Credit Market Innovations and Sustainable Homeownership: The Case of Non-Traditional Mortgage Products

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It has long been recognized that homeownership is a primary vehicle for household wealth building in the United States. For most households, purchasing a home using available liquid resources is not possible, meaning that homeownership is achievable only through the use of credit. Thus, developments in the credit market can have an important impact on attainment of homeownership and the ability of a household to sustain homeownership. This paper focuses on one such development – the increased prevalence of non-traditional mortgage products during the 2000s.

Non-traditional mortgage products (NTMs) are mortgages with features that make them distinct from the typical conventional conforming or government-insured mortgage products. While there is no standard definition of non-traditional mortgage products, many view option adjustable rate mortgages (ARMs), negative amortization loans, and interest only loans, among others, as products falling into this category. These products increase the number of options that prospective homebuyers have for financing their purchase, and are widely believed to help expand access to credit.

The prevalence of NTMs expanded dramatically during the 2000s, in concert with a general increase in mortgage lending activity. While annual new home purchase mortgage originations increased by 1.6 million loans between 2002 and 2006, the volume of NTMs increased from 200,000 to 1.8 million (FFIEC; author calculations). By 2006, NTMs represented about 30 percent of all home purchase mortgage originations, with lending activity concentrated geographically such that they comprised more than 50 percent of all originations in some markets.

The outstanding question is what role NTMs played regarding homeownership attainment and retention. The question arises because homeownership rates did not

increase during the period of greatest NTM penetration; rather, the rate peaked at 69 percent in 2004 and remained at that level through 2006. A second reason the question arises is because NTMs have features that are associated with higher levels of risk, such that unexpected developments can quickly result in default and foreclosure. Given the experiences during the housing bust, a natural question is whether NTMs were associated with sustainable homeownership or a more fleeting form of homeownership particularly vulnerable to many types of shocks. We seek to help provide clarity regarding both of these issues.

This question is important because, as we continue to reform the United States' mortgage finance system, there will be on-going discussions about the place for product and process innovations. Indeed, recent regulatory actions reflect a view, shared by many, that innovations such as NTMs were problematic. For example, in order to qualify for the qualified mortgage's safe harbor established via the Dodd-Frank financial reform legislation, a loan must not feature negative amortization, be interest only, or be no documentation (Regulation Z). The current research seeks to provide information that either support or add nuance to how one should think about financial market innovations, and thereby help provide a perspective that can inform discussions regarding innovations yet to be seen.

We find that NTMs are associated with different effects through the business cycle, with higher levels of NTM activity being associated with elevated homeownership during the housing boom and more depressed homeownership during the bust. However, these effects are not uniform across the country. In particular, while all types of metropolitan areas experienced the positive boom relationship, only those metropolitan areas with high

population and home value growth showed the negative relationship during the bust. This suggests that people choosing in markets with strong demand and price pressures ended up in a more precarious position that was not sustainable as the economy deteriorated.

We also test for whether there is evidence consistent with the notion that NTMs eased credit constraints for those often thought to be most subject to them, namely young first-time homebuyers and minority households. The patterns we observe do not suggest this. Rather, they suggest that the mortgage credit dynamic is very different in minority communities, such that financial market innovations are not as effective as in the broader population.

The first section of this paper reviews the literature on the link between credit supply and homeownership in particular as it applies to the recent housing cycle. Section II presents the data and the empirical approach. Section III describes and interprets the results on the relation between NTMs and homeownership. Section IV discusses the policy implications and concludes.

I. Credit Market Innovations and Homeownership

Innovations in the housing finance sector have the potential to increase access to homeownership by increasing the efficiency of the allocation of capital to the housing sector, resulting in lower cost of credit and expanded access for borrowers. Credit is available only to borrowers with credit risk profiles above some threshold level, where credit risk is assessed along a number of underwriting dimensions. The literature has highlighted three key dimensions – wealth, income, and credit quality – and documented

that underwriting standards introduce constraints for each that limit borrower access to credit (Linneman and Wachter, 1989; Bostic, Calem, and Wachter, 2005).

Economic theory suggests that credit rationing beyond that caused by standard underwriting rules is possible when there are information asymmetries between lenders and borrowers, such that lenders limit the number of loans they make out of a fear of adverse selection. For example, borrowers can have information about the causes of prior credit repayment troubles that lenders might not have, and this information could provide insights regarding the likelihood of future repayment problems. From a lender perspective, this dynamic means that there is likely to be some borrowers who will accept a mortgage at a given interest rate that pose risks greater than the interest rate would imply. Stiglitz and Weiss (1981) show that lenders can rationally respond to such potential adverse selection by rationing credit.

Credit market innovations, including the introduction of new mortgage products and underwriting processes, have the potential to remove certain constraints, potentially resulting in increased access to mortgages and, by extension, homeownership. There is a rich history of innovation in mortgage markets, and the evidence suggests they have achieved exactly this. From 1940 to 1965, the US homeownership rate rose from 44 percent to 63 percent (Fetter 2011). The evidence suggests that, along with favorable demographic trends, rapid economic growth, and suburbanization, the expansion of the mortgage market was an important factor in this evolution. In particular, the availability of long-term fixed-rate fully amortizable mortgage products with down payments of 20 percent or less contributed to increase access to homeownership for younger households by enabling them to smooth their housing consumption over the life cycle (Fetter, 2011).

Fetter (2011) estimates that up to 40 percent of the increase in homeownership over this period can be explained by changes in the mortgage market.

NTMs are another class of financial innovations in the mode of the long-term fully amortizing fixed rate mortgages. The products considered to be NTMs all serve to ease constraints in the market that limit access to credit. For example, interest only and negative amortization mortgages ease income constraints by allowing borrowers to pay less than the rate required to cover the accrued interest plus principal.[1] Similarly, zero down payment loans remove the wealth constraint, as borrowers no longer need to have sufficient wealth to be able to afford a down payment.

