

# Vintage View of Mortgage Quality

Tony Hughes

The recent erosion in mortgage credit quality has been stunning. According to data based on Equifax credit files, the delinquency rate on all mortgage debt has jumped nearly one-half a percentage point over the past year to 2.5% of all mortgage debt outstanding at the end of last year. This is just under the peak in delinquency hit in the immediate wake of 9/11 and the 2001 recession.

Most of the credit problems have been concentrated in the subprime part of the mortgage market. Subprime lending accounted for an estimated 20% of origination volume last year and accounts for nearly 15% of all mortgage debt outstanding. The delinquency rate on subprime loans has surged to well over 20%, according to the Equifax data.

The problems in subprime lending have had a substantial impact on the industry. Some 30 lenders have either failed or sold themselves to avoid failure. Freddie Mac recently decided to significantly tighten the underwriting standards it applies to such loans. Regulators have issued increasingly tougher guidance to lenders, making it more difficult to extend new credit.

The dramatic tightening in underwriting standards runs a risk of overshooting, restricting available financing for borrowers who are, under most circumstances, good credit risks. At the very least, this will be an added weight on the housing market, and under more extreme scenarios the broader economy could be hurt. Indeed, fallout from the subprime mortgage meltdown is emerging as the most significant risk to economic expansion.

The aim of this article is to examine the anatomy of the subprime mortgage

market and to forecast subprime credit quality. To achieve these ends, a new method for modeling aggregate mortgage credit data is presented. The models used to predict current events clearly missed the sharp erosion in quality. While the approach presented here may not have successfully predicted the extent of losses sustained in recent months, current events underscore the need to be vigilant in updating modeling and forecasting procedures. The approach presented here holds the potential to make a significant contribution to the understanding and forecasting of future losses not only in subprime mortgages, but for all consumer credit products across the prime/subprime spectrum.

**Methodology.** Consider for a moment three hypothetical families—the Montoyas, the Changs and the Smiths—and their respective experiences in the U.S. mortgage markets. Each family has an equivalent credit score when their mortgage is originated—they are typical subprime borrowers—but we observe them entering the housing market at completely different times. While the Montoyas bought their home in 1998 when local housing markets were growing strongly and the economy was booming, the Changs took their step in early 2002 when the economy was in the midst of a short but sharp recession. The Smiths, meanwhile, entered the market in late 2005 when the housing boom was in full swing and credit provision was, arguably, at its laxest.

Based purely on this information, a surprising amount is known about the likely experiences that each borrower has faced and will likely face in coming years. The Montoyas took out their

mortgage and were hit by recession at a point in the mortgage lifecycle when default probability was likely to be very high. The Changs, meanwhile, were confident enough about future job market conditions in 2002 to make the biggest purchase of their lives during difficult economic times; they then faced a sustained and ongoing period of rapid house-price and employment growth through the key early years of their mortgage. If the Montoyas were likely defaulters, the timing of the recession may have precipitated an earlier default than might have otherwise been expected. The Changs, meanwhile, might have toughed out a soft period in their personal economic fortunes in the knowledge that they were accumulating a significant enhancement in housing-related wealth as prices increased rapidly through the boom.

This example demonstrates that the shape of the lifecycle that each borrower faces is a function of the underlying business cycle. In an aggregate sense, each vintage of loans will be affected by economic shocks at different points in time as the maturation of the vintage unfolds. Because the impact of shocks is persistent and can be forecasted, lifecycle structure can be modeled using econometric techniques; presumably such an approach will yield projections of future lifecycles that are more accurate than the static lifecycle structure assumed by traditional techniques.

It is unclear what lies in store for the Smith family, but their house may well have already declined in value as the housing boom devolved into a bust. More to the point, though they had equivalent credit scores to the others, the Smiths lacked the ability to fully

document their income; this was not a problem in 2005, however, because companies were lowering their standards to accommodate families just like the Smiths. Importantly, however, this lowering of standards was not a random event; instead, lenders were responding to market pressures and economic realities and trying to grow profitable businesses. It is vital to recognize that vintage quality, in terms of likely future average probability of default, depends on lending standards that wax and wane depending, in turn, on the performance of the broader economy.

Typically, the supply of credit is most abundant during booms so vintage quality will tend to be countercyclical. Further, consider again the types of people who take out mortgages during recessions and contrast them with those who got their loans during booms. People like the Changs were probably better credit risks than the Montoyas and the Smiths because they were willing to take on a mortgage despite the poor economy. Additionally, recessions may distort credit scores in a downward direction, placing some who are prime credit risks (after controlling for economic conditions) incorrectly in subprime territory. All these considerations point to the reality that vintage credit quality should be modeled as a function of macroeconomic as well as industry drivers.

