

Subprime Credit: The Evolution of a Market

THE SUBPRIME LENDING CRISIS IS SIMPLY THE LATEST VARIATION OF A TRADITIONAL CYCLE

By John Silvia



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About once every decade or so economists get to witness the evolution of a credit market. In the 1970s there were mutual funds, in the 1990s there were high yield bonds, and today we have subprime lending. How do we establish a framework for a market that allows itself to undergo a quiet evolution but ends in speculation and credit revolution? America's latest credit cycle, subprime lending, is not a unique experience but rather the latest variation of a traditional cycle of innovation, excess, and correction that is compounded by public policy laxity and followed by overreaction. Indeed, there is little that is new or creative in the whole subprime saga. This is disappointing because the subprime credit patterns we observe are so typical that

they suggest much of the recent experience could have been avoided. This provides a simple analytical framework for the sub-prime credit market. It suggests that public policy actions, taken as if the subprime lending is simply a matter of speculative excess, fail to properly address the dynamic of credit markets that we have witnessed in the financial market over the last thirty years.

America's latest credit cycle, subprime mortgage lending, is not, contrary to popular commentary, a unique experience. Rather, it is the latest variation of a traditional cycle of innovation, excess, and correction that has been compounded by public policy laxity. Earlier cycles included the go-go mutual funds of the 1970s, energy lending in the 1980s, and high-yield bonds of the 1990s. In hindsight, the subprime credit pattern of innovation/excess/correction was quite typical. A challenge for analysts and policymakers is developing a reliable means by which to recognize these patterns before the correction.

This paper aims to provide such a statistical framework—one that economists can use to disentangle even as complex a pattern of behavior as a credit bubble. For economists, the value added is that time series that suggest a change in credit markets and asset prices—such as those for homes—can be monitored to give a possible heads-up on significant change. This provides the caution flags that management can understand to better manage risks and avoid significant financial losses, even in the case of “hot” markets such as housing and subprime lending.

1. Sub-prime Lending: Different Asset Class—Similar Credit Cycle

In many ways the market for subprime loans is typical of any credit market from a cyclical perspective. There is both a demand and supply for that credit, reward and risk are judged, and a price is assigned to that credit. This simple framework highlights that in any decision-making network, it is important to recognize that credit reflects the dynamics of both supply and demand. Moreover, the dynamics of the credit market reflect the interaction of finance and the real economy over time.

So how does the dynamic credit process apply to the subprime experience? The demand for mortgage credit is a derived demand for housing. It reflects the influence of factors such as personal income, household wealth, interest rates, and current and expected home prices. On the credit supply side, we have a lender who qualifies and issues a mortgage that enables the borrower to purchase a home. The supply of credit reflects the influence of factors such as bank reserves, global liquidity, the value of the housing asset, the expected value of the asset in the future, and the credit experience of the lender.

Expectations drive both supply and demand. During the past four years, what have expectations been and how did they evolve? The buyers expected home price appreciation—in some markets very big appreciation—and often expected

their personal income to also rise over time to cover their future payments. In Figure 1, we can see that assumptions about higher home prices were validated up to mid-2006. The builder saw a healthy housing market and was willing to build many homes that were expected to sell at a profit in a very short time. The lender also anticipated a healthy mortgage market and expected there to be an active market for the ultimate holders of the mortgages. Moreover, up until the end of 2005, the delinquency experience on subprime mortgages was very favorable.

2. What Made the Subprime Market Different and Yet a Logical Outcome of Traditional Lending?

Residential mortgages are typically broken down into three categories. Prime mortgages are the traditional type with borrowers with good credit, traditional down payments, and documented income (DiMartino and Duca, 2007). Borrowers are generally classified by credit score (Fair Isaac & Co. or FICO) as follows:

Subprime: 620 FICO and below

Near prime: 621 - 679

Prime: 680 or greater FICO

Historically, a lower credit score is associated with higher frequency of default. For example, a FICO score below 479 has been associated with a 17 percent frequency of default, while a FICO score between 560 and 579 has been associated with a five percent frequency of default. FICO scores above 660 have been associated with a frequency of default of two percent or less.¹

Approximately 80 percent of outstanding U.S. mortgages are prime, while 14 percent are subprime, and six percent are considered Alt-A mortgages, a class that is riskier than prime but less risky than subprime. This composition has changed over time, and the change reflects the dynamism of the credit process.

Residential asset-backed securities began to emerge as a market when many mortgage loans made by lenders exceeded Federal National Mortgage Association (FNMA or Fannie Mae) or Federal Home Loan Mortgage Corporation (FHLMC or Freddie Mac) underwriting guidelines.

