HOUSING POLICY DEBATE, 2017
VOL. 27, NO. 3, 393–418
http://dx.doi.org/10.1080/10511482.2016.1249003

Routledge
Taylor & Francis Group

Homeownership and Nontraditional and Subprime Mortgages

Arthur Acolin[a], Xudong An[b], Raphael W. Bostic[a] and Susan M. Wachter[c]

[a]Price School of Public Policy, University of Southern California, Los Angeles, USA; [b]Finance Department, San Diego State University, San Diego, USA; [c]Real Estate Department, University of Pennsylvania, Philadelphia, USA

ABSTRACT

This article documents the growth and geographic distribution of nontraditional mortgages (NTMs) and subprime mortgages during 2000-2006, and examines the association between these products and homeownership at the county level between 2000 and 2012. It finds a significant relationship between the origination of NTM and subprime mortgages during the boom and changes in the number of homeowners (positive during the 2000-2006 period and negative during the 2006-2012 period) but no significant relationship with the change in the homeownership rate. Looking at specific categories of the population, the results indicate a positive relationship between the presence of NTMs and subprime mortgages and increased numbers of homeowners for young households as well as for low income and minority households, but the relationship is smaller than for the general population. Overall, the relationship between NTMs and homeownership is stronger than the relationship between subprime mortgages and homeownership during the boom and it is less negative during the bust.

ARTICLE HISTORY
Received 17 March 2016
Accepted 12 October 2016

KEYWORDS
Homeownership; subprime mortgages; nontraditional mortgages; credit

Most households cannot purchase a first home without a mortgage. Thus, credit markets are important for access to homeownership (Linneman & Wachter, 1989). The first half of the 2000s saw significant changes and innovations in mortgage markets, perhaps most notably the increased prevalence of nontraditional mortgage products (NTM) and increased access to mortgages for subprime borrowers.[1]

The prevalence of NTM and subprime mortgages expanded considerably between 2001 and 2006, both absolutely and as a share of total mortgage lending across the nation.[2] For NTM, this represented an expansion into the mainstream of mortgage products that had been marginal until then. For subprime mortgages, the growth reflected an expansion of mortgages to borrowers with lower credit scores. Whereas numerous articles have shown that the prevalence of NTM and subprime mortgages have contributed to the run-up of house prices and the subsequent mortgage market crisis (see, e.g., Bostic & Lee, 2008; Goetzmann, Peng, & Yen, 2012; Mian & Sufi, 2011; Pavlov & Wachter, 2011), little has been done regarding the association between NTM and subprime mortgages and homeownership.

This is an important issue because a popular narrative points to a role of the expansion of credit in the early 2000s in the increase in homeownership. In particular, the public discourse conflates the expansion of subprime and NTM lending with an expansion in homeownership, particularly for low-income and minority households. This relationship has actually not been examined empirically in the literature, and has important implications for the role of credit supply expansion in the increase in homeownership numbers and rate during the crisis, and the closing of homeownership gaps across racial and ethnic groups.

CONTACT Arthur Acolin acocapid@usc.edu

This article addresses this gap by estimating the association between the presence of NTM and subprime mortgages at the county level between 2001 and 2006 and the change in the number and share of homeowners between 2000 and 2006 (the boom period) and 2006 and 2012 (the bust period). In this article we define NTM as purchase mortgages with features that differ from the traditional fully amortizing 30-year mortgages and subprime mortgages as loans to low-credit-score borrowers.[3] We use a database that contains information on the characteristics of mortgages that are securitized in private label securities (PLS) to measure the prevalence of NTM. Subprime loans are identified by either the list of subprime lenders developed by the U.S. Department of Housing and Urban Development (HUD) or borrower FICO score. The NTM definition is therefore based on product characteristics, whereas subprime is based on lender or borrower characteristics.

During the early 2000s, NTM and subprime mortgages evolved from being niche products to representing a substantial share of mortgages used for home purchases during the housing boom, to virtually disappearing after the housing bust. We develop a unique county-level data set that combines census data on homeownership with public data on subprime mortgages and proprietary data for NTM. Because we include demographic data on borrower age and racial/ethnic status, we can examine the relationship of the use of these products and homeownership for subgroups as well as for the entire population.

We find a positive and significant association between NTM and subprime mortgage use and changes in the number of homeowners, but no significant association with changes in the homeownership rate, during the boom period of 2000 to 2006. We extend the examination of these relationships through 2012 and find a negative and significant association between NTM and subprime mortgage activity and changes in the number of homeowners during the bust. Over the 2000–2012 period, the relationship between the number and share of NTM and subprime mortgages originated during the boom and changes in the number of homeowners remains positive overall.

Looking at specific categories of the population, we find a positive relationship between the presence of NTM and subprime mortgages and increased numbers of homeowners for young households as well as for low-income and minority households, but the relationship is smaller than for the general population. These results are consistent with a view that these products were not used in a way associated with increases in homeownership more by low-income and minority households. The findings suggest that the expansion of NTM and subprime lending was not associated with a disproportionate increase in homeownership among minority and low-income households.

We also distinguish the relationships associated with NTM from those associated with subprime mortgages. As above, we consider whether any differences are robust to the cycle across geographies. Overall, the relationship between NTM and homeownership is stronger than the relationship between subprime mortgages and homeownership during the boom and it is less negative during the bust, pointing to a distinction between product and borrower characteristics.

The rest of the article proceeds as follows. Section 1 reviews the literature that has analyzed nontraditional and subprime mortgages and their impact on economic outcomes such as household consumption and prices. Section 2 presents the data set and definitions we develop to document the evolution of NTM and subprime mortgages and establish some stylized facts about each. Section 3 presents the empirical exploration of the relationship between NTM and subprime mortgages and homeownership. Section 4 discusses policy implications and concludes.

1. Literature Review

An extensive literature examines the role of the credit expansion in the recent housing boom and bust (Brueckner, Calem, & Nakamura, 2012, 2016; Campbell, 2013; Cocco, 2013; Essene & Apgar, 2007; Mayer & Pence, 2008; Mian & Sufi, 2011; see Levitin & Wachter, 2013 for a review) and whether the expansion was concentrated among low-income and minority borrowers (Mian & Sufi, 2011, 2015) or more widespread (Adelino, Schoar, & Severino, 2015, 2016; Foote, Loewenstein, & Willen, 2016).

Rather than focusing on the means and mechanisms through which credit expanded, which has been the subject of a number of articles on this topic (Bhutta, 2015; Foote et al., 2016; Mayer & Pence,

2008), this article focuses on an end product of mortgage credit – homeownership. Specifically, we ask whether the expansion of credit at the local level through NTM and subprime mortgages was associated with an increase in the number of homeowners and in the homeownership rate. Whereas it is often assumed that the expansion in credit through NTM and subprime credit was associated with an increase in the number or share of homeowners, this need not be the case.

NTM and subprime mortgages could have contributed to an increase in homeownership by contributing to the relaxation of credit constraints found in the literature (Acolin, Bricker, Calem, & Wachter, 2016a, 2016b; Barakova, Calem, & Wachter, 2014; Brueckner et al., 2016; Gabriel & Rosenthal, 2015). Theoretical models show that NTM and subprime mortgages can effectively remove borrowing constraints (Chinloy & MacDonald, 2005; Cocco, 2013; LaCour-Little & Yang, 2010). Results from an experiment show that the type of credit offered affects households' stated tenure choice (Fuster & Zafar, 2016).

It is also possible that the expansion of NTM and subprime mortgages was not associated with a change in the number and share of homeowners. Existing homeowners may have used NTM and subprime mortgages to consume more housing or purchase housing in better neighborhoods, or to purchase nonhousing goods (Foote et al., 2016). New homeowners may have substituted NTM and subprime mortgages for existing mortgage products. For example, borrowers may have substituted mortgages insured by the Federal Housing Administration (FHA) with subprime mortgages (Jaffee, 2009; Nichols, Pennington-Cross, & Yezer, 2005) or traditional Fixed Rate Mortgage (FRM) and Adjustable Rate Mortgage (ARM) products with NTM (Amromin, Huang, Sialm, & Zhong, 2011; LaCour-Little & Yang, 2010). With regards to NTM at least (Amromin et al., 2011; LaCour-Little & Yang, 2010), the evidence indicates that they were used by consumers with higher credit scores, suggesting they might have acted more on the intensive margin (the quantity of housing consumed) than on the extensive margin (new homeowners). Another reason for the possible absence of a link between homeownership and the use of NTM and subprime mortgages is that investors may have disproportionately used these mortgages (Bhutta, 2015; Haughwout, Lee, Tracy, & Van der Klaauw, 2011). Finally, the increase in prices associated with NTM and subprime lending worked against the affordability gains possible via the features of these products, potentially limiting the number of new homeowners. In short, the relationship between these products and homeownership remains an outstanding question.

In addition, an important aspect of access to homeownership identified in the literature is the degree to which associations vary across populations, with a particular consideration of whether associations were stronger or weaker among young, low-income or minority populations. Young, low-income and minority households are most affected by borrowing constraints (Gyourko, Linneman, & Wachter, 1999; Haurin, Hendershott, & Wachter, 1997), and might have a higher demand for mortgage products with backloaded amortization features if their current income is substantially below their permanent income (Brueckner et al., 2016). The early literature on mortgage discrimination and redlining pointed to geographical differences at the local level in the supply of mortgage credit as impacting homeownership outcomes. More recently, Mian and Sufi (2011) point to the increase in mortgage debt in the boom years among lower income households, as a way of increasing consumption including housing consumption.

2. The Evolution of NTM and Subprime Mortgages Over Time

We begin by documenting trends in the volume and distribution of NTM and subprime mortgages.[4] For this article, we use a definition of NTM as any loan that substantially differs from the traditional fully amortizing and documented FRM and ARM products. 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: (a) interest only (IO), (b) option ARM with negative amortization, (c) balloon payment, (d) teaser rate, (e) terms longer than 30 years,[5] (f) combined loan-to-value ratio (CLTV) at origination above 100%[6] or (g) low or no documentation.[7] The first four categories (IO, option ARM, balloon, and teaser) are characterized by features enabling a backloading of payments – what Brueckner et al. (2016) call alternative mortgage product (AMP) – which along with longer repayment terms addresses the income constraint by decreasing initial payments, but results in a payment shock. No- or low-documentation loans can let

Table 1. Number of nontraditional features by mortgage.

Number of traits	Number of loans	Share of loans (%)
1	2,193,571	43.8
2	1,680,978	33.6
3	863,153	17.2
4	242,456	4.8
5	25,595	0.5
6	2,612	0.1
7	160	0.0

Note. Authors' calculations based on data from BlackBox Logic.

Table 2. Nontraditional and subprime mortgage volume, 2001–2008.