Standard approaches to modeling aggregate credit vintage data, however, do not account for persistent economic vintage and lifecycle effects. These effects, instead, are assumed to be implicitly unpredictable. As a result, only the performance of pre-existing vintages is considered when forecasting the behavior of a portfolio, no attempt is made to predict the behavior of future vintages. One can easily see the importance of this when one considers that the most recent runup in subprime mortgage defaults occurred because credit quality was slipping in 2005 and 2006 so that now, despite low unemployment and a generally buoyant economy, defaults are rising rapidly. Forecasts made using standard methods during 2004 would consider only the good quality vintages that were originated in the early years of the housing boom. It is not surprising that

such myopic forecasts systematically underpredicted the actual erosion in credit quality at the present time.

If vintage quality does turn out to be forecastable, however imperfectly, events like the current one should, in the future, prove less surprising. Countercyclical vintage quality may even uncover new opportunities for savvy lenders and investors. The clear implication is that companies whose standards tighten too much will be effectively pricing subprime credit risk too highly. Companies that can target the marginal rejectees of the major lenders could therefore be among the most profitable finance companies over the next few years and beyond.

The remaining component of the data is that which is typically focused on and forecasted in the industry—the underlying behavior of the data after vintage and life cycle effects have been filtered out. Ostensibly, here, it is assumed that the grapes have been grown and the wine bottled and aged yet its market value still depends on macroeconomic business cycle fluctuations. This third component is, for both wine and subprime mortgages, pro-cyclical in the sense that underlying conditions for mortgage compliance improve as macroeconomic conditions get better and better.

Standard models typically assume that all time varying independent variables enter into the model to explain this third component. Such an assumption is, however, unsustainable. Consider for a moment the impact of frost on wine values. A bad frost during the growing season will tend to spoil the vintage and thus detract from future market prices. Frost, however, only affects vintage quality; once the wine is in the bottle, frost, no matter how bad, can have no further impact on a bottled wine's market price. The same idea holds for subprime mortgages. There is no doubt that lax underwriting standards will impact on future delinquency, but once the mortgages are written, underwriting standards will have no direct impact on the subsequent performance of the vintage.

The final point worth making here is that no assumptions are made of independence between the three components mentioned above.

Vintage, lifecycle and time effects are all assumed to be part of a single seamless system and all three parts are modeled simultaneously. Attempting to isolate individual components before modeling them—also a standard practice in the industry—is difficult to achieve without distorting the underlying relationships that are being modeled. Instead, the model presented here is a parsimonious representation of the entire process involved in determining future subprime mortgage credit quality.

**Data and estimation.** The data used in this analysis pertain to aggregate foreclosure rates for subprime mortgages as reported to Moody's Investors Service and published as the Moody's Home Equity Index Composite.

The data aggregate individual account information from a number of credit providers up to the national level, although note is taken of each loan's origination date, allowing vintage level aggregates to be computed. While annual vintage results are published monthly, the data used here are for quarterly vintages. Data are available on vintages from 1993 through the third quarter of 2006, although vintages formed before July 1994 are excluded because early vintages are thin and thus poorly behaving and difficult to incorporate in the analysis. Outcomes from all the vintages are observed monthly, the most recent observation being for December 2006.

The dependent variable is the natural log of the percentage of accounts in foreclosure in terms of end of period dollar balances. Foreclosed accounts are those where lenders have taken legal action to recover the collateral used to secure the mortgage loan. Around 4% of subprime mortgage balances are in a foreclosed state at any given time. Foreclosure is an advanced state of delinquency and losses sustained by financiers are proximate once this point in the process is reached. Earlier delinquency buckets are equally amenable to use with these types of models but are not the focus of the current study. Using the log of the dependent variable ensures that foreclosure rate forecasts are always non-negative.

As mentioned earlier, the technique employed in this analysis involves filtering the foreclosure data into vintage,

**Table 1: Partial Regression Results for Vintage Quality**

	Coefficient	Standard Error	t-statistic
Unemployment rate, %	-0.0283	0.0120	-2.35
Federal funds target rate, %	0.1318	0.0064	20.48
Housing affordability index	-0.0122	0.0014	-8.75
Household assets, % change year ago	-0.0024	0.0002	-12.54
Personal bankruptcies, % change year ago	-0.0122	0.0026	-4.63
Financial obligations ratio, %	0.3825	0.0220	17.42
Loan-to-value ratio, %	0.0221	0.0052	4.29
Senior loan officers survey, implied level	-1.7316	0.2249	-7.7

macroeconomic, and lifecycle components and modeling each simultaneously. Forecasts for the overall foreclosure rate can then be computed by reconstituting the three separate components.

**Vintage quality.** In modeling the performance of subprime vintage quality, two important features of the data can be exploited. First, because vintages are observed over time, the data resemble panel data, although normally panels relate to cross sections observed over time rather than vintages, which are obviously time series in and of themselves. Because vintages are time series, a multitude of macroeconomic data that define the economic conditions that pertained when the vintage was originated can be examined.

Vintage quality is a function of the supply and demand conditions that underpin the mortgage market at any given time. Strong labor and housing markets will ensure that applications for mortgages will be strong right across the credit quality spectrum, but lenders can elect to accept or reject the mortgages for which they have received applications. If competition from credit suppliers is high relative to the size of the pool of subprime mortgage applications, marginal potential mortgagees will tend to gain approval from somewhere and overall vintage quality will tend to weaken.