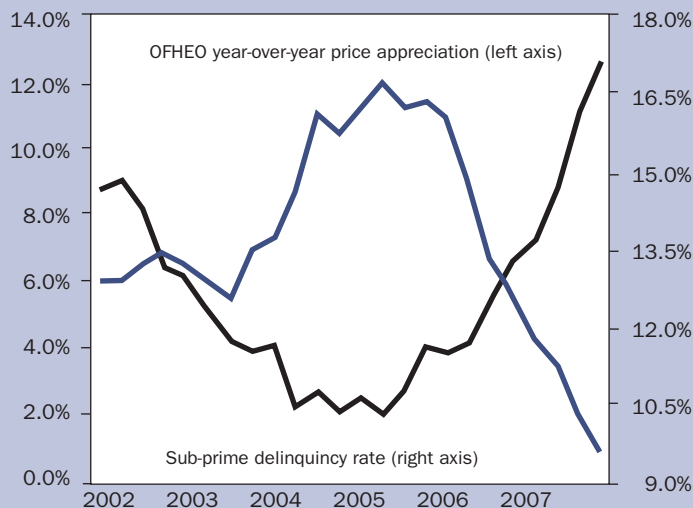
3. Economic Evolution and the Changing Risk/Reward Calculation

Three types of change affected the subprime and the broader mortgage credit market. First,

¹Data from Loan Performance and Wachovia Capital Markets, LLC.focus”.

FIGURE 1

SUBPRIME MORTGAGE LOAN DELINQUENCY AND PRICE APPRECIATION
Percent of Loans Past Due, Seasonally Adjusted, and Year-Over-Year Price Appreciation



Sources: Mortgage Bankers Association, Office of Federal Housing Enterprise Oversight

there were changes in the values of the independent variables, particularly expected home prices and expected delinquency rates. Second, there was a change in the importance of the independent variables, where expected home price appreciation began to dominate decision-making far more than income or credit variables. Finally, there was a change in the independent variables themselves, as securitization and the globalization of mortgage credit began to drive the origination process. The emergence of the originate-to-distribute securitization model came to dominate the originate-to-hold model of lending that was the basis for housing since WW II. As a result of ignoring these structural changes, both public and private market decision-makers were caught off guard; and neither public economic policies nor private sector strategies were suitable as the mortgage market evolved.²

Public policy for the housing market had developed along the path that the role of government was to provide financing, or at least a seal of approval, from the Federal Housing Administration, as well as secondary market liquidity in the form of several government-sponsored enterprises, such as FNMA and FHLMC. This financing boosts the liquidity in the mortgage market. In the pre-globalization era of the 1960s through 1980s, standardization and liquidity were major issues for the housing market. However, since the early 1980s, global capital markets evolved to provide more than adequate liquidity and securitization of mortgage loans. Unfortunately, as the global credit markets evolved both in origination and investment preferences, public policy in the United States did not adjust. The net result is that in recent years liquidity at any given level of risk became overwhelming, and financing was no longer a constraint on home purchases. For example, foreign investors have purchased mortgage-backed securities at an accelerating rate over the past ten years.³ In fact, it may be said, that too much liquidity helped over-expand the home-buying possibilities in recent years. Mortgage originators saw a ready market for home mortgages, so we can say that this is a case of too much credit chasing too few homes.

Cyclical recovery (2002-2004) in the housing market—in typical credit-cycle fashion—gave way, in 2005-2007, to boom and then bust. Positive fundamentals of rising household incomes and low mortgage rates were supported by rising liquidity, beginning the process of raising both housing demand and supply. Unfortunately, effective demand, driven by expected future prices, rose faster than

²Schumpeter (1964) cited the role of innovations in business cycles, but here we are more focused on both apparent and real changes in the economic structure or outcomes to which decision-makers wish to respond, regardless of whether there is a real fundamental innovation to the economy.

³Treasury International Capital Data, March 2008.

supply, and thereby generated rapidly rising prices that were higher than previously expected.

