Home-equity indicators with new credit data methods for improved mortgage risk analytics

Experian℠
Decision Analytics

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Executive summary

In the run-up to the United States' (U.S.) housing downturn and financial crisis, perhaps the greatest single risk-management shortfall was poorly predicted home prices and borrower home equity. This paper describes new improvements in housing market indicators and analytics derived from local-area credit and local real-estate information.

Home appraisers and real-estate agents have long used local real-estate market information, but only aggregate housing-market indicators are typically tracked and discussed. True housing market data are very local, and until recently, these data have not been systematically available and interpreted for broad use in modeling and analytics.

Local area credit information, similarly, is relatively new, and its potential for new indicators of local housing market conditions is studied here in Experian's Premier Aggregated Credit Statistics[SM] (Premier ACS, or PACS). At the aggregated national level, for example, as illustrated in Figure 1, mortgage borrowers' credit performance began showing signs of deterioration well in advance of the general downturns in home prices, which began around mid-2006.

Figure 1: Residential credit performance peaked before home prices

Mortgage Delinquency Rate

Residential percent 30+ Delinquent Pct of Total 'Secured Balances

Source: Federal Reserve
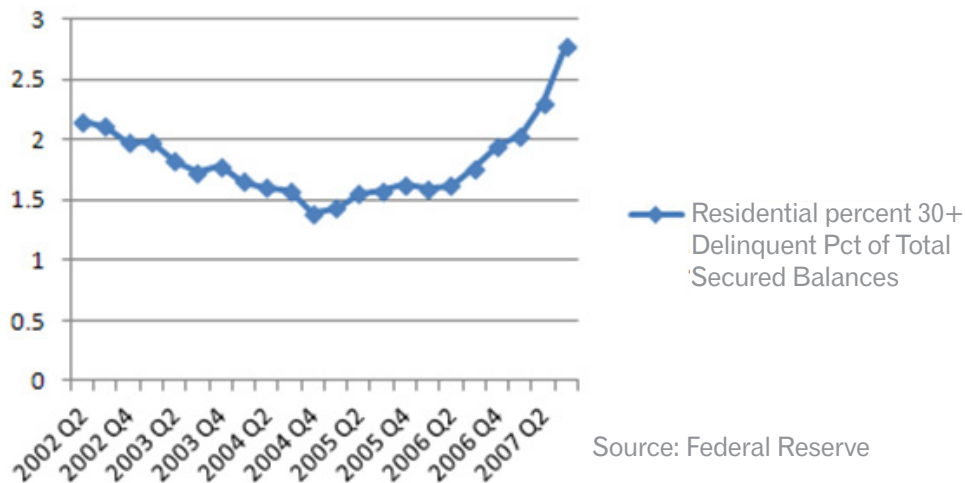
This paper discusses and demonstrates the continued need for deeper granularity of home-price and equity data, new attributes, and smarter models and analytics, including:

- Combined housing-market and credit attributes at the local neighborhood level, looking for new and improved leading indicators of home prices, borrower equity and market conditions
- Borrowers' combined, current up-to-date mortgage and lien balances, captured in credit data and public-record lien information

- Economic peer neighborhoods, at the sub–ZIP Code™ level — local housing-market neighborhoods defined within and across ZIP® codes, for improvements leading to better empirical definitions of local housing markets

- Proactive use of timely credit and housing-market data in improved models and strategies that respond more quickly to changing local-market conditions with better current loan-to-value (LTV) estimates, models, forecasts, portfolio analytics, strategies, valuation, pricing, etc.

Better approaches like these remain especially needed today, as banks and investors continue to face sizable risks and capital needs from legacy mortgage losses, even as they now also work to grow profitable new books of business. Approximately 20 to 30 percent of all mortgages in the United States remain underwater (with negative equity), with more than 50 percent still in some distressed areas. Home values and equity are key determinants of mortgage default/loss and pre-payment, housing-market behavior, other credit behavior and consumer buying patterns. Better models, analytics and strategies can lead to higher profits with faster renewed stability and stronger and more durable economic growth.

Resolving an asymmetry

Credit data and home-equity information are key inputs for many models and systems — but with an asymmetry. On the credit side, we've had both model-based credit scores and hundreds of detailed credit attributes. However, on the home-equity side, portfolio modelers and analysts have typically had to rely on a single automated valuation model (AVM) or even just time-adjusted home values using home price indexes (at the ZIP Code level at best). This also has been coupled with limited or no information on other mortgage liens. This asymmetry in model inputs is odd given that borrower credit histories are something we can observe for most borrowers, but only about five percent of U.S. homes are sold each year for an observable price, and subordinate liens are quite common and fluid. We've generally had more limited data available to gauge true home equity, even though it is less observable and more uncertain.

More recent tools (Cascades) combine AVMs, seeking the best AVM for each geographical area, while for loan balances, public property records have been used to capture the presence of other liens with the original loan balance. However, there are constraints and limitations here.[1] Unlike the credit data side, we've still not had wide use of more granular, timely and accurate data attributes — home-equity indicators — for modelers and analysts to test.

Banks, investors, appraisers, regulators and other clients are seeking improved market-condition and equity tracking services for local housing markets. More granular and timely local-market data and corresponding local-area credit information provide new inputs that can be distilled into predictive variables.[2]

[1] For example, a recent Federal Reserve white paper ("The U.S. Housing Market: Current Conditions and Policy Considerations," Jan. 4, 2012) observes: "Among other problems, the current system for lien registration in many jurisdictions is antiquated, largely manual and not reliably available in cross-jurisdictional form. Jurisdictions do not record liens in a consistent manner, and moreover, not all lien holders are required to register their liens" (p. 24). An online registry of liens is suggested. Other limitations are discussed below.

[2] A recent survey of risk managers in financial services flagged insufficient data as one of the key barriers cited to effective risk management ("Too good to fail? New challenges for risk management in financial services," 2011, Economist Intelligence Unit).

Leading indicators of cyclical and other neighborhood distress and recoveries can include: 1) local home-market data such as home sales versus homes on the market (e.g., absorption rate, months of remaining inventory), days on market, sold to list price ratios, distressed-sale prices, etc., 2) local-area credit variables such as pending distress sales in recent delinquencies and foreclosures and other indicators of neighborhood stress, and 3) changes in estimated area incomes and wealth and other neighborhood stability indicators.

In addition, the geographic granularity of the local-area data can be optimized. Limited attempts to define housing-market neighborhoods have tended to focus on geographic proximity. However, the most relevant local home-market areas are defined not just by distance, but also by economic peer neighborhoods or micro neighborhoods (sub-ZIP Code, and to a lesser degree, across ZIPs) in property, income/wealth and credit characteristics. This approach can better measure what home appraisers and real-estate brokers recognize as "true comparable" homes and neighborhoods in a local housing market. "Micro-aggregated" data from more precisely measured neighborhood home markets should tend to have larger effects on home values and borrower behavior. This should lead to more predictive and more robust input variables and models.

For the numerator of a borrower's current total LTV ratio, borrower-level credit data also moves beyond original lien balances to track total current mortgage balances each month. This should help to satisfy enhanced regulatory requirements on the monitoring of subordinate liens.[3]

Experian® and Collateral Analytics[4] have been working to combine products and further develop and refine these kinds of approaches to help better estimate and project current home-equity and mortgage and other credit behavior. More granular data and new attributes can be tested for use in mortgage default/loss forecasting and pre-pay models, other credit models, AVMs, home-price forecasting and analysis, portfolio analysis, security valuation, appraisals, policy and regulatory analysis, etc. This paper describes the background of the work, discusses an illustrative model and alternative methods of incorporating and testing new home-equity indicator variables, and shows new illustrative results that highlight some of the currently available variables and data.

A new finding

For example, we find that, as expected, both combined-current-loan-to-value (CCLTV, including all observed current lien balances) and borrower credit information are significant determinants of recent mortgage defaults on existing loans. However, adding to a base default model that uses CCLTV and borrower Credit Score (VantageScore®), we find that local-area credit variables tend to be stronger add-on default predictors than the individual borrower credit variables.

[3] "Regulators Reissue Guidance on Junior Liens," American Banker, Jan. 31, 2012

[4] Collateral Analytics, a provider of home-valuation and appraisal tools and forecasts, has one of the leading individual AVM models in the United States (based on independent testing), a part of the LPS Advantage Cascade run by AVMetrics.

See Figure 2 for an example of this result: ACS are the Premier Aggregated Credit Statistics (PACS) variables from sub-ZIP Code areas, Premier are the Experian individual-borrower credit attributes, and Base is the basic mortgage default model including CCLTV and borrower VantageScore.