Unlike the 30-year fixed-rate mortgage, though, NTMs carry additional risk factors that make borrower repayment over the long-term more tenuous. For example, many of these products feature interest rates that can adjust rather than remain fixed. For such loans, monthly payments can rise significantly if interest rates increase, meaning there can be an elevated risk that a borrower's income will not be sufficient in the future. Option-ARMs and negative amortization mortgages feature risks in that successful navigation of these products often involves refinancing. Thus, borrowers who take on these mortgages are susceptible to liquidity risk, or the risk that credit will not be available for refinancing.[2] Some have coined these additional risks as a source of *instrument risk* (Bostic and Lee, 2008).

Evidence clearly indicates a relationship between the prevalence of NTMs and home prices during the 2000s. A number of papers that have conclusively linked NTMs and changes in house prices over that period (Adelino et al 2012; Duca et al 2011; Goodhart

[1] In the former case, a borrower only pays the interest while in the latter the borrower can pay less than the accrued interest, with the residual amount being added to the principal.
[2] This was a major source of risk during the Great Depression

and Hofman 2008). In particular, a number of papers show a causal impact of the supply of NTMs and subprime lending on changes in house prices, resulting in higher price volatility in areas with more of such lending as they experienced larger price increases during the boom and larger declines during the bust (Coleman et al 2008; Goetzman et al 2012; Pavlov and Wachter 2011; Sanders 2008).

However, these observations regarding house price dynamics do not provide an unambiguous picture regarding homeownership. There are at least two reasons why this is so. First, the rapid increase in prices that accompanied the increased presence of NTMs could have offset some of the affordability benefits that NTMs provide, meaning that ownership attainment was not enhanced through the products. Second, elevated instrument risk for NTMs implies that, in addition to house price dynamics, an important consideration is homeownership sustainability, and the elevated risk could be associated with less sustained ownership and consequently no significant change in the amount of homeownership in the population.

The next section presents the data and the estimation strategy used to try to identify with more clarity the relationship between NTMs and homeownership.

II. Empirical Strategy and Data

To explore these questions, we employ a straightforward strategy. We tally the prevalence of NTMs in a county and observe whether there is any association between NTM prevalence in that county, measured in several ways, and homeownership. Specifically, we estimate models where we regress homeownership on a set of control variables plus NTM prevalence, with the coefficient on this latter variable our coefficient

of interest. We look at this from 2005 to 2013, and thus cover the latter years of the housing boom, the housing bust, and beyond.

Because no single database includes all the information required to conduct this sort of analysis, we combined information from several data sources to create a single unified dataset. Annual county-level data on homeownership and homeownership rates was obtained using the Census Bureau's American Communities Survey (ACS). Annual ACS data are only available at the county level and for counties with more than 65,000 residents for confidentiality purposes. The dataset contains all 743 counties for which there are annual data available for the period 2006-2013. This is our sample frame. This sample covers about 80 percent of all households, despite the fact that it represents less than a quarter of the US 3,144 counties.[3] We define three dependent variables: the number of homeowners in a given county in a given year; the county homeownership rate in a given year; and the change in the number of homeowners year-over-year and over various periods.

Regarding mortgages, we compiled data from two sources. First, we use the BlackBox dataset on private label securities (PLS) to count the number of NTMs originated in a county in a given year. BlackBox data has detailed information about more than 14 million first-lien loans originated between 1998 and 2013 that were securitized in PLS. We believe that the BlackBox data are representative of the universe of NTMs because most NTMs were securitized via PLS, though some mortgage originators kept NTM loans on portfolio. Moreover, estimates of NTM loan volumes

[3] Our sample is therefore biased toward large metropolitan counties.

using BlackBox conform to estimates using other data sources.[4] In addition, there is no evidence suggesting that NTMs kept on portfolio have a different spatial distribution than those securitized in PLS. Given that there is no official definition of NTMs, we choose one and apply it to the BlackBox data. For this paper, a loan is classified as an NTM if it is a mortgage to purchase an individual unit (condo, co-op, single family) and has any of the following characteristics: (i) interest only, (ii) Option-ARM with negative amortization, (iii) balloon payment, (iv) prepayment penalty, (v) low or no documentation, (vi) terms longer than 30 years, or (vii) combined loan to value ratio at origination above 100 percent.

Our second mortgage-related data source is data collected pursuant to the Home Mortgage Disclosure Act (HMDA data). Banking and other institutions that make decisions on whether to originate a mortgage are required to report on all mortgage applications they receive. These data are collected on annual basis and provide a good snapshot of mortgage origination activity nationwide and at small geographies.[5] We use the HMDA data to tally total mortgage volume in a county in a given year. Together, the BlackBox and HMDA data allow us to calculate the NTM share of all mortgages in a county in a given year, which will be a key variable of interest.

Figure 1 shows how NTM origination volumes evolved from 1997 through 2010. After being a very minor product through 2000, never totaling more than 50,000 loans, the market saw an explosion in NTM incidence. NTM volume doubled each year from 2001 to 2004, and annual NTM origination volume doubled again between 2004 and

[4] For example, we estimate that 30 percent of mortgages issued in 2006 were NTMs, a figure identical to the proportion reported in Sanders (2008) using CoreLogic data and close to the 32 percent reported in Inside Mortgage Finance (2013).
[5] Avery, et al. (2011) estimates that HMDA data cover more than 80 percent of the total mortgage origination market.

2006. After 2006, though, the use of NTMs dropped precipitously, as the housing crisis and the Great Recession that ensued resulted in a rapid change in supply and demand for NTMs across the nation. By 2010, less than 100 NTMs were originated for the entire year. By the end of our study period, this product type had not made a comeback.

