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MODEL METHODOLOGY

Moody's Analytics Methodology for Forecasting Foreclosures

Prepared by
Sunayana Mehra
Assistant Director

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BY SUNAYANA MEHRA

Moody's Analytics and RealtyTrac have partnered to create a comprehensive U.S. foreclosure time series database. The historical dataset includes 16 concepts, eight each for inventory and starts, covering every stage of residential foreclosure: preforeclosure, auction and bank-owned (REO). Measures are available at seven U.S. geography levels, from nationwide to individual ZIP code areas. There are 715,000 ZIP code-level series and 46,000 others that include 50 states, 395 metro areas and metro area divisions, and more than 3,000 counties. The series are reported monthly and start as early as April 2005.

RealtyTrac data augment information from the Mortgage Bankers Association national delinquency survey—data that Moody's Analytics also houses and forecasts in its U.S. and state models. The MBA reports data further back in history, but the RealtyTrac foreclosures dataset offers greater (and different) detail by stage of foreclosure and far greater detail by geography. The MBA survey provides information for the U.S. and the states on delinquency buckets (30-, 60- and 90-day delinquent) as well as on initial foreclosure filings and foreclosure inventories.

RealtyTrac not only covers a greater number of geographies but also collects data on the stages of foreclosure. A detailed depiction of the foreclosure process is sketched out in Chart 1. These detailed data allow analysts to better identify the timing at which homes will come on the market as a distress sale and how this varies by detailed geography. RealtyTrac reports filings at the initial stages of foreclosure (preforeclosure), when the auction announcement occurs (auction notice), and when the auction process is completed with a bank repossession at auction (REO). The data are also broken out by judicial and nonjudicial filings. Depending on state laws, foreclosures in a state may all be judicial, all nonjudicial, or a combination of both. RealtyTrac provides both foreclosure activity (or a new foreclosure) and foreclosure inventory.

Filings and inventories are reported as numbers as well as numbers of filings per thousand households. Seasonally adjusted filings are available. Inventories are only reported as not seasonally adjusted. The inventory data do not exhibit seasonal patterns.

Moody's Analytics has developed a forecast model of RealtyTrac foreclosure metrics that includes early-stage foreclosure (preforeclosure and auction combined) and REO foreclosure for the states, census divisions and regions, and metro areas/divisions. Forecasts for both filings and inventories are available.

Forecasting foreclosures

In order to better predict near-term U.S. and regional house price movements, Moody's Analytics has developed a forecast model of RealtyTrac foreclosure metrics. The forecast measures include early-stage foreclosure (in-process foreclosure, which is equivalent to the sum of preforeclosure and auction[1]) and REO foreclosure for the U.S. states, census divisions and regions, and metro areas/divisions. Forecasts for filings and inventories are available both as numbers and as numbers per thousand households. The total foreclosure category is set equal to the sum of in-process and REO foreclosures.

The Moody's Analytics simultaneous equation macroeconomic model and comprehensive regional forecast models underpin the RealtyTrac foreclosure forecasts. The following section describes the models in detail.

U.S. foreclosure model

The U.S. foreclosure forecast model uses a roll-rate approach in which each stage of foreclosure filing and inventory is forecast separately but with the appropriate interlinkages with each other as well as with the Mortgage Bankers Association delinquency rates that are forecast by the Moody's Analytics macroeconomic model.

Economic factors such as unemployment, debt burden and house prices also have an impact on the foreclosure forecast, although this occurs mostly through the MBA delinquency and foreclosure forecasts.[2] A high jobless rate, high loan-to-value ratios, a high consumer financial obligations ratio, and falling house prices tend to force mortgage delinquency rates

1 Modeling preforeclosures separately from auctions is complicated by the fact that, in some states, a preforeclosure filing is unnecessary, and thus the data are sparse. In addition, the time series of a preforeclosure's share of total foreclosures jumps suddenly in some geographies, suggesting there may have been changes in reporting methodology that are unrelated to fundamental drivers of foreclosure. The in-process foreclosure data are more stable and thus a better candidate for forecasting.

2 There is clearly simultaneity in modeling house prices and foreclosures. This simultaneity is difficult to capture in the context of Moody's Analytics macroeconomic model, given the short period of time that foreclosures have had an impact on house prices. An auxiliary house price model has been constructed to better evaluate this effect.

higher. In addition to being driven by late-stage delinquency rates, house price depreciation and job losses are strong drivers of foreclosure.