Figure 2: Alternative models on recent mortgage defaults

Receiver operating characteristic curves
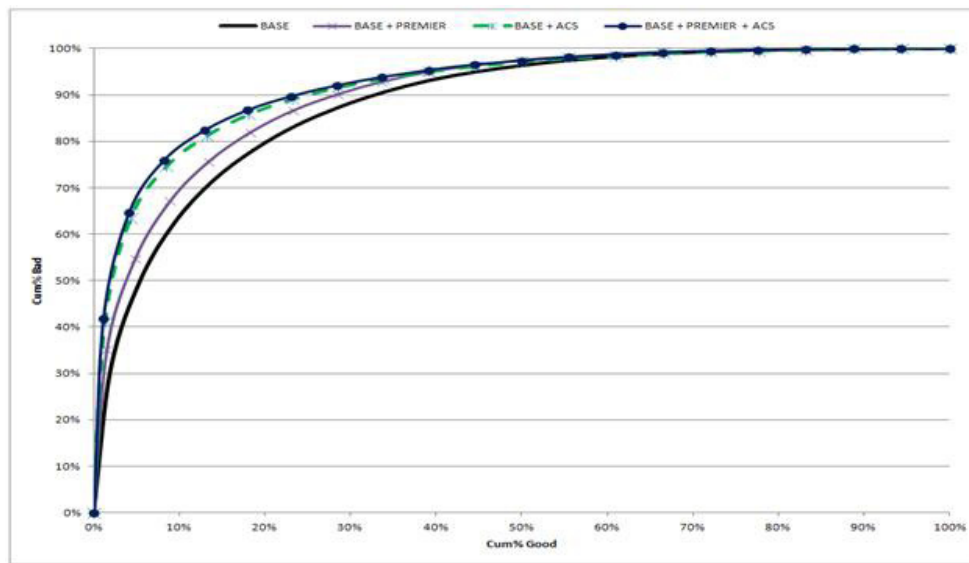
The basic models summarized in Figure 2 suggest, for example, that a mortgage portfolio analyst, in evaluating high-risk segment concentrations for their effect on portfolio risk, could identify a low-scoring group with small false positives — five percent of Goods — that captures about 47 percent of the Bads at this cutpoint using CCLTV and VantageScore. Adding only individual-borrower credit attributes to this model increases the efficiency of this identification to about 55 percent of Bads, while adding only local-area credit variables increases the efficiency considerably further to about 67 percent of Bads (with some marginal additional gain from adding both sets of data). Sharpening the model's risk identification lens with area credit can thus produce a more accurate portfolio risk assessment. Alternatively, if a valued and generally profitable customer offer is made to sufficiently low-risk customers in the mortgage portfolio, then these same results imply that adding local-area credit variables can allow a baseline offer rate of 75 percent, for example, to increase to 82 percent while keeping the default rate the same. So profitable new-offer volume can increase almost 10 percent (7/75), with no increase in default costs.[5]

Our overall findings suggest that in multivariate models that account in various ways for current LTV, and for measured historical and outcome-period home-price effects, local-area credit information contains significant leading indicators of pending

[5] Assuming constant loss given default

mortgage default conditions. We posit that this seems to be due to a combination of: 1) larger or smaller neighborhood credit stresses leading to more or fewer foreclosure sales and resulting negative or positive local home-price effects, 2) neighborhood mortgage-default "demonstration" or "social contagion" effects, and 3) a "data substitution" effect, whereby the local-area credit data contains more information when the local real-estate transaction volume is sparse and current home values and LTVs are less certain.

This is a potentially valuable new finding for risk and portfolio management, risk-managed growth, securities pricing, etc., and Experian is ready to assist clients with their own testing of the PACS and other data. A new patent-pending PACS mortgage score is also being tested for availability soon. For existing loans, the mortgage industry generally has been focused on CLTV; credit scores; other loan-level data; and in more recent years, to a degree, detailed borrower-level credit attributes. Previously, the detailed credit variables had only been used in mortgage scoring models for the most part, typically in AUS models. In recent years, evaluators of private-label MBS pools, for example, have acquired de-identified detailed borrower credit attributes on the loans in these pools. We now have found in this paper that on existing mortgage loans, the local-area credit data (properly distilled) is an even more important add-on mortgage default predictor than the individual borrower credit attributes, when both are included and analyzed together.

Sections of the paper

Section I of the paper discusses uncertainties and stresses of the recent and current housing-market environments and implications for future housing projections. Section II discusses the importance of analyzing housing markets using more granular local data to obtain greater accuracy in evaluating a mortgage portfolio and to determine the most appropriate portfolio actions. Section III focuses on specific measurement aspects of the components of current home equity. Section IV explains and shows the empirical tests of area credit statistics (Premier ACS). Section V discusses ongoing work with further refinements of local-area housing market definitions. Section VI concludes.

Uncertainties and stresses in current and future environments

In many areas of the United States since 2006, recent foreclosure sales — more precisely, real-estate-owned (REO) sales after the foreclosure — other bank-owned or investor sales, and short sales have affected local home prices. This has been seen particularly in the most distressed housing states: Arizona, California, Florida, Michigan, and Nevada. (This has also been an international phenomenon, of course, following large home-price declines in many countries, but in this paper we limit our attention to the U.S. market.) In part, these home price effects have stemmed from potential non-distressed home sellers holding normal home sales off the market (waiting for stronger pricing), which has lowered the market share of normal sales.

Nationwide or Metropolitan Statistical Area (MSA) averages that include distressed-property sales, however, can be misleading for most markets. Widely reported home price index values provide useful benchmarks, but they have limitations and only scratch the surface of neighborhood and individual characteristics that determine home values (Miller and Sklarz, 2008).

Distressed-property sales, while given much prominence in recent years and lowering overall home-price averages, have affected but not dominated most local home markets. The reporting of continued heavy price discounts for distressed sales (20 percent or significantly more in most areas) is a positive sign of market normality. It typically takes a significantly large build-up of distressed property sales in a local area or neighborhood home market to pull down regular property sale prices to their level. For normal or regular home valuation, distressed sales are typically discounted due to their "fire sale" nature, "as is" sales, and property neglect or damage. This means that the non-distressed or regular home price trends are most relevant for most homes in most neighborhoods.[6]

This also implies that national fears of distressed properties flooding a mythical single national home market — variously described as "*the* housing market" — have been overblown. Both nationally and locally, large volumes of foreclosure sales tend to be geographically concentrated, leaving many homeowners and potential homebuyers affected relatively little by the most distressed areas. One Barclays analyst, for example, also recently observed that:

> *There are now two kinds of buyers in the market: those who'll take a chance on a bargain-priced, distressed property and those who'll only make a conventional transaction… Even if the banks decide to move their inventory more aggressively, and I suspect they will, it's OK because the buyer is making a distinction.*[7]
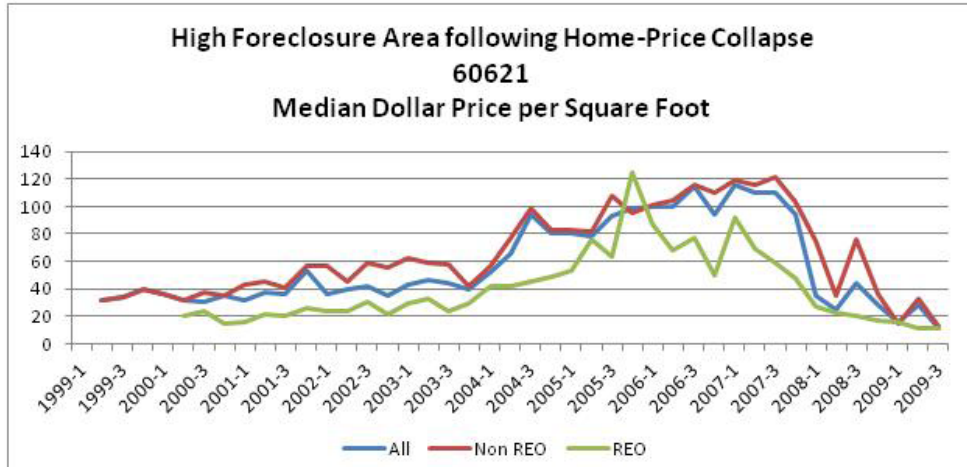
Rauterkus, Miller, Thrall, and Sklarz (2010) find that the REO distressed-property discount price gap, as expected, is quite sizable in ZIP-Code-level neighborhoods with relatively few foreclosures. They also find this discount price gap to be significantly smaller, as expected, in neighborhoods more dominated by foreclosures. This demonstrates how non-REO selling prices are "dragged down" or similarly discounted by a high frequency of distressed sales.

Figure 3 shows an example from a high-foreclosure Chicago-area ZIP Code. Notice that the REO price per square foot (the green line) began to fall in early 2006 in this case, whereas the non-REO price (the red line) eventually fell precipitously — but not until the second half of 2007. This raises the issue of identifying "tipping points" where non-distressed home values become more significantly affected by neighboring distressed property sales, and where foreclosures may at some point begin to rise at an increasing rate. At the sub-ZIP level, these types of pronounced local "micro neighborhood" downturns have been even more frequent than at the ZIP level.

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[6] For further discussion and examples, see Straka (2011a). High volumes of foreclosure sales and higher emphasis by financial institutions on maintaining REO properties also may have lessened REO discounts to some degree.

[7] Stephen Kim, cited in "Residential Housing Ready to Awaken?" on CNBC, Dec. 9, 2011

Figure 3

High Foreclosure Area following Home-Price Collapse
60621
Median Dollar Price per Square Foot

For comparison, Figure 4 shows the MSA average difference between the price of distressed (green line) and non-distressed (red line) properties in all of metro-area Chicago. This almost constant difference illustrates that more aggregate data can often mask most of the underlying neighborhood and micro-neighborhood activity of interest.