	2001	2002	2003	2004	2005	2006	2007	2008
NTM	51,771	147,563	256,068	700,273	1,368,395	1,742,624	725,316	15,941
Interest only (%)	2.0	2.8	14.9	30.1	36.2	30.5	33.3	28.4
Option – ARM with negative amortization (%)	1.6	1.9	0.1	4.8	9.5	7.1	7.4	4.0
Balloon payment (%)	11.4	25.9	20.6	18.4	15.0	28.7	25.9	21.3
Teaser rate (%)	2.5	3.0	10.3	15.1	19.7	15.6	18.4	36.3
Low or no documentation (%)	75.8	70.4	57.9	48.4	55.8	59.8	70.3	57.3
Terms > 365 months (%)	14.8	7.0	9.6	8.9	8.1	22.3	20.0	23.2
CLTV at origination ≥100 (%)	11.0	14.5	23.0	33.2	30.4	41.3	38.4	31.0
Subprime								
HMDA definition	269,640	378,572	580,408	923,009	1,226,920	789,564	NA	NA
BlackBox definition	44,240	106,174	167,550	364,477	602,765	609,852	160,771	4,404

Note. ARM: Adjustable Rate Mortgage; CLTV: Combined Loan To Value; HMDA: Home Mortgage Disclosure Act. Since many nontraditional mortgages have more than one nontraditional feature, the sum of the percentage adds up to more than 100%.
Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA.

people with irregular or undocumented assets and income qualify for a mortgage. Finally, high CLTV loans address the wealth constraint by lowering the downpayment requirement.[8]

We use the proprietary BlackBox data set, which includes all loans securitized in PLS, to count the number of NTM originated in a county in a given year. BlackBox has detailed information about more than 14 million first-lien loans originated between 1998 and 2013 that were securitized in approximately 7,400 different PLS. We believe that the BlackBox data are representative of the universe of NTM because most NTM were securitized via PLS, although some mortgage originators kept NTM loans on portfolio. Moreover, estimates of NTM loan volumes using the BlackBox data conform to estimates using other data sources.[9]

The BlackBox data demonstrate that NTM are a complex group of loans. Whereas a mortgage could have any one of seven distinct characteristics and be considered an NTM for this study, many loans originated during this period had multiple qualifying features. Table 1 shows how the mortgages are distributed along this metric for the period 2001–2010 among counties in our sample. We see that a majority of the loans had at least two such features, and a significant fraction had more than four such features.

Table 2 provides a picture of which characteristics were most common among NTM in our sample, by reporting the fraction of NTM in a given year that had a particular feature. We see that low and no documentation were common features among NTM in every year. By contrast, between 2001 and 2006 we see large growth in the incidence of IO mortgages, and mortgages with a high CLTV at origination. Option ARM with negative amortization was the least common feature.

For subprime lending, we use data collected pursuant to the Home Mortgage Disclosure Act (HMDA). Banking and other institutions that make decisions on whether to originate a mortgage are required to report annually on all mortgage applications they receive.[10] We use the number of loans issued by subprime lenders, which were identified by HUD, as our measure of the number of subprime mortgages. The HUD subprime lender list is publicly available via the Urban Institute (Pettit & Droesch, 2009). This

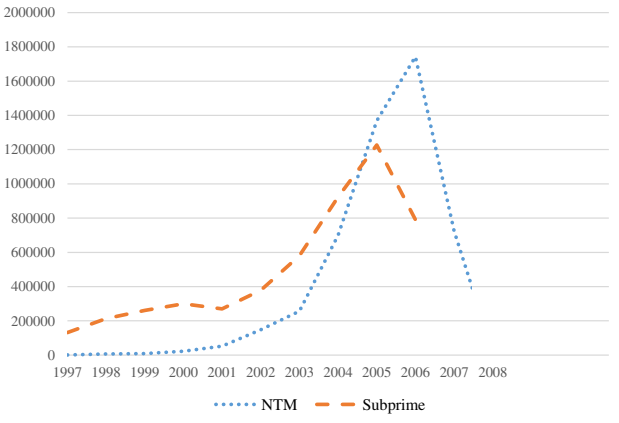

Figure 1. Nontraditional mortgage and subprime originations, 1997–2010.
Note. Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA.

list is imperfect since all loans issued by a subprime lender will be classified as subprime even if the lender also issued prime or alt-a loans. Nonetheless, it offers a reasonable picture of trends over time, and comparisons with other sources show that whereas the levels vary, the trends using HMDA are similar to those using LPS data (Mayer & Pence, 2008). Comparisons with a measure of subprime developed using the subprime variable available in BlackBox based on the borrower FICO score at origination being below 720 show similar trends despite differences in levels, with a correlation between the two measures of .88. Because the HMDA-based measure is estimated to be more comprehensive and is generally used in the literature, we use it in the empirical analysis below.

Figure 1 shows how NTM and subprime mortgage origination volumes evolved from 1997 through 2010 for NTM and through 2006 for subprime mortgages in counties in our sample. After being a very minor product through 2000, never totaling more than 50,000 loans, NTM incidence exploded. NTM volume doubled each year from 2001 to 2004, and annual NTM origination volume doubled again between 2004 and 2006. Overall, NTM increased from less than 100,000 to more than 1.7 million over this period. Similarly, whereas there were less than 300,000 subprime mortgage originations in 2000, there were more than 1.2 million of them in 2005.[11] After 2006, the prevalence of NTM and subprime loans dropped precipitously, as the housing crisis resulted in a rapid change in the supply of these products across the nation. By the end of our study period, NTM had not made a comeback.

The rise of NTM and subprime mortgages during the early 2000s was coupled with an increase in their market share (see Figure 2). NTM were a tiny fraction of all mortgages originated from 1997 and 2001, and first exceeded a 5% market share only in 2003. However, the mortgage market share for NTM rose rapidly after 2003, and topped out at about 30% in 2006. This rise is all the more dramatic because total mortgage lending grew by more than 2 million loans (about 40%) between 2001 and 2005, meaning that much of the net increase took the form of NTM. Subprime mortgages represented about 5% of the market going back to the late 1990s; their share also expanded. In 2005, they represented 18% of the market.

Figure 2 also shows the homeownership rate during that period. It increased from 66% in 1997 to 69% in 2004, remaining at this level until 2006. In aggregate, the homeownership rate did not increase between 2004 and 2006, the period of higher supply of NTM and subprime mortgages. It then decreased back to 65% by 2012. Although the homeownership rate did not increase during the 2004–2006 period, the number of homeowners kept rising by 0.9 million a year during that period; the pace slowed compared with the 1.2 million a year experienced in the 2000–2004 period (U.S. Census 2014).

When looking at the distribution of NTM and subprime mortgages over time and across space, we observe substantial variations across counties (see Figure 3). In 2003, NTM represented more than 20% of mortgages in only a few places, specifically California counties concentrated in the San Francisco and

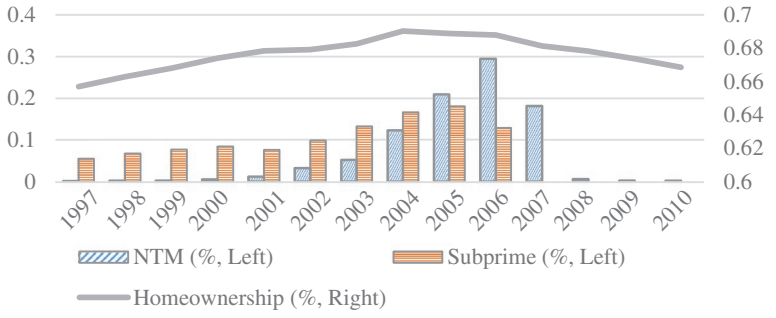

Figure 2. Nontraditional and subprime mortgages as a percentage of total purchase originations and homeownership rate, 1997–2010.
Note. Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA, U.S. Census: CPS/HVS.Subprime share is only shown up to 2006.

Los Angeles metropolitan areas (see Figure 3a). 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 3a, by 2006 the NTM origination share exceeded 20% in many counties, with proportions exceeding 40% in nearly 20 counties. Several California counties even exceeded 60% 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, five were in Florida, four were in the Washington, DC, metropolitan area, two were in the New York City metropolitan area, and each was located in Hawaii and Nevada. The median NTM share was less than 20% in 2006, and markets in the lowest NTM share decile had percentages of less than 10%. Thus we see that NTM incidence was not uniform across geographies during this period.

The final panel of Figure 3a shows NTM origination activity during 2008, after the NTM boom had effectively ended (2007 shows a sharp decline). By that point, NTM did not represent more than 10% of originations in any county, as the supply of NTM rapidly retracted with the crisis.

Figure 3b shows a relatively similar pattern with regard to the spatial distribution of subprime mortgages in 2003 and 2006, with a concentration of subprime mortgages seen in the West and in Florida. Two differences are of note. First, in 2003, subprime mortgages were more prevalent than NTM, especially in a number of California counties. Second, the penetration of subprime mortgages in 2006 was higher than the penetration of NTM in a number of counties in the Midwest and Northeast. In these counties, the rate of subprime mortgages was often above 30%.

Table 3 compares the geographic distribution of the features of NTM and subprime mortgages. To create this table, we ranked counties according to the frequency of a given feature and then calculated the correlation coefficient of pairwise rankings. We find many product features are distributed similarly across counties. Correlation coefficients exceeding 0.9 were found between the distribution of mortgages with no and low documentation with the distributions of mortgages with teaser rates and with interest-only features; between the distribution of mortgages with teaser rates and interest-only loans; and between the distributions of loans with balloon payments and the distributions of loans with high CLTV and with long amortization periods. Among the NTM features, the geographic distributions of option ARM and mortgages with high CLTV were least alike, although a correlation coefficient of 0.55 is still high. The correlations between the geographic distributions of individual NTM features and the geographic distribution of subprime mortgages range between 0.36 and 0.54, with a correlation coefficient between the NTM and subprime mortgage geographic distributions of 0.58 overall.