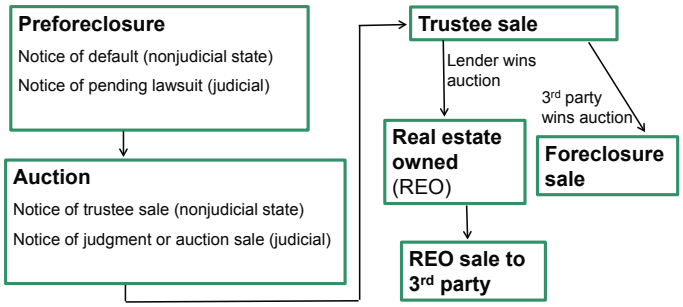
As such, the MBA delinquency rates are the starting point for the RealtyTrac foreclosure forecasts, with the delinquency rates driving the MBA foreclosure starts rate and this rate correlating closely with RealtyTrac in-process foreclosure starts per thousand households.[3] The RealtyTrac in-process measure is a broader measure of foreclosures started. The MBA measure includes only the first foreclosure filing, whereas the RealtyTrac measure includes both preforeclosure filings in states where they occur and auction filings.

The first column in Table 1 shows the statistically significant and strong relationship between foreclosures started as measured by the MBA foreclosure rate and the RealtyTrac in-process foreclosure rate. A 1-percentage point increase in the MBA foreclosure rate will result in an increase of three foreclosures per thousand households. House price appreciation has a negative impact on in-process foreclosure filings. The greater the price declines, the more likely a property will proceed from the preforeclosure filing to an auction filing. The impact is statistically significant but small. Depreciation of 1% in house prices will result in an increase of 19 foreclosures per million households. The small impact may result from the fact that the MBA foreclosure rate is already picking up the effect of house prices.

The main driver for in-process filings is REO filings (see the second column in Table 1). The more foreclosures that servicers start, the more REOs eventually reach completion. The coefficient for in-process filings is small, which reflects the fact that the foreclosure timeline has lengthened, weakening the relationship between the initial stages of foreclosure and when the foreclosure is finally completed with an REO filing. Additionally, at least through 2010, an increasing number of loans in foreclosure are resolved prior to REO, either through a short sale, deed in lieu, or some type of loan modification plan.

New filings and house price appreciation predict foreclosure inventories (see the third and fourth columns of Table 1). Moreover, the pipeline's impact is strong on inventories. For example, if in-process filing per thousand households increased by an average of one over the past six months, in-process inventories will increase by seven. The strong influence of filings on inventories is also related to the lengthening foreclosure timeline. Inventories are building up as servicers are taking an increasingly longer time to process foreclosures. House price appreciation has a greater impact on inventories than on filings, but the impact is still small. A 1% decline in house prices will generate five homes in in-process foreclosure inventory per 10,000 households. House prices did not successfully explain REO inventories. As in the case of the foreclosure filings regressions, the pipeline terms in the equations are already picking up the impact of house prices appreciation.

Chart 1: Foreclosure Timeline



Foreclosures can drop out before completion for a number of reasons including short sale, deed in lieu, or borrower repayment. Short sales, deed in lieu, or REO sale to 3rd party are considered distress sales.

Regional foreclosures

The regional foreclosure forecast models are structured differently from the U.S. models because of the short history and oftentimes volatile nature of the regional data. Rather than taking the roll-rate approach, the state models are share-downs from the U.S. and the metro models are share-downs from the states. A lagged dependent structure was also used if necessary. Tables 2 and 3 summarize the regression results for the states and metro areas.

In the share-down approach, measures of economic and demographic performance such as the jobless rate are used to differentiate foreclosure performance among regions relative to an average. For example, state in-process inventories are driven by U.S. in-process inventories. The extent to which the state in-process inventories differ from each other depends on the relative performance of state unemployment and in-process filings (see the third column in Table 2). The higher the unemployment rate in a state relative to the national unemployment rate, the higher the in-process inventories in the state. Similarly, the higher the rate of in-process filings in the state relative to the national average, the higher the state's in-process inventories.

