SURF Spotlight: Another Look at Mortgage Default [1]
2018 Q1

Credit performance and loan losses in mortgage portfolios are seen as primarily driven by regional or metropolitan area housing market and economic conditions as they impact home values and borrower incomes. Relaxation of lending standards and expansion of non-traditional lending (on the supply side) and expanded appetite for debt (on the demand side) just prior to a housing and economic downturn will drive the losses higher, as we witnessed during the mortgage crisis.

Multiple empirical studies drawing on data from the mortgage crisis strongly support these broad principles, while ongoing research on mortgage default continues to develop new insights having potentially important risk management or policy applications. We select for our SURF Spotlight two recent studies that add substantially to our understanding of mortgage default. The first is a Fannie Mae study entitled "Credit Risk of Low Income Mortgages" (by Hamilton Fout, Grace Li, and Mark Palim), and the second is a Federal Reserve Bank of Atlanta working paper, "Fracking and Mortgage Default" (by Chris Cunningham, Kristopher Gerardi, and Yannan Shen):

http://www.fanniemae.com/resources/file/research/datanotes/pdf/credit-risk-of-low-income-mortgages-white-paper.pdf

https://www.frbatlanta.org/research/publications/wp/2017/04-fracking-and-mortgage-default-2017-03-29.aspx

"Credit Risk of Low Income Mortgages" examines the marginal credit risk associated with lower income borrowers in the fixed-rate, conforming, home-purchase mortgage market. Relying on data from Fannie Mae, separate assessments are conducted for three origination periods representing distinct housing market and lending environments: 2002-2004; 2005-2007; and 2011-2013. Credit risk in relation to borrower income is assessed controlling for key risk characteristics including credit score, loan-to-value ratio, and market conditions (using fixed effects state location and for year and month and of origination.) In addition, inferences are drawn regarding the risk-mitigating impact of post-crisis underwriting restrictions, via repeating the analysis after excluding (for the earlier periods) loans that would not have qualified under those restrictions.

The paper is distinguished by its detailed examination of credit risk across income groups and lending environments. The main findings are summarized in Tables 3 and 4 from the paper, reproduced below.

Table 1 reports uncontrolled, 24 month cumulative default rates by sample period and income range, overall and broken out by eligible (under post-crisis underwriting) and non-eligible. Across the three periods, the relation to income is fairly stable. For example, the default rate within the 50-80 percent of median income range is consistently about double the default rate in the above median income range. Default frequencies are dramatically lower after applying the tighter, post-crisis lending standards to the earlier periods (eligible compared to non-eligible), across all income ranges.

[1] This commentary was written by Paul Calem, vice president in the Supervision, Regulation, and Credit Department of the Federal Reserve Bank of Philadelphia. The views expressed here are solely those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

Table 2 reports default frequencies in the lower income ranges relative to the default rate of eligible loans in the above median income range (standardized at 1.0), before and after controlling for key risk factors, by sample period and by eligible and non-eligible. With controls, the marginal credit risk in relation to income is modest until incomes fall into the very low range of below 50 percent of area median income.

The findings are potentially important for policymakers and regulators. For instance, the results suggest that the elevated credit risk associated with lending to lower income households is mostly attributable to key dimensions of credit risk that can be controlled via appropriate calibration of lending standards. However, the traditional risk measures used in underwriting may not suffice for evaluating the risk of borrowers at the very low end of the income spectrum. Accurately assessing credit risk and financing sustainable homeownership may be particularly challenging for the latter cohort.

The dramatic reduction in default frequencies observed after restricting the pre-crisis and crisis samples to "post-crisis eligible" loans underscores the major role of loosened underwriting standards in fueling the explosion of defaults during the mortgage crisis. As bank mortgage portfolios currently are comprised mostly of loans originated post-crisis, it is important that regulators account for the impact of the underwriting environment in stress testing or otherwise assessing the credit risk of these portfolios.