Figure 4

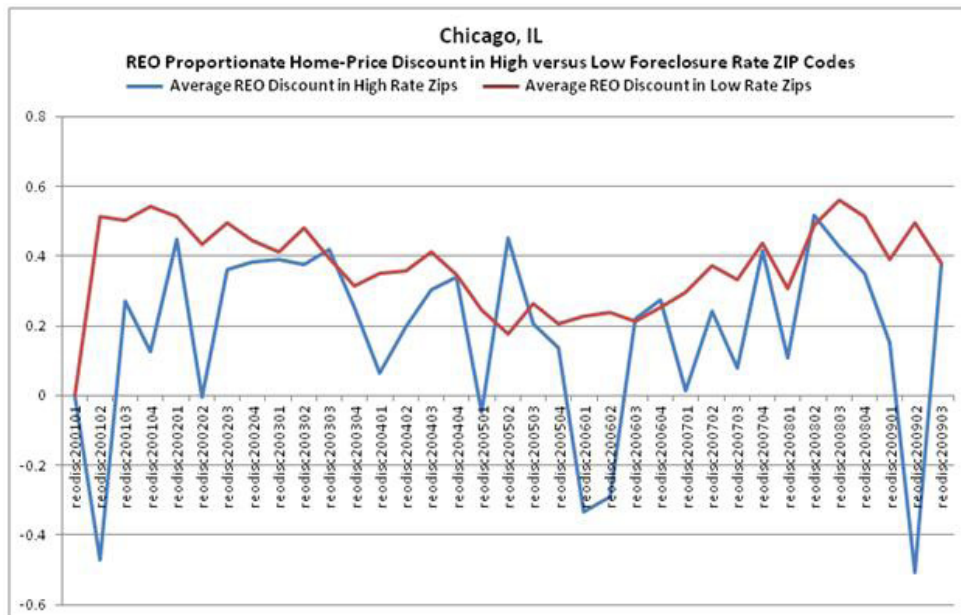Chicago, IL
Median Dollar Price Per Square Foot
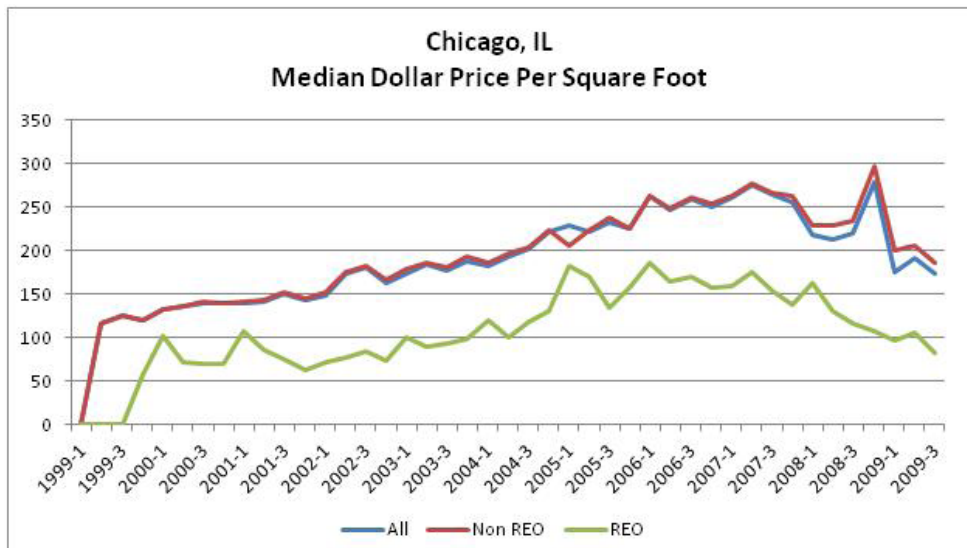
Source: Rauterkus, Miller, Thrall, and Sklarz (2010)

It is important to note that the concentrated influence of distressed property sales on non-distressed sales is not just a relatively recent phenomenon that is likely to fade or disappear. As seen in Figure 5, even as house prices boomed in general during the first part of the last decade, high foreclosure ZIP codes in the Chicago area (the blue line) also had a lower difference between REO and non-REO sales prices than did low foreclosure areas (the red line). While the incidence of high foreclosure areas will very likely continue to decline, market price contagion effects (negative and positive) are a lasting phenomenon — and models, forecasts and simulations must seek to capture these effects.[8]

Home values were very difficult to assess, of course, during the height of the recent housing-market and financial crises, with home prices falling by unprecedented amounts in various areas, and significant price declines that were widespread — something not seen since the Great Depression of the 1930s. Significant uncertainty remains today, with various areas having been in moderate double-dip, stable or recovering patterns. For imminent default risks among underwater borrowers, it is what the borrower believes about their expected home price, if sold, that really matters most. In any uncertain environment, homeowners, professional appraisers and housing analysts naturally tend to look for multiple indicators of home value. The need for multiple market indicators is reflected, for example, in the appraisal requirements of Fannie Mae and Freddie Mac, as updated in 2009 with new required indicators in "market conditions" assessments.[9]

Figure 5

Chicago, IL
REO Proportionate Home-Price Discount in High versus Low Foreclosure Rate ZIP Codes
— Average REO Discount in High Rate Zips   — Average REO Discount in Low Rate Zips

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[8] One silver lining of the recent environment, of course, is the large increase in available observations from stressed areas and neighborhoods, which should help in the construction of improved models and analytics.

[9] Fannie Mae Form 1004MC, Freddie Mac Form 71. As discussed throughout this paper, Experian, Collateral Analytics and others offer multiple products today that can improve these local-market assessments.

The importance of analyzing housing markets using more granular local data
With a desire for simple stories, the environment of recent years has included an excessive focus on aggregate home-price index values. There is not one single aggregate market for homes, but a wide distribution of differing markets and outcomes in tens to hundreds of thousands of local neighborhoods across the nation. Straka (2011a), for example, demonstrates that, despite common aggregate-index reporting of a "double dip in the housing market," a review of 51 metro-area counties across the United States suggested that around 60 percent of the underlying population and number of homes may have instead experienced stable or rising home prices in recent quarters. Straka (2011b) demonstrates a remarkably wide variation in 2005 to 2011 home price change within ZIP Codes. While it is tempting to simply assume that the ZIP Code level is "good enough" for housing market analysis, the data suggests otherwise. Financial institutions, investors and regulators that seek out and learn how to use local housing market data will generally be much closer to true housing markets.

The home-price meltdown had very different effects both across and within ZIP codes. Unfortunately, by the nature of the preceding boom, lower-income neighborhoods generally fared worse in the bust. At the same time, mixed-income areas became more common in the United States following failures in concentrated affordable housing in the 1960s and 1970s. As a result, in recent years, very large home-price drops also have occurred in lower-income micro-neighborhoods, with higher-income micro-neighborhoods — literally right next door — affected much less. Figure 6 shows ZIP+2 neighborhoods in San Diego County, for example. Lower-income neighborhoods, with greater price declines, are clearly concentrated to the south, near the central city, and in the east, farther away from the central city. However, there also are some pockets of larger price declines elsewhere in the metro area.

Figure 6
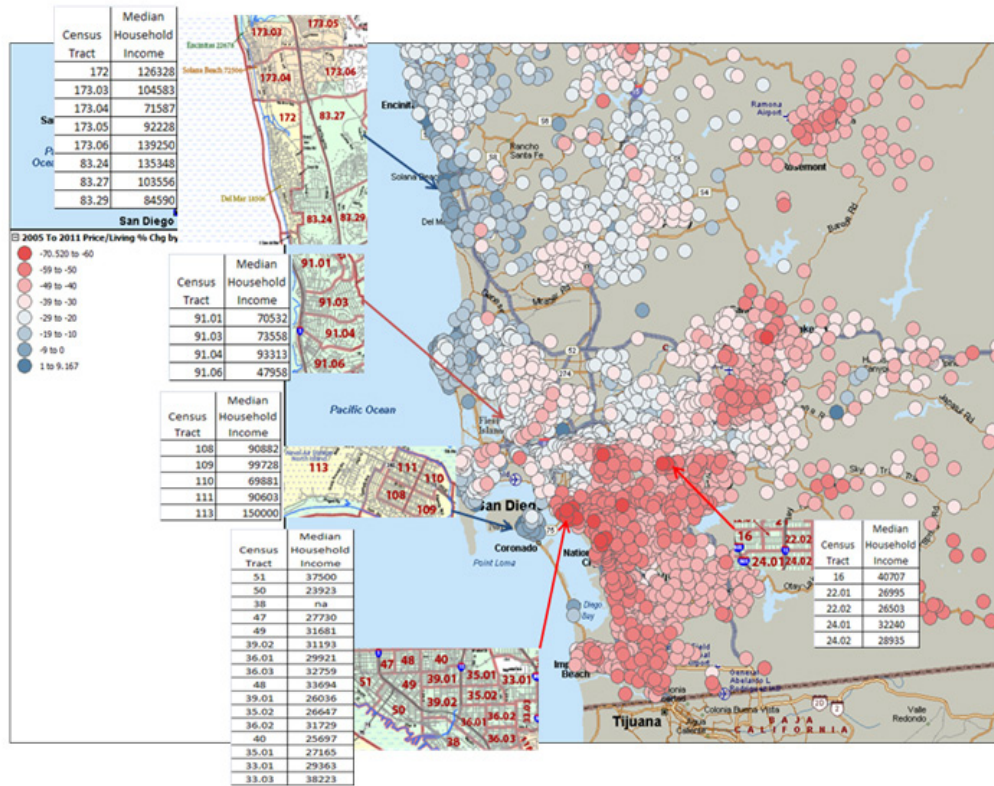
San Diego County ZIP+2 neighborhoods 2005 to 2011 home price/living area percent change from severe decline (red) to little or no decline (blue)

(examples of median household income from 2005 to 2009 U.S. Census American Community Survey)

Figure 7, in comparison, shows some overall more dispersed area home-price stress across the ZIP+2 neighborhoods of Sacramento. The neighborhood income-related pattern also is clearly evident in this case (illustrated here through home values). However, in Sacramento, the lower-income or lower-home-value and more stressed housing neighborhoods have been concentrated to the north and south away from the central city area near the rivers.

Figure 7

East Sacramento Summary From Trulia.com
Median sales price Jun 11 to Aug 11: $346,000 based on 48 sales.
From period one year ago: median sales price decreased 6.6%,and number of sales decreased 26.2%
Average price per square foot for East Sacramento was $276, a decrease of 8.9% compared to year ago.