Figure 4 shows the share of NTM and subprime mortgages across counties broken down by quintiles on three characteristics as of 2000: median house value to median income ratio as a measure of affordability, and share of Hispanic and black households. The graphs show that NTM were much more prevalent in the 2001–2006 period in counties that had a higher house value to income ratio as of 2000, reflecting a lack of affordability. NTM represent more than twice the share of mortgages in the

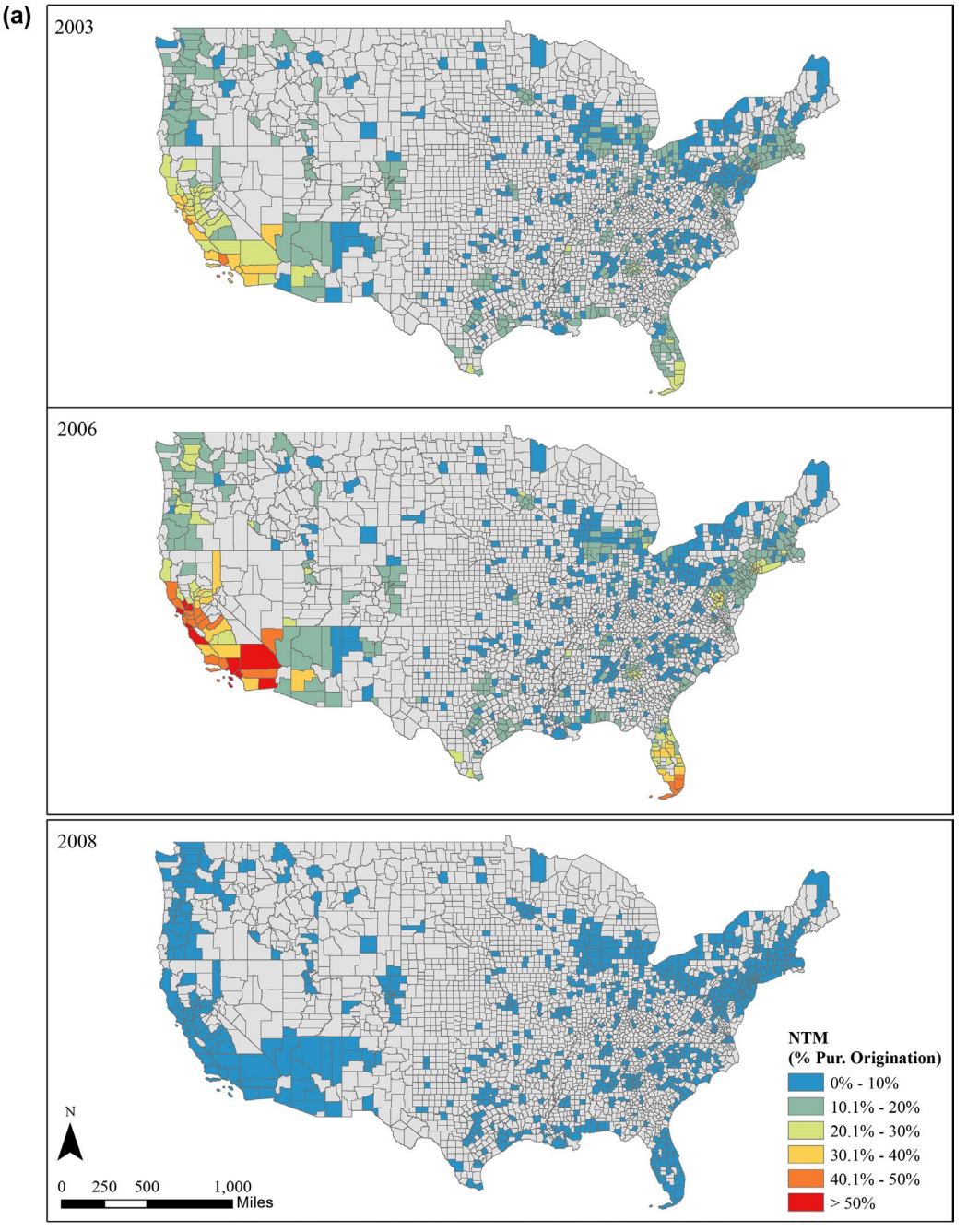

Figure 3. Geographic distribution of nontraditional and subprime mortgages. (a) Nontraditional mortgages, 2003, 2006, and 2008. (b) Distribution of subprime mortgages, 2003 and 2006. Subprime mortgages based on the originator definition are only available until 2006.
Note. Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA.

least affordable counties as compared with the most affordable counties (14.5% vs. 6.6%) as shown in Figure 4A (i). The same relationship shown in Figure 4B (i) exists for subprime mortgages, although it is less pronounced (22.9% vs. 16.3%).

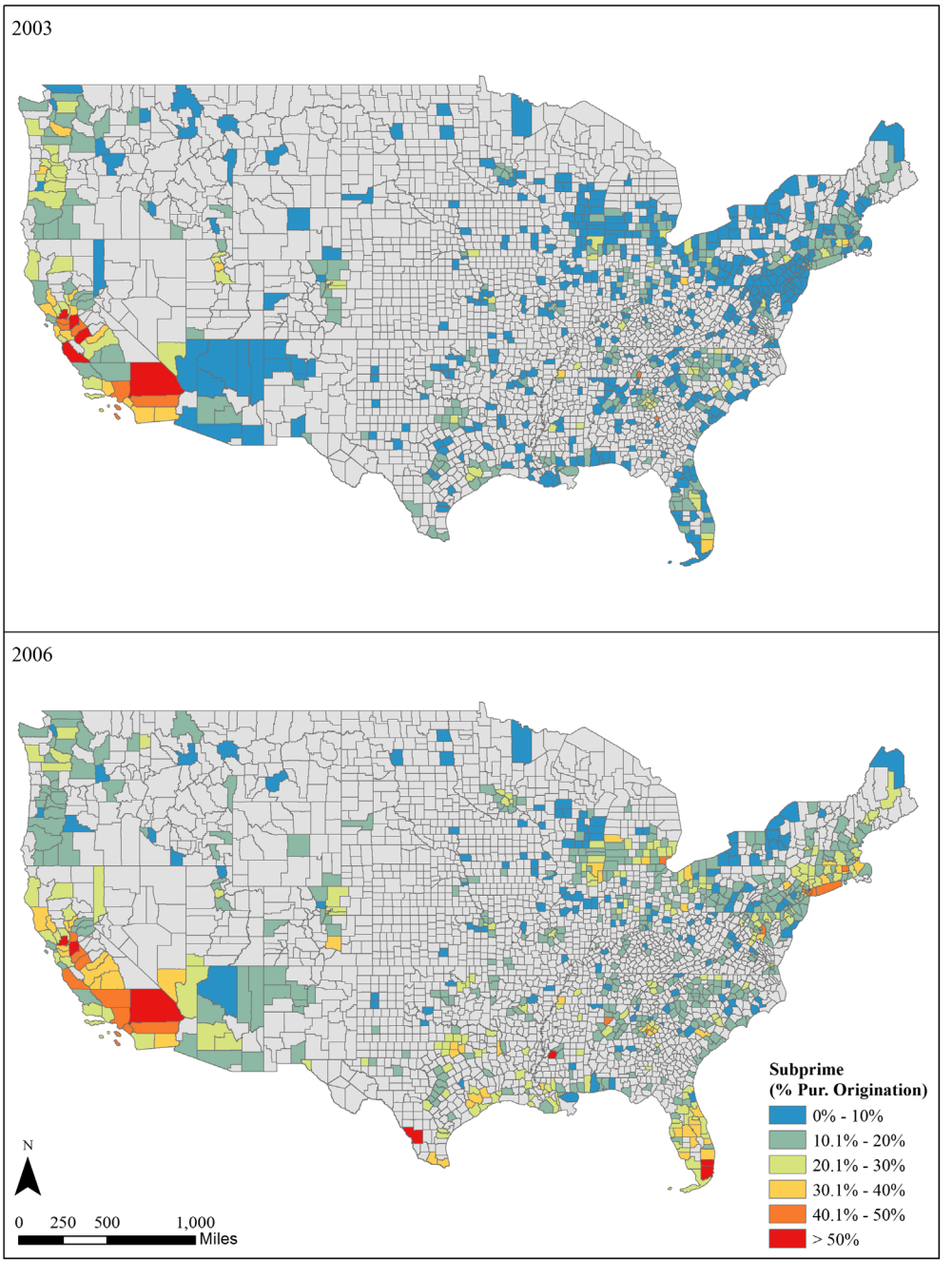

Figure 3. (*Continued*).

We observe a similar pattern as pertains to lending in counties ranked according to the prevalence of Hispanic households. NTM and subprime mortgages were both more prevalent in counties with a higher share of Hispanic households (14.5% vs. 5.8% for NTM [Figure 4A (ii)] and 25% vs. 14.9% for subprime mortgages [Figure 4B (ii)]).

The pattern for lending in counties ranked by the presence of black households differs from the Hispanic pattern. Whereas we again observe an increase in the share of subprime loans as the share

Table 3. Correlation in penetration of different nontraditional mortgages across counties in 2006.

	Interest only	Option – ARM with negative amortization	Balloon payment	Teaser rate	Low or no documentation	Terms > 365 months	CLTV at origination ≥ 100	NTM	Subprime
Interest only	1								
Option – ARM with negative amortization	0.84	1							
Balloon payment	0.76	0.59	1						
Teaser rate	0.92	0.78	0.78	1					
Low or no documentation	0.91	0.82	0.87	0.92	1				
Terms >365 months	0.75	0.62	0.97	0.75	0.86	1			
CLTV at origination ≥ 100	0.77	0.55	0.93	0.83	0.86	0.90	1		
Subprime	0.46	0.38	0.46	0.54	0.52	0.36	0.54	0.58	1

Note. Option-ARM: option adjustable rate mortgage; CLTV: combined loan to ratio; NTM: nontraditional mortgage.
Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA.

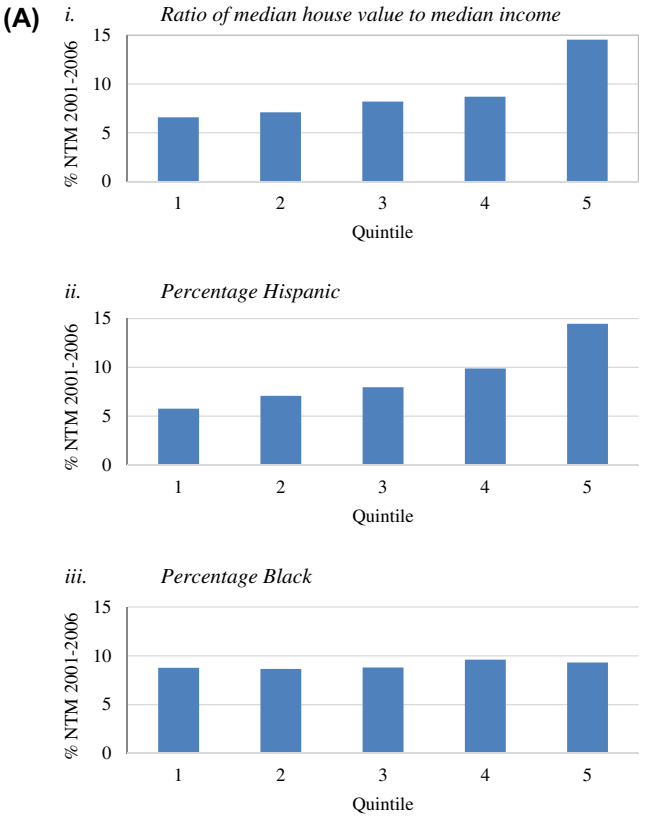

Figure 4. Nontraditional mortgages (NTM) and subprime mortgage share of all mortgage originated from 2001 to 2006, by county quintiles grouped by selected characteristics as of 2000. (a) NTM Share 2001–2006. 1 = lowest quintile. (b) Share of subprime 2001–2006.
Note. Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA and 2000 Census.

of black households in a county increases, the relationship is less strong (Figure 4B (iii)). Moreover, we see no discernable pattern in the prevalence of NTM across counties that vary in the black population share (Figure 4A (iii)). This suggests that the NTM and subprime mortgage dynamics may differ for the black population relative to others.