The rise of NTM incidence during the early 2000s was coupled with a rise in the prevalence of NTMs (figure 2). NTMs were a tiny fraction of all mortgages originated from 1997 and 2001, and only first exceeded a 5 percent market share in 2003. However, the mortgage market share for NTMs rose rapidly after 2003 and topped out at about 27 percent in 2006. This rise is all the more dramatic because total mortgage lending grew by more than 2 million loans (about 40 percent) between 2001 and 2005, while NTMs increased from less than 100,000 to more than 1,5 million over the same period meaning that much of the increase is attributable to the rise of NTMs. These aggregate volume data suggest that it is unlikely that NTMs played a large role in rising homeownership leading up to the 2000s, but their more significant presence after 2003 raises the possibility that they were an important vehicle in the years after that.

Looking at the NTMs in our dataset, it is first important to recognize that NTMs are a complex group of loans. While we noted 7 distinct characteristics a mortgage could have to be included as an NTM, many loans originated during this period had multiple qualifying features. Table 1 shows how the mortgages in our sample are distributed along this metric. We see that a majority of the loans had at least 2 features and a significant fraction had more than 4 features.

Table 2 provides a sense of which features were most common among NTMs in our sample by reporting the fraction of NTMs in a given year that had a particular feature.

We see that low or no documentation and prepayment penalties were common features in every year. By contrast, between 2001 and 2006 we see large growth in the incidence of interest only mortgages, and high CLTV at origination. Option-ARMs with negative amortization were consistently the least common feature during this period.

When looking at the distribution of NTMs over time and across space, we observe substantial variations across counties (figure 3). As of 2003, NTMs represented more than 20 percent of mortgages in only a few places, specifically California counties concentrated in the San Francisco and Los Angeles metropolitan areas. This changed significantly during 2004 and 2005, when NTM origination grew significantly in the sand states – Florida, Arizona, Nevada, and California – as well as in high cost markets on the east and west coasts. As seen in the second panel of figure 3, by 2006 the NTM origination share exceeded 20 percent in many counties, with proportions exceeding 40 percent in nearly 20 counties. Several California counties even exceeded 60 percent NTM shares in 2006. Among the top 50 counties ranked by their NTM share of all purchase originations in 2006, 37 were located in California, 5 were in in Florida, 4 were in the Washington, DC metropolitan area, 2 were in the New York City metropolitan area, and 1 each was located in Hawaii and Nevada. While there was a significant NTM presence in these areas, it is useful to note that NTMs were also a substantial share of the market in counties in a number of other markets across the country, including Detroit, Chicago, Houston, and Dallas. At the same time, NTM incidence was not uniform during this period. County with the median NTM share had a share of less than 20 percent in 2006, and many markets in the lowest NTM share decile had percentages of less than 10 percent.

The final panel of figure 3 shows NTM origination activity during 2008, after the NTM boom had effectively ended. Not surprisingly, very few counties show a significant NTM share of originations. NTMs continued to be originated across much of the nation, though.

As a final descriptive table, table 3 compares the geographic distribution of the features of NTMs. To create this table, we ranked counties according to the frequency of a given feature and then calculated the correlation coefficient of pairwise rankings. This answers the question of whether, for example, mortgages with high CLTV have the same geographic distribution as balloon payments. We find many product features are distributed similarly across counties. Correlation coefficients exceeding 0.90 were found for low and no documentation and extended loan term, low and no documentation and interest only and between balloon payments and high CLTV. Among the NTM features, option ARM and high CLTV had geographic distributions that were least alike, although a correlation coefficient of 0.58 is still generally high.

We follow the literature on homeownership as a guide for including control variables in our homeownership model (Gabriel and Rosenthal, 2005; Gabriel and Rosenthal, 2015). Controls are included to account for socio-demographic, job market, and housing market factors that have been shown to be associated with changes in homeownership. Our dataset includes a vector of county-level demographic variables collected from the ACS, including population, mean household size, percent of family with children, percent Black, percent Hispanic, percent foreign born, percent with some college education. Regarding job market conditions, we include median household income from the ACS and the annual unemployment rate from the Bureau of Labor Statistics.

For housing market factors, we include from the ACS median house value, the ratio of the median rent and median house value, and the ratio of the median house value and median income. We also use the MSA-level house price index from the Federal Housing Finance Agency to construct variables measuring house price volatility over the last 5 years and a projected 1-year forward house price change, to account for past house price performance and future expectations.[6] Finally, we include dummy variables for whether a county is in an MSA and whether it is suburban.[7]

III. Results

Our first test is a simple estimation of the relationship between NTM activity and homeownership over our entire sample period (table 4). [8] The result shows that, after controlling for county characteristics, NTM activity is associated with an increase in the number of homeowners in a county between 2000 and 2012. Here, we use an aggregate measure of the number of NTMs originated during the 2001 to 2006 period and the regression indicates that each 10 additional NTM loans originated is associated with 6 additional homeowners. This finding, that NTM activity is positively associated with homeownership is surprising and runs counter to the narrative that exists regarding the role of NTMs in housing markets.

[6] House price volatility is calculated as "the variance of the five-year percentage change in the price index across 13 years of quarterly values" (Gabriel and Rosenthal, 2015: 11). The 1-year forward expected percentage change in house prices is estimated using metropolitan-level (or non-MSA part of the state) coefficients of an AR(5) regression of the FHFA HPI for the period 1980-2014. Both approaches follow Gabriel and Rosenthal (2015).

[7] These are defined by the Office of Management and Budget.

[8] We present results using the aggregate number of NTMs originated during 2001-2006 as the key variable of interest. We also considered using a lag structure and have run all the analyses using up to 8 period lags. We further re-estimated the relationships using the maximum NTM share in a county over the cycle as the key independent variable. The results are robust to these alternative specifications.

We find a somewhat different result when we use an alternative measure of NTM activity – the percentage of all mortgages in the county that were NTMs. This is a measure of NTM penetration, and is an indicator of the importance of NTMs in a market. Using this measure, we see in the second column of table 4 that NTMs activity is positively associated with homeownership, but this relationship is not statistically significant. The lack of a significant relationship between NTM penetration and homeownership is also somewhat surprising, given the evidence regarding the strong effect of NTMs on house price volatility.