Central Oak Park Summary From Trulia.com
Median sales price Jun 11 to Aug 11: $61,000 based on 43 sales
From period one year ago: median sales price decreased 10.8% and number of sales decreased 4.4%
Average price per square foot for Central Oak Park was $63, a decrease of 38.2% compared to year ago
South Oak Park Summary From Trulia.com
Median sales price Jun 11 to Aug 11: $55,782 based on 26 sales
From period one year ago: median sales price decreased 22% and number of sales decreased 33.3%
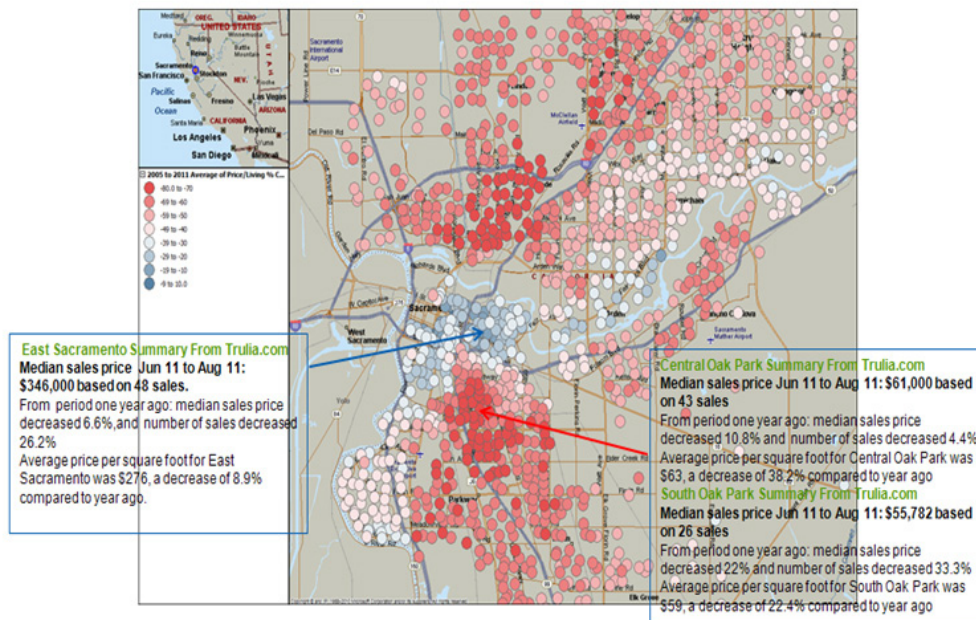Average price per square foot for South Oak Park was $59, a decrease of 22.4% compared to year ago

Sacramento County ZIP+2 neighborhoods 2005 to 2011 home price/living area percent change from severe decline (Red) to little or no decline (blue)

(examples of median sales prices from public records and trulia.com)

The additional pattern of larger percentage home-price drops in more affordable and generally newer-built outer-suburb areas (or, similarly, smaller distant "satellite" cities) has been a common one across many U.S. metropolitan areas. Other examples of cases in this general pattern include the outer suburbs and Inland Empire east of Los Angeles, California (Riverside, etc.); Stockton, California; and the Prince William and Loudon County, Virginia, and Prince Georges County, Maryland, areas outside of Washington, D.C. Home prices in such outer areas tended to boom during the housing bubble as many homebuyers sought new, but more affordable, homes further away from central cities. However, the subsequent percentage bust in home values was generally greater in these areas following the major sea change in the home price trend and in general home-price expectations. The S&P, Case-Shiller home price indexes, for example, also have evidenced this general pattern with a significantly larger percentage drop in a lower-value home price index.

A significant contribution to lower-value home price risk during 2003 to 2007 came from subprime mortgages, which became more concentrated in purchase-money loans (proportionally less in traditional debt consolidating refinances) as overall subprime lending boomed. Lower-income targeted subprime loans, along with Alt-A mortgages (including little- or no-doc loans,) became more concentrated in lower-income neighborhoods. Traditional subprime loan terms, including LTV limits, became relaxed, and certain interest-only (including option ARM) Alt-A loan products became "affordability" vehicles for virtually any borrower (particularly in

expensive metro areas and the most booming states, California, Nevada, Arizona and Florida). The new subprime and Alt-A financed buyers fueled strong entry-level and move-up housing demand. Purely speculative home buying became common (in the most booming areas especially) as prices continued to climb, and the run-up of the home-price bubble continued until the great general downturn began in mid 2006 and 2007.

As home prices turned down, the more recent subprime and Alt-A borrowers with high LTVs became the first to face negative equity on top of premium rates and other more costly loan terms. High percentages of these borrowers defaulted, with more severely declining home prices in lower-income neighborhoods generally resulting.

Deeper insights into these major developments, and their lessons and importance for assessments of local housing markets today, is best realized with very local housing-market, credit and income/wealth information. As noted earlier, appraisers valuing homes and using area home-value indicators for market assessments are required to focus heavily on local neighborhood home markets. Mortgage, other credit and home-value modelers and analysts now need to do the same.[10]

All parties now keen to avoid past mistakes — banks, investors, regulators, etc. — can benefit significantly from sub-ZIP Code level neighborhood home-equity indicators in their testing and evaluations. One effect, for example, of local geographic concentration of the steepest home price declines, evaluated with insufficiently granular home-price data, is a subtle inflation of estimated current LTVs and negative equity. To illustrate, consider a hypothetical ZIP Code with four equal-sized sub-ZIP neighborhoods: three with home prices down 20 percent from original values and one with home prices down 60 percent. The estimated home-price drop at the ZIP Code level is thus 30 percent. With many prime mortgages in the 70 to 80 original LTV range, the estimated minus 30 percent for all homes identically in the ZIP Code, versus the actual minus 20 percent for three-quarters of the homes in the ZIP, may push half of those mortgages or more into estimated negative equity when, in actuality, some modest positive equity remains. Generally speaking, regulators will favor more conservative assumptions requiring more capital, while banks may favor less conservative assumptions to free up capital for growth. However, the actual facts on the ground in the type of case just illustrated are not assumptions. They are simply actual facts being missed owing to inadequate data.

The importance for defaults, capital and growth
Home price declines create more negative-equity conditions across borrowers (especially among those with higher original LTVs). This establishes the necessary condition for most mortgage defaults, making negative equity the first key driver of default behavior overall, especially during market downturns and in the later stages of mortgage delinquency. Most borrowers with negative equity continue to pay down their loans, but borrowers experiencing a "trigger event" — significant income interruption or unexpected large bills, etc. — frequently stop paying their mortgage when the home is underwater.

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[10] Defining neighborhood boundaries and reporting on neighborhood value indicators are part of the appraisal process. However, missing from this, traditionally, was much of any involvement of statistical analysis in assessing the required determination of local market direction. New tools for appraisers from Collateral Analytics, LPS, and other vendors have been filling this void.

Other borrowers without personal hardship but with more "ruthless" default behavior, such as multiple-property investors, or those "strategically" defaulting, are likewise inclined to default on their mortgage under negative equity (especially when it becomes more negative and less likely to recover soon). In contrast, with positive equity, borrowers experiencing hardship may fulfill their mortgage obligation by selling the home or drawing on home-equity credit, and strategic defaulting becomes irrelevant.

Because of transactions costs in home sales, negative equity begins at a cumulative or combined current LTV value less than 100 percent (95 percent or even 90 percent have been useful benchmarks in the past); transactions costs vary by market and location. The imprecision in measures of current LTV makes it difficult to establish a single precise LTV cutoff defining borrowers with negative equity. This brings added uncertainty to the assessment of negative-equity percentages in mortgage portfolios. Nonetheless, measured mortgage default rates clearly increase substantially with higher measured current LTVs.

Credit card and other credit payments and behavior also are affected by negative home equity. In the 1990s and more easily in the boom before 2007, many borrowers who became over-extended on credit cards or other debt were able to pay off this higher-interest debt by consolidating it into a lower-interest second- or first-lien mortgage. This "safety valve" reduced stressed borrowers' interest rates and monthly debt payments, and mortgage interest tax deductibility provided additional relief. The high-risk segment of debt-consolidation loans (bad credit, high debt-to-income, low or no reserves) was a primary share of traditional subprime mortgages — a market segment that largely disappeared in 2007, although lower-risk debt consolidations into mortgage have continued to varying degrees. Any type of debt consolidation in a mortgage requires positive equity — and considerable equity has been needed in the uncertain and risk-averse lending environment of recent years. Thus, with greater negative equity in general and the disappearance of most subprime mortgages, borrowers that became overextended on higher-interest debt had far fewer mortgage debt-consolidation options after 2007, which impacted credit card and other credit losses.[11]

Consumers' willingness to spend is affected by their wealth perceptions, which are also impacted by home equity. For most of the U.S. population, home equity has been the largest component of wealth, affecting consumer spending decisions and the economy in general. The links between home equity, other credit and the economy overall further enhance the need for better and more granular home-equity information.

As a result, for both mortgage and overall capital, and for growth and marketing needs, banks have a strong interest in the paths of home prices and borrowers' home equity.

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[11] Card and other credit delinquencies such as autos have since recovered much more rapidly than mortgages, with the higher-risk credits cycled out relatively quickly and credit tightening and consumer deleveraging keeping the recent books very clean (indeed, credit card delinquencies reached new historic lows in 2011, and auto lending has been doing very well).