In addition, the states and metro areas are estimated in a separate fixed effects panel regression that allows for increasing the number of observations used in the regression. Given the short historical time series available, it is particularly useful to combine the regional data. Doing so adds to the accuracy of the regression coefficient estimates.

The fixed effects panel regression also accounts for region-specific factors that may differ across areas but stay constant over time. An example of such a factor is a state's legal structure. States may be judicial, nonjudicial or both, but this status stays constant over time.[4]

3 The RealtyTrac modeling work is based on rate-per-thousand-households data. Unless otherwise noted, references to RealtyTrac foreclosures in the remainder of this article will be to the rate rather than the level of foreclosures.

4 This estimation technique, however, does not pick up the fact that the foreclosure process is taking longer to complete as servicers and the court systems contend with an unprecedented flood of foreclosures. To the extent that the national forecasts pick up the lengthening foreclosure timelines, so, too, will the state and metro area forecasts.

Table 1:

U.S. RealtyTrac Foreclosure Equations

	Dependent Variable: RealtyTrac Foreclosure Variable, per 1,000 households			
Independent Variables	In-process filings	REO filings	In-process inventories	REO inventories
Constant	0.403*	-0.037	-5.622*	1.668*
U.S. MBA foreclosures started, % of MBA mortgages	3.459*			
Case-Shiller Home Price Index, % change yr ago, 6-mo MA	-0.019*		-0.450*	
RealtyTrac in-process foreclosure filings per 1,000 hh, 3-mo MA		0.355*		
RealtyTrac in-process foreclosure filings per 1,000 hh, 6-mo MA			7.350*	
RealtyTrac REO filings per 1,000 hh, 6-mo MA				7.813*
Observations	36	36	36	36
Adjusted R-squared	0.919	0.796	0.917	0.901
Durbin-Watson Statistic	0.520	0.463	0.267	0.816
HAMP dummy (effective for 2009-2011 only)*	Apr 2005 to Aug 2010	Apr 2005 to Aug 2010	Oct 2007 to Aug 2010	Oct 2007 to Aug 2010

*Statistically significant at the 5% level

*The HAMP dummy accounts for the fact that when HAMP started up, a large number of trial modifications were offered to borrowers who ultimately could not qualify for a permanent modification. While they were in the trial stage, however, servicers could not complete these foreclosures.

Impact on house prices

A large foreclosure inventory will have a noticeable effect on other aspects of the housing market as well, especially home prices.

Distressed homes—or homes in which homeowners are having difficulty keeping up with their monthly mortgage payments—weigh on house prices because they are typically sold at a discount. A distress sale can occur at any stage of the mortgage delinquency or foreclosure process (see Chart 1). Typically, a distressed home can be disposed of in one of three ways: as a short sale, a deed in lieu of foreclosure, or a foreclosure sale. Short sales and DILs can take place when a loan is delinquent or already in the foreclosure process.

A short sale occurs when a mortgage borrower sells his home at a price below the unpaid balance of his mortgage. The lender has an incentive to agree to discount the loan balance because a short sale typically costs less than a completed foreclosure. Foreclosures entail costs such a maintaining the home and paying property taxes while seeking a buyer.

Similarly, a deed in lieu of foreclosure is a less costly alternative to a foreclosure. In a DIL, the borrower voluntarily hands the title of the property to the lender in exchange for a release from all obligations under the mortgage. The benefit to the borrower is an immediate release of obligations. Deed in lieus can be completed quickly, whereas even short sales are taking increasingly longer to complete.

Foreclosure sales are sales of homes at the foreclosure auction. The vast majority of homes at auction are sold back to the lender. These homes end up on lenders' balance sheets as real estate owned and are categorized as nonperforming assets. Lenders will then sell these homes as REO sales to third parties.

The types of distress sales that drive house prices, at least the Case-Shiller repeat purchase, are short sales and REO sales to third parties. DILs and foreclosure sales would not be included, as they are not true market transactions. The Case-Shiller repeat-purchase index would include short sales and REO sales to the extent that the price changes implied by these sales do not depart too greatly from the average market price change. These sales would be considered within the bounds of normality in markets that are heavily dominated by distress sales and thus would be included in the index.

Although not all foreclosure sales are listed through a real estate agent, the NAR tries to account for the full impact of distress sales on the median existing-house price through a supplementary survey of real estate agents.