The analyses include state and MSA fixed effects to control for variation in state and regional circumstances that might bias estimates of the NTM relationship. We show in Appendix A that a likelihood ratio test indicates that inclusion of the fixed effects improves model fit but does not affect the sign and magnitude of the coefficients of interest. For the remainder of this section, we therefore present results that include specific state- and MSA-level characteristics (i.e., sand state indicators) in lieu of fixed effects, though we do cluster standard errors at the MSA level.

Given the important change in the housing market that occurred in late 2006, we first divide the sample into two periods: 2000 to 2006 (the boom) and 2006 to 2012 (the bust). Table 5 shows the results for the boom and bust periods.

During the boom period, increased NTM activity is associated with more homeowners, whether NTM activity is measured in number of loans or penetration. The point estimate using number of loans is about the same as that for the entire period (table 5). The penetration result indicates that a 1 percentage point increase in the NTM share is

associated with 482 more homeowners, and the estimate is statistically significant. This result differs from the result obtained for the full period, where this is not significant.

The results of the analysis focusing on the bust period are shown in the last two columns of table 5. Here we see that an opposite relationship between NTM activity and homeownership prevailed during the bust. While the number of NTM loans was associated with an increase in the number of homeowners in the boom, it was associated with a *decline* in the number of homeowners between 2006 and 2012. This is consistent with the volatility result seen in the literature. Interestingly, though, the magnitude of this negative relationship is far smaller than the magnitude of the positive relationship during the boom. An additional 10 NTM loans in a county was associated with 1 less homeowner in that county. Similarly, when one looks at NTM penetration, we observe a smaller number of homeowners for a given level of penetration than during the boom period. This reduction helps explain why we do not observe a statistically significant relationship looking at the entire sample period.

Given these observed relationships and possible explanations, we run a series of alternative tests to distinguish among them. In particular, we run 3 tests. First, we explore whether there are significant differences between the relationship of NTM activity and homeownership in places with high population growth and high house price growth as compared with other places. This is a test of whether the NTM-homeownership relationship is sensitive to how local demand and pricing pressures vary in local markets and, if so, how this variation flowed through borrower choices for NTMs and outcomes for homeowners. The second test looks at whether the results are different for sand states relative to other locations. There was a wide recognition that much of the

volatility and distress in housing centered in the sand states (Arizona, California, Florida, Nevada), and the evidence discussed above clearly shows that NTM activity was more intensely focused in these places. So we explore whether the NTM dynamic was different in these areas. Third, we look at whether the NTM relationship was particularly strong among minority families and first-time homebuyers, two populations for which we would expect income and wealth constraints to be most binding. To the extent that NTMs serve to relieve these constraints, we might expect to see the strongest effects among these groups.

For the first test, when we stratify the sample based on population and house value growth, we find the NTM-homeowner relationship to be the same as observed for the full sample but stronger in areas experiencing both high population and house value growth (table 6). These areas saw NTM activity positively associated with homeownership during the boom and negatively associated with ownership during the bust, and the relationship holds for both of our measures of NTM activity. Interestingly, for other areas, the NTM-homeownership relationships are largely not statistically significant and smaller in magnitude, especially during the downturn. This pattern of results is consistent with the notion that under normal market conditions NTMs can be a positive innovation. However, they also suggest that in markets with strong local demand and significant pricing pressures NTMs can be an accelerator, providing a "last resort" means of accessing mortgage credit for borrowers that results in homeownership that is not sustainable. In these latter markets, this lack of sustainability means that there are few net gains to ownership if any are observed at all.

Our second test takes this analysis further, by trying to establish whether there is a similar distinction between markets in sand states and other markets by interacting a dummy for a county being in a sand state with the measures of NTM activity. The results, shown in the final columns of table 6, suggest that during the boom the association between NTM activity and homeownership was stronger in the sand states with both measures but not during the bust, being more negative, but not significantly so.

The final set of tests evaluates the extent to which NTMs appear to have been an effective vehicle for easing market constraints. For this test, we use percentage of homeowners with a household head younger 35 years of age as a proxy for first time homebuyers, based on the idea that young homeowners are unlikely to have been in multiple homes. The results, shown in the first column of table 7, indicate that there is a positive relationship between NTM activity and first time homebuyers during the boom but there is a strong negative relationship between the share of first time homebuyers and changes in homeownership during the bust. This suggests that, while NTMs were potentially a vehicle for first-time homebuyers to access homeownership, these first-time buyers were particularly vulnerable to the risks associated with NTMs.

We repeat this analysis, this time replacing a proxy for first-time homebuyer with race-related variables to determine whether NTM activity has an association with minority homeownership. We look for relationships for black and Hispanic homeowners separately. These results, shown in the final columns of table 7, reveal different results by race. Unlike for the total population, for blacks increasing levels of NTM activity were not associated with increases in homeownership during the boom. This is a striking result that stands in stark contrast to anything observed for other populations. Clearly, a

different NTM dynamic was at play for black households during the boom. During the bust, however, the relationship between NTM activity and black homeownership mirrored the relationship seen overall. Greater NTM activity was associated with bigger declines in black homeownership, and the relationship is larger in magnitude for black homeowners. These data indicate that NTMs were not a positive for black homeowners.

The results for Hispanic homeowners are a bit muddled. We see a negative relationship between NTM activity and Hispanic homeownership during the boom. Further, we see no significant relationship between NTM activity and homeownership during the bust. These are both unexpected and puzzling results and counterintuitive. More research is needed to better understand what these relationships imply about how NTMs affect Hispanic populations.

IV. Discussion

This paper explores the relationship between the rise of non-traditional mortgage products (NTMs) during the 2000s and homeownership. Using a newly-constructed dataset including information on county homeownership rates and county-level lending volumes for NTMs and all products, we identify a complex relationship between NTM lending activity and homeownership. We find that NTM activity is associated with an increase in the number of homeowners during the boom period of 2000 to 2006, but is negatively associated with homeownership during the bust period of 2007-2012. Moreover, the bust period relationship is much smaller than the boom period relationship, suggesting a positive net effect through the recent unprecedented housing cycle.