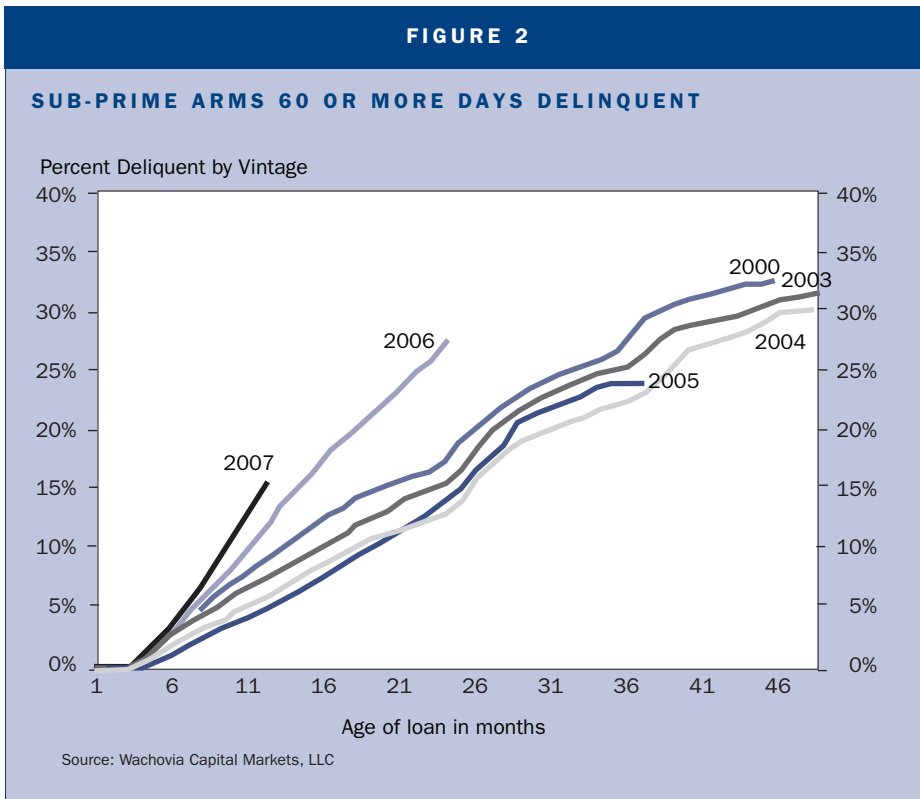
On the demand side, as households began to count their current and expected future gains on their housing investments, speculative fever began to build with the typical, ultimately disastrous, results that have been seen in prior credit cycles. Also, as household expectations of capital gains rose sharply, there was an increase in investor and second-home demand relative to the demand for actual owner-occupation. Thus, over time, the composition of house purchases shifted from owner-occupied living quarters to speculative acquisition by absentee investors. In effect, housing migrated from an owner-occupied demand to an investor demand, where monthly payments for owner-occupants became a tax-deductible rent payment and a hedge position on price appreciation. Combined with the oversupply of liquidity, this evolution of buyer motivations led to rapidly rising home prices, as seen in Figure 1, that further altered the perceived risk/reward tradeoff for buyers. House-flipping, not occupancy, became the rationale for the marginal buyer.

Home buyers were willing to bid up home prices and accept adjustable-rate mortgages on the anticipation of home price appreciation. For builders, rising prices were the incentive needed to buy land and anticipate the easy pass-through of higher prices to willing homeowners (or speculators). Mortgage lenders, with agency guarantees and global liquidity in hand, found the financing of such home purchases fast and easy.⁴ This housing/credit cycle fed upon itself. What is important to note is that at the margin, outsized recorded prices on a limited set of properties were perceived to be characteristic of all properties. Yet, few homeowners realized any significant profits from such speculation, contrary to widespread perception.

On the supply side, securitization and the globalization of mortgage credit began to drive the origination process. The emergence of the originate-to-distribute model came to dominate the originate-to-hold model of lending. The emergence of collateralized debt obligations (CDOs) and foreign investors introduced a source of demand for mortgage products that did not exist prior to the current expansion. This demand was less discriminating on risk. By 2005, home equity asset-backed issuance volume exceeded \$500 billion compared to less than \$20 billion in 1995. The investors in CDOs relied on modeling assumptions as a means of judging risk. As we shall see, the rapid expansion of buyers for mortgages in a rapidly changing market using a new model for evaluating and granting credit was a prescription for speculation and mispricing of risk.

⁴The role of innovations in the mortgage market is covered neatly by Doms and Motika (2006).

Moreover, a careful observer would have started to notice that the delinquency data had turned to the dark side, as evidenced in Figure 2. Subprime adjustable-rate mortgages (ARMs) exhibit a pattern of rising delinquencies for each vintage of the loans. With 2000 as the oldest vintage and as a baseline, we can see that delinquencies actually declined into 2003 and then 2004.⁵ Unfortunately, by the 2005 vintage the delinquency rate had started to repeat the 2000 pattern and was clearly worse than 2003-2004. The worsening pattern of credit quality was amplified in the 2006 and 2007 vintages.



4. Introducing the Wake-up Call

With the evolution of the economic structure and the progression of ever-more optimistic assessments of returns relative to risk, market pricing increasingly became disassociated from the long-run fundamentals of the market. At some point, the housing market no longer clears at the continually rising inflated prices, and the wake-up call is issued. In the past, these wake-up calls were associated often with the failures of financial institutions (Penn Square, Continental Illinois, Barings) or a particular deal (United Airlines' buyout of 1989) or strategy (convergence trading for Long-Term Capital Management).