In specifying the vintage quality model, therefore, the variables that may indicate the relative strength of supply and demand in the subprime mortgage market and how this may impact on the observed vintage quality must be accounted for (see Table 1).

Each of the variables is appropriately signed and statistically significant at all reasonable levels of significance. A note on interpretation of the signs here

is warranted. A negative coefficient on the unemployment rate variable means that, holding everything else constant, an increase in the unemployment rate at vintage formation is associated with a lower foreclosure rate across the life of that particular vintage. As mentioned earlier, families like the Changs, who were able to take on a mortgage during difficult times, generally represent a lesser credit risk.

Housing market conditions affect the vintage component in two ways. First, an increase in housing affordability is associated with a decreased future foreclosure rate for the vintage in question. On the converse, this implies that a booming housing market with decreased affordability leads to an erosion in underlying credit quality. In expanding housing markets, banks are generally willing to lend to marginal applicants because even if they default on payments, full restitution is still likely after the house is sold for a capital gain. Only the foreclosure rate is being modeled here and not subsequent losses so it is not surprising that rapid house-price growth is associated with poorer vintage quality in terms of the likelihood of subsequent foreclosure.

The growth in household assets also encompasses housing but also other assets like stocks and cash. This variable represents the dynamic in the amount of collateral held by households to guard against possible insolvency and, for this reason, it is unsurprising that a faster growth rate yields a better quality subprime vintage.

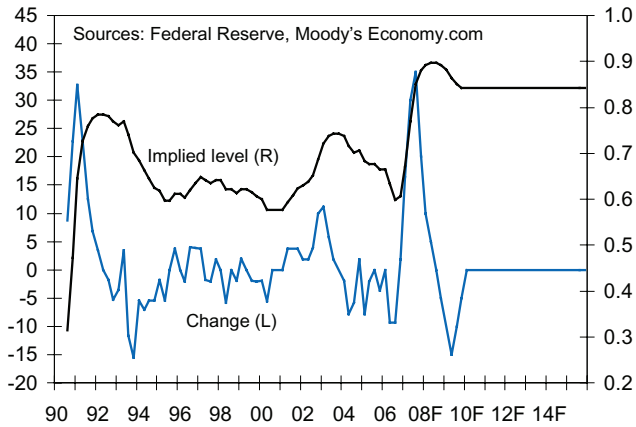
The next set of variables pertains broadly to credit quality at the time of origination. The financial obligations ratio is an oft used measure of how financially stressed retail credit customers are at any time. One would expect that

a greater degree of financial stress in the macroeconomy would sour the subprime mortgage vintage, and this is exactly what is found. The loan-to-value ratio also gives an indication of consumer credit strain as well as the financial sector's willingness to extend finance despite the lack of significant down payments. A higher LTV is associated with higher levels of future foreclosure. The bankruptcy rate, meanwhile, is a negative indicator of vintage quality because it represents the degree to which the worst credit risks are being removed from the available pool of potential subprime mortgagees. Clearly, a higher bankruptcy rate at origination tends to increase the average quality of people to whom banks will consider extending finance.

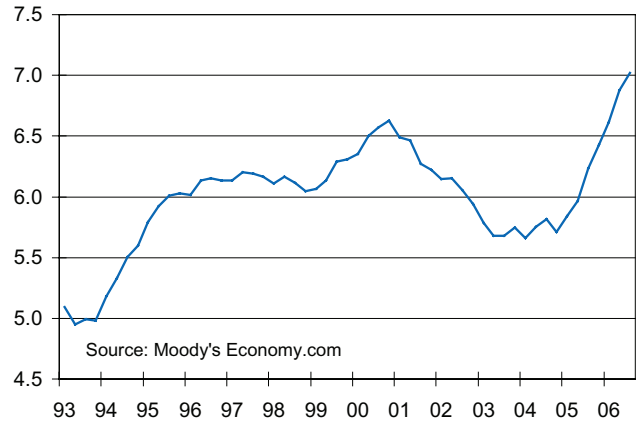
The interest rate variable, the strongest vintage indicator in the model, acts on foreclosures in a number of ways. First, a higher rate generally implies higher repayments on origination for fixed rate mortgages and it implies a higher reset rate for adjustable rate mortgages. Second, from the bank's perspective, a higher interest rate provides a greater return and thus a greater incentive to establish the mortgage even if it embodies a greater degree of risk. A number of interest rates were tested, but the funds rate was found to be the sharpest indicator.

The final variable included in the vintage component is an indicator of the banks' supply response in terms of their willingness to extend mortgages to marginal applicants. The series used was derived from the Federal Reserve's senior loan officer survey which asks bank officials whether they are becoming tighter or looser in their credit standards. In this case, though, we require a level indicator rather than a change (see Chart 1). To overcome this, it is assumed that loan officers were either "strict" or "loose," arbitrarily established an initial proportion of "strict" officers, and then allowed the official survey result to govern changes in the underlying proportion of "strict" senior bank officers. This measure is far from perfect but it may well be the best available indicator of credit supply conditions available in the marketplace. A number of different initial conditions were tried; the results described below do not qualitatively change with the assumptions made regarding this arbitrary choice.