Subsequent analyses explore the robustness of these relationships, to determine whether they are sensitive to local market dynamics and whether there is evidence consistent with the view that NTMs were effective in easing credit market constraints. Regarding the former, we consistently find a positive NTM-homeownership relationship during the boom period across all market types. However, during the bust, a significant negative relationship is observed only in areas that had experienced a large growth in both population and house value during the boom.

Regarding the easing of constraints, we find mixed results regarding first-time homebuyers, who we proxy for with young homeowners. We see mixed results, with positive relationships during the boom and negative relationships during the bust, though statistical significance is not consistent. Our final set of results indicates that this innovation did not have the same effect for racial minorities. We see no positive relationship during the boom, and either a negative relationship (for blacks) or no relationship (for Hispanics) during the bust.

We interpret the first of these findings as being consistent with the view that NTMs can be a positive innovation under "normal" market conditions, but can be problematic in markets with strong demand or significant pricing pressures. On balance, the case for NTMs easing constraints is mixed at best. We see some evidence consistent with this when looking at first-time homebuyers, but none when we look at minorities. It is quite interesting that the relationships for minorities are quite different, and strongly suggests that different mechanisms work in minority neighborhoods. Some have argued that minority communities had less access to mainstream credit markets, meaning that they were forced to take on additional instrument risk, and were more subject to predatory

lending. These could have muted any positive relationships that may have been observed during the boom and exacerbated negative relationships during the bust.

The debate about whether innovation in financial markets has been beneficial for homeowners and communities reached a fever peak in the wake of the housing crisis. The clear link between subprime lending and high levels of default and foreclosure led many – these authors included – to highlight the detrimental effects that innovation can have on markets if regulatory and other institutions are not carefully disciplined in their execution of strategy. On the other hand, the evidence here, coupled with evidence on prior innovations that have resulted in decades of benefits (e.g., Fetter (2011), suggests the relationship between product innovation and homeownership is far from clear. Our research highlights the nuances of financial markets and local housing market dynamics as key factors, but the sophistication of homebuyers and the diligence of regulators are undoubtedly important as well. Future research should focus on what market and institutional features best maximize the likelihood that innovation produces broad benefits and to minimize the likelihood that it results in significant risk and costs. This research is essential and will serve as a key building block for ensuring that we establish sustainable access to homeownership as a path toward economic and social mobility for households.

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Table 1: Number of non-traditional features by mortgage

Number of NTM Features	Number of Loans	Share of Loans
1	2,581,743	42.2%
2	1,932,521	31.6%
3	1,081,564	17.7%
4	434,055	7.1%
5	82,821	1.4%
6	4,771	0.1%
7	291	0.0%

Source: BlackBox

Table 2: Non-traditional mortgages over time

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NTM	94,916	204,050	397,434	919,556	1,580,011	1,808,574	763,797	16,338	680	39
Interest Only	1.1%	2.0%	9.5%	22.7%	31.0%	29.0%	31.3%	27.5%	0.0%	66.7%
Option-ARM with neg. amortization	0.9%	1.4%	0.1%	3.6%	8.1%	6.8%	7.0%	3.9%	0.0%	0.0%
Balloon payment	6.0%	18.5%	13.1%	13.8%	12.8%	27.2%	24.2%	20.5%	5.0%	0.0%
Prepayment penalty	45.6%	31.4%	44.6%	49.5%	47.4%	47.8%	42.2%	29.1%	73.2%	0.0%
Low or no documentation	41.4%	50.9%	37.3%	36.9%	48.3%	57.6%	66.8%	55.9%	66.0%	0.0%
Terms >360 months	34.7%	27.7%	37.9%	36.2%	32.5%	39.9%	43.0%	54.4%	43.5%	74.4%
CLTV > 100	6.0%	10.5%	14.8%	25.3%	26.3%	39.8%	36.5%	30.3%	20.6%	0.0%

NOTE: Since many non-traditional mortgages have more than 1 non-traditional feature, the sum of the percentage adds up to more than 100%
Source: BlackBox

Table 3: Correlation in penetration of different non-traditional mortgages across counties in 2006

	Interest Only	Option-ARM with negative amortization	Balloon payment	Prepayment penalty	Low or no documentation	Terms > 360 months	CLTV at origination > 100
Interest Only	1						
Option-ARM with neg. amortization	0.85	1					
Balloon payment	0.78	0.62	1				
Prepayment penalty	0.56	0.61	0.68	1			
Low or no documentation	0.92	0.85	0.83	0.67	1		
Terms >360 months	0.90	0.85	0.88	0.74	0.95	1	
CLTV at origination > 100	0.73	0.58	0.90	0.73	0.82	0.86	1

Source: BlackBox

Table 4. Results of initial change in homeownership regressions, 2000-2012

	(1)	(2)
NTM 2001-2006 (#)	0.607***	
	(0.128)	
NTM 2001-2006 (%)		225.1
		(183.4)
Population	-0.0163***	0.000773
	(0.00545)	(0.00346)
Owner Occupied 2000 (%)	-51.23	-67.04
	(121.2)	(121.8)
Mean Household Size	-15,047***	-16,868***
	(4,378)	(4,693)
College Educated (%)	298.8***	231.0**
	(94.71)	(93.43)
25-34 (%)	761.2*	523.5
	(459.8)	(468.1)
35-44 (%)	59.86	427.6
	(774.1)	(841.1)
45-54 (%)	-765.8	-1,478
	(851.4)	(1,025)
55-64 (%)	624.5	269.4
	(721.8)	(692.4)
Family with Children (%)	1,018***	980.9***
	(234.8)	(234.5)
Foreign Born (%)	107.7	68.61
	(316.0)	(278.6)
Hispanic (%)	55.97	69.87
	(137.0)	(125.5)
Black (%)	-177.5**	-226.3***
	(71.74)	(67.47)
Unemployment (%)	186.6	-691.2
	(475.0)	(614.4)
Median Household Income (000)	1.078***	0.865***
	(0.277)	(0.292)
Median Rent	-26.28*	-10.16
	(14.63)	(14.70)
Median House Value (000)	-261.7***	-227.7***
	(51.77)	(51.97)
Rent to Value	7,986	-4,149
	(12,095)	(13,910)