⁵2001 and 200 were similar to 2000 so they are not shown in order to simplify the figure.

In what appears to be a “New York minute,” market participants engage in a deliberate attempt to alter the existing incentive structure, which no longer generates the economic outcomes these same participants desire. Simply put, greed turns into fear. Speculators who attempt to realize their paper capital gains find that their actual returns are very disappointing. The economy still works, and markets do function; and yet market outcomes no longer suit the preferences of buyers and sellers (and therefore of policymakers).

In the scramble that follows, market actions send the economic and financial process off in uncertain directions

that increase market risk, decrease expected returns, and ultimately are unlikely to return markets to anything like their prior equilibrium. We have already noticed that subprime delinquencies began to rise in 2005 (Figures 1 and 2), while Figure 3 shows that the ABX spread did not respond to this information until early 2007.⁶

Credit spreads on the ABX.HE index, an indicator of perceived risk, rose as the expected value of the home equity cash flows declined—due, in part, to rising fears of mortgage delinquencies.

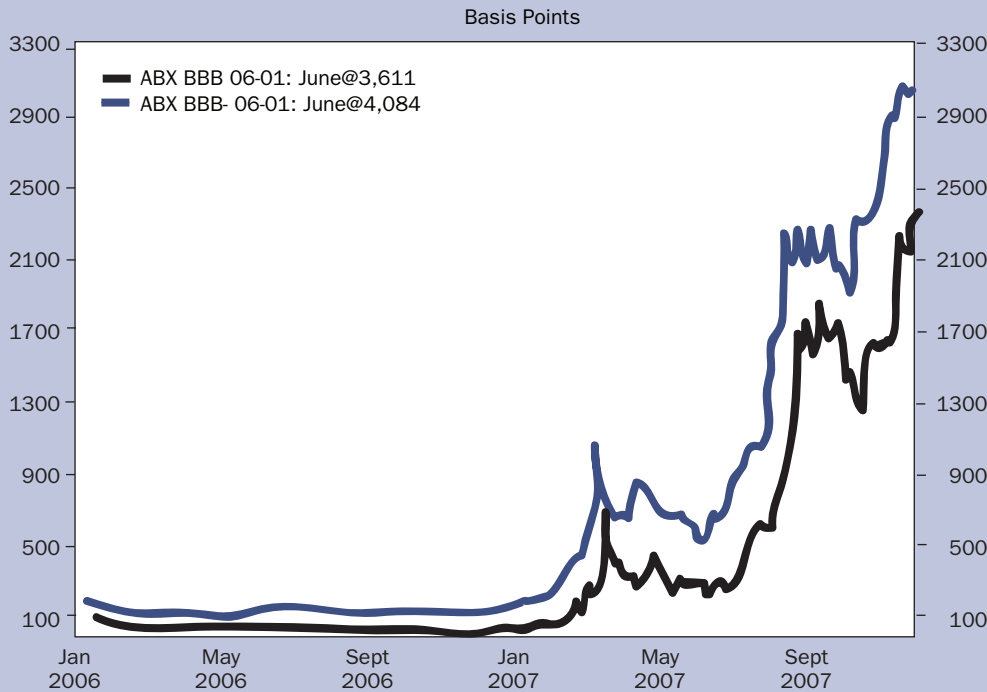
5. Precise Mathematics Give Way to Imprecise Reality: What Happens to Markets When the Average Expected Return and the Variability of Returns Become Uncertain?

To complicate matters, as buyers and sellers alter their price expectations, their behavior will affect not only the pace and distribution of economic events, but also increase the degree of uncertainty of economic outcomes. The blowout in market pricing radically alters the average expected rate of return and its variability. Change brings greater uncertainty to all economic agents. Greater uncertainty creates institutional barriers for some whose exposure to risk rises significantly compared to the “sure thing” that they had expected in home buying and mortgage origination. Prospective delinquencies and capital losses rep-

⁶The ABX index measures the cost, or spread, of credit-default swaps secured by sub-prime mortgages and home-equity loans. An increase in the spread indicates deterioration in the perception of credit quality; a decline suggests improvement. The index tracks 20 asset-backed securities that contain loans rated BBB-, the lowest level of investment grade debt. <http://www.bloomberg.com/apps/news?pid=20601103&sid=adb-sVAhN68TM&refer=us>.

FIGURE 3

ABX SYNTHETIC SPREADS: BBB AND BBB-



is that the pace of growth, and therefore home prices and delinquencies, may differ from what is discounted in current home/bond asset prices.⁷ Momentum in the market may be on the downside. In this case, housing prices/delinquencies would be disappointing relative to expectations.

Thus, we are focused on identifying periods of acceleration and deceleration about a generally positive trend of a time series. In the present context, we wish to determine whether the current housing slowdown could have been identified before the housing correction became a bust.

