed them—quite the opposite. They would have profited from making questionable loans in the short term, until the system collapsed and everyone paid the price—most of all, investors. As more and fuller evidence emerges, both direct and indirect, from the fallout of this crisis, we will be able to see what happened in more detail. Clearly there is a lot of work left to be done to flesh out the role of moral hazard.

Comments and conclusions

The long-standing deterioration in foreclosure rates since 1979 was marked by two periods. The first was accompanied by a lowering of standards such as loan-to-value ratios in the 1990s. The second change, which was not seen in observable loan characteristics such as down payment and credit history, was associated with the rise of the subprime market and non-agency securitization after 2000.

The surge in defaults after 2005—especially subprime defaults—was undoubtedly the result of several factors happening at once. Unfortunately, available metrics do not monitor the causes of default effectively. Our research enables us to create indexes of both underwriting quality and economic conditions for mortgage loans. These indexes should be valuable to policy-makers and investors who wish to monitor or assess the risks in mortgage pools and mortgage markets.

The long-run trend since the 1970s of technical progress in underwriting and pricing of mortgages enabled lenders

to gradually buy deeper into the credit spectrum; the performance history, especially in the 1990s, suggested that subprime performance was tolerable, that credit score- and LTV-based underwriting models worked well and that nationally diversified pools of mortgages were safe. These developments made extending securitization into non-traditional areas look promising.

However, the favorable economic conditions of the 1990s made mortgage lending and securitization practices look better than they really were. When economic conditions reversed and house prices began falling in most of the country, diversified pools were not of much help. At the same time, securitization invited moral hazard in ways that credit scores and LTV could not detect.

Have we reached a turning point in the cycle?

We return now to our worst-case-scenario exercise, which compares expected life-of-loan mortgage defaults by vintage in a baseline scenario with a worst case. Often when we begin to ask “How bad can things get?,” we are nearing a turning point in the cycle. This appears to be the case with mortgage defaults in recent quarters.

The index is telling us that the worst economic environment for making mortgage loans is now in the past. The loans originated in fourth-quarter 2008 and first-quarter 2009 are likely to default at the highest rates after controlling for other risk factors like LTV and credit scores. At the same time, recent vintages have been much more strictly underwritten by lenders. As a result, we can be optimistic that the rate of defaults on the serviced portfolio of outstanding loans can decline as well.

Given the tools to distinguish risks arising from economic conditions and underwriting, decision-makers can adjust pricing and portfolio holdings appropriately for the economic environment. Indeed, it can be argued that the single biggest mistake that decision-makers made in the current crisis was their failure to incorporate the rapidly changing economic environment into their decisions.

Frequently, stress tests for loan portfolios miss risks such as the future local economic, product-structure and future collateral-performance risks, which can be caught two to five years early with proper risk-management practices. In this article, we hoped to show how analysis of the past—and not just the recent past—can shed light on the present and have enough predictive power to illuminate the future. **MB**

Dennis Capozza is professor of real estate finance at the University of Michigan Ross School of Business, Ann Arbor, Michigan, and a founding principal of University Financial Associates LLC (UFA), Ann Arbor, from whose research some of this article was drawn. He pioneered the use of contingent claims and arbitrage methods to value consumer loans and related instruments. Robert Van Order is a principal of UFA and professor of real estate finance at George Washington University, Washington, D.C. He was chief economist for Freddie Mac from 1987 to 2003, and prior to that served as director of the Department of Housing and Urban Development's (HUD's) housing finance analysis division. UFA's mission is to bring state-of-the-art analytical tools to lenders. To that end, the company recently released its newest product, ForeScore Location, which allows lenders and investors to score local economic risks at the ZIP-code level using a pay-per-click Web solution. The authors can be reached at dcapozza@ufanet.com and rvanorder@ufanet.com.