This interest extends to regulators like the Federal Reserve as well. In a recent white paper and statements by Chairman Ben Bernanke, the Federal Reserve has made clear its concerns that the continued relatively weak state of the housing sector overall is inhibiting overall economic growth and the pace of the economic recovery.[12]

Measuring the components of current home equity
For each mortgage borrower, current equity and current cumulative or combined LTV (CCLTV) is determined by:

- The total of the unpaid principal balance (UPB) and any other balance on the:
  - First mortgage lien
  - Second mortgage lien
  - Any other subordinate mortgage lien
  - Any other liens (tax liens, mechanics liens, etc.)
- Current market value of the home

For holders of a first (subordinate) lien, the unpaid balance of the subordinate (first) lien(s) is not generally available, except in cases where the same investor owns both the first and subordinate liens. The unpaid balance of the "off us" liens can be measured most precisely through credit data, and this can cover the large majority of cases, as discussed below, although not perfectly.

Unpaid mortgage loan and lien balances
To fully gauge risks and behavior, banks, investors and others need to measure a borrower's current cumulative or combined LTV (CCLTV) reflecting all liens. This requires the current unpaid balances of "off us" liens. Consumer credit data in Experian's Premier Attributes[SM] now can provide access to most of this information with very high quality at relatively low cost. The limited gaps in credit reporting, however — and also several limitations in county public-records alternatives — also need to be understood.

The value and limitations of consumer credit data: The credit data is a very high-quality source for measuring the current unpaid balance of open liens. Its main values lie in: 1) consistent and broad coverage in nationwide reporting, 2) timely and largely complete reporting of the current unpaid balance of open liens, and 3) relatively low cost. Moreover, the value of credit data for this purpose is assisted by borrower behavior. For the large majority of cases, for example, borrower first and subordinate lien information can be matched with high confidence in the credit data because the borrower has only one first lien and one home. Borrowers with more than a first very typically also have only one subordinate lien.

Despite all of these strengths, however, credit data is not a fully complete and perfect solution for capturing all open liens, for complete timely reporting of new mortgage liens, and for properly matching lien balances in all cases to accurately and precisely measure the CCLTV of every mortgage loan.

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[12] Federal Reserve, "The U.S. Housing Market: Current Conditions and Policy Considerations," Jan. 4, 2012.

Industry vendor CoreLogic Credco, in promoting a recent new combined reporting product, has claimed that its "preliminary analysis" finds that around 7.5 percent (one in 13) of pieces of consumer credit information are not present in "traditional credit reports," and that these are "often mortgage obligations."[13]

Missing mortgage elements seem likely to reflect the following: 1) Despite very strong encouragement from regulators, advocacy groups, state reporting requirements, etc., there is still allowed voluntary under-reporting of credit data, including mortgage data, [14] 2) Credit unions and small banks may report to only one or two of the credit repositories, requiring a tri-bureau report for their credit data to be captured, 3) new mortgage liens, as loans sold into the secondary market, etc., often encounter a lag in credit reporting of about two to three months typically, to up to even five months or so in a few cases, and this may exceed the new mortgage recording lag that also is found in county public records data, 4) someone with a Chapter 7 bankruptcy who does not sign a reaffirmation agreement for a mortgage may not see the loan on credit reports because the debt was not officially reinstated in bankruptcy court, which loosens reporting requirements, and 5) in rare cases, reporting errors in names, addresses, etc., may cause credit data recording errors.[15] As with any other record, the credit data is dependent on timely full and accurate reporting from the mortgage lender or servicer source.

For more fully and properly matching lien balances attached to the correct property — at least as well as possible in view of country-record limitations (discussed below) — county public property records also are needed to better reflect the behaviors of borrowers with multiple mortgages (property investors, who typically rent their non-owner-occupied properties) and those fewer borrowers who own secondary homes (e.g., vacation homes). All together, these multiple-property cases typically account for around 10 to 15 percent of mortgage borrowers.

The value and limitations of county public property records: The main value of these data lie in their abilities to close some of the credit-data reporting gaps and shortcomings discussed above. Used properly, these data can provide some clear value for this purpose. But these county records data themselves also have several clear limitations and shortcomings. For these reasons, even with a combination of credit data and county records, there is no perfect solution available today to fully, accurately, and precisely measure mortgage loan CCLTVs in all cases.[16]

Some of the limitations of county records are as follows:
1) As cited earlier in footnote 1, "Among other problems, the current system for lien registration in many jurisdictions is antiquated, largely manual and not reliably available in cross-jurisdictional form. Jurisdictions do not record liens in a consistent manner, and moreover, not all lien holders are required to register their liens" (Federal

[13] CoreLogic Credco, "CoreScoreTM Credit Report," March 2012.

[14] "Mortgage company not required to report payments," Experian.com, Sept. 28, 2011.

[15] Anna Assad, "Why Isn't My Mortgage on My Credit Report?" San Francisco Chronicle, 2011.

[16] Additional privately owned mortgage loan data, collected and aggregated from mortgage servicers and from securities information from MBS data sources, have been assembled by industry vendors CoreLogic and LPS (the mortgage securities loan data also is more widely available, e.g., from Lewtan). However, these data also have limitations. For example, CoreLogic and LPS are restricted around loan-level information on GSE loans, since the GSEs, as the Master Servicers and owners of their loans, assert their ownership of the servicing loan data (e.g., see Freddie Mac Servicer Bulletin Number 2011-9, May 17, 2011). All known industry solutions today have to fall back, at bottom, on various imperfect matching algorithms and assumptions for at least some subsets of cases.

Reserve White Paper, p. 24). Parts of the public property records are unavailable in some areas.

2) A key limitation of county records is that they only capture the original mortgage balance with the recording of a mortgage lien, with no view at all of current balances for non-defaulted mortgages. This is a serious limitation for accurate CCLTV measurement.

Without accurate current unpaid balances from credit data, the measurement error on CCLTV can be significant. For example, a home valued at $250,000 with an original $50,000 second lien that is now 90 percent paid off will have a CCLTV overstated by 18 percent if the $5,000 current UPB of the second is not captured and the original UPB is used instead. With this original UPB assumption method applied to HELOCs that begin with a zero UPB, but are then significantly utilized, the CCLTV is significantly understated. Simple assumptions that might be made on amortization of a subordinate lien, in particular, have no easy grounding, as borrower behavior in the payoffs of subordinate liens varies a great deal. [17]

3) It can take many months, or even years, for a paid-off subordinate lien, for example, to be expunged from property records (many borrowers discovered this to their annoyance during recent mortgage refinancing waves, for example). For this and the prior reason above, county records data, if used alone, can overstate subordinate lien balances. In the credit data, in contrast, any paid-off lien should generally be recorded with the next monthly credit reporting cycle.

4) An important corollary of limitation #1 above, and of generally more limited automation, is that county public records information can be relatively costly to collect overall, which raises their comparative end data costs.

5) Mortgage loan amounts in county records may be found in three sources: i) the original Deed of Trust, with the original loan amount, ii) any Notice of Default from a lender (which includes the current amount in arrears and name of the creditor), and iii) any subsequent Notice of Trustee Sale once a property is well into foreclosure and about to become bank- or investor-owned (which also includes the amount in arrears). These are all public documents, and notices typically include at least some form of publication. For defaulted loans, the total amount of arrears will typically include any unpaid interest and fees due to the late or missing payments. However, if the borrower has made up these payments and restored the loan, or if some type of loan modification workout or forbearance has become involved, changes in the details of the unpaid balance may not appear in any county records, or may appear only after some considerable delay.

[17] The measurement of subordinate liens also has taken on a particular importance in the housing and finance crisis, with controversies and uncertainty generated by the relative roles of first and subordinate liens in mortgage modifications and by the loss exposure and capital needs of major banks that hold a high proportion of outstanding subordinate-lien mortgages. For some discussions of the issues, see Yoon (2010) and Podmolik (2010). For a summary of these issues and a look at mortgage lien data and the implied combined or total LTVs, see Goodman, Ashworth, Landy, and Yin (2010). Both measurement and policy uncertainties with respect to subordinate mortgage liens have hindered the recoveries of the housing, mortgage, and banking sectors.

In view of the above limitations, banks, investors, regulators, etc. are advised to consult with one or more industry and data experts to best address the challenges in combining credit data and county records to measure CCLTVs, etc.

Current value of the home:
Home values and prices are determined by the factors of:

- Environment and uncertainties
- Comparable property sales
- Property characteristics and condition
- Buyer's willingness to pay

In traditional practice, market or analytic measures of home value can typically rely on one or more of the following (at successively higher costs):

- Automated valuation model (AVM)
- Broker price opinion (BPO)
- Appraisal: Desktop, Field exterior-only, or Full on-site

As noted earlier, many newer appraisal assistance tools are now available through vendors like Collateral Analytics, LPS, CoreLogic, etc. These home valuation methods are all reasonable depending on the need and budget, although each is far from perfect, particularly in uncertain markets. With their prices easily ranging up to several hundred dollars per loan, the costs of the full manual expert-opinion appraisal methods can often be prohibitive for portfolio evaluations. Lower-cost simple property inspections combined with AVMs are one of the valuation tools now available in-between an AVM and a full expert appraisal. Because of their relatively much lower costs through modeling-based automation, and resulting widespread use in mortgage portfolio valuations and projections, AVMs have taken on a particularly important role in the assessment of current home values.