Value to Income	14,824***	8,604**
	(3,757)	(3,771)
HPI Variance (5 years)	-1,017	-13,126
	(14,209)	(14,756)
Projected 1 Year HPI Change	238.0	276.8
	(241.8)	(242.0)
MSA (ref.=Not MSA)	-1,084	-1,722
	(978.5)	(1,085)
Suburban County (ref.=Central County)	-575.5	-242.4
	(802.5)	(857.1)
Constant	-46,601*	-4,466
	(24,205)	(26,308)
State FE	YES	YES
Observations	753	753
R-squared	0.499	0.411

NOTE: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses. The dependent variable is the change in the number of homeowners in a county between 2000 and 2012. These regressions include state and MSA fixed effects.

Table 5. Homeownership regression results, sample partitioned by boom and bust periods

	2000-2006		2006-2012	
	(1)	(2)	(3)	(4)
NTM 2001-2006 (#)	0.653***		-0.0915	
	(0.0999)		(0.0848)	
NTM 2001-2006 (%)		481.8***		-215.8**
		(149.3)		(101.4)
Population	-0.00733	0.0109***	-0.00678*	-0.00920***
	(0.00446)	(0.00332)	(0.00364)	(0.00151)
Owner Occupied 2000 (%)	-13.36	-17.19	19.23	22.71
	(87.95)	(101.2)	(50.52)	(52.84)
Mean Household Size	-13,836***	-14,857***	1,937	1,730
	(3,559)	(3,956)	(1,890)	(1,851)
College Educated (%)	160.1**	127.6*	99.42**	83.98*
	(62.98)	(72.03)	(49.05)	(48.49)
25-34 (%)	661.2**	433.7	769.4***	779.9***
	(287.3)	(316.2)	(245.1)	(240.9)
35-44 (%)	195.9	613.8	-466.8	-433.1
	(474.9)	(584.0)	(363.9)	(357.4)
45-54 (%)	-799.1*	-1,626**	23.58	24.29
	(436.7)	(650.5)	(356.5)	(360.0)
55-64 (%)	460.5	58.00	102.2	181.3
	(437.5)	(508.5)	(354.1)	(375.9)
Family with Children (%)	713.9***	609.1***	111.3	120.8
	(158.9)	(154.7)	(75.23)	(77.34)
Foreign Born (%)	69.65	15.82	95.17	109.8
	(198.9)	(152.0)	(134.0)	(138.0)
Hispanic (%)	61.16	60.54	-32.92	-18.97
	(85.27)	(75.10)	(61.00)	(62.98)
Black (%)	-94.01	-172.7***	-106.5***	-77.15***
	(63.66)	(63.38)	(32.61)	(26.83)
Unemployment (%)	316.3	-627.5	43.04	211.2
	(360.6)	(547.4)	(225.8)	(264.5)
Median Household Income (000)	0.616***	0.407*	234.0**	236.3**
	(0.212)	(0.232)	(98.52)	(100.6)
Median Rent	-10.10	0.435	-3.907	-1.973
	(10.36)	(10.70)	(5.125)	(4.946)
Median House Value (000)	-168.8***	-129.1***	-25.32*	-26.08*
	(42.32)	(40.76)	(14.01)	(14.43)
Rent to Value	3,769	-7,888	-2,158	-2,845
	(9,408)	(11,606)	(4,000)	(3,933)

Value to Income	9,407***	2,739	1,188	1,512*
	(3,332)	(3,464)	(863.1)	(794.2)
HPI Variance (5 years)	-5,844	-18,685*	-110.3	-156.5
	(9,304)	(10,927)	(104.0)	(127.0)
Projected 1 Year HPI Change	184.4	163.9	-59.28	-68.76
	(153.3)	(155.4)	(55.18)	(55.96)
MSA (ref.=Not MSA)	-487.8	-1,205	-564.7	-423.1
	(655.3)	(797.3)	(690.5)	(671.4)
Suburban County (ref.=Central County)	-793.2	-431.8	39.94	-23.22
	(583.8)	(669.0)	(587.7)	(588.9)
Constant	-22,209	20,266	-22,857**	-24,570**
	(19,521)	(22,929)	(10,421)	(10,748)
State FE	YES	YES	YES	YES
Observations	753	753	746	746
R-squared	0.724	0.611	0.627	0.625

NOTE: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses. The dependent variable is the change in the number of homeowners in a county between 2000 and 2012. These regressions include state and MSA fixed effects.

Table 6. Homeownership regression results, sample partitioned geographically

Panel A. Population growth partition

	2000-2006		2006-2012	
	High Growth Counties	Low Growth Counties	High Growth Counties	Low Growth Counties
NTM 2001-2006 (#)	0.422***	0.195	-0.377***	0.0493
	(0.0668)	(0.122)	(0.0989)	(0.121)
NTM 2001-2006 (%)	251.1	-4.911	-373.3**	-380.2***
	(173.1)	(96.06)	(147.2)	(118.3)

Panel B. House price growth partition

	2000-2006		2006-2012	
	High Growth Counties	Low Growth Counties	High Growth Counties	Low Growth Counties
NTM 2001-2006 (#)	0.825***	1.252***	-0.144***	0.333
	(0.104)	(0.224)	(0.0538)	(0.346)
NTM 2001-2006 (%)	905.1**	57.92	-436.2**	-184.2
	(443.0)	(100.3)	(171.6)	(137.4)

Panel C. Sand state interaction

	2000-2006	2006-2012
NTM 2001-2006 (#)*Sand state	-0.669***	-0.0268
	(0.135)	(0.199)
NTM 2001-2006 (%)*Sand state	57.06	-230.2
	(399.2)	(153.2)

NOTE: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses. Each coefficient represents the result of a separate regression estimate using the same specification as in tables 1 and 2, excepting the state and MSA fixed effects. The dependent variable for each regression is the change in the number of homeowners in a county between 2000 and 2012. "High growth counties" are those lying above the median regarding the population dimension; "Low growth counties" represent the remainder.