Since the use of NTM and subprime mortgages by minority and low-income households is higher than in the general population (Bayer, Ferreira, & Ross, 2016; Haughwout, Mayer, Tracy, Jaffee, & Piskorski, 2009; Jaffee, 2009; Mian & Sufi, 2011) it is also possible that the relationship with homeownership might be higher. As shown in Appendix A, the correlation coefficients between the share of NTM and subprime mortgages and changes in number of homeowners in the entire population and among subgroups (young, Hispanic, and black) at the local level are, overall, positive for the period 2000 and 2006 and negative for the period 2006–2012, but there are some substantial differences in the magnitude of the coefficients across groups. We turn in the next section to examining the relationships between NTM and subprime lending and homeownership further.

3. Results for NTM, Subprime Lending, and Homeownership

3.1. Methodology

To explore these associations, we estimate a series of models in which we regress the change in the number of homeowners and the change in the homeownership rate on a set of additional variables plus NTM and subprime mortgage prevalence, measured by the number of NTM and subprime mortgages originated and their market share. The coefficients on these latter variables are our coefficients of

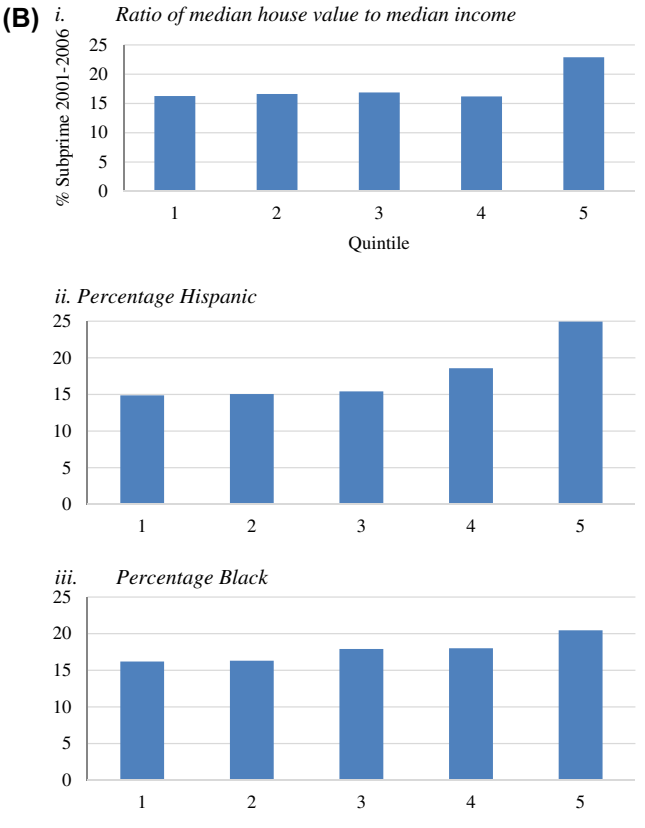

Figure 4. (*Continued*).

interest. We examine these relationships from 2000 to 2012, and thus cover changes in homeownership during the housing boom, the housing bust, and the overall cycle.

The baseline models we estimate are:

$$\Delta HO_{it+1} = \alpha_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 NTM0106_i + \gamma_s + u_{ist} \quad (1)$$

$$\Delta HO_{it+1} = \alpha_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 Subprime0106_i + \gamma_s + u_{ist}, \quad (2)$$

where ΔHO_{it+1} represents the change in the number of homeowners[12] in county i over the period t to $t+1$ (2000–2012, 2000–2006, and 2006–2012),[13] X_{1it} the vector of housing market controls for county i at period t, X_{2it} the vector of demographic controls, X_{3it} the vector of job market controls, $NTM0106_i$ the number or the share of mortgage originated that were NTM in county i over the period 2001–2006, $Subprime0106_i$ the number or share of subprime mortgages and γ_s state fixed effects that capture unobservable time-invariant state-level characteristics.[14]

We ran alternate models with the change in the number of minority or young homeowners as the dependent variable or with the change in the homeownership rate, and partition the data or introduce interaction terms as discussed further below.[15]

For housing market factors, we include, from the American Community Survey (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 Metropolitan Statistical Area (MSA) level house price index from the Federal Housing Finance Agency (FHFA) to measure the change in median house value over the period t to $t+1$, and construct a variable measuring house price volatility over the last 5 years to account for

Table 4. Descriptive statistics.

	2000			2006		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Change in number of homeowners						
2000–2006	6,425	−50,262	133,715			
2000–2012	5,186	−96,183	135,434			
2006–2012				−1,238	−86,762	46,872
NTM volume, 2001–2006						
Number	5,505	46	240,250	5,505	46	240,250
Share	9.0	1.5	28.4	9.0	1.5	28.4
Subprime mortgage volume, 2001–2006						
Number	9,910	126	436,165	9,910	126	436,165
Share	17.8	1.4	62.0	17.8	1.4	62.0
Number of households	111,628	18,798	3,133,774	118,788	19,118	3,172,032
Owner occupied 2000 (%)	63.5	18.4	84.5	63.5	18.4	84.5
Mean household size	2.66	2.07	3.81	2.66	2.14	3.83
College educated (%)	51.3	27.1	83.8	53.7	29.7	82.1
Age share (%)						
25–34	13.6	7.6	25.4	13.3	8.2	19.6
35–44	16.0	10.6	21.7	14.3	9.6	20.6
45–54	13.6	7.9	18.4	14.5	8.2	19.6
55–64	8.8	4.8	15.1	10.7	5.8	16.7
Family with children (%)	29.9	15.2	48.8	31.4	13.8	48.3
Foreign born (%)	6.3	0.4	50.9	7.5	0.3	50.3
Hispanic (%)	7.7	0.3	94.4	9.4	0.2	95.1
Black (%)	9.9	0.1	66.6	10.5	0.0	65.7
Unemployed (%)	3.9	1.4	17.4	4.7	2.0	15.4
Median household income (1000s)	42.8	22.9	82.9	48.9	23.1	100.3
Median rent	568	320	1,185	723	401	1,442
Median house value (1000s)	113	39	493	195	54	902
Rent to value (%)	6.5	2.6	11.2	6.4	2.0	15.5
Value to income	2.60	1.37	7.68	3.83	1.34	13.23
HPI variance	0.03	0.00	0.27	2.95	0.01	23.14
HPI change (%)	57.5	9.6	176.3	−10.3	−62.9	44.8
MSA (%)	87.4			87.4		
Suburban county (%)	20.6			20.6		
N	732			732		

Note. NTM: nontraditional mortgage; HPI: Housing Price Index; MSA: Metropolitan Statistical Area. Authors' calculations based on data from BlackBox Logic, Urban Institute calculation of HMDA and 2000 Census.

past house price performance.[16] Together, these capture price and affordability considerations, which can both influence and be influenced by the use of NTM and subprime mortgages.

We include a vector of county-level demographic variables collected from the ACS, including number of households, mean household size, percentage of family with children, percentage black, percentage Hispanic, percentage foreign born, and percentage 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. Finally, we include dummy variables for the state the county is in, whether a county is in an MSA, and whether it is suburban.[17] Table 4 reports sample statistics for these variables.

3.2. Baseline Results

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 and the overall period.[18] The analyses in Tables 5 and 6 include state fixed effects to control for variation in state circumstances that might bias estimates of the NTM and subprime mortgage relationships. Appendix B provides the full regression results, reporting the coefficients for all control variables. We also show in Appendix B that a likelihood-ratio test indicates that inclusion

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

	2000–2006		2006–2012		2000–2012	
	(1)	(2)	(3)	(4)	(5)	(6)
Nontraditional mortgages (NTM)						
NTM 2001–2006 (No.)	0.717*		−0.0758		0.693*	
	(0.121)		(0.0894)		(0.146)	
NTM 2001–2006 (%)		731.0*		−83.88		510.1**
		(197.1)		(99.62)		(206.9)
Observations	729	729	729	729	729	729
R^2	0.724	0.617	0.636	0.634	0.506	0.415
Subprime mortgages						
Subprime 2001–2006 (No.)	0.433*		−0.103**		0.375*	
	(0.0763)		(0.0446)		(0.0943)	
Subprime 2001–2006 (%)		165.8**		−139.2*		−14.70
		(73.85)		(43.60)		(78.16)
Observations	729	729	729	729	729	729
R^2	0.706	0.610	0.645	0.639	0.476	0.410

Note. Robust standard errors are in parentheses. The dependent variable is the change in the number of homeowners in a county between 2000 and 2006 or 2006 and 2012. These regressions include state fixed effects, whether a county is in an MSA, and whether it is suburban and control for county household number, household size, age structure, share of family with children, college graduate, foreign born, black, Hispanic, median household income, median house value, median gross rent, rent to value ratio, value to income, HPI variance and HPI change, and 2000 homeownership rate.
*$p < .01$; **$p < .05$; ***$p < .10$.

Table 6. Homeownership rate regression results.

	2000–2006		2006–2012		2000–2012	
	(1)	(2)	(3)	(4)	(5)	(6)
Nontraditional mortgages (NTM)						
NTM 2001–2006 (No.)	1.38e-05		−9.38e-06		−6.85e-06	
	(1.63e-05)		(2.01e-05)		(2.01e-05)	
NTM 2001–2006 (%)		0.00449		−0.0373		−0.0487
		(0.0705)		(0.105)		(0.103)
Observations	729	729	729	729	729	729
R^2	0.410	0.409	0.273	0.273	0.388	0.388
Subprime mortgages						
Subprime 2001–2006 (No.)	2.03e-05***		−2.67e-06		4.57e-06	
	(1.05e-05)		(1.24e-05)		(1.26e-05)	
Subprime 2001–2006 (%)		0.0232		−0.0476		−0.0284
		(0.0306)		(0.0380)		(0.0300)
Observations	729	729	729	729	729	729
R^2	0.411	0.410	0.273	0.275	0.388	0.388

Note. Robust standard errors are in parentheses. The dependent variable is the percentage change in the homeownership rate in a county between 2000 and 2006, 2006 and 2012 and 2000 and 2012. Each coefficient represents the result of a separate regression estimated using the same specification as in Table 5.
*$p < .01$; **$p < .05$; ***$p < .10$.

of the fixed effects improves model fit but does not affect the sign and magnitude of the coefficients of interest. We cluster standard errors at the MSA level for all specifications to account for potential correlation of the error terms at the local level. We also show the result weighted by population in the appendix, but use the unweighted results throughout.[19]

During the boom period (see Table 5, columns 1 and 2), increased NTM and subprime mortgage activity is associated with more homeowners, whether NTM and subprime lending are measured in number or share of loans (although not a higher homeownership rate, as discussed below). For the number of loans, we use an aggregate measure of the number of NTM or subprime loans originated during the 2001 to 2006 period. The regression indicates that the origination of 10 additional NTM in

the 2001 to 2006 period is associated with seven additional homeowners between 2000 and 2006, whereas the origination of 10 additional subprime loans is associated with four additional homeowners, which is a smaller but still significant increase. These results hold when we use the percentage of all mortgages in the county that were NTM or subprime mortgages as an independent variable. The share results indicate that a 1-percentage-point increase in the NTM share is associated with 731 more homeowners, and the estimate is statistically significant. A 1-percentage-point increase in the subprime share is associated with 166 more homeowners, a substantially smaller estimate than for the share of NTM, but the estimate is also statistically significant.