Table 2:

State RealtyTrac Foreclosure Equations

	Dependent Variable: RealtyTrac Foreclosure Variable, per 1,000 households			
Independent Variables	Log of in-process filings	Log of REO filings	In-process inventories	REO inventories
Constant	-0.081	-0.112	1.099	1.022
Log of in-process filings per 1,000 hh, 1-mo lag	0.510			
Log of in-process filings per 1,000 hh, 2-mo lag	0.183			
Log of in-process filings per 1,000 hh, 3-mo lag	0.106			
Log of MBA foreclosures started, %	0.125			
Log of U.S. in-process filings per 1,000 hh, 1-mo lag	0.059			
Log of REO filings per 1,000 hh, 1-mo lag		0.476		
Log of REO filings per 1,000 hh, 2-mo lag		0.208		
Log of REO filings per 1,000 hh, 3-mo lag		0.090		
Log of U.S. REO filings per 1,000 hh		0.180		
Log of MBA foreclosures started as % , weighted with a 1- to 4-mo lag		0.270		
HAMP dummy (effective for 2009-2011 only)*		-0.077		
U.S. in-process inventory per 1,000 hh, times the ratio of the state in-process filings per 1,000 hh to U.S. in-process filings per 1,000 hh			0.545	
U.S. in-process inventory per 1,000 hh, times the ratio of the state unemployment rate to the U.S. unemployment rate			0.175	
U.S. REO inventory per 1,000 hh, times the ratio of the state REO filings per 1,000 hh to U.S. REO filings per 1,000 hh				0.402
U.S. REO inventory per 1,000 hh, times the ratio of the state unemployment rate to the U.S. unemployment rate				0.296
Observations	3,060	3,060	1,836	1,836
Adjusted R-squared	0.936	0.911	0.963	0.942
Durbin-Watson Statistic	2.022	1.968	0.689	0.534
Sample	Apr 2005 to Aug 2010	Apr 2005 to Aug 2010	Oct 2007 to Aug 2010	Oct 2007 to Aug 2010

All coefficients statistically significant at the 5% level; State fixed effect coefficients available upon request

*The HAMP dummy accounts for the fact that when HAMP started up, a large number of trial modifications were offered to borrowers who ultimately could not qualify for a permanent modification. While they were in the trial stage, however, servicers could not complete these foreclosures.

Distress sales alone will not necessarily hurt house prices, but the larger the proportion of distress sales to normal, nondistress sales, the greater the downward pressure on house prices. There is a clear negative correlation in recent years between the change in the distress sales share of the total and house price appreciation[5] (see Chart 2).

5 The strong relationship between the distress sales share of total sales and house price appreciation is unique to the last several years. Although house price declines have always driven foreclosures, the number of foreclosures has never been large enough to drive the national house price downward until this correction.

Estimates of the current distress sales share range from the NAR's survey-based 35% in September to Zillow's estimate of 20% (see Table 4). Corelogic, RealtyTrac and Zillow base their estimates on deed data. Zillow's estimate does not include short sales. According to Corelogic, 22% of existing-home

Table 3:

Metro Area RealtyTrac Foreclosure Equations

	Dependent Variable: RealtyTrac Foreclosure Variable, per 1,000 households			
Independent Variables	Log of in-process filings	Log of REO filings	In-process inventories	REO inventories
Constant	-0.782	-0.320	0.242	0.620
Log of in-process filings per 1,000 hh, 1-mo lag	0.281			
Log of in-process filings per 1,000 hh, 2-mo lag	0.179			
Log of in-process filings per 1,000 hh, 3-mo lag	0.106			
Log of state in-process foreclosure filings per 1,000 hh	0.526			
Ratio of metro area to state unemployment rate	0.509			
Log of REO filings per 1,000 hh, 1-mo lag		0.266		
Log of REO filings per 1,000 hh, 2-mo lag		0.154		
Log of REO filings per 1,000 hh, 3-mo lag		0.092		
Log of state REO filings per 1,000 hh		0.549		
Log of 6-mo MA of ratio between metro and state REO foreclosure filings per 1,000 hh		0.093		
HAMP dummy (effective for 2009-2011 only)*		0.034		
State in-process inventory per 1,000 hh, times the ratio of the MSA in-process filings per 1,000 hh to state in-process filings per 1,000 hh			0.420	
State in-process inventory per 1,000 hh, times the ratio of the MSA unemployment rate to the state unemployment rate			0.458	
State REO inventory per 1,000 hh, times the ratio of the MSA REO filings per 1,000 hh to State REO filings per 1,000 hh				0.191
State REO inventory per 1,000 hh, times the ratio of the MSA unemployment rate to the state unemployment rate				0.605
Observations	24,192	23,424	13,824	13,824
Adjusted R-squared	0.802	0.835	0.986	0.968
Durbin-Watson Statistic	1.960	1.889	0.783	0.328
Sample	Apr 2005 to Aug 2010	Apr 2005 to Aug 2010	Oct 2007 to Aug 2010	Oct 2007 to Aug 2010