7. Decomposing Trends and Cycles

Repetitive, increasingly long cycles in one direction (up or down) tend to influence the markets' perception of trend, particularly for home prices. For example, for much of the post-WWII period strong economic growth gave rise to the perception that trend growth in home prices was positive, and that a housing price bust, such as that of the 1930s, was not in the cards. For example, boom times appeared to be a permanent facet of the outlook for Florida and California. Of course, this perception has changed sharply in 2007 and 2008. Apparently, trends that over time become one-sided, either toward growth or recession, are amplified by perception as well as reality and become a cycle. Our challenge is to develop a process to identify the change in the home price cycle/trend before the correction becomes a bust.

How can we distinguish for decision-makers the components of trend growth and cycles around that trend for home prices and delinquencies? The approach we have adopted here is the Hodrick-Prescott filter approach. This approach begins with the recognition that aggregate economic variables experience repeated fluctuations around their long-term growth path (Lucas, 1981). Moreover, we

⁷For a review of regional delinquency data and its link to home price appreciation see Doms et al (2007).

resent significant challenges to private capital and public policy expectations.

Why is this critical? The problem is that pricing models for investors that balance risk and reward depend on small changes in one variable, such as price, to generate understood valuations. But what happens when both the expected price and its variability change over time? In this case, uncertainty rises significantly; and investors are far less willing to invest, given the higher level of uncertainty. Thus, the market freezes up, and trading halts. We have seen instances of this in the stock market crash of 1987 and the high-yield bond collapse in the early 1990s.

6. Benchmarking the Credit Cycle: The Economist's Contribution to Risk Management

Can the identification of credit cycles and the dissection of patterns of any time series help us to better inform our clients? While the polar positions of housing boom/bust certainly make for colorful debate, the more subtle flows of the housing/mortgage credit cycle are of greater significance on a regular basis for decision-makers.

For decision-makers, a period of a housing price correction would be characterized by continued positive, although below-trend, economic growth. Our issue, however,

can hypothesize that the growth or trend component of any economic series itself varies smoothly over time. That is, the trend in most variables is not a constant number, but varies over time, as would be noticeable with productivity and real interest rates, for example.

How might we decompose our time series of interest? The observed series is viewed here as the combination of a cyclical and a growth component. Our assumption is that the growth (trend) component varies smoothly over time.

The Hodrick- Prescott Filter

The Hodrick and Prescott (HP) filter has two justifications—one theoretical and one statistical (Hodrick and Prescott, 1997). The theoretical part of the HP filter is connected with the real business cycle (RBC) literature. For instance, in the RBC world, the trend of a time series is not intrinsic to the data, but it is a representation of the preferences of the researcher and depends on the economic question being investigated. The popularity of the HP filter among applied macroeconomists results from its flexibility to accommodate these needs, as the implied trend line resembles what an analyst would draw by hand through the plot of the data (Kydland and Prescott, 1990).

The selection mechanism that economic theory imposes on the data via the HP filter can be justified using the statistical literature on curve fitting (Wabha, 1980).

The conceptual framework presented by Hodrick and Prescott (1997) can be summarized as follows:

$$y_t = g_t + c_t \\ \text{for } t = 1, 2, 3, \dots, T.$$

Where T is the sample size. A given series (y_t) is the sum of a growth component (g_t) and a cyclical component (c_t). Actually, there is also a seasonal component; but as the data are seasonally adjusted, this component has already been removed by those preparing the data series.

In this framework, the HP filter optimally extracts a trend (g_t) that is stochastic but moves smoothly over time and is uncorrelated with the cyclical component (c_t). The assumption that the trend is smooth is imposed by assuming that the sum of squares of the second differences of g_t is small. Details on the estimation process for the growth and cyclical components are provided in Hodrick and Prescott (1997).

One key advantage (with many others) of the HP filter, once we estimate the g_t and c_t , is that we can see, at any point of time, whether the current growth rate of the given series is below the trend growth (slowdown) or above the trend (boom). This feature of the HP filter may help policymakers in their future decision-making process. For in-

stance, where y_t is actual real GDP growth (log form) and g_t its long-run growth path, if the economy continuously grows (positive growth rate) but at rate less than g_t for a period of say two years, we don't see a recession, but we do see a slowdown. That is, its level does not decline, but its growth rate—while still positive—is below the trend rate. It is certainly possible to imagine a severe and long slowdown that causes more hardship than a mild and short recession. In fact, long slowdowns in employment and demand growth have occurred repeatedly in recent times, even while output and supply growth held up well, supported by technology and productivity (Zarnowitz and Ozyildirim, 2006). So, with the help of the HP filter, we can see where we stand now: Are we in a slowdown? Rather than waiting for recession, slowdowns also need serious consideration, e.g., slowdown in employment and demand growth can lead to overall slowdown or, maybe, to recession.