Table 6 reports the results of the same set of regressions with the change in the homeownership rate as the dependent variable. The coefficients associated with the number or share of NTM and subprime mortgages are generally not significant when using the percentage change in the homeownership rate as the dependent variable for that subperiod (or for any other period).

The findings showing NTM and subprime mortgage activity as positively associated with the change in the number of homeowners in the 2000 to 2006 period are consistent with the narrative that exists regarding the role of NTM and subprime mortgages in housing markets over the recent cycle, whereas the lack of relationship between the change in the rate of homeownership and NTM and subprime mortgages is not consistent with this narrative.

We next turn to the results of the analysis for the bust period, which are shown in columns 3 and 4 of Table 5. Whereas originations of NTM and subprime mortgages were associated with an increase in the number of homeowners during the boom, they were associated with a decline in the number of homeowners between 2006 and 2012. Starting with subprime mortgages, we find the origination of 10 additional subprime loans during the boom was associated with a loss of about one homeowner during the bust. Similarly, we find that a 1-percentage-point increase in the share of subprime mortgages in a county is associated with 139 fewer owners. For NTM, the origination of additional 10 mortgages in a county from 2001 to 2006 was also associated with a reduction of one homeowner in that county from 2007–2012. When we look at NTM penetration, we observe that a 1-percentage-point increase in the share of NTM among mortgages originated during the boom was associated with a decline of 84 homeowners during the bust. However, none of these results is statistically significant, indicating a weaker negative association between NTM and homeownership during the bust than what was found for subprime mortgages. For both subprime mortgages and NTM, the magnitude of this negative relationship is smaller than the magnitude of the positive relationship during the boom.

We also present estimates of the relationship between NTM and subprime mortgage activity and homeownership over the entire sample period (see Table 5, columns 5 and 6). For the 2000–2012 period, 10 additional NTM originated is associated with seven additional homeowners, whereas 10 additional subprime loans originated is associated with four additional homeowners.

The control variables reported in Appendix B are generally of the expected sign with areas with higher income, a higher share of families and college graduates, and a higher rent to value experiencing a larger increase in the number of homeowners over the entire period and in each subperiod, whereas areas with a higher share of black residents, and higher rent and house value, experience a smaller increase.

Appendix C reports results for the same models as those shown in Tables 5 and 6, but with the NTM and subprime mortgage measures combined.[20] The results are overall similar, although they strengthen the positive association for NTM relative to subprime mortgages. In the model with the number of NTM and subprime mortgages, the coefficients on the measure of subprime lending become insignificant. In the model with the share of NTM and subprime mortgages, the positive association found for subprime during the boom becomes negative but not statistically significant, and becomes negative and significant for the overall period. The associations between NTM and subprime mortgages and changes in homeownership rate remain insignificant across all periods in that specification as well.

3.3. Results by Subgroups of Homeowners and by County Characteristics

We next take these general results and explore whether they hold across demographic groups of homeowners and across counties grouped by population subgroup share. We examine three dimensions of demographic groups: age, race and ethnicity, and income.

We first explore the association of homeownership and the use of NTM and subprime loans for the young. The literature has shown that young homeowners are particularly subject to borrowing constraints (Haurin et al., 1997). If NTM are associated with greater homeownership, through overcoming constraints to lending, the population most likely to reflect a positive relationship between homeownership and the use of NTM and subprime loans would be first-time homebuyers. Young homeowners, defined as homeowners whose household head is less than 35 years old, are a reasonable proxy for first-time homebuyers, as it is considerably less likely that such homeowners have bought multiple homes (Berson & Berson, 1997).

The literature also suggests reasons that the relationships observed in the previous section might not hold across racial and ethnic subgroups. There is considerable evidence on deeper subprime mortgage penetration in communities with large minority populations than in the general population (Calem, Gillen, & Wachter, 2004; Mayer and Spence 2008). There are competing arguments as to the implication of this for homeownership. On one hand, it could be that subprime mortgage (as well as NTM) products better match with the circumstances faced by minority borrowers, and so are more important for their access to homeownership (Cocco, 2013). Alternatively, a deeper penetration could arise due to incomplete markets and predatory lending strategies that place minority households at greater risk, which ultimately manifests itself in the form of weaker or negative homeownership relationships (Agarwal, Amromin, Ben-David, Chomsisengphet, & Evanoff, 2014; Agarwal & Evanoff, 2016; Calem, Courchane, & Wachter, 2009; Gramlich, 2007). An earlier literature focused on whether minority borrowers were differentially excluded from access to borrowing for homeownership because of mortgage lending discrimination based on minority status or redlining (Bostic, Calem, & Wachter, 2005; Guttentag & Wachter, 1980; Munnell, Tootell, Browne, & McEneaney, 1996). Indeed, *greenlining*, or the minimizing of rationing and a concomitant increase in homeownership with the introduction of nonprime mortgage, has been associated with the use of NTM and subprime lending.

A similar set of arguments could be made regarding income. Calem et al. (2009) provide evidence that a larger share of prime and subprime mortgages were originated to low-income borrowers during the boom. Deeper penetration could reflect better product efficacy, resulting in stronger ownership relationships, or increased vulnerability to abuse, which could lead to weaker or even negative relationships between homeownership and NTM and subprime lending.

Because our data do not identify lower income homeowners, we can only analyze the income relationships by using county-wide characteristics. We use the indirect measure of the county median income as a proxy for the presence of low-income homeowners. We stratify counties based on median income, with low-income counties being those in the lowest quartile and high-income counties being the remaining counties. We then compare trends between the two sets of counties. Tables 7–10 report the key results for the young and minority homebuyer analyses.[21] These analyses reveal interesting findings. The homeowner relationships with both NTM and subprime mortgages for both young and minority buyers during the boom are weaker than those for the entire population of homeowners.

First, Table 7 shows the homeownership relationships for NTM and subprime mortgages for young homeowners during the boom. Because the baseline homeownership numbers and rates differ for young households and the overall population, one cannot directly compare regression coefficients. Rather, one must standardize the coefficients to make them comparable. We do so by expressing the effects in terms of standard deviations.[22] For example, a one standard deviation increase in the share of NTM is associated with a 0.31 standard deviation larger change in the number of homeowners in the overall population and a 0.26 standard deviation larger change in the number of young homebuyers. For the share of subprime mortgages, the associations are 0.12 and 0.07, respectively. Second, we see the opposite relationships during the bust. Here, the coefficients on NTM and subprime mortgage

Table 7. Homeownership regression results, with change in the number of young homeowners as the dependent variable.

	2000–2006		2006–2012	
	(1)	(2)	(3)	(4)
Nontraditional mortgages (NTM)				
NTM 2001–2006 (No.)	0.166*		−0.143*	
	−0.0397		−0.0363	
NTM 2001–2006 (%)		128.1**		−69.94**
		−50.92		−31.2
Observations	729	729	729	729
R^2	0.43	0.263	0.749	0.74
Subprime mortgages				
Subprime 2001–2006 (No.)	0.113*		−0.0993*	
	−0.0238		−0.0182	
Subprime 2001–2006 (%)		19.29		−36.91**
		−20.44		−14.44
Observations	729	729	729	729
R^2	0.433	0.252	0.755	0.685

Note. Robust standard errors are in parentheses. Each coefficient represents the result of a separate regression estimated using the same specification as in Table 5. The dependent variable for each regression is the change in the number of young homeowners in a county between 2000 and 2006 or 2006 and 2012.
*$p < .01$; **$p < .05$; ***$p < .10$.

activity are negative, and the magnitude of the relationships is larger for young homeowners than for all homeowners together. A one standard deviation higher share of NTM is associated with a 0.11 standard deviation larger decline for young homeowners compared with a 0.05 standard deviation larger decline for the overall population. A further difference from what was seen for the total population is that the NTM relationship is larger than the subprime relationship in the bust.

Tables 8 and 9 report the results of the analysis for minority homeowners. The results for Hispanic homeowners (see Table 8) indicate largely the same pattern as shown for young homeowners. We see positive relationships during the boom period, and negative relationships during the bust, with the boom coefficients exceeding the bust coefficients. However, the coefficients are smaller. For instance, a one standard deviation higher share of NTM is associated with a 0.3 standard deviation higher change in the number of homeowners during the 2000–2006 period for the whole population, but with a 0.1 higher change in the number of Hispanic homeowners. Here, again, the NTM relationships are stronger than the subprime mortgage relationships in both the boom and bust periods.

The results for black homeowners (see Table 9) look generally similar to those for the young and Hispanic homeowners, with two important differences. First, unlike any of the other findings, here the magnitude of the subprime mortgage relationship is statistically indistinguishable from the magnitude of the NTM relationship. This is consistent with results in other work showing that subprime mortgages played a larger role in black communities than in the general population. Second, we do not observe negative relationships in the bust period between homeownership for black households and either NTM or subprime mortgages.[23]

These results identify differences by subgroup. The main difference is that the positive relationship between NTM and subprime prevalence and change in the number of homeowners found in the general population during the boom appears to be relatively smaller for minority households and in minority and low-income areas. This is consistent with the notion that, for these subgroups, these products might have been substitutes for existing products rather than providing additional access to homeownership. This may be behind our finding few additional new homeowners for these subgroups.

Table 10 presents the findings for the county-level income-based analysis. Here, low-income counties are defined as those counties with median income in the lowest quartile, and we compare experiences between this grouping of counties and those counties with median incomes in the highest quartile. There is no substantial difference between low- and high-income counties in the coefficients for the number of NTM and subprime mortgages during the boom.

Table 8. Homeownership regression results, with change in the number of Hispanic homeowners as the dependent variable.

	2000–2006		2006–2012	
	(1)	(2)	(3)	(4)
Nontraditional mortgages (NTM)				
NTM 2001–2006 (No.)	0.284*		−0.116*	
	−0.053		−0.032	
NTM 2001–2006 (%)		181.2**		35.5
		−75.51		−44.75
Observations	637	637	618	618
R^2	0.854	0.78	0.29	0.197
Subprime mortgages				
NTM 2001–2006 (No.)	0.215*		−0.0679*	
	−0.021		−0.015	
NTM 2001–2006 (%)		37.61		−2.76
		−33.26		−19.69
Observations	637	637	618	618
R^2	0.875	0.778	0.268	0.196

Note. Robust standard errors are in parentheses. Each coefficient represents the result of a separate regression estimated using the same specification as in Table 5. The dependent variable for each regression is the change in the number of Hispanic homeowners in a county between 2000 and 2006 or 2006 and 2012.
*$p < .01$; **$p < .05$; ***$p < .10$.

Table 9. Homeownership regression results, with change in the number of black homeowners as the dependent variable.

	2000–2006		2006–2012	
	(1)	(2)	(3)	(4)
Nontraditional mortgages (NTM)				
NTM 2001–2006 (No.)	0.0316***		0.0448***	
	−0.019		−0.0266	
NTM 2001–2006 (%)		153.9*		29.57
		−53.28		−49.07
Observations	590	590	573	573
R^2	0.224	0.234	0.229	0.208
Subprime mortgages				
NTM 2001–2006 (No.)	0.0294**		0.00326	
	−0.0129		−0.00753	
NTM 2001–2006 (%)		59.35*		−20.04
		−21.13		−16.86
Observations	590	590	573	573
R^2	0.23	0.234	0.207	0.209

Note. Robust standard errors are in parentheses. Each coefficient represents the result of a separate regression estimated using the same specification as in Table 5. The dependent variable for each regression is the change in the number of black homeowners in a county between 2000 and 2006 or 2006 and 2012.
*$p < .01$; **$p < .05$; ***$p < .10$.