Table 1: Early Default Odds and Rates by Income Group – Eligible vs. Non-eligible Loans

	2002-2004		2005-2007		2011-2013	
	Relative Risk to hi-inc. Elig. 02-04	Default Rate	Relative Risk to hi-inc. Elig. 05-07	Default Rate	Relative Risk to hi-inc. Elig. 11-13	Default Rate
Overall						
Income/AMI <= 50%	**8.1**	**4.4%**	**10.2**	**11.1%**	**4.0**	**0.7%**
Income/AMI > 50% and <= 80%	**5.6**	**3.0%**	**7.4**	**8.0%**	**2.3**	**0.4%**
Income/AMI > 80% and <= 100%	**4.3**	**2.3%**	**5.8**	**6.3%**	**1.8**	**0.3%**
Income/AMI > 100%	**2.7**	**1.5%**	**3.8**	**4.2%**	**1.0**	**0.2%**
Non-eligible Loans Under Current Underwriting Standards						
Income/AMI <= 50%	12.3	6.6%	15.4	16.8%		
Income/AMI > 50% and <= 80%	8.8	4.8%	11.7	12.7%		
Income/AMI > 80% and <= 100%	7.1	3.9%	9.5	10.4%		
Income/AMI > 100%	4.8	2.6%	6.7	7.3%		
Eligible Loans Under Current Underwriting Standards						
Income/AMI <= 50%	3.5	1.9%	2.6	2.9%	4.0	0.7%
Income/AMI > 50% and <= 80%	2.3	1.3%	1.8	2.0%	2.3	0.4%
Income/AMI > 80% and <= 100%	1.7	0.9%	1.4	1.5%	1.8	0.3%
Income/AMI > 100%	1.0	0.5%	1.0	1.1%	1.0	0.2%
Number of Observations	2.2 million		2.0 million		1.1 million	

Note: 1. Table shows the odds ratio of 90+day delinquency rate within the first 24 month post origination relative to higher income group (Income/Area Median Income above 100%) within the specified time period.
2. Default Rates shown are the actual rate of 90+day delinquency within the first 24 month post origination for each income group within the same time period.
3. Population: Fannie Mae conventional acquisitions of owner occupied, 1 to 4 unit (excluding condos and manufactured housing) purchase FRM loans only.

Table 2: Early Default Odds by Income Group with Controls – Eligible vs. Non-eligible Loans

Variable	2002-2004 Relative Risk to hi-inc. Elig. 02-04		2005-2007 Relative Risk to hi-inc. Elig. 05-07		2010-2013 Relative Risk to hi-inc. Elig. 10-13	
	No Additional Controls	With Direct Controls	No Additional Controls	With Direct Controls	No Additional Controls	With Direct Controls
Non-Eligible Loans Under Current Underwriting Standards						
Income/AMI <= 50%	12.3***	2.2***	15.4***	2.0***		
Income/AMI > 50% and <= 80%	8.8***	1.9***	11.7***	1.9***		
Income/AMI > 80% and <= 100%	7.1***	1.9***	9.5***	1.8***		
Income/AMI > 100%	4.8***	1.7***	6.7***	1.8***		
Eligible Loans Under Current Underwriting Standards						
Income/AMI <= 50%	3.5***	1.7***	2.6***	1.4***	4.0***	1.8***
Income/AMI > 50% and <= 80%	2.3***	1.3***	1.8***	1.1***	2.3***	1.2***
Income/AMI > 80% and <= 100%	1.7***	1.2***	1.4***	1.0	1.8***	1.2***
Income/AMI > 100%	1.0	1.0	1.0	1.0	1.0	1.0
Number of Observations	2.2 million		2.0 million		1.1 million	

Note: 1. No additional control results correspond to the default odds for each income group relative to Income/Area Median Income above 100% without controlling for other risk characteristics or state and time fixed effects.
2. Direct control results correspond to the default odds ratio for a given income group relative to Income/Area Median Income above 100%, when controlling for DTI, LTV, FICO, subordinate financing indicators, number of borrowers, third party originator indicators, term, number of units and state and vintage fixed effects in the logit regression.
3. Population: Fannie Mae conventional acquisitions of owner occupied, 1 to 4 unit (excluding condos and manufactured housing) purchase FRM loans only.
4. *10%, **5%, ***1% Significance Levels.

"Fracking and Mortgage Default" tests the impact of the shale boom on mortgage credit risk in Pennsylvania counties straddling the Marcellus Formation, by analyzing the repayment performance through 2012 of mortgages originated in 2004 through 2006. This origination cohort precedes the tighter mortgage credit conditions that arose during 2007 (thus avoiding potential simultaneity bias) and the fracking boom that began in late-2007.