**Chart 1: Variables Used to Measure Bank Response**  
**Net % of banks tightening standards for mortgage loans**



**Chart 2: Vintage Quality–Historic**  
**Lower numbers indicate better vintage quality**



As expected, stricter bank lending standards significantly improve the quality of vintages in terms of future foreclosure. The model thus encompasses both the demand side of credit in terms of customer willingness to establish new mortgages and the response of financial institutions to changes in market fundamentals.

Putting all this together, the model suggests that vintage quality generally deteriorated through the latter part of the 1990s (see Chart 2). Given that the economy was booming through much of this time, this underscores the observation that mortgage vintage quality tends to be countercyclical. The onset of the recession in the early part of the decade saw banks tighten their standards and vintage quality improved, at least through the end of 2002. During the early part of the housing boom, credit quality slipped a little but this accelerated markedly in 2005 and 2006. By the end of the sample period, vintage quality was worse than at any point in the observed series.

**Macroeconomic conditions.**

Once the vintage is in the bottle, so to speak, macroeconomic conditions influence its ongoing performance. In this case, the theoretical model is rather

more straightforward since the bank's role is reduced to merely determining how aggressively to pursue non-payers, which is difficult to model without fairly specific company or industry level data. In terms of the behavior of mortgagees, meanwhile, a strong economy here should unambiguously cause ongoing foreclosure rates to decline, holding everything else constant (see Table 2).

House-price growth plays a central role in determining the macroeconomic conditions facing existing mortgagees. As price growth accelerates, mortgage foreclosures decline for a number of reasons. First, since the owners' equity in the property is growing rapidly, there is a strong fiscal incentive to remain compliant with the provisions of the mortgage contract. Second, greater home equity and growing prices allow at-risk borrowers to refinance their mortgages and thus ease their short-term financial solvency issues. Third, with rising house prices, there is an incentive for banks to take a more lenient view of delinquent accounts and thus move to foreclosure at a slower pace. Any way you cut it, strong house-price growth should improve the conditions in the economy for strong mortgage compliance.

House-price growth is therefore both a positive and a negative factor in determining future foreclosure rates. Strong price gains improve fortunes for existing vintages, but they also induce lenders to be more aggressive in extending credit to new vintages. It is therefore unclear whether housing booms are positive events in terms of the underlying long-term foreclosure rate we observe in the economy.

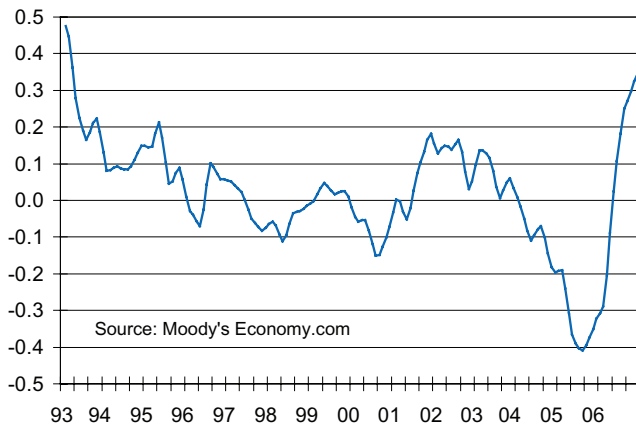
Like the house price growth variable, the unemployment rate also has a differential impact on vintage quality and macroeconomic conditions. While higher joblessness is a positive for quality, it is a decided negative in terms of the prevailing macro conditions. This result is straightforward – an erosion in labor market conditions is detrimental to the foreclosure probabilities of existing vintages. Other measures associated with the business cycle can, however, be positive for both components, illustrating the nuanced view one can reach by separating the vintage data into its various constituent parts. For example, consider wage growth and the growth in the value of household assets; both of these factors are unambiguously positive in terms of promoting conditions that are conducive for good credit outcomes.

The lagged amount of refi activity, meanwhile, is a negative indicator of macroeconomic conditions. Since many people use refis to draw cash on their homes to fund consumption, this sort of activity is inherently more risky than merely funding the purchase of a home over a long time period. It is little wonder that high amounts of refi activity go hand-

**Table 2: Partial Regression Results for Macroeconomic Conditions**

	Coefficient	Standard Error	t-statistic
Unemployment rate, %	0.0557	0.0077	7.28
Household assets, % change year ago	-0.0005	0.0001	-5.3
Median house price, % change year ago	-0.0452	0.0200	-2.26
Wages, % change year ago	-0.0247	0.0051	-4.83
Refi share of mortgage originations	0.0015	0.0003	5.18

**Chart 3: Macroeconomic Conditions—Historic**  
*More negative numbers indicate better conditions*



in-hand with poorer outcomes in terms of future foreclosure rates.