All coefficients statistically significant at the 5% level; State fixed effect coefficients available upon request

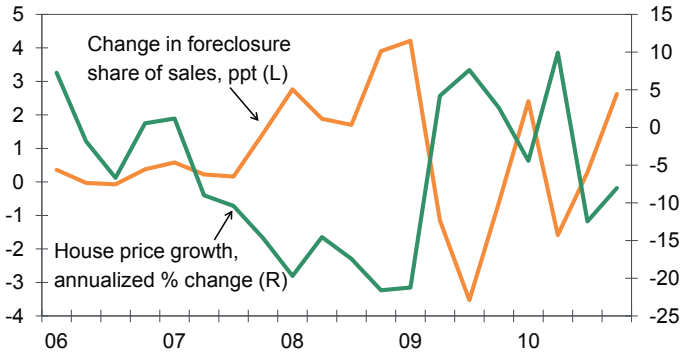
*The HAMP dummy accounts for the fact that when HAMP started up, a large number of trial modifications were offered to borrowers who ultimately could not qualify for a permanent modification. While they were in the trial stage, however, servicers could not complete these foreclosures.

sales in August were REO sales and 9% were short sales. This share has increased from 6% one year ago, as servicers have tried different paths to move the large number of foreclosures or potential foreclosures out the door.

Because of its greater share of sales and the deeper discount, REO sales to third parties are a good indicator for house price movements. According to RealtyTrac, the average preforeclosure sale—which is often a short sale—is discounted by 19%, while an REO sale is discounted by 41%. REO inventories, in particular, lead sales as most of these homes will end up as a sale to a third party. RealtyTrac does not report REO sale data by metro area, but new REO starts less the net change in REO inventories can be a proxy for REO sales. The more this proxy increases in a metro area, the more distress sales will occur and the greater the decline in house prices (see Chart 3).

Not surprisingly, Nevada has the largest number of REO inventories per household among the 50 states and Washington

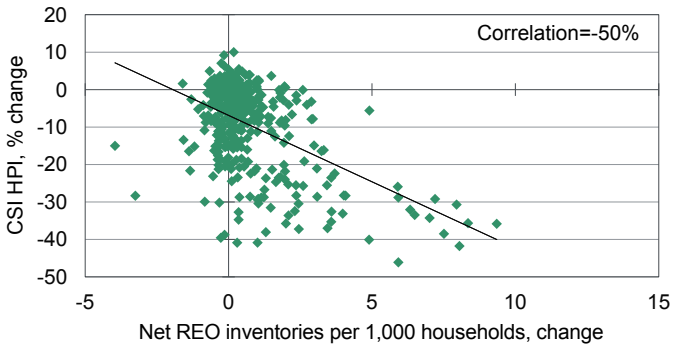
Chart 2: Foreclosures Weigh on House Prices



Sources: Fiserv, Zillow, Moody's Analytics

Chart 3: REO Inventories Weigh on MSA Prices

2008Q1 to 2010Q4



Sources: Fiserv, FHFA, RealtyTrac, Moody's Analytics

DC (see Chart 4). At nearly 27 properties per thousand households in Nevada, REO inventories vastly exceed the rate in the next worst state, Michigan. Moreover, Nevada easily tops the chart in terms of total foreclosure inventories (see Chart 5) as well as in terms of new foreclosures adding to inventories (see Chart 6). On a positive note, the number of new filings has improved greatly in the last year, both nationally and in Nevada, where filings peaked in early 2009 at more than 10 preforeclosures per thousand households compared with the current less than four filings. In 2005, however, Nevada filings were on par with the national average of only 0.2 per thousand households.