Decomposing Trend and Cycles in Delinquencies and Home Prices: Giving Decision-makers the Heads-up

Putting the Hodrick-Prescott filter into practice, we begin by examining the trend/cycle patterns associated with both prime and subprime delinquent loans. In Figures 4 and 5, we plotted the trend and the log of the delinquent loans on prime mortgages (Figure 4) and subprime mortgages (Figure 5). We can note several interesting developments. First, over the period reviewed, the logs of the actual series are very volatile relative to the underlying trends. Moreover, we find that the log of the series in delinquencies of prime loans moved abruptly upward prior to the start of the March 2001 recession and then again beginning in mid-2006. A similar pattern appears in subprime loans.

Second, these periods of alternating decelerations/accelerations in delinquency rates do indeed provide opportunities for economists to contribute to effective financial decision-making. The trend component of delinquencies is fairly smooth, while periods of credit stress and strength are quite frequent. Therefore, there are frequent opportunities for an economist to add value to the lending/risk assessment process in our institutions. Such observations also provide value-added into any baseline for long-run strategic planning.

Finally, there are short but significant periods of above- and below-trend delinquency persistence. These periods suggest that such deviations are not likely to be random, but may reflect changes in underlying fundamentals for current economic activity and future economic/financial activity. For example, long periods in both 2000-2001 and now 2006-2007 suggest that economists had an opportunity to add value by identifying periods where the underlying patterns in the economy/credit markets may have shifted.

The Bell Does Ring: Deviations from Trend as Financial Warning

In this section we tried something a bit different. We examined the deviations of the cyclical component from trend and considered them as an innovation in the sense that the deviation from trend would elicit a response in the form of a deviation from trend in the other series we plotted. For example, in Figure 6 we plot the deviations from trend of home prices for the United States and the deviations from trend experience with delinquencies.

Here we see that the acceleration in home prices from mid-2003 to early 2006 was associated with a steady fall in delinquencies. Credit experience improved steadily as home prices cycled above trend in the overall U.S. economy.

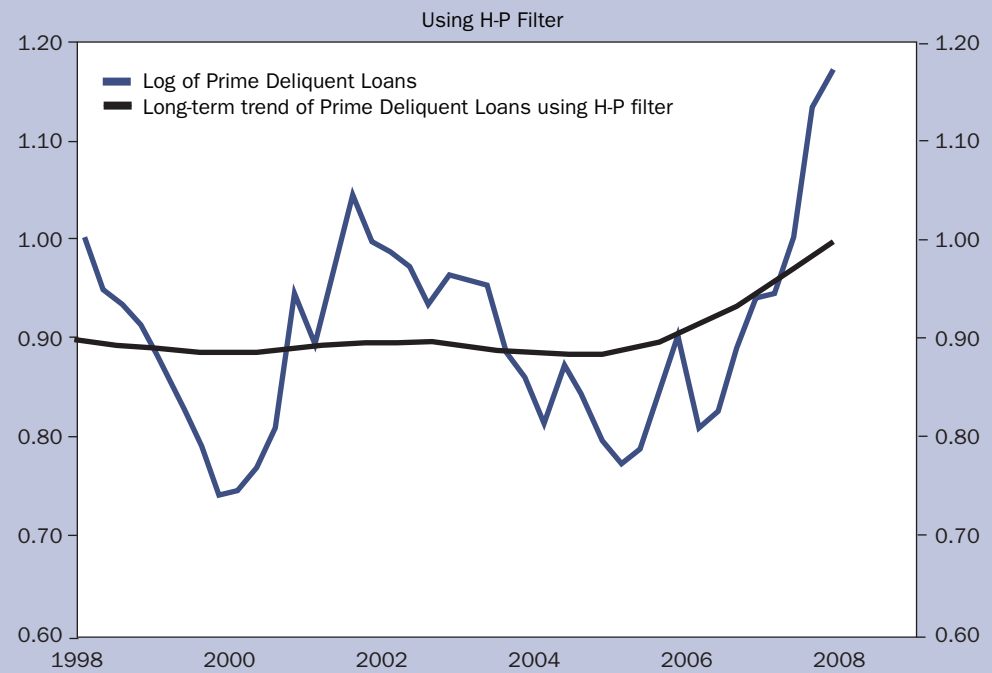
In contrast, the rapid drop-off in home prices beginning in mid-2006 was associated with a rapid run-up in delinquencies. At the time this article was submitted for publication, the continued decline in home prices relative to trend suggested continued increases in delinquencies above trend. This appears to have been the case. Figure 7 provides evidence that such an approach works with a single state, such as Florida.