Aggregating the individual contributions of these variables, the evolution of the macroeconomic conditions underlying the subprime mortgage sector over the past decade and a half can be traced (see Chart 3). The model suggests that conditions were generally improving through the 1990s right up until the onset of the short but sharp recession in 2001; the impact of the recession on credit quality can be seen quite clearly. During the housing boom, conditions for mortgage compliance improved markedly to the point where, in mid-2005, they were considerably better than at any other point in the observed data. The end of the housing boom, however, and the dramatic declines in house price growth rates witnessed in 2006 have seen conditions deteriorate markedly. At the end of 2006, the situation had turned on a dime and conditions were worse than they had been throughout the sample period. The current situation, therefore, is worrisome as both vintage quality and macroeconomic conditions are weighing on subprime credit quality.

One glance at the t-statistics from the vintage and macroeconomic regressions indicates that most of the variation in foreclosure rates is due to variations in vintage quality rather than changes in macroeconomic conditions. This means that correctly modeling the conditions seen during vintage formation is absolutely essential in generating accurate forecasts of the overall performance of the portfolio. The traditional approach

ostensibly, impossible to understand.

**Lifecycle component.** The remaining component is the lifecycle component or the so-called maturation effect. By its nature, this component represents a more technical challenge as it is inherently nonlinear. It describes the baseline probability of default after vintage and macroeconomic effects have been accounted for.

As mentioned earlier, foreclosure rates are typically very low in the early months following origination. This rate then rises to a peak before trailing off as the age of the mortgage progresses. Because this is inherently nonlinear and because economic theory tells us nothing about the appropriate shape of the curve, we use a nonparametric cubic spline function relating the log foreclosure rate to the age of the vintage to trace the underlying nonlinearity in a parsimonious way.

Here, though, the impact of economic variables on the shape of the lifecycle is important. To make this a function of economic variables, the economic data are interacted with the variables making up the cubic age spline. These interaction terms are then included in the general model specification. In this case, we want to guard against overspecifying such a complex piece of the

to modeling this type of data erroneously assumes that vintage quality cannot be modeled using time series macroeconomic data; variables that should feed into vintage quality are instead modeled as influencing the conditions being faced by existing vintages. In traditional models, the estimates are a hodgepodge of both vintage and time effects; they are thus,

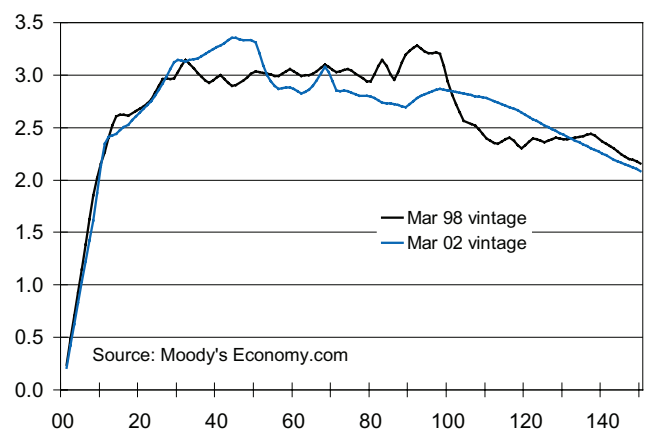
model so we limit our attention to three variables. Representing overall economic conditions we use the real growth rate in GDP; representing housing market conditions we use the growth rate in median house prices; and representing shifts in the strictness of the banking system in implanting foreclosure rules we use the Federal Reserve's senior loan officer survey in its original form.

The interpretation of the individual coefficients is rather difficult here but F-tests reveal that all three variables are each jointly significant (by a wide margin) in influencing the overall shape of the lifecycle.

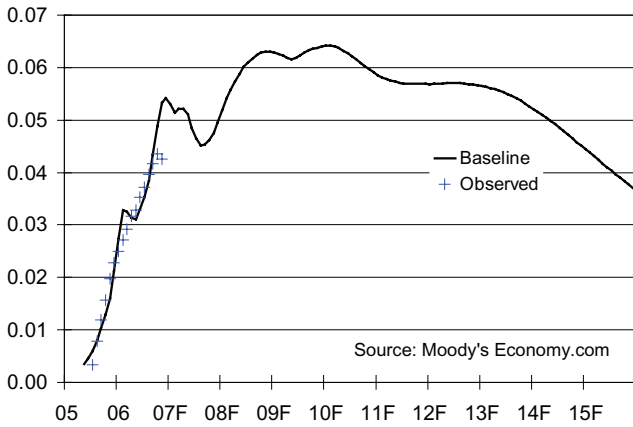
Perhaps the easiest way to interpret the estimated maturation curves is by looking at a realistic example. Once again consider the Montoyas and the Changs. The Changs, who took on their mortgage during the recession, faced a more difficult start relative to the Montoyas, who enjoyed the last throes of the late 1990s boom in the early part of their homeownership experience (see Chart 4). The impact of the recession on the Montoyas, however, was to keep the baseline default probability high for a much longer period of time. The earlier originators gained the benefit of the housing boom around 100 months after starting their mortgage. For the Changs, meanwhile, who started their mortgage four years later, these events can clearly be seen in the estimated lifecycle occurring roughly 48 months sooner than they did for the Montoyas.