Florida, Arizona and California—other states that had particularly wild housing booms that were fueled in part by lax lending—show up consistently with high foreclosures by all three measures. Michigan and Illinois are also saddled with many foreclosures. The housing boom was less exuberant in these states, but an early and severe recession, combined with a slightly elevated share of subprime lending during the boom years, has led to a large number of foreclosures. Utah, another state with a large number of foreclosures, has a housing cycle that lags the nation's slightly. House price appreciation in Utah continued well into 2007, even as the national price index fell. Additionally, a higher share of young households—who tend to have fewer financial resources to fall back on—contribute to the large number of foreclosures in Utah.

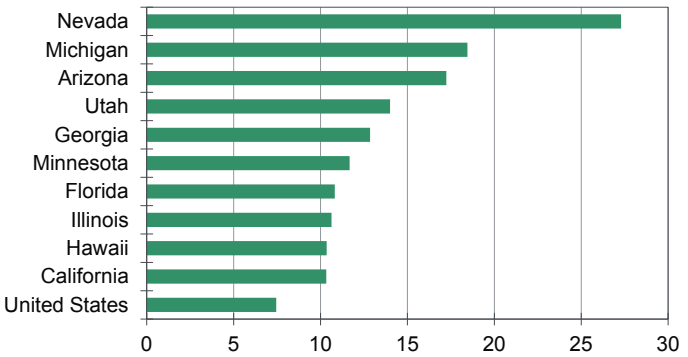
Metro area rankings show similar trends (see Chart 7). REO inventories are highest in the sand states and the industrial Midwest. The Northeast, where household wealth is highest and where home equity has held up better, stands out as the healthiest region in terms of its exposure to foreclosures. The Plains states also have few foreclosures thanks to stable housing markets and a low share of subprime mortgages originated early in the decade. The South outside of Florida and Georgia is also in good shape.

The disposition of this record-high inventory of foreclosures will drag house prices down into 2012. As servicers work through this backlog of foreclosures, an increasing share of homes will be sold at substantial discounts through a short sale, at auction to a third party, or as an REO sale to a third party.

Foreclosures accounted for 28% of total U.S. home sales in the first quarter of 2011, an uptick from the previous quarter and the highest share posted since the first quarter of 2010. Moreover, the average sales price of a home in foreclosure was 27% lower than a property not in foreclosure, reinforcing the

Chart 4: States With the Greatest REO Risk

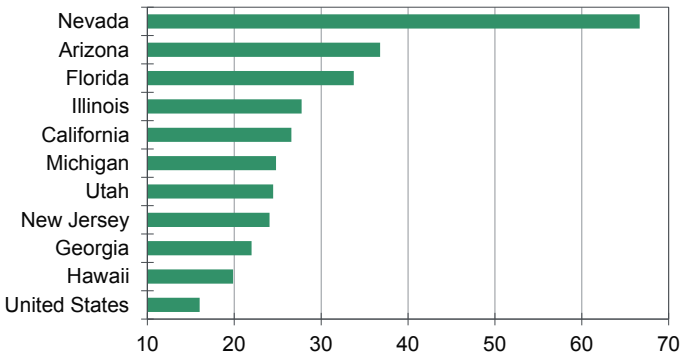
REO inventories per 1,000 households, Apr 2011



Sources: RealtyTrac, Moody's Analytics

Chart 5: States With Most Foreclosures

Total foreclosure inventories per 1,000 households, Apr 2011



Sources: RealtyTrac, Moody's Analytics

Table 4:

Distress Sales Share

Provider	Reference Date	Types of sales	Share of total sales	One yr ago
National Association of Realtors	Sep-10	Short sales & foreclosed homes	35%	29%
CoreLogic	Aug-10	Short sales & REO sales	28%	25%
RealtyTrac	Third quarter 2010	Short sales & REO sales	25%	25%
Zillow	Sep-10	REO sales	20%	16%

downward pressure of foreclosures on home prices that is likely to continue in 2011.