8. Conclusion: The Character of Economic Time Series—Even Credit Bubbles Can Be Predicted

Critical economic time series can be analyzed as the combination of trend and cyclical components. For

FIGURE 4

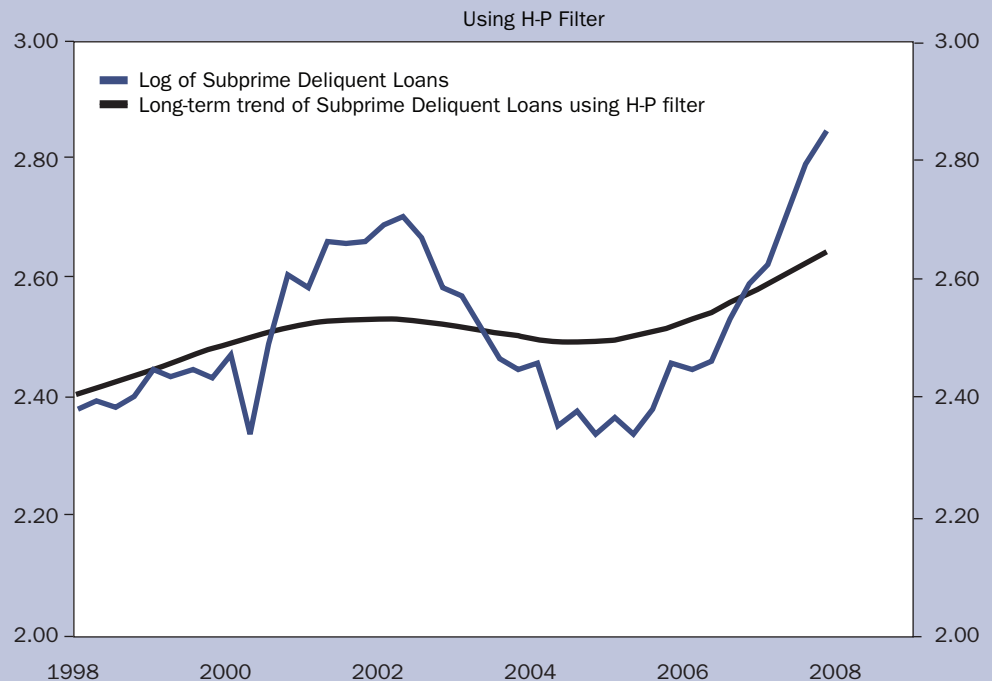
DECOMPOSING PRIME DELINQUENT LOANS



Source: Mortgage Bankers Association and Wachovia Corp.

FIGURE 5

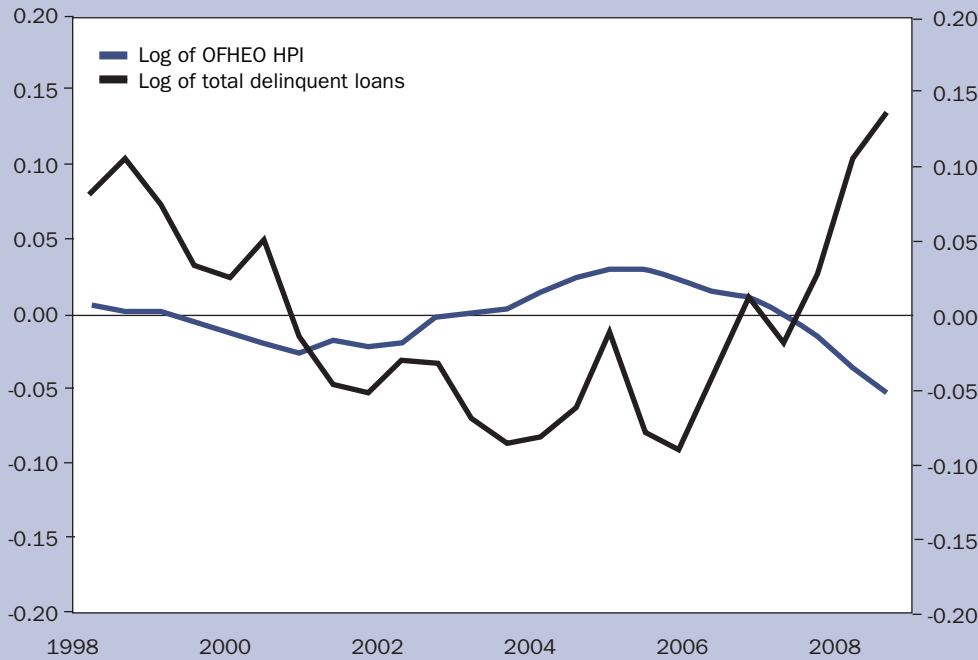
DECOMPOSING SUBPRIME DELINQUENT LOANS



Source: Mortgage Bankers Association and Wachovia Corp.