The fact that two vintages experience such distinct lifecycles illustrates the power of this kind of modeling. The point is that not all vintages are created

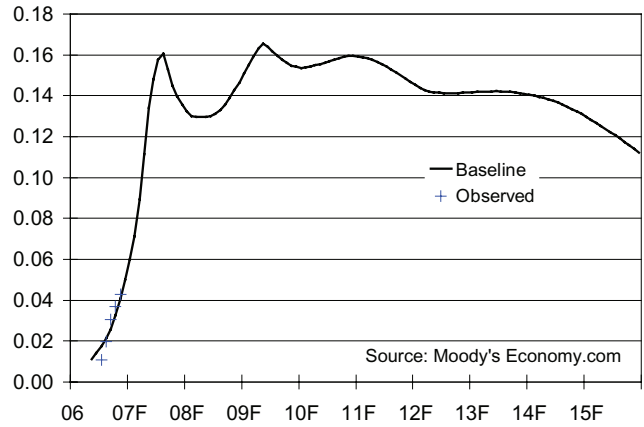
**Chart 4: Estimated Life Cycles for Two Vintages**  
*Months since origination*



**Chart 5: Projections for June 2005 Vintage  
Foreclosure rate, %**



**Chart 6: Projections for June 2006 Vintage  
Foreclosure rate, %**



equal and the timing of economic events is very important in determining observed outcomes.

**Outlook.** Putting the vintage, macroeconomic, and life cycle components together produces forecasts for each vintage. It is most interesting to consider the future performance of two recent vintages, formed before and after the recent deterioration in vintage quality. Between the June quarter of 2005 and the equivalent stanza in 2006, the deterioration in vintage quality is very noticeable (see Charts 5 and 6). To put this into context, the 2005 vintage, a pretty good one by historical standards, is expected to top out soon with a foreclosure rate of around 6%. Fast forward to 2006 and the predicted rate soars to 16% at the peak of the cycle. Such a high foreclosure rate probably cannot be sustained for as long as the model suggests—this vintage

really is testing the limits of the model's capability—but this does demonstrate the difficulty that financial institutions will have with late 2006 subprime loan vintages throughout this year and next before the industry's response shifts fully into gear.

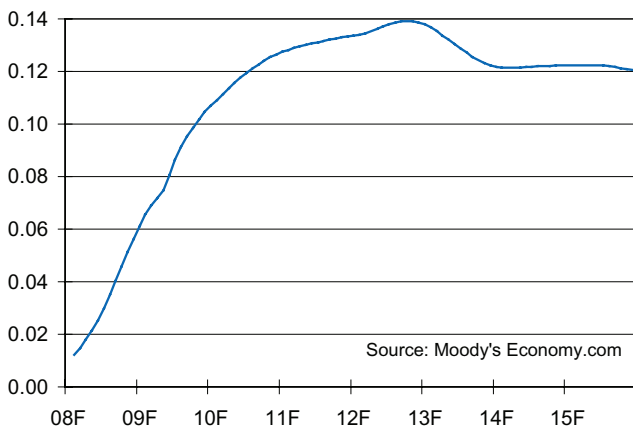
An attractive feature of the model is that it is not restricted to the examination of existing vintages; the future behavior of future vintages can also be determined. The March 2008 vintage, for example, will experience a modest improvement in vintage quality under the assumption of no recession and only a moderate tightening in bank lending standards (see Chart 7). This result also illustrates the very poor current conditions in the subprime sector and the lengths to which banks will need to go to ensure that a full correction takes place in the sector. These looming vintages are likely to be of

small size because of weakness in the housing market combined with the likely ferocity of the industry's pullback after several years of overly rapid growth.

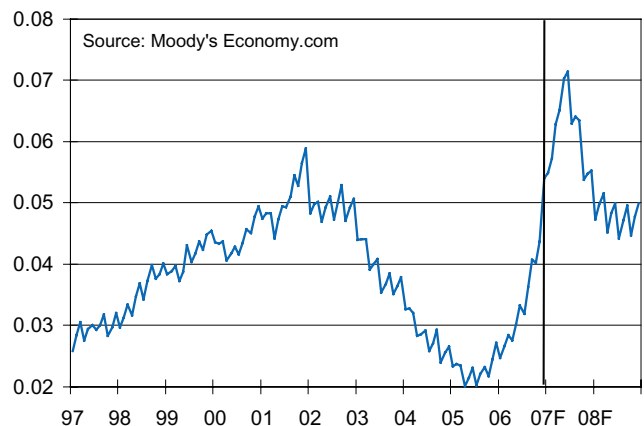
Factoring in the predicted size of each vintage through the forecast horizon, we can use the model to construct an overall foreclosure rate for the entire subprime lending sector (see Chart 8). The current overall foreclosure rate stands at around 5.5% but this is predicted to soar to around 7% early in the summer of 2007. As the vintage quality and broader housing market corrections unfold, this rate will quickly improve to a point just below 5%, which we expect to be maintained through the end of 2008. This rate is quite high by historical standards.