The study relies on mortgage performance data from LPS and on permit data from the Pennsylvania Department of Environmental Protection which provide the exact longitude and latitude of each well, the type of well (conventional/fracking), the issuance date of the permit and the date of drilling (if drilling occurs.) In addition, geologic data pertaining to locational variation in thickness and depth of the shale formation are utilized (in construction of instruments for fracking activity.)

Repayment performance is assessed in relation to the level of fracking activity associated with the ZIP code location of the subject property, controlling for borrower and mortgage characteristics at origination, including FICO score and loan-to-value ratio at origination (along with fixed effects for county location and for year and month of origination.) The primary emphasis in the paper is on an instrumental variables specification utilizing variation in shale thickness and depth as instruments for fracking activity, in recognition that issuance of permits may be endogenous to local economic conditions.

The results indicate that fracking had a large, negative effect on mortgage default rates. Residing in a zip code with any active fracking reduces the monthly probability of severe delinquency by 0.26%; notably, this is approximately 110% of the average monthly delinquency rate in the sample (0.24%) and "roughly equivalent to increasing the borrower's FICO score at origination from 580 to 700."

The authors motivate the study in part as a contributing to debate over the benefits and costs of fracking, which presents a number of environmental concerns to be weighed against the potential economic benefits to rural localities. In addition, the authors argue that the impact of fracking on mortgage default was primarily due to a favorable impact on jobs and incomes, and not through raising home values. As such, they view their study as evidence that mortgage default depends on both home prices and local economic conditions (the so-called "dual-trigger view" of mortgage default.)

The study makes a unique and important contribution by highlighting the fact that local economic conditions can be the primary (and a very significant) driver of mortgage performance in a context where house prices and housing equity appear to be secondary. The literature on mortgage default is expansive; yet I can recall no other paper documenting the strong impact of a local economic boom (or bust) on mortgage default, such that house price volatility or minimal or negative equity is not the dominant part of the story.

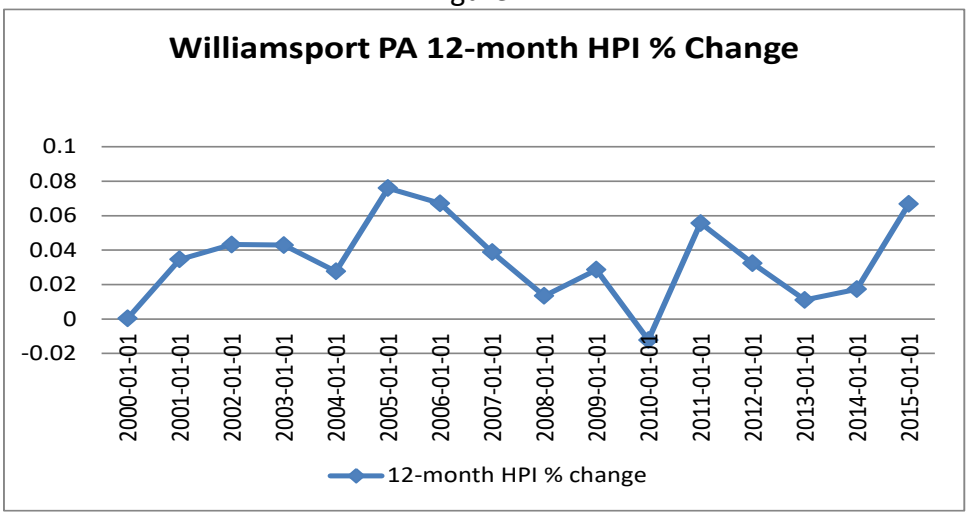
Indeed, the rural Pennsylvania counties examined in this study were isolated from any "house price bubble" and experienced minimal or no house price decline after 2007, unlike what was occurring in much of the nation. Illustrating this, Figures 1-3 below show house price appreciation rates in three areas associated with the Marcellus fault: the Williamsport MSA and Bradford and Cambria counties. Moreover, only 13 percent of the mortgages in the sample had an LTV at origination exceeding 80 percent.

Clearly, then the context here was one where house prices would have been secondary to employment and income growth as drivers of mortgage performance. The finding that the economic boom had an impact comparable to a 120 point improvement in FICO score is remarkable given this context.