With regards to the share of NTM and subprime mortgages, the positive relationship persists in counties with high median incomes, but is not seen in counties with low median incomes. For the low-median-income counties, the coefficients are negative, unlike in other cases, but they are not significant. This suggests that lower income areas with higher levels of NTM and subprime mortgage activity did not experience disproportionate increases in the number of homeowners. Rather, the positive relationship found between overall growth in number of homeowners and growth in NTM and subprime loans as a share of overall loans is stronger in high-income counties and either nonexistent or negative in low-income counties. During the bust, the coefficients are actually slightly more negative in high-income counties, although the differences are largely not statistically significant.

Table 10. Homeownership regression results, stratified by county income level.

	2000–2006				2006–2012			
	Low Income	High Income	Low Income	High Income	Low Income	High Income	Low Income	High Income
Nontraditional mortgages (NTM)								
NTM 2001–2006 (No.)	0.783**	0.705*			0.0691	–0.0677		
	(0.333)	(0.115)			(0.169)	(0.0919)		
NTM 2001–2006 (%)			–137.3	517.1**			–166.0**	–232.0**
			(156.2)	(218.4)			(80.65)	(92.79)
Observations	189	564	189	564	193	578	193	578
R^2	0.502	0.703	0.479	0.568	0.506	0.569	0.516	0.570
Subprime mortgages								
Subprime 2001-2006 (No.)	0.352***	0.414*			–0.005	–0.118*		
	(0.190)	(0.0777)			(0.0931)	(0.0437)		
Subprime 2001–2006 (%)			–80.31	56.69			–78.34*	–215.6*
			(56.71)	(95.08)			(24.95)	(50.95)
Observations	189	564	189	564	193	578	193	578
R^2	0.498	0.666	0.483	0.560	0.505	0.582	0.524	0.581

Note. Robust standard errors are in parentheses. Each coefficient represents the result of a separate regression estimated using the same specification as in Table 5. The dependent variable for each regression is the change in the number of homeowners in a county between 2000 and 2006 or 2006 and 2012. *Low-income counties* are those with median income below the 1st quartile; *high income counties* represent the remainder.

*$p < .01$; **$p < .05$; ***$p < .10$.

4. Conclusion

This article explores the relationship between the rise of nontraditional mortgage products (NTM) and subprime mortgages and homeownership. It estimates these relationships during the 2000s when the prevalence of both subprime and nontraditional mortgages increased dramatically. It first documents the evolution of both NTM and subprime mortgages during this period, and establishes some stylized facts about their volume and geographic distribution. Origination activity in both mortgage categories grew dramatically during the early 2000s and then abruptly ended after 2006. Activity for both was concentrated in high-cost markets and sand states, although subprime mortgage activity was distributed more broadly across the United States.

We find that NTM and subprime activity was associated with an increase in the number of homeowners, but not in changes in the homeownership rate, during the boom period of 2000 to 2006. NTM and subprime activity during the boom period was negatively associated with changes in the number of homeowners during the bust period of 2007–2012. There is no significant relationship between the prevalence of NTM and subprime mortgages during the boom and changes in the homeownership rate at the local level during the bust. These results are specific to the periods examined here and would not necessarily hold for other periods during which NTM and subprime mortgages represented only a small share of the mortgage market.

When considering groups most likely to face borrowing constraints, we find less of a relationship between increase in number of homeowners and use of NTM and subprime loans for these subgroups than for the entire population. For young homeowners who are thought to be most hampered by credit constraints (Haurin et al., 1997), we see a significant positive relationship between NTM and subprime mortgage prevalence and homeownership during the boom. We see no significant relationship during the bust years. For racial minorities, another key group for whom credit constraints are particularly binding, we observe somewhat different patterns. The results for Hispanic homeowners indicate largely the same pattern (positive association during the boom, negative but smaller relationship during the bust), but the coefficients are smaller than for young homeowners or the overall population. The results for black homeowners follow the same patterns but differ in two ways from what was observed for the other groups. First, the NTM and subprime mortgage relationships are similar in magnitude. Second, the relationships during the bust are positive and generally insignificant. Finally, the positive relationship during the boom is not higher in areas with lower income levels. Taken together, these results suggest that, whereas NTM and subprime loans may be associated with increasing homeownership at the local level, these benefits vary across the population.

Finally, we find that, overall, the relationship between NTM and homeownership is stronger than the relationship between subprime mortgages and homeownership during the boom but it is less negative during the bust.

These results are informative for several areas of policy concern. First, the gap in homeownership outcomes across racial and ethnic groups has been a policy issue of longstanding concern. Whereas the literature has addressed issues on the predatory aspects of nonprime loans, it is possible that a more general outcome of such lending is the closing of homeownership gaps, for low-income and minority households and for low-income and minority areas. However, we find that there is no substantial difference between low- and high-income counties, and weaker NTM and subprime mortgage relationships for minority households. Thus, these findings do not support the conclusion that nontraditional lending products assisted in *decreasing* gaps in homeownership outcomes, geographically or by borrower racial or ethnic status.

Second, in response to the crisis, two strands of literature have taken opposite positions on the role of lending to low-income households. Mian and Sufi (2011, 2015) point to disproportionate lending to low-income communities, whereas Adelino et al. (2015, 2016) and Foote et al. (2016) point to expansion of credit across the board for households at all income levels, although they do not focus on nonprime lending. Here, we find that the relationship found by Mian and Sufi for lending does not hold for homeownership.

Taken together, these results call into question the view that an untargeted relaxation of borrowing constraints can result in the closing of persistent gaps across racial and ethnic groups and between groups stratified by income. Instead, they suggest that in order to address existing homeownership gaps, more targeted measures are needed to improve access to mortgage credit in a sustainable manner. Such policies could potentially include education programs to increase financial literacy, preownership counseling programs to improve consumer choice of context-appropriate mortgage products, posthomeownership counseling to ensure that the early years of homeownership are weathered smoothly, saving schemes to enable households to save for downpayments and overcome economic shocks that could threaten loan repayment, and enforcement of regulations that prevent the steering of consumers toward mortgage products that are not beneficial to them.

Notes

1. These two developments are connected but separate. Nontraditional mortgages are mortgage products with characteristics that differ from the fully amortizable 30-year fixed-rate mortgages, "the American Mortgage" (Green and Wachter 2005, p. 93). Subprime mortgages are loans made to borrowers with low credit score (variously defined as below 680, 640, or 620) but because of data availability limitations, loans issued by lender on the U.S. Department of Housing and Urban Development's (HUD) list of subprime lenders are used as a proxy for subprime mortgages. Many NTM were originated to subprime borrowers and many subprime borrowers used NTM (Bostic et al., 2012). The correlation between the share of NTM and the share of subprime mortgages at the county level is 0.58 based on the data and definition used in this article.
2. We restrict our sample to purchase mortgages here, but these products were also used for refinancing.
3. We provide more details about the data sets used to measure NTM and subprime in Section 2.
4. For both types of product, we restrict our sample to first-lien purchase mortgages.
5. The threshold used is actually 365 months since mortgages with terms between 360 and 365 are not different by nature and may reflect reporting error.
6. CLTV combines the balance on the first and second mortgage (piggyback) to capture the overall level of leverage.
7. This is a comprehensive definition of NTM that goes beyond the definition of *alternative mortgage products* used in LaCour-Little and Yang (2010) and Brueckner et al. (2016) or of complex mortgages in Amromin et al. (2011) that restrict the definition to IO and option ARM, for example. We also tried alternative definitions by including hybrid ARM, mortgages with prepayment penalties, and changing the threshold for CLTV to strictly above 100% CLTV or decreasing it to 97%. The results are broadly similar and available upon request.
8. This definition of NTM is inclusive but heterogeneous, and the relationship with homeownership could vary across attributes. As we discuss below, the correlation between different attributes is always above 0.5 but substantially below 1. To test for the importance of this heterogeneity, we separated the attributes based on the type of constraint they are expected to contribute to overcoming: income (option ARM with negative amortization, IO loans, loans with balloon payments, low or no documentation, terms over 30 years, and teaser rates) or wealth (high CLTV). In both cases, the estimates are similar to those obtained with the overall NTM measure.
9. For example, we estimate that 31% of mortgages issued in 2006 were NTM, a figure close to the 30% reported in Sanders (2008) using CoreLogic data and to the 32% reported in Inside Mortgage Finance (2013). Further, there is no evidence suggesting that NTM kept on portfolio have a different spatial distribution than those securitized in PLS.
10. Avery, Bhutta, Brevoort, and Canner (2011) estimate that HMDA data cover more than 80% of the total mortgage origination market.
11. The way subprime loans are identified from HMDA changes after 2006, from relying on a list of subprime originators identified by HUD to being based on a spread of the mortgage rate at origination relative to prime (3 percentage points). To remain consistent, and given our period of interest, the lender-based definition is the only one used in this study.
12. Our measure of the change in the number and share of homeowners comes from the U.S. Census and American Community Survey (ACS) and is therefore unlikely to be biased by the reporting of owner-occupy status by investors on mortgage applications, as discussed in Haughwout et al. (2011).
13. These periods correspond roughly to the boom and bust periods. Whereas some view the end of the boom as occurring in late 2006, when house prices began to decline, other point to early 2007 when credit tightened and its availability became constrained. We selected an endpoint for the boom – the end of 2006 – that fell between these two while also being straightforward to implement. Based on data availability for the American Community Survey (ACS), it is not possible to measure the change in homeownership on an annual basis for the period prior to 2005. We also ran an annual regression at the state level with lagged annual NTM and subprime numbers for the period 2000–2006, and results are similar to those found over the entire 2000–2006 period. We also restricted the

NTM and subprime measures to the 2004 to 2006 period with similar results. Future work can expand the study past 2012 – a period in which markets were still in recovery.