Table 7. Homeownership regression results, with interactions for first-time homebuyers and minority share

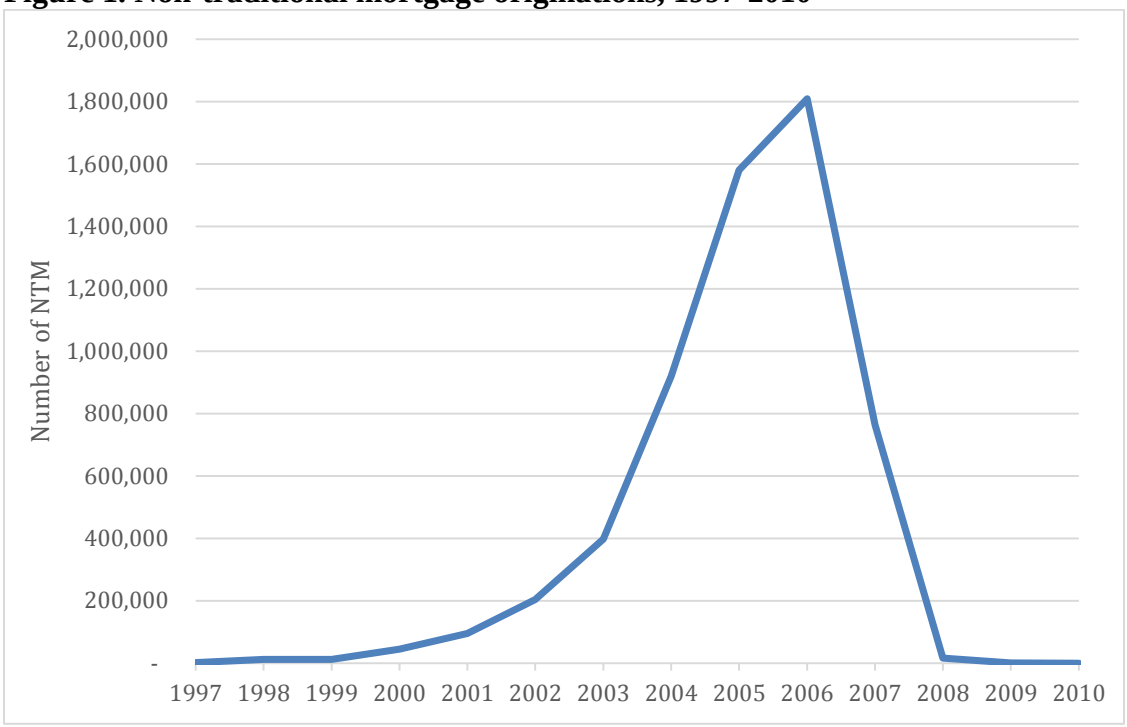
Panel A. First-time homebuyers

	2000-2006		2006-2012	
	(1)	(2)	(3)	(4)
NTM 2001-2006 (#)	-0.717**		-0.239	
	(0.327)		(0.260)	
NTM 2001-2006 (%)		-1,071**		-269.9
		(450.7)		(220.2)
Young Homeonwers (%)	-30.67	-297.3	-228.8**	-219.9
	(192.8)	(304.3)	(111.6)	(138.4)
Young Homeonwers*NTM	0.0888***	96.75***	0.00960	1.845
	(0.0193)	(34.05)	(0.0127)	(13.01)
Observations	753	753	746	746
R-squared	0.757	0.575	0.556	0.554

Panel B. Minority shares

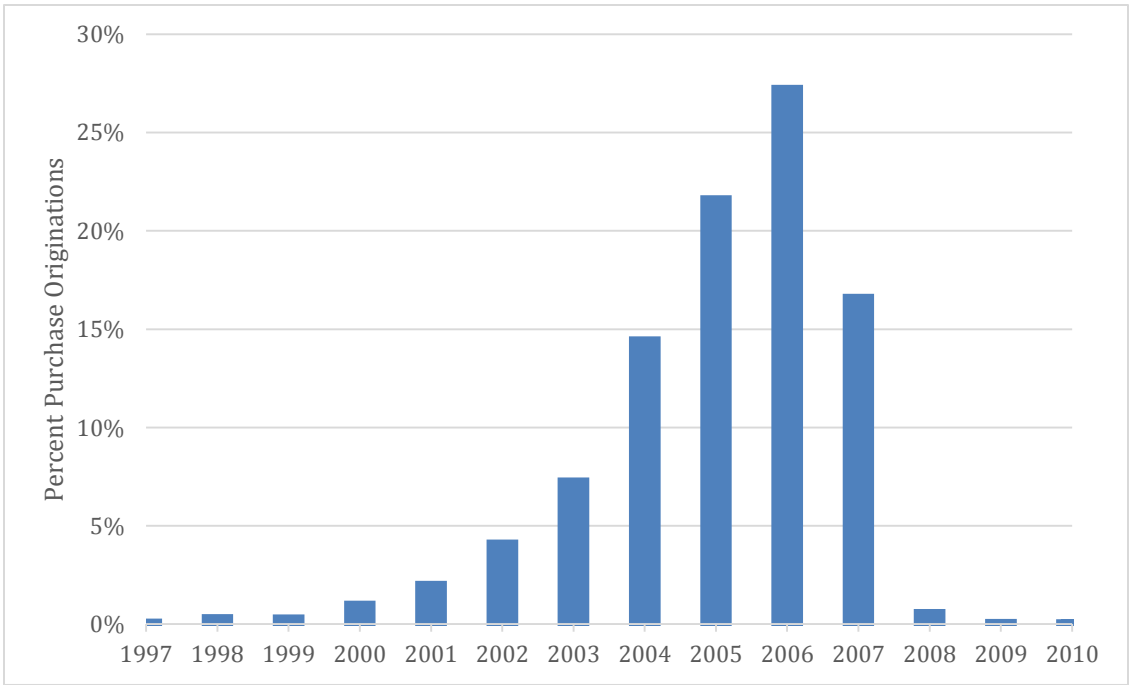
	2000-2006		2006-2012	
	(1)	(2)	(3)	(4)
NTM 2001-2006 (#)	1.003***		-0.121	
	(0.130)		(0.0886)	
NTM 2001-2006 (%)		363.6**		-7.957
		(158.0)		(95.12)
Hispanic (%)	147.7**	97.49	42.11	138.8**
	(64.94)	(106.0)	(33.17)	(60.35)
Hispanic*NTM	-0.0119***	-0.711	0.00263	-5.678
	(0.00370)	(8.515)	(0.00188)	(3.628)
Black (%)	-107.1**	-119.5	24.01	142.6**
	(50.17)	(93.13)	(24.86)	(64.72)
Black*NTM	-0.00511	-3.424	-0.0127***	-15.74***
	(0.00568)	(8.314)	(0.00454)	(5.707)
Observations	753	753	746	746
R-squared	0.722	0.555	0.602	0.566