The factors used in AVMs are:

- Public and private property and loan information
- Time adjustment using home price indexes
- Regression models and other methods that relate these fixed and varying factors to observed home sale prices
- Weighted-repeat-sales methods in indexing that limit the data used but keep properties in the mix the same to control for the many unobserved cross-sectional differences
- Hedonic models that account for more detailed property characteristics (e.g., number of bedrooms and baths) and can control for changes in the property mix this way
- MLS (Multiple Listing Service) data on the real-estate listings, sales, activity, etc. in the local home market

MLS data provide a significant boost to AVM accuracy and coverage with their heightened level of local property, market and neighborhood detail that most AVMs have traditionally not been able to access. Collateral Analytics and the other AVM

vendors cited above (LPS and CoreLogic) have been able to use business channels to secure access to this local market information in recent years to significantly improve AVM model results.[18]

These local real-estate market data provide multiple advantages over more traditional public record sales data, such as:

- The data is more timely, because new listings come on the market every day and there is great emphasis on making this data public as soon as possible.

- Sales data is typically reported to the local MLS within days of recording, which is counter to many public record sources where it may take weeks if not several months for sales to show up at the recorder's office.

- MLS data offers a multidimensional picture of the real-estate market since one can find not only what a home has sold for, but also what price the home has not sold for if it was taken off the market or what price is being asked for it if it is currently listed. This provides a much clearer picture of supply versus demand in a particular marketplace.

- MLS data is the only source of sold price information in non-disclosure states such as Texas, Indiana and Utah.

- MLS data also can be used to create powerful leading indicators for the future direction of home prices and sales activity. Some indicators are Sold Market Times, Months of Inventory Remaining (MRI) and Sold-To-List Price Ratio. Research by Collateral Analytics has found that these indicators typically lead home prices by anywhere from six to 24 months and are particularly helpful in identifying turning points in the market. In addition, MRI can be used to compare the supply/demand balance for different geographic areas (e.g., CBSA, county, city, ZIP Code or neighborhood) as well as help stratify it within the same area by property type, price range, home size, etc. Collateral Analytics, and others, offer local-market-condition indexes.

Empirical tests of local-area credit statistics
As noted, home appraisal requirements now stress the need for better assessments of the state of the relevant local home market — are the home values in this local market stable, declining or recovering? As discussed, this is not just a question for individual appraisers, but also for banks' risk management and capital, growth outlooks and portfolio policies overall, with considerable negative-equity risks remaining, along with new opportunities for risk-managed growth.

Along with the more traditional, and now more readily accessible, local housing market indicators discussed above, local-area credit data like Experian's Premier Aggregated Credit Statistics (Premier ACS, or PACS) also can provide early indicators

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[18] Collateral Analytics' AVM has ranked first in one set of recent independent industry tests. This AVM is included in the LPS Cascade Advantage, which is being run by AVMetrics (a leading independent AVM evaluator). The LPS Cascade Advantage also includes individual LPS AVM(s), which appear to be in the "top three or four right now," according to recent LPS statements (Dan Berman, in December 2011 Mortgage Banking). These observations appear to make the LPS Cascade Advantage the best vendor-based combined AVM tool in the market today — with the other very significant competitor here being CoreLogic. Each of these companies warrants their legal access through business channels to the local-market information being used.

of neighborhood financial stresses in housing markets. Mortgage delinquencies and other local-area stresses create a pipeline that leads to pending distressed-property sales, with their resulting market effects on home values and consequent impacts on further mortgage default likelihoods. Local-area credit data may similarly, of course, reveal early indications of market stabilizations and recoveries. The effects of these credit data, like other area home-equity indicators, also may result from changes in market perceptions and home price expectations. Actual and perceived home values, along with local market behavior, are influenced by:

- Comparable and pending sales, foreclosure sales and off-market listing activity
- Property contagion effects and property conditions, including effects from deferred or stable home maintenance, and — particularly important for condos, for example — upkeep of taxes, dues and insurance payments
- Borrower "contagion" and peer-defaulter "demonstration" effects, including neighborhood and market economic strength and beliefs, reflected in local peer behavior (defaults and pre-payments, etc.), neighborhood turnover, etc.

All else constant, home values and borrower defaults, including strategic defaults, can reflect borrowers' confidence in the strength of their neighborhood, and credit data may help to reveal this weakening or strengthening neighborhood confidence.

In addition, local-area credit data may in certain times and places offer a "data substitution" effect, whereby the local-area credit data contains more information when and where local-area real-estate transaction volume is sparse, making current home values, CCLTVs and market trends particularly unclear. Whether observed local home-sales and recorded market prices are sparse due to a "frozen" state of the local market, or due to a sparsely populated area, or due to poor local-market data (such as a lack of public property records), there generally will be considerably more available consumer credit observations to aggregate up into a picture of local-area consumers.

The empirical tests
We have tested the Experian PACS data for its statistical significance and value in predicting recent mortgage defaults on existing loans. For this model testing purpose, Experian credit data along with AVM home value and home price data from Collateral Analytics have been used to test a set of basic mortgage default equations.

Data: The primary modeling data used was a mortgage loan database drawn from a five-percent random, de-identified research sample from Experian's File One[SM] credit data. These data are summarized in Summary Table 1 on the following page

Summary Table 1

Model test sample for Experian PACS data
Five percent random mortgages from File One research data
- Observation point March 2009
- Outcome point March 2011
- Bad: 90+ DPD, Good: current to 30 DPD, Indeterminate: 60 DPD
- Consumer has one first mortgage
- The first mortgage is no more than 60+ DPD as of the observation point
- Attributes:
  – Premier borrower-level credit attributes
  – Credit Scores (primarily VantageScore)
  – CCLTV: Combined Current Loan-To-Value (home values from Collateral Analytics AVM)
  – Other borrower/loan/collateral data
  – PACS ZIP, ZIP+2 and ZIP+4™ data
  – Control Variables: home price or AVM variables from outcome period and historical

As shown above, the observation point of focus was March 2009, with subsequent mortgage loan performance observed through March 2011. The Bads definition used was every 90-plus days past due. Experian's Premier borrower credit attributes and the VantageScore were used along with CCLTV and other limited variables at this point. The PACs variables were borrower Premier credit attributes from the local area aggregated to the ZIP Code, ZIP+2 or ZIP+4 level. Control variables were used for home price changes over the outcome period and historically.

Model: The general default model specification used was the logistic regression:

(1) $\ln(p/1-p) = \alpha + \beta_1\ CCLTV + \beta_2\ Credit\ Score + \beta_3\ Detailed\ Borrower\ Credit\ Attributes + \beta_4\ Other\ Borrower/Loan/Collateral\ Characteristics + \beta_5\ Local\ Area\ Credit\ Statistics + \beta_6\ HousePriceChangeControlVariables$

Where p = probability of a mortgage default

A previous internal version of this paper (and corresponding slides presented at Experian's 2011 Vision conference) included a theoretical discussion of underlying structural equations. This is now moved to a separate paper. But to briefly summarize here, the unduly restrictive assumption (imposed by most traditional mortgage modeling) that the true home value is perfectly measured is freed. An alternative embedded model approach to home equity is described and specified, with the vectors of relevant home-equity indicators. This leads to three alternative or complementary approaches to measuring home equity and its effects: an embedded-model approach, enhanced AVM modeling or enhanced time series modeling.

Estimates of equation (1) centered around the base model specification including CCLTV and Credit Score. (To obtain insights into some of the home price control variables to be tested, we also drew on independent Collateral Analytics experience estimating a hazard mortgage default model with other third party data.)

Findings: The main finding was summarized earlier at the outset in Figure 2 described in the Executive Summary. Adding to the strong primary base default model that uses Credit Score (Vantage) and CCLTV — CCLTV, not surprisingly, provides significant model lift over VantageScore alone — we found that local-area credit variables tend to be stronger add-on default predictors than the individual borrower credit atttributes.

The qualitative finding that the PACS variables are statistically significant in this model was not surprising, given the discussions above in this paper. The strength of the PACS variables compared to other variables in the equation, however, was fairly surprising. This led us to several attempts to discover if the PACS results would be weakened with different geographically granular home-price and AVM variables from Collateral Analytics used as controls: home-price predictions as of 2009:03; actual changes during the outcome period including, in effect, a "perfect foresight" test on home values; and historical changes since the home-price peaks. The result in each case to date has been virtually no weakening of the key finding, with very little change in the PACS results. Further testing on these and other aspects of these data and results continues; as such, we consider our findings to date quite noteworthy, but still preliminary.

Based on other statistical testing, we believe that the PACS variables overall contain leading, current and lagging local area credit stress indicators. However, our specific PACS findings and control-variables testing here have found that in varying multivariate models, with CCLTV and multiple home-price effects included, the PACS local-area credit variables contain valuable additional leading indicators of pending local home-market and mortgage default conditions.

The individual PACS variables found to matter in these results also are very intuitive and "right signed," with sensible geographic patterns. As noted in the Executive Summary, a new patent-pending PACS mortgage score also is being tested for availability soon.

In addition to the prior posited theoretical reasons for these findings (the explanations for why local-area credit should matter, all else constant, discussed above), it is worth discussing here another intuitive empirical explanation for the relative magnitude of the PACS findings. This explanation centers on the fact that, for existing mortgage loans, once a delinquent loan has progressed to 30 DPD and 60 DPD, the effects of individual borrower credit attributes on the likelihood of subsequent transitions to full default have traditionally been found to be small or even non-existent. The key driver of the likelihood of full mortgage default for more seriously delinquent loans is typically negative equity (at this stage, most of the delinquent borrowers have significantly weakened credit, making borrower credit variables generally less able to help distinguish the risks of further transition to full default). For this reason, because the PACS variables are picking up local housing market effects that are correlated with greater negative equity, and other local-area influences described above, it makes sense that they would come in stronger than the individual borrower credit attributes in the ever-90-plus DPD model tested.

Robustness and relative strength across geographic areas: With the nature of the very differing regional and local home market outcomes described earlier and throughout this paper, the results of these model findings across different metro areas of the United States also is of great interest. Figure 8 summarizes these findings across MSAs throughout the country.