Digging deeper, we can also break these results down and project each of the specific components. Turning first to vintages, the model predicts that

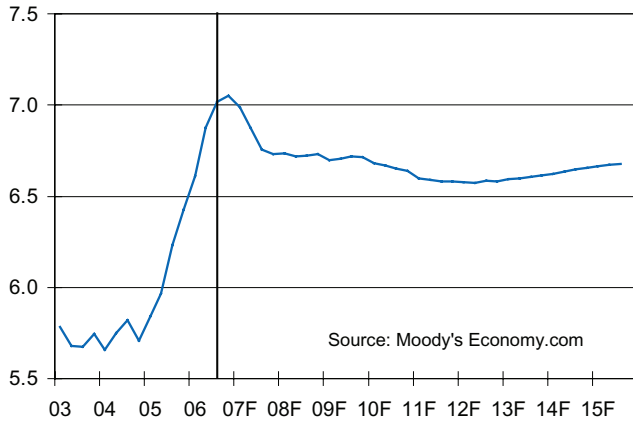
**Chart 7: Projections for March 2008 Vintage  
Foreclosure rate, %**



**Chart 8: Aggregating Data and Forecasts Across Vintages  
Foreclosure rate, %**



**Chart 9: Vintage Quality Projections**  
*Lower values indicate better vintage quality*



quality has effectively bottomed and that the most recently established December vintage is likely to be the poorest performing (see Chart 9). Vintages will then improve ostensibly throughout the remainder of the forecast horizon. By the end of 2007, the bulk of the improvement in vintage quality will have already been booked and subsequent improvements, though ongoing, will be modest.

Disconcertingly, the model predicts that vintage quality will remain far poorer than the historical average throughout the forecast period. The analysis described above suggests that a recession may be necessary for vintage quality to be driven back to its historical average but such an occurrence is not part of our baseline forecast. The initial response of the banks is driven by our forecast for the Federal Reserve senior loan officer survey; here we predict a tightening in conditions that is slightly more abrupt than that seen during the early 1990s recession (which seems ominously appropriate); a more severe financial markets response would also drive vintage quality back to historical averages. A combination of a recession and an overly aggressive response by credit providers would see us enter a “golden age” in terms of low foreclosure rates of newly established vintages, although this would in no way represent an optimal outcome for the industry generally.

Turning to macroeconomic conditions, the nadir comes in early 2007 when the housing market itself is expected to bottom, and then conditions improve through the horizon to a point close to the historical average (see Chart 10). In the second half of 2007,

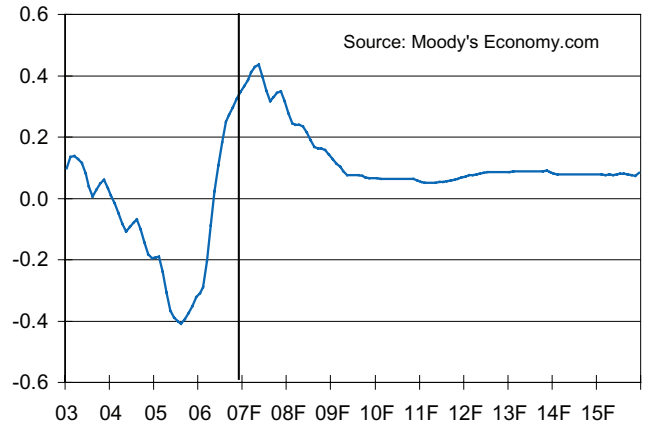
reverberations in the business cycle are expected to cause a slight deterioration in conditions but, other than this, the improvement through the forecast period will be inexorable. A recession in this context will cause conditions to deteriorate markedly relative to the baseline, though detailed scenario analyses are beyond the scope of the present study.

In terms of the lifecycle component, the interesting dynamic is the impact that the looming tightening in credit standards will have on the shape of future foreclosures (see Chart 11). Our analysis indicates that all vintages will experience a spike in foreclosure activity as finance companies clamp down on existing clientele. For vintages formed most recently, in 2006, we expect the peak in foreclosures to come considerably sooner than might have been expected without such a clear policy response.