FIGURE 6

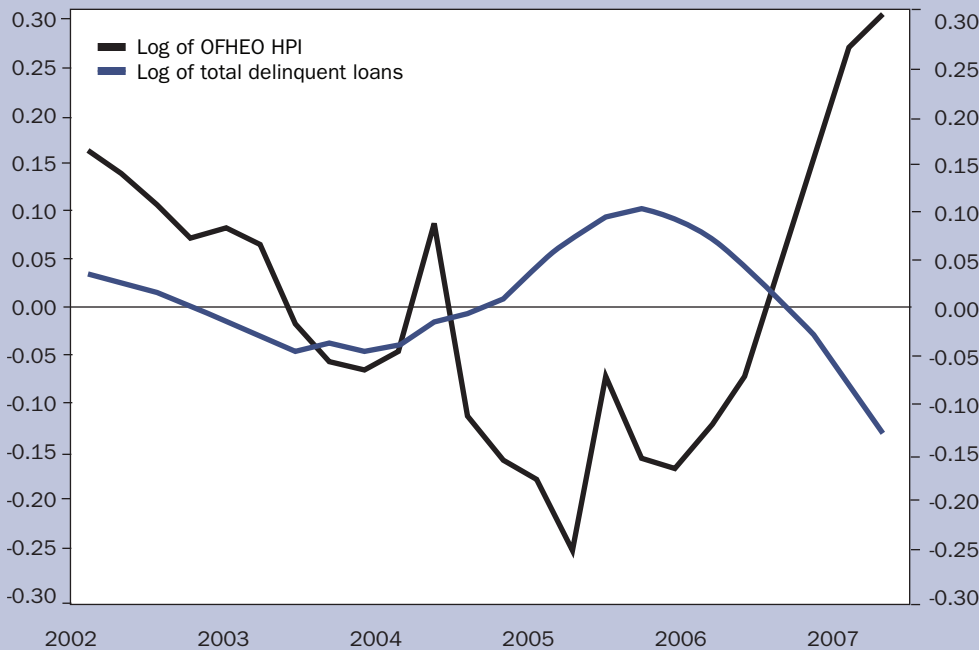
DEVIATION FROM TREND OF U.S. HOME PRICES AND DELINQUENT LOANS



Source: OFHEO, Mortgage Bankers Association, and Wachovia Corp.

FIGURE 7

DEVIATION FROM TREND OF FLORIDA HOME PRICES AND DELINQUENT LOANS



Source: OFHEO, Mortgage Bankers Association, and Wachovia Corp.

economists, this offers the opportunity to identify and portray the short-run volatility of any series along with a view of the longer-run trend value of that series. As the majority of the time for any economic series is spent in movement between below- and above-trend periods, economists can therefore identify such periods and offer insights into the direction of change and how decision-makers might respond to such change. Within our own forecasting and analytical work, the deviations from trend are both a product of economic activity and an influence on future activity. These deviations are therefore signals that economists can use to improve their analysis and forecasting efforts.

This paper attempts to provide a statistical framework that economists can use to disentangle a pattern of behavior—even for a phenomenon as complex as a credit bubble. For economists, the value added is that time series that suggest a change in credit markets and asset prices can be monitored to give a possible heads-up on significant change. This provides the caution flags that management can understand to better manage risks and avoid significant financial losses even in the case of “hot” markets, such as housing and subprime lending.

For policymakers, the failure to adapt to changing circumstances, such as the clear signals that prices/delinquencies are moving swiftly away from trend, will likely lead to ruin in short

order.⁸ Therefore, this statistical approach may also be of use for policymakers. However, too much flexibility in policy, particularly on lending guidelines/tax rates/capital controls, can lead to significant adjustment costs and higher risks associated with the inability to identify changes in the cycle as opposed to structural change in the entire credit process.

Economics is a discipline of choice. Economic choices occur within a specific institutional structure that is itself changing with the economy. Feedback from economic developments provides decision-makers with information. Based on this information, leaders can decide whether to react and alter their earlier decisions or the earlier framework for decision-making. Moreover, the decision not to change is also a choice. For subprime lending, private actors have a decision to make with respect to lending standards and the price of credit in order to allow for variations in the riskiness of subprime loans. Public policymakers have a choice on how to set standards on the quality and quantity of loans they will accept for federal forms of insurance or their portfolios. Our approach here is to provide a statistical guideline to make better choices. ■

ACKNOWLEDGMENTS

Special thanks to Azhar Iqbal, Sam Bullard, Tim Quinlan, and two anonymous referees.

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⁸See Stiglitz (2002) for a critique (chapter nine especially) of the failure of international institutions such as the IMF and the World Bank to adapt to change.