Figure 8 is first consistent with the findings of a recent VantageScore stress-test study, which showed still strong performance but, unsurprisingly, the lowest credit-score risk separation ability in the states with the worst home-price and unemployment outcomes (California, Arizona, Florida, Nevada, Michigan) (VantageScore 2.0 Stress Testing, October 2011; see also Straka 2012). Figure 8 shows that the model performance of VantageScore alone, measured by the Gini coefficient, clearly tends to be weakest in MSAs with the weakest housing markets, etc., such as Las Vegas, Nevada, and remaining weaker MSAs in California, Florida and Arizona, along with Detroit, Michigan.

The inclusion of the full additional model variables, however, including the strong addition of PACS, significantly improves the relative performance of the model in weaker housing markets, thus much better equalizing the model's overall performance across the country. This finding suggests further support for the conclusion that the PACS findings reported in this paper seem to reflect significant added default model lift from previously unmeasured local housing market effects.

Conversely, Figure 8 also shows that while the added model variables are robust in their effects across the MSAs, their relative added value also is less in those MSAs where housing markets have been relatively stronger and the VantageScore alone has thus correspondingly been stronger performing.

Figure 8
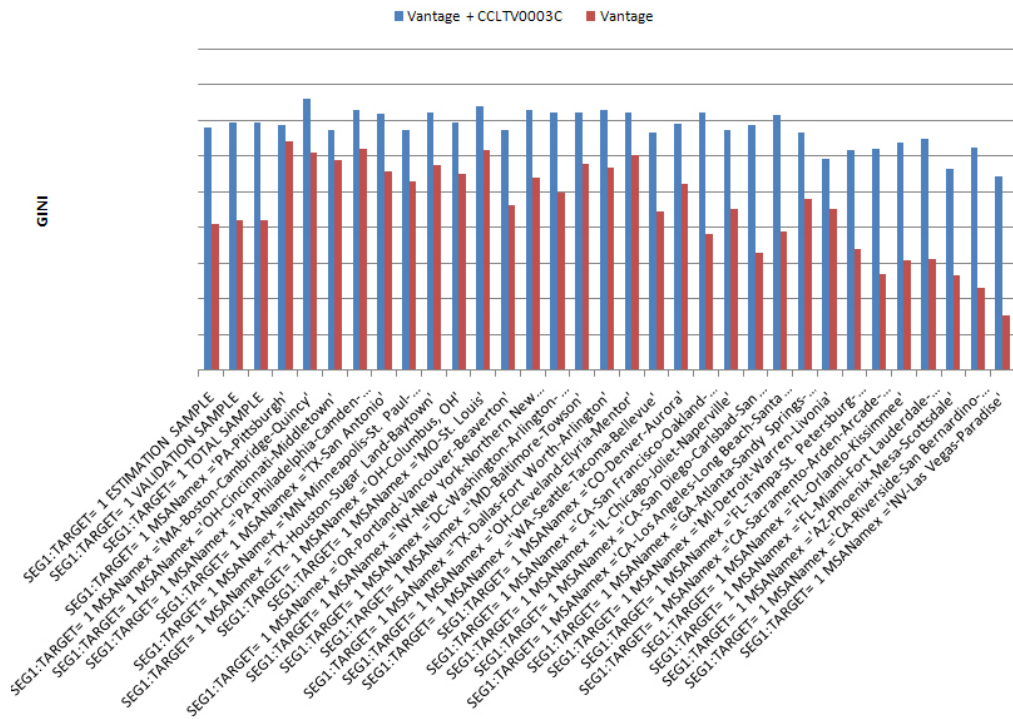
VantageScore vs. full model including CCLTV, Premiers and PACS (CCLTV0003C)
Strongest model lift better equalizes model performance in weakest housing markets

Refining and improving mortgage models with improved local-housing market definitions
The PACs testing in this paper has centered, for simplicity, on simplified definitions of local housing market areas based simply on ZIP+2s and ZIP+4s. Even so, in the underlying PACS findings, some interesting and intuitive local geographic patterns emerged.

With further research and testing, the geographic granularity of all local area data used can be better optimized. Attempts to define local housing market areas have naturally tended to focus on geographic proximity, and yet the most relevant local home market areas are defined not just by distance, but also by economic peer neighborhoods or micro-neighborhoods (sub-ZIP Code, and to a lesser degree across ZIPs) in property, income/wealth and credit characteristics.

This approach can better measure what home appraisers and real-estate brokers recognize as "true comparable" homes and neighborhoods in a local housing market. In future reported work, "micro-aggregated" data from more precisely measured local neighborhood home markets should tend to have larger effects on home values, defaults and other borrower behavior. This should lead to even more predictive and robust input variables and models.

Experian has begun working with Collateral Analytics to help refine the definition of generally sub-ZIP micro-neighborhood home markets. To reflect the most influential neighborhood comparables for property values and borrower behavior, the goal is to create and test economic peer neighborhood home markets defined through relative homogeneity in:

• Property information and values

• Estimated income and wealth and certain demographics (e.g., average length of residence)

• Credit history information [19]

Collateral Analytics has already developed and used a large database of neighborhood names and the corresponding boundary files for most of the United States. These local appraiser-based definitions were created by aggregating specific ZIP+4s and using the names and locations typically used by realtors, homeowners or appraisers. The initial set of these has been geographically based such that a neighborhood represents an aggregation of homes with similar size, lot area, age, quality, etc. There is great potential to continue refining these geographically based neighborhood definitions with credit, income and wealth indicators to further refine empirical neighborhood definitions into measures of local home markets with relationships that realtors and appraisers and others will recognize, representing differentially proximate areas with not only similar homes, but also similar household financial and demographic characteristics. The better empirical definition of these economic peer local housing markets should lead to more accurate home valuations with AVMs and similar tools, improved forecasts of future market trends, and better models of mortgage performance and other behavior. [20]

Figure 9 shows an example of 13 specific micro-neighborhoods currently defined by Collateral Analytics within a particular Honolulu ZIP code called Hawaii Kai, while Figures 10, 11 and 12 show examples of specific home market data indicators available for each of these micro-neighborhoods. Figure 13 goes to the level of individual condo developments. To consider a specific example of a leading market indicator, notice from Figure 10 that the average single-family sold price per square footage of living area began falling in most micro-neighborhoods of the Hawaii Kai ZIP code in the second half and fourth quarter of 2006, and, as seen in Figure 11, the average sold-property time on market in Hawaii Kai bottomed out and began rising two years prior, in the second half and fourth quarter of 2004.

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[19] From Green and Malpezzi (2003, p. 30): "Fundamentally, for a place to be defined as a housing market, it must be homogeneous in at least one dimension, and almost certainly more than one. It is this homogeneity that allows different houses to be substitutes for one another. To define things negatively, if two houses are not substitutes, they are not part of the same housing market."

As noted above, Experian's PACS draws on the extensive Premier Attributes[SM]. Other useful local-area indicators based on the Premier data can be aggregated up from Experian's borrower-level ability-to-pay tools, including Income Insight[SM], Debt-to-Income Insight[SM], Asset Insight[SM] and other relevant products. Estimates of local-area average income and wealth can thus similarly be created at the level of various local home-market areas to be tested.

[20] Peer local housing markets should be able to distinguish micro peer neighborhoods even within the closely proximate mixed-income neighborhoods discussed earlier.

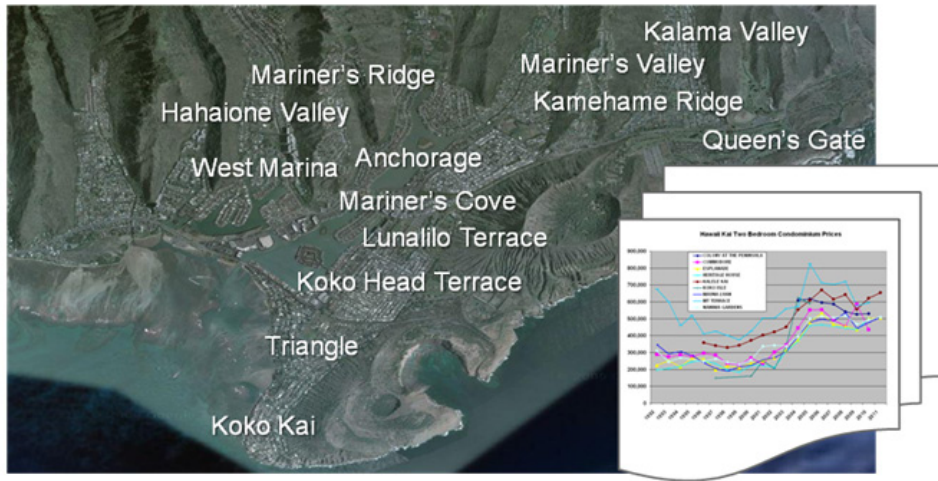Figure 9: Extensive granular information now available on U.S. detailed economic peer neighborhoods within zip codes