**Conclusions.**

The techniques developed and described in this article represent a clear improvement over traditional approaches. While the separation of aggregate vintage data into their three components is a well worn path, modeling and forecasting all three components is not. Just this feature alone should highlight the desirability of this method when

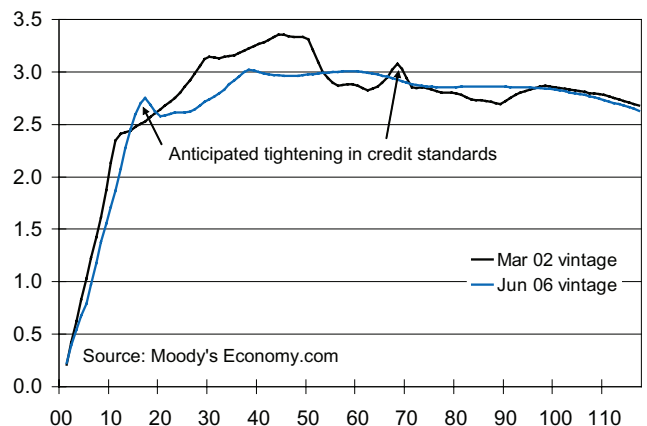
**Chart 10: Projected Macroeconomic Conditions**  
*More negative numbers indicate better conditions*



applied to consumer credit risk modeling. In many instances, not least the recent runaway in subprime defaults, one of the culprits is a declining standard of mortgage origination. Modeling and forecasting using only existing vintages, as is the case with traditional methods, have no hope of accurately predicting a poor quality future vintage. Instead, an attempt must be made to forecast this key component if a full understanding of likely future portfolio behavior is ever to be gleaned.

The results presented here on aggregate subprime mortgage foreclosure show extraordinary promise. First, the estimated model yielded strongly statistically significant and interpretable results in all three of the constituent component submodels underlying subprime mortgage foreclosure rates. Second, the estimated historical movement of each subseries accorded closely with our understanding of how the

**Chart 11: Estimated Life Cycles for Two Vintages**  
*Months since origination*



mortgage market has developed over the past dozen years or so. Third, forecasts of likely future movements in the foreclosure rate exhibited evidence of a looming market correction. This correction seems a little underweight given the current state of the market; we suspect that the exogenous response of the financial sector may be somewhat more aggressive than that we assumed in constructing our forecasts.

The real utility of this technique can be seen in its potential application to specific portfolios of loans of any color. The Basel II treaty requires financial institutions to develop models of economic capital and then to use severe economic stress tests to determine reserve levels that ostensibly ensure solvency even under dire circumstances. If the behavior of future vintages is not considered in this analysis, one wonders whether economic capital predictions will fully represent the behavior of the portfolio in its totality. The results presented here clearly demonstrate that economic shocks can be transmitted not only through the time dimension but also through the vintage quality component and the shape of the

lifecycle. If these two components are assumed to be static when portfolios are stress tested, the potential for incorrect conclusions is extreme. A recession not only boosts overall default in existing vintages, it also hastens it. Not only this, a recession also improves the likely quality of new vintages, meaning that businesses should not necessarily shut the door to new customers when responding to crises like the one currently unfolding. It is very doubtful whether traditional consumer credit models will be able to pick up this fundamental dynamic.

The final point to note is that industry portfolio managers often have access to more detailed data than that available in the development of this model. The use of firm level data, such as the minimum credit score at which finance will be offered, the total advertising budget, and the number of days accounts must be delinquent before collections officers will be employed, would significantly enhance the model's accuracy. The first two variables would be logical explanators of future vintage quality—blanket advertising should certainly decrease average vintage

quality—while the latter variable would feed logically into the shape of the lifecycle and how aggressively non-payers are actually pursued.

The point is that using only publicly available economic data has limited the ability to fully model responses made by financial institutions to the trends identified. Banks should, however, be able to overcome such data inadequacies and use these techniques to model, forecast and simulate their ideal responses to any difficulties. A full Basel II preparedness would allow the institution to not only accurately consider the impact of dire economic stresses but also the institutions' particular responses to such stresses.

In the current environment, where subprime lenders look shakier than ever, the performance of the sector will be as much a function of how well it is managed as how well the broader economy holds up through 2007 and 2008. A mild economic downturn could be a disaster for the industry if the response of banks is ham-fisted or in any way overly aggressive.

© 2007, Moody's Economy.com, Inc. ("MEDC"), and/or its licensors. All rights reserved. The information and materials contained herein are protected by United States copyright, trade secret, and/or trademark law, as well as other state, national, and international laws and regulations. Except and to the extent as otherwise expressly agreed to, such information and materials are for the exclusive use of MEDC's subscribers, and may not be copied, reproduced, repackaged, further transmitted, transferred, disseminated, redistributed or resold, or stored for subsequent use for any purpose, in whole or in part. MEDC has obtained all information from sources believed to be reliable. Because of the possibility of human and mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. UNDER NO CIRCUMSTANCES SHALL MEDC OR ITS LICENSORS BE LIABLE TO YOU OR ANY OTHER PERSON IN ANY MANNER FOR ANY LOSS OR DAMAGE CAUSED BY, RESULTING FROM, OR RELATING TO, IN WHOLE OR IN PART, ERRORS OR DEFICIENCIES CONTAINED IN THE INFORMATION PROVIDED, INCLUDING BUT NOT LIMITED TO ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES HOWEVER THEY ARISE. The financial reporting, analysis, projections, observations, and other information contained herein are statements of opinion and not statements of fact or recommendations to purchase, sell, or hold any securities. Each opinion must be weighed solely as one factor in any investment decision made by or on behalf of any user of the information contained herein.