Conclusion

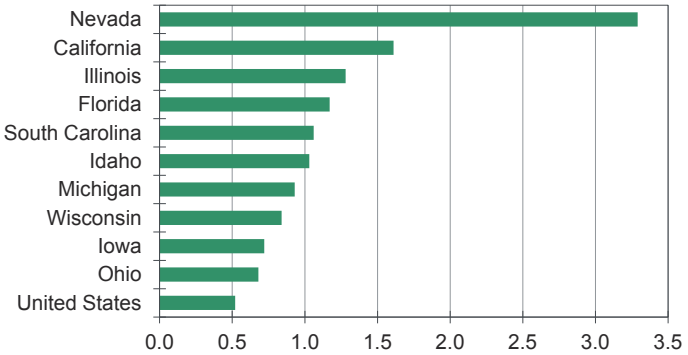
Using our comprehensive fundamentals based macroeconomic model and comprehensive regional forecast models, Moody's Analytics has developed a forecast model of RealtyTrac foreclosure metrics for activity and inventory for key stages of the foreclosure process. In addition to the U.S., the models are available for states, census divisions and regions, and metro areas/divisions.

The models indicate that both late-stage delinquency rates and local economic conditions as reflected in house price depreciation and job losses are the main drivers of foreclosures. Such variables are particularly helpful in capturing the foreclosure dynamics in more disaggregated geographies such as metro areas where historical data are sparse and at times volatile.

An important fallout of mounting foreclosure inventories is their effect on other housing market variables. Of most interest is the weight a large number of foreclosures places on the recovery of house prices. The RealtyTrac database reports and forecasts foreclosure filings and inventories at key stages of the process, providing insight on the depth and timing of the foreclosure problem by region and the implications for the house price outlook.

Chart 6: Where New Foreclosures Are Occurring

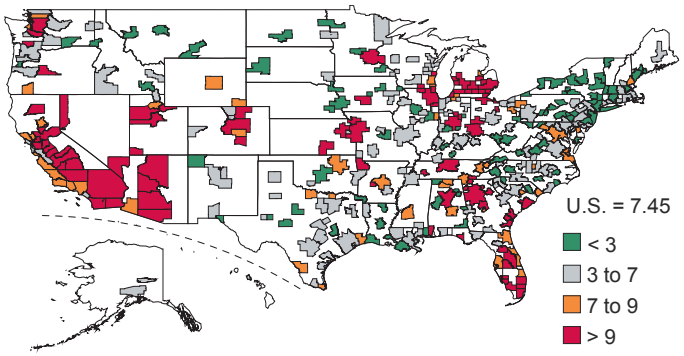
Preforeclosure filings per 1,000 households, Apr 2011



Sources: RealtyTrac, Moody's Analytics

Chart 7: Fewer Foreclosures in Northeast

REO inventories, per 1,000 households, Apr 2011



Sources: RealtyTrac, Moody's Analytics

About Moody's Analytics
Economic & Consumer Credit Analytics

Moody's Analytics helps capital markets and credit risk management professionals worldwide respond to an evolving marketplace with confidence. Through its team of economists, Moody's Analytics is a leading independent provider of data, analysis, modeling and forecasts on national and regional economies, financial markets, and credit risk.

Moody's Analytics tracks and analyzes trends in consumer credit and spending, output and income, mortgage activity, population, central bank behavior, and prices. Our customized models, concise and timely reports, and one of the largest assembled financial, economic and demographic databases support firms and policymakers in strategic planning, product and sales forecasting, credit risk and sensitivity management, and investment research. Our customers include multinational corporations, governments at all levels, central banks and financial regulators, retailers, mutual funds, financial institutions, utilities, residential and commercial real estate firms, insurance companies, and professional investors.

Our web and print periodicals and special publications cover every U.S. state and metropolitan area; countries throughout Europe, Asia and the Americas; and the world's major cities, plus the U.S. housing market and other industries. From our offices in the U.S., the United Kingdom, and Australia, we provide up-to-the-minute reporting and analysis on the world's major economies.

Moody's Analytics added Economy.com to its portfolio in 2005. Its economics and consumer credit analytics arm is based in West Chester PA, a suburb of Philadelphia, with offices in London and Sydney. More information is available at www.economy.com.

CONTACT US
For further information contact us at a location below:

U.S./CANADA
+1.866.275.3266

EMEA
+44.20.7772.5454

ASIA/PACIFIC
+852.3551.3077

OTHER LOCATIONS
+1.610.235.5299

Email us: help@economy.com
Or visit us: www.economy.com

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