Figure 10: Hawaii Kai single family neighborhood prices
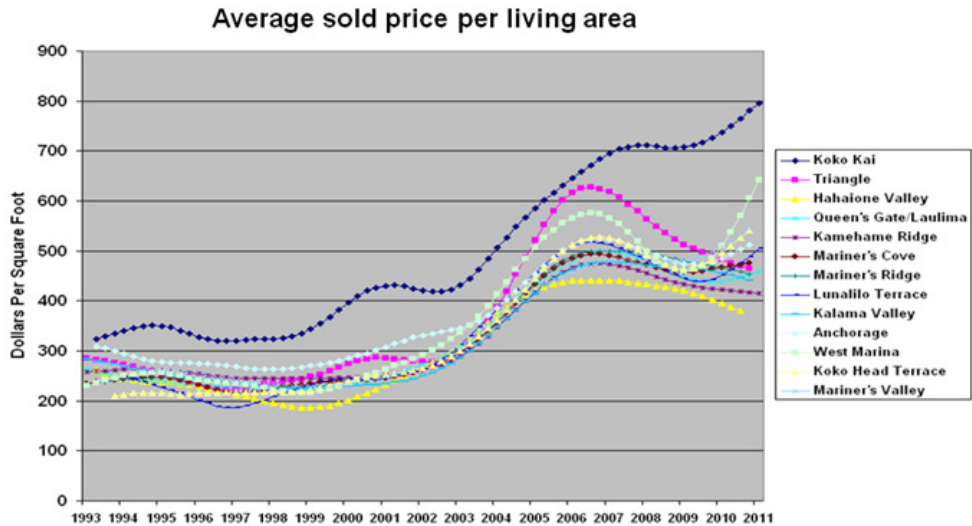
Figure 11: Hawaii Kai single family market-based leading indicators

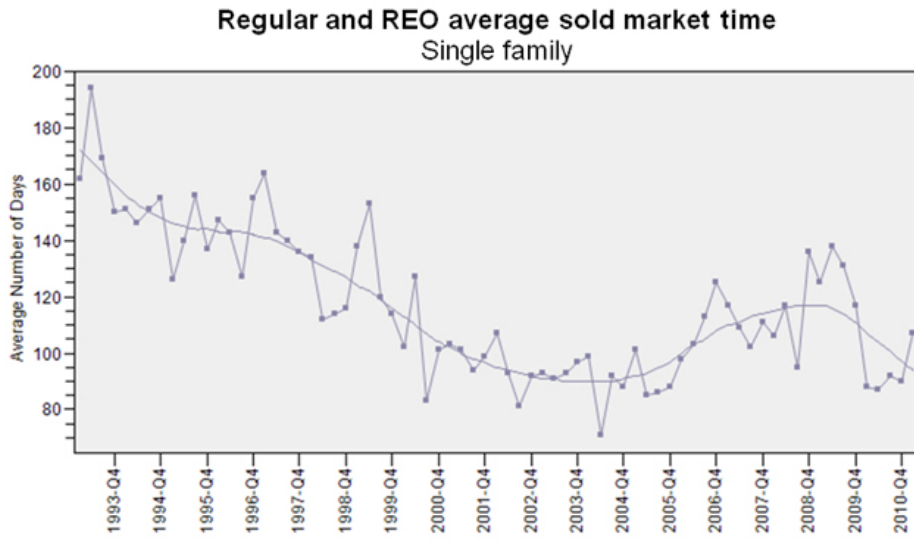**Regular and REO average sold market time**
Single family

Figure 12: Hawaii Kai single family market-based leading indicators

Average sold to list price ratio
Single family
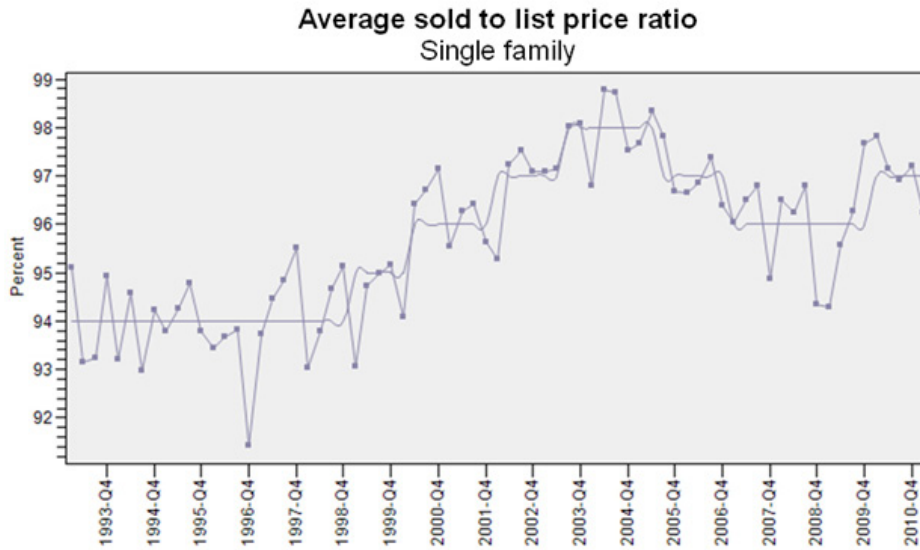
Figure 13: Hawaii Kai two-bedroom individual condominium prices

Hawaii Kai two-bedroom condominium prices

Legend:
- COLONY AT THE PENINSULA
- COMMODORE
- ESPLANADE
- HERITAGE HOUSE
- KALELE KAI
- KOKO ISLE
- MAUNA LUAN
- MT TERRACE
- NANIWA GARDENS
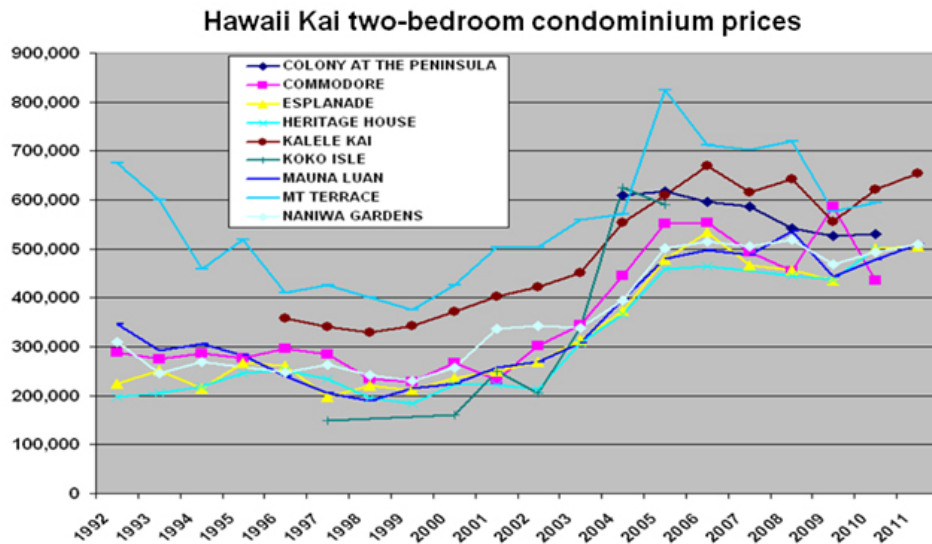
Conclusion

As developments in the recent housing and financial crises showed clearly, better model inputs and methods, estimates and predictions are critical to an improved future for consumers in housing and financial markets, and for banks, investors and many others.

This paper has described and established some promising new directions for better data and business tools to better measure the full effects of negative equity in local housing markets and opportunities for sound risk-managed growth in stable or recovering local markets.

While this paper has illustrated the potential value in Experian's PACS variables, for example, in a mortgage default model, other potential modeling applications for PACS and multiple home equity indicators include:

- AVM and home price forecasting models and market-condition assessments
- Portfolio modeling
  - Behavioral scorecards and models for delinquency and transitions
  - Loss given default
  - Pre-payment
  - Loss forecasting and stress simulations
- Marketing models of home buying and general consumer spending and credit usage
- Acquisitions modeling
  - Pre-screening
  - Scorecards
- Security valuation and pricing models

About Experian's Decision Analytics' Global Consulting Practice

Experian's business consultants deliver powerful insight that is used by clients to enhance credit-management strategies across their consumer and small-business portfolios and the Customer Life Cycle. Experian's Global Consulting Practice is a credentialed consultancy dedicated to creating measurable and sustainable value for organisations around the globe in financial services, banking, mortgage, automotive finance, telecommunications and utilities, microfinance, retail credit and debt collections. We specialise in analytics-based decision strategies, data-driven products and services, regulatory compliance and fraud risk management across acquisitions, customer management, collections and overall portfolio management.

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Previously Dr. Straka held various leadership positions at Freddie Mac for nearly 18 years, most recently as Vice President of customer facing models and analytics. He led teams responsible for all statistical scoring models, along with other models, including automated underwriting, behavioral scoring, and loss mitigation modeling and analytics. Dr. Straka also has worked as an economist at the Social Security Administration and in macroeconomic forecasting and analysis at the Congressional Budget Office. He earned a B.A. in economics from Williams College and a M.A. and Ph.D in economics from Cornell University.

Chuck Robida is a Chief Scientist at Experian and responsible for the model development methodology of custom and generic applications. Robida has served as the technical lead on U.S. reporting agency scores such as VantageScore®*, Scorex PLUSSM, Bankruptcy PLUSSM, and Experian's suite of In the Market ModelsSM and as a consultant on an Experian Panamanian reporting agency score. Additionally, Robida serves as an adviser to Experian's Data Intelligence group, which defines the STAGG AttributesSM for North America.

Robida has been with Experian for 15 years and previously managed Experian's analytical group. He also has developed products and services for U.S., Canadian and Central American clients. Robida earned his undergraduate and master's degrees from the Georgia Institute of Technology.

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Previously, Dr. Sklarz was Head of Analytics at Fidelity National Financial and Chief Valuation Officer for Fidelity National Information Solutions. Dr. Sklarz was also the Director of Research at Prudential Locations, Inc., where he helped pioneer the development of new analytic tools and databases to track and forecast the U.S. real estate market. Dr. Sklarz holds a B.S. in Engineering Mathematics from Columbia University and a M.S. and Ph.D. in Ocean Engineering from the University of Hawaii.

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Disclaimers

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