Figure 1. Non-traditional mortgage originations, 1997-2010



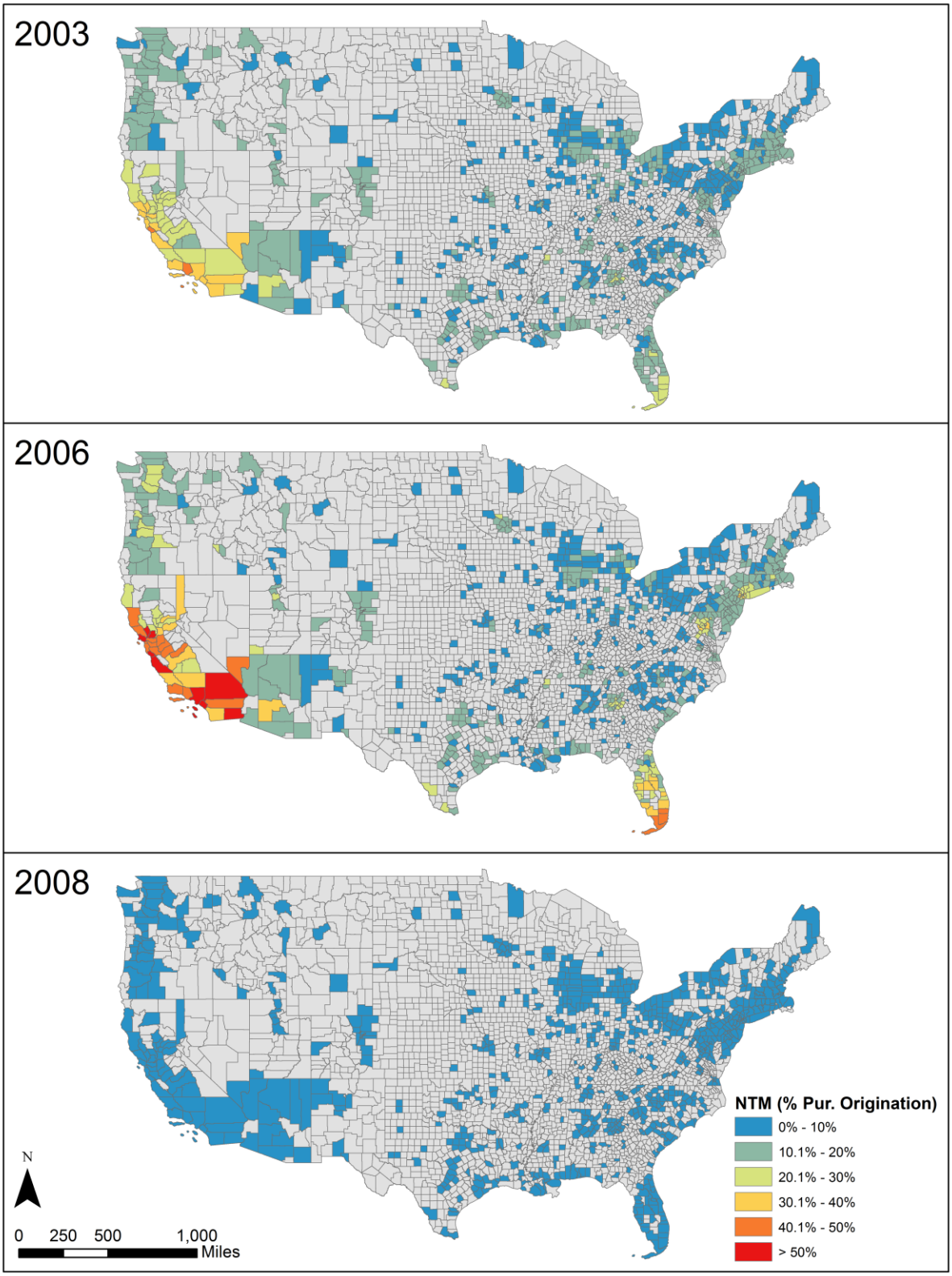
Source: BlackBox

Figure 2. Non-traditional mortgage as a percentage of total purchase originations, 1997-2010



Source: HMDA, BlackBox

Figure 3. Geographic distribution of non-traditional mortgages, 2003, 2006 and 2008



Source: HMDA, BlackBox