14. Both population-weighted and nonweighted regressions were run with broadly similar results (Appendix B). The results discussed in the analysis are not weighted by population. As suggested by a reviewer, we also combined the NTM and subprime measure into the same model. Because of the high level of collinearity between the two measures, we do not report the results. Those are available from the authors on demand.
15. We leave for further work to determine whether there are homogeneous effects across regions.
16. For non-MSA counties, we use the state-level index for non-MSA parts of the state produced by FHFA. 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 & Rosenthal, 2015, p. 11).
17. As defined by the Office of Management and Budget.
18. We present results using the aggregate number of NTM originated during 2001–2006 as the variable of interest. We also tested whether the effect changed by year, using annual lags for the number and share of NTM. We ran all the analyses for the 2006–2012 period using up to eight period lags. We further reestimated the relationships using the maximum NTM share in a county over the cycle as the independent variable. The results are robust to these alternative specifications.
19. In addition, as a robustness check we ran a specification that included the change in renters. The results are robust to that specification. This suggests that counties in which there was a higher prevalence of NTM and subprime mortgages experienced a higher increase during the boom and a higher decrease during the bust in the number of homeowners, but that it was proportional to their overall population gains.
20. We thank two anonymous referees for suggesting this additional specification.
21. We also conducted first-time homebuyer and racial group tests using two other approaches, with similar results. Specifically, we created interaction terms involving the NTM and subprime mortgage metrics and the share of the county population that is either young (for the first-time homebuyer analysis) or black or Hispanic (for the racial group analysis). We also stratified our sample based on their share of young, black or Hispanic households and compared the relationship in high- and low- young and minority counties. The results of these analyses, which yield qualitatively similar results to the analysis reported in the text, are available upon request.
22. We adopt the same approach for all subgroups.
23. We also looked at the relationships between NTM and subprime mortgages and changes in the young, Hispanic and black homeownership. As in the general population, the relationships are not significant, indicating that areas with a larger number or share of these products did not experience a larger increase or decrease in young and minority homeownership rate during the boom or bust.

Acknowledgments

The authors are grateful to Barry Cynamon and Neil Bhutta for helpful comments on an earlier version of this article. All errors are the responsibility of the authors alone. An gratefully acknowledges data access through the UCLA Ziman Center for Real Estate during his visit to the Center. Wachter gratefully acknowledges support from the Research Sponsors Program of the Zell/Lurie Real Estate Center at The Wharton School of the University of Pennsylvania.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on Contributors

Arthur Acolin is a PhD student in the Price School of Public Policy at the University of Southern California. His research focuses on housing strategies designed to deliver adequate and affordable homes in different contexts.

Xudong An is professor of Finance and the Endowed Professor of Real Estate at San Diego State University. His research mainly focuses on mortgage default risk, although he has wide interests in real estate finance, risk management, structured finance, and housing economics.

Raphael W. Bostic is the Judith and John Bedrosian Chair in Governance and the Public Enterprise at the Sol Price School of Public Policy at the University of Southern California. His work focuses on access to homeownership, housing finance, neighborhood change, and the role of institutions in shaping policy effectiveness.

Susan M. Wachter is the Albert Sussman professor of Real Estate and professor of Finance, The Wharton School and Codirector, Penn Institute for Urban Research, at the University of Pennsylvania. She is an expert on housing finance and housing policy.

References

Acolin, A., Bricker, J., Calem, P., & Wachter, S. (2016a). Borrowing constraints and homeownership. *The American Economic Review: Papers and Proceedings, 106*, 625–629.

Acolin, A., Bricker, J., Calem, P., & Wachter, S. (2016b). *Borrowing constraints and homeownership over the recent cycle* (Working Paper no. 793). Philadelphia, PA: Wharton Real Estate Center.

Adelino, M., Schoar, A., & Severino, F. (2015). *Changes in buyer composition and the expansion of credit during the boom* (No. w20848). National Bureau of Economic Research.

Adelino, M., Schoar, A., & Severino, F. (2016). Loan originations and defaults in the mortgage crisis: The role of the middle class. *Review of Financial Studies, 29*, 1635–1670. doi:10.1093/rfs/hhw018

Agarwal, S., Amromin, G., Ben-David, I., Chomsisengphet, S., & Evanoff, D. D. (2014). Predatory lending and the subprime crisis. *Journal of Financial Economics, 113*, 29–52.

Agarwal, S., & Evanoff, D. D. (2016, September). *Loan product steering in mortgage markets* (NBER Working Paper No. 22696). Cambridge, MA: The National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w22696

Amromin, G., Huang, J., Sialm, C., & Zhong, E. (2011). *Complex mortgages* (NBER Working Paper No. w17315). Cambridge, MA: The National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w17315

Avery, R. B., Bhutta, N., Brevoort, K. P., & Canner, G. B. (2011). The mortgage market in 2010: Highlights from the data reported under the home mortgage disclosure act. *Federal Reserve Bulletin, 97*, 1–82.

Barakova, I., Calem, P. S., & Wachter, S. M. (2014). Borrowing constraints during the housing bubble. *Journal of Housing Economics, 24*, 4–20.

Bayer, P., Ferreira, F., & Ross, S. L. (2016). *What drives racial and ethnic differences in high cost mortgages?* (NBER Working Paper No. w22004). Cambridge, MA: The National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w22004

Berson, D. W., & Berson, D. L. (1997). The importance of demographics in economic analysis: The unusual suspects. *Business Economics, 32*(1), 12–16.

Bhutta, N. (2015). The ins and outs of mortgage debt during the housing boom and bust. *Journal of Monetary Economics, 76*, 284–298.

Bostic, R. W., Calem, P. S., & Wachter, S. M. (2005). Hitting the wall: Credit as an impediment to homeownership. In N. P. Retsinas & E. S. Belsky (Eds.), *Building assets, building credit: Creating wealth in low-income communities* (pp. 155–172). Washington, DC: Brookings Institution Press.

Bostic, R., Chomsisengphet, S., Engel, K. C., McCoy, P. A., Pennington-Cross, A., & Wachter, S. (2012). Mortgage product substitution and state anti-predatory lending laws: Better loans and better borrowers? *Atlantic Economic Journal, 40*, 273–294.

Bostic, R. W., & Lee, K. O. (2008). Mortgages, risk, and homeownership among low-and moderate-income families. *The American Economic Review, 98*, 310–314.

Brueckner, J. K., Calem, P. S., & Nakamura, L. I. (2012). Subprime mortgages and the housing bubble. *Journal of Urban Economics, 71*, 230–243.

Brueckner, J. K., Calem, P. S., & Nakamura, L. I. (2016). House-price expectations, alternative mortgage products, and default. *Journal of Money, Credit and Banking, 48*, 81–112.

Calem, P. S., Courchane, M., & Wachter, S. (2009). *Sustainable homeownership* (Samuel Zell and Robert Lurie Real Estate Center Working Paper No. 643). Philadelphia, PA: Wharton School. Retrieved from http://realestate.wharton.upenn.edu/research/papers.php?paper=643

Calem, P. S., Gillen, K., & Wachter, S. (2004). The neighborhood distribution of subprime mortgage lending. *The Journal of Real Estate Finance and Economics, 29*, 393–410.

Campbell, John. Y. (2013). Mortgage market design. *Review of Finance, 17*(1), 1–33.

Chinloy, P., & MacDonald, N. (2005). Subprime lenders and mortgage market completion. *The Journal of Real Estate Finance and Economics, 30*, 153–165.

Cocco, J. F. (2013). Evidence on the benefits of alternative mortgage products. *The Journal of Finance, 68*, 1663–1690.

Essene, R. S., & Apgar, W. C. (2007). Understanding mortgage market behavior: Creating good mortgage options for all Americans. Cambridge, MA: *Joint Center for Housing Studies of Harvard University*. Retrieved from http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/mm07-1_mortgage_market_behavior.pdf

Foote, C. L., Loewenstein, L., & Willen, P. S. (2016). *Cross-sectional patterns of mortgage debt during the housing boom: Stocks and flows* (Working Paper). Boston, MA: Federal Reserve Bank of Boston. Retrieved from http://groups.haas.berkeley.edu/realestate/research/2016%20conference%20papers/FLW_2016_03_31.pdf

Fuster, A., & Zafar, B. (2016). To buy or not to buy: Consumer constraints in the housing market. *The American Economic Review, 106*, 636–640.

Gabriel, S. A., & Rosenthal, S. S. (2015). The boom, the bust and the future of homeownership. *Real Estate Economics, 43*, 334–374.

Goetzmann, W. N., Peng, L., & Yen, J. (2012). The subprime crisis and house price appreciation. *The Journal of Real Estate Finance and Economics, 44*, 36–66.

Gramlich, E. M. (2007). *Subprime mortgages: America's latest boom and bust*. Washington, DC: The Urban Institute.

Green, R. K., & Wachter, S. M. (2005). The American mortgage in historical and international context. *The Journal of Economic Perspectives, 19*, 93–114.

Guttentag, J. M., & Wachter, S. M. (1980). *Redlining and public policy*. New York, NY: New York University, Graduate School of Business Administration, Salomon Brothers Center for the Study of Financial Institutions.

Gyourko, J., Linneman, P., & Wachter, S. (1999). Analyzing the relationships among race, wealth, and home ownership in America. *Journal of Housing Economics, 8*, 63–89.

Haughwout, A., Lee, D., Tracy, J. S., & Van der Klaauw, W. (2011). *Real estate investors, the leverage cycle, and the housing market crisis* (FRB of New York Staff Report No. 514). New York, NY: Federal Reserve Bank of New York. Retrieved from https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr514.pdf

Haughwout, A., Mayer, C., Tracy, J., Jaffee, D. M., & Piskorski, T. (2009). Subprime mortgage pricing: the impact of race, ethnicity, and gender on the cost of borrowing. *Brookings-Wharton Papers on Urban Affairs, 1*, 33–63.

Haurin, D. R., Hendershott, P. H., & Wachter, S. M. (1997). Borrowing constraints and the tenure choice of young households. *Journal of Housing Research, 8*, 137–154.

Inside Mortgage Finance. (2013). *The 2007 mortgage market statistical annual*. Bethesda, MD: Author. Retrieved from http://www.insidemortgagefinance.com/catalog/newsletters/-1000007533-1.html

Jaffee, D. M. (2009). The U.S. subprime mortgage crisis: Issues raised and lessons learned. In M. Spence, P. C. Annez & R. M. Buckley (Eds.), *Urbanization and growth* (pp. 197–236). Washington, DC: World Bank Publications.

LaCour-Little, M., & Yang, J. (2010). Pay me now or pay me later: Alternative mortgage products and the mortgage crisis. *Real Estate Economics, 38*, 687–732.

Levitin, A. J., & Wachter, S. (2013). Why housing? *Housing Policy Debate, 23*, 5–27.

Linneman, P., & Wachter, S. (1989). The impacts of borrowing constraints on homeownership. *Real Estate Economics, 17*, 389–402.

Mayer, C. J., & Pence, K. (2008). *Subprime mortgages: What, where, and to whom?* (NBER Working Paper No. w14083). Cambridge, MA: National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w14083

Mian, A., & Sufi, A. (2011). House prices, home equity-based borrowing, and the U.S. household leverage crisis. *American Economic Review, 101*, 2132–2156.

Mian, A. R., & Sufi, A. (2015). *Fraudulent income overstatement on mortgage applications during the credit expansion of 2002 to 2005* (NBER Working Paper No. w20947). Cambridge, MA: National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w20947

Munnell, A. H., Tootell, G. M., Browne, L. E., & McEneaney, J. (1996). Mortgage lending in Boston: Interpreting HMDA data. *The American Economic Review, 86*(1), 25–53.

Nichols, J., Pennington-Cross, A., & Yezer, A. (2005). Borrower self-selection, underwriting costs, and subprime mortgage credit supply. *The Journal of Real Estate Finance and Economics, 30*, 197–219.

Pavlov, A., & Wachter, S. (2011). Subprime lending and real estate prices. *Real Estate Economics, 39*(1), 1–17.