This finding does not quite fit into the conventional, "dual-trigger" paradigm for explaining fluctuations in mortgage default rates. The conventional wisdom is that households who experience difficulty making monthly payments due to income or liquidity shortfalls will default on their mortgages to the extent that reduced equity inhibits repayment via sale of the property. Therefore, volatile housing markets characterized by periodic, systematic declines in home values drive mortgage default, particularly to the extent that the house price declines are accompanied by weakening economic conditions.

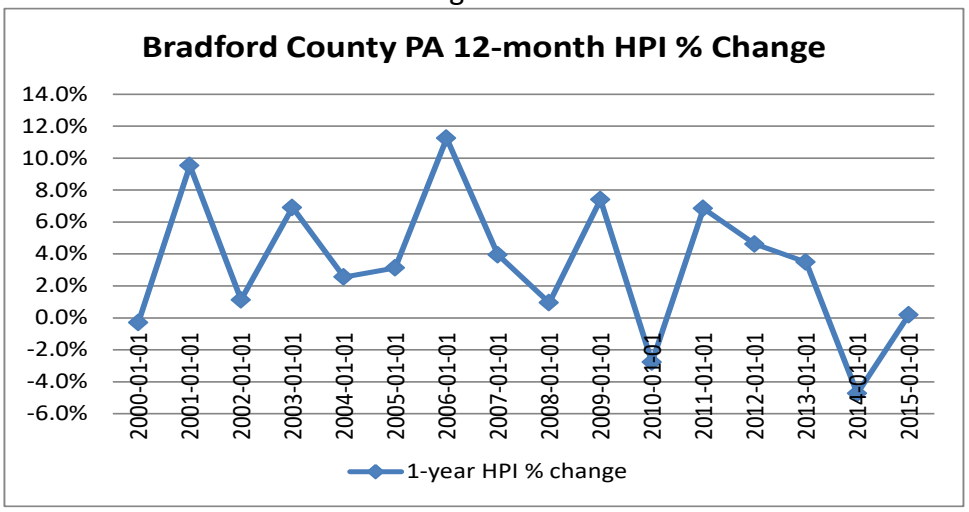
Thus, "Fracking and Mortgage Default" suggests an alternative, "dual-trigger" paradigm: that even under stable housing market conditions, some fraction of borrowers have minimal or negative equity for idiosyncratic reasons such as neighborhood effects or their home having been originally overvalued. Therefore, mortgage default may respond significantly to systematic shifts in labor market conditions. From a banking supervision viewpoint, such an alternative paradigm is potentially useful for assessing mortgage credit risk, or may provide an alternative construct for stress testing mortgage portfolios.

Figure 1:



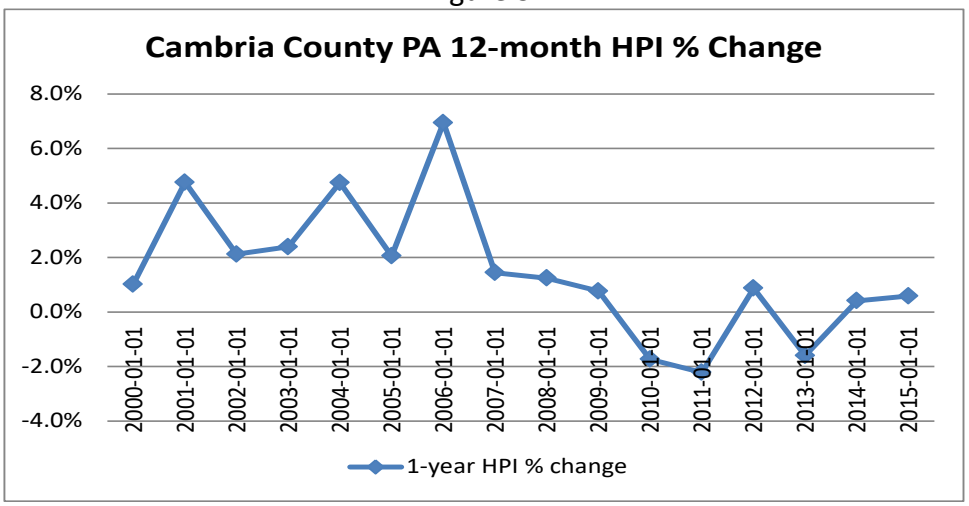
Source: Federal Housing Finance Agency Home Price Index

Figure 2:



Source: Federal Housing Finance Agency Home Price Index

Figure 3:



Source: Federal Housing Finance Agency Home Price Index