Pettit, K. L. S., & Droesch, A. (2009). *A guide to home mortgage disclosure act data*. Washington, DC: The Urban Institute. Retrieved from http://www.urban.org/sites/default/files/alfresco/publication-pdfs/1001247-A-Guide-to-Home-Mortgage-Disclosure-Act-Data.PDF

Sanders, A. (2008). The subprime crisis and its role in the financial crisis. *Journal of Housing Economics, 17*, 254–261.

U.S. Census Bureau. (2014). *Housing vacancies and homeownership: CPS/HVS*. Retrieved from https://www.census.gov/housing/hvs/data/histtabs.html

Appendix A. Pairwise Correlation Coefficients.

	2000–2006	2006–2012	2000–2012
Change in the number of homeowners			
No. NTM 2001–2006	0.75*	−0.59*	0.32*
% NTM 2001–2006	0.43*	−0.28*	0.22*
No. Subprime 2001–2006	0.71*	−0.63*	0.26*
% Subprime 2001–2006	0.30*	−0.33*	0.06***
Change in the homeownership rate			
No. NTM 2001–2006	0.13*	−0.21*	−0.10*
% NTM 2001–2006	0.10*	−0.25*	−0.18*
No. Subprime 2001–2006	0.13*	−0.20*	−0.09***
% Subprime 2001–2006	0.01	−0.21*	−0.22*
Change in the number of young homeowners			
No. NTM 2001–2006	0.005	−0.83*	−0.71*
% NTM 2001–2006	0.09**	−0.45*	−0.33*
No. Subprime 2001–2006	−0.04	−0.83*	−0.74*
% Subprime 2001–2006	0.03	−0.41*	−0.34*
Change in the number of hispanic homeowners			
No. NTM 2001–2006	0.88*	−0.24*	0.74*
% NTM 2001–2006	0.44*	−0.10***	0.38*
No. Subprime 2001–2006	0.90*	−0.20*	0.78*
% Subprime 2001–2006	0.42*	−0.06	0.38*
Change in the number of black homeowners			
No. NTM 2001–2006	0.18*	−0.15*	0.04
% NTM 2001–2006	0.23*	−0.06	0.14*
No. Subprime 2001–2006	0.18*	−0.22*	−0.001
% Subprime 2001–2006	0.21*	−0.15*	0.05
Change in the homeownership rate of young homeowners			
No. NTM 2001–2006	0.09**	−0.15*	−0.09**
% NTM 2001–2006	0.11*	−0.27*	−0.24*
No. Subprime 2001–2006	0.10*	−0.14*	−0.08**
% Subprime 2001–2006	0.06***	−0.18*	−0.17*
Change in the homeownership rate of hispanic homeowners			
No. NTM 2001–2006	0.01	−0.10**	−0.06***
% NTM 2001–2006	−0.004	−0.18*	−0.13*
No. Subprime 2001–2006	0.01	−0.10**	−0.06***
% Subprime 2001–2006	−0.01	−0.13*	−0.08**
Change in the homeownership rate of black homeowners			
No. NTM 2001–2006	0.01	−0.05	−0.02
% NTM 2001–2006	0.03	−0.02	0.03
No. Subprime 2001–2006	0.02	−0.05	−0.02
% Subprime 2001–2006	0.07	−0.07	−0.02

Note. NTM: nontraditional mortgage.
*$p < .01$; **$p < .05$, ***$p < .10$.

Appendix B. Comparison Between Models With and Without Fixed Effects and With Population Weights.

	(1)	(2)	(3)	(4)	(5)	(6)
NTM 2001–2006 (No.)	0.677*	0.656*	0.745*			
	(0.151)	(0.131)	(0.170)			
NTM 2001–2006 (%)				398.9**	242.9	1,267**
				(193.3)	(185.0)	(605.6)
Number of households	−0.0441*	−0.0413*	−0.0600*	0.00183	0.00333	−0.0102***
	(0.0156)	(0.0141)	(0.0130)	(0.00986)	(0.0106)	(0.00554)
Owner occupied 2000 (%)	−49.26	−161.7	−1,380***	−58.63	−166.3	−1,376***
	(122.4)	(108.2)	(776.2)	(123.1)	(104.4)	(753.9)
Mean household Size	−17,945*	−11,751*	−24,853***	−16,365*	−9,318**	−21,865
	(4,623)	(4,281)	(14,175)	(4,760)	(4,186)	(14,718)
College educated (%)	293.3*	350.1*	788.6*	250.1**	341.2*	805.1*
	(94.67)	(61.88)	(221.5)	(97.84)	(65.96)	(239.6)
25–34 (%)	787.4***	970.8**	2,071***	510.8	1,111**	3,137***
	(458.4)	(438.9)	(1,116)	(468.1)	(480.1)	(1,630)
35–44 (%)	95.44	246.6	−1,350	432.3	247.5	−844.7
	(760.3)	(668.3)	(2,973)	(856.3)	(705.2)	(3,289)
45–54 (%)	−792.9	−1,141	542.2	−1,494	−1,080	179.5
	(857.5)	(915.2)	(4,204)	(1,034)	(946.5)	(4,241)
55–64 (%)	492.7	2,273*	6,812*	245.9	2,291*	7,256*
	(699.6)	(511.7)	(1,890)	(687.8)	(554.6)	(2,057)
Family with children (%)	1,027*	927.3*	2,992**	941.0*	1,089*	3,349*
	(239.6)	(228.6)	(1,161)	(239.8)	(225.7)	(1,109)
Foreign born (%)	98.03	−7.126	387.4	64.61	−89.89	−39.56
	(300.7)	(285.9)	(620.6)	(277.9)	(281.0)	(620.8)
Hispanic (%)	63.72	170.5***	89.52	64.96	175.5**	132.5
	(133.2)	(95.18)	(272.3)	(124.8)	(87.48)	(261.6)
Black (%)	−165.0**	−158.4*	−640.3*	−231.7*	−203.4*	−839.9*
	(70.42)	(41.96)	(215.4)	(70.73)	(47.08)	(234.2)
Unemployment (%)	208.2	−333.3	−597.9	−695.7	−795.8**	−2,965**
	(498.3)	(316.9)	(1,289)	(607.9)	(358.3)	(1,244)
Median household income (1000s)	1.096*	1.262*	1.686*	0.863*	0.718*	1.421**
	(0.281)	(0.275)	(0.626)	(0.293)	(0.273)	(0.704)
Median rent	−28.00***	−35.94**	−80.50**	−14.38	−5.356	−69.26
	(15.64)	(14.94)	(36.51)	(14.93)	(14.73)	(46.14)
Median house value (1000s)	−256.3*	−266.0*	−261.1**	−220.8*	−212.3*	−309.3**
	(49.28)	(48.82)	(113.0)	(53.00)	(44.47)	(130.7)
Rent to value	10,058	34,343*	85,548*	−3,023	12,028	61,886***
	(12,759)	(11,303)	(32,799)	(14,117)	(12,326)	(37,128)
Value to income	14,889*	16,636*	15,127	8,384**	8,786*	11,127
	(3,954)	(3,783)	(9,911)	(3,852)	(3,353)	(9,418)
HPI variance (5 years)	−2,625	7,296	−16,478	−11,909	−2,739	1,432
	(14,595)	(11,282)	(28,153)	(14,815)	(10,373)	(30,029)
Projected 1-year HPI change	255.8	−108.3	1,442	237.8	−156.3	702.7
	(245.3)	(239.2)	(1,167)	(243.5)	(242.2)	(1,153)
MSA (ref. = not MSA)	−905.1	12.55	2,438	−1,748	−774.4	−2,510
	(956.9)	(1,013)	(3,486)	(1,081)	(1,057)	(4,387)
Suburban county (ref. = central county)	−575.4	621.4	6.026	−239.0	986.4	570.0
	(782.4)	(928.5)	(1,962)	(855.4)	(940.3)	(2,421)
Constant	−44,037***	−86,238*	−130,437**	−4,869	−65,334*	−131,380***
	(24,382)	(23,030)	(64,718)	(26,458)	(24,478)	(70,114)
State FE	Yes	No	No	Yes	No	No
Population weighted	No	No	Yes	No	No	Yes
Observations	746	746	746	746	746	746
R^2	0.501	0.420	0.497	0.412	0.314	0.399
Likelihood-ratio test (Assumption: no fixed effect nested in fixed effect model)	LR chi2(49) = 117.84 Prob > chi2 = 0.000			LR chi2(49) = 115.71 Prob > chi2 = 0.000		

Note. NTM: nontraditional mortgage; HPI: House Price Index; MSA: Metropolitan Statistical Area; State FE: State Fixed Effects. Robust standard errors are in parentheses. The dependent variable for each regression is the change in the number of homeowners in a county between 2000 and 2012.

*$p < .01$; **$p < .05$; ***$p < .10$.

Appendix C. Combined Nontraditional Mortgages and Subprime Models

Table C1. Change in number of homeowners as dependent variable.

	2000–2006 (1)	2006–2012 (2)	2000–2012 (3)
NTM 2001–2006 (No.)	0.592**	0.228	0.820**
	(0.235)	(0.256)	(0.391)
Subprime 2001–2006 (No.)	0.094	−0.227	−0.095
	(0.147)	(0.148)	(0.260)
Observations	729	729	729
R^2	0.725	0.65	0.507
NTM 2001–2006 (%)	759.5*	176.2	824.4*
	(243.2)	(127.9)	(268.6)
Subprime 2001–2006 (%)	−18.25	−179.6*	−216.8**
	(89.7)	(56.8)	(101.7)
Observations	729	729	729
R^2	0.617	0.64	0.418

Note. NTM: nontraditional mortgage. Robust standard errors are in parentheses. The dependent variable is the change in the number of homeowners in a county between 2000 and 2006 or 2006 and 2012. The regressions are estimated using the same specification as in Table 5 but with the measure of NTM and subprime included in the same model.
*$p < .01$; **$p < .05$; ***$p < .10$.

Table C2. Change in homeownership rate as dependent variable.

	2000–2006 (1)	2006–2012 (2)	2000–2012 (3)
NTM 2001–2006 (No.)	−0.0510	0.0474	−0.0118
	(0.105)	(0.144)	(0.123)
Subprime 2001–2006 (No.)	0.0355	−0.0585	−0.0255
	(0.0446)	(0.0540)	(0.0344)
Observations	729	729	729
R^2	0.410	0.275	0.388
NTM 2001–2006 (%)	−2.16e-05	−5.53e-05	−5.58e-05
	(3.54e-05)	(4.11e-05)	(4.21e-05)
Subprime 2001–2006 (%)	9.15e-06	5.20e-05	3.65e-05
	(2.22e-05)	(4.04e-05)	(4.11e-05)
Observations	729	729	729
R^2	0.273	0.413	0.389

Note. NTM: nontraditional mortgage. Robust standard errors are in parentheses. The dependent variable is the change in the homeownership rate in a county between 2000 and 2006 or 2006 and 2012. The regressions are estimated using the same specification as in Table 5 but with the measure of NTM and subprime included in the same model.
*$p < .01$; **$p < .05$; ***$p < .10$.