Why are aggressive mortgage products bad for the housing market?

Andrew Davidson (Andrew Davidson & Co.)

Alex Levin (Andrew Davidson & Co.)

Andrey D. Pavlov (Simon Fraser University)

Susan M. Wachter (University of Pennsylvania)

In this paper we identify the relationship of the pricing of residential mortgage lending products to their market share during the run up to the financial crisis of 2007. We then use this relationship to decompose the total impact of nontraditional mortgage products on house price declines during the crisis into impact due to their pricing and due to other characteristics. Using alternative measures of mortgage pricing, we document that pricing has a statistically significant but small impact on the difference in market share of nontraditional mortgage products by State. We further document that factors which lead to the increased market share of nontraditional products other than pricing are likely responsible for the impact of those products on the house price declines during the crisis. Our findings imply that going forward underwriting standards and other characteristics of nontraditional mortgage products should be monitored and regulated.

1. Introduction

In this paper we identify the relationship of the pricing of residential mortgage lending products to their market share during the run up to the financial crisis of 2007. We then use this relationship to decompose the total impact of nontraditional mortgage products on house price declines during the crisis into impact due to their pricing and due to other characteristics.

The link between the expansion of nontraditional mortgage lending and real estate market valuations has recently been established in the literature. For instance, Pavlov and Wachter (2011) document that a high share of subprime mortgages, in a region, magnifies the price appreciation, in that area, during the boom years and the decline during the crisis years. In this paper we replicate this latter result using a new data set of nontraditional mortgage products and extend it to the bust period of 2008 – 2009. We document that a high share of nontraditional mortgage products resulted in larger price declines during the crisis. Similarly, Davidson and Levin (2014) compute the share of these products and show that the four States that used these products the most (60% to 70% share in Nevada, Arizona, Florida and California) also led the HPI decline (40% to 50%).

While the relationship between nontraditional mortgage product (NTM) expansion and real estate price appreciation is highly robust, the mechanism behind this remains elusive as does the mechanism behind the subsequent decline in prices. Common conjectures include that nontraditional mortgage products relax a liquidity constraint many potential homeowners face (e.g., He, Wright, and Zhu, 2014). Alternatively, the mechanism could

be that NTM products are mispriced, thus providing an effective subsidy to home buyers (e.g., Pavlov and Wachter, 2009). Levin and Davidson (2014) assess the amount of mispricing via a "Credit OAS" simulation process that operates *ex-ante* (without the knowledge of the HPI decline that followed). They show that, while credit risk in non-prime-quality loans was generally mispriced going into the 2004-2006 housing bubble, this mispricing was relatively modest for FRMs and spectacularly large for ARMs. Some of these results are also given in Davidson, Levin and Wachter (2014). The mispriced risk and/or the relaxed liquidity constraint may have contributed to house price declines in the crisis.

In this paper we examine the mechanisms that relate the expansion of nontraditional mortgage products to the generation of price appreciation and price declines. We find that the expansion of market share of these products was related to pricing; however, there are substantial differences in the elasticity by State, so that pricing alone does not provide a complete explanation of the expansion of market share.

Similarly, we find that the negative impact of nontraditional loan products on the real estate markets during the house price decline was not directly related to mispricing during the boom. Instead, we document that the negative impact was due to other aspects of nontraditional products, such as lax underwriting requirements, aggressive marketing or other State related institutional factors.

Specifically, in a first-stage estimation we establish a relationship between the market share of nontraditional mortgage products and their pricing. While it is intuitive that

3

market share for mortgage product should be determined by the pricing of that product, this relationship has not been tested in the literature.

In a second-stage estimation, we use the mortgage rate driven (explained) market share and residual (unexplained) market share to model the real estate market declines in the crisis period of 2008 – 2009. We document that the residual (unexplained) nontraditional mortgage market share dominates the mortgage rate driven (explained) market share component.

We proceed as follows. Section 2 describes the data sources. Section 3 presents empirical results for the relationship between nontraditional mortgage instruments' market share and house prices using this new data source. Section 4 estimates the price elasticity of nontraditional products in each state and relates it to price declines. Section 5 shows the geography of nontraditional mortgage product use and lists possible reasons for nontraditional mortgage products finding their way in force to some States and not to others. Finally, we conclude with suggestions for future research.

2. Data Sources

Our origination dataset is compiled from Intex Solutions' non-agency MBS data and aggregated by calendar year and quarter. Overall, the dataset covers 23.65 million of securitized loans represented by 273 thousand quarterly origination records. For the analysis of borrower affordability and the related home-price dynamics, loans used for real-estate purchases ("purchase loans") are of a particular importance to us. There are 7.28 million purchase loans represented by 112 thousand origination records.

Each loan record includes information about loan type (ARM or not), origination shelf (Prime, Alt-A, Subprime, etc.), coupon rate, loan size, FICO score, loan-to-value (LTV) ratio (both for the loan alone and the combined – if available). Among the nontraditional mortgage products, we define aggressive lending products as ALT-A ARM, ALT-A Option ARM, and Subprime ARM. (We perform regressions on both the full NTM dataset and the "aggressive products.") Quarterly aggregation is done by geographical State, which makes this dataset suitable for our study.

We further collect total agency origination volumes by State from HMDA. This data allow us to compute the share of nontraditional products out of total originations, agency and non-agency. We focus on this measure as, in our view, it best captures the share of aggressive products in a market. As a robustness test, we also perform our analysis using the share of non-traditional volume originations out of total non-agency volume. Our main findings are highly robust to either definition of nontraditional share.

Figure 1 illustrates non-agency origination volumes for purchase loans. We see that subprime ARMs rose from obscurity to prominence and were responsible for about one half of origination volume. We compare historical loan rates for different ARM products in Figure 2.

The Gross State Product data are compiled by Moody's Analytics from data provided by the BEA. These figures are represented in millions of inflation-adjusted chained (2009) dollars. The housing price data comes from the FHFA. All Transactions Home Price Index by State, seasonally adjusted, with 1980Q1=100. Table 1 provides sample statistics.

3. Market Share and Home Prices

Market Share and Home Prices 2007-2009

We first replicate a well-established relationship between share of aggressive products and home price decline during the crisis.[1] Specifically, we estimate the following cross-sectional model:

$$\Delta HPI_{i,2008-2009} = \beta_0 + \beta_1 \Delta GDP_{i,2008-2009} + \beta_3 \Delta HPI_{i,2002-2007}$$

$$+\beta_3 \left(Cumulative\ Aggressive\ Share_{i,2002-2007} \right) \quad\quad (1)$$

where $\Delta HPI_{i,t1-t2}$ denotes the total house price index percent change for State i during the *t1* to *t2* period, $\Delta GDP_{i,t1-t2}$ denotes the total percent change in State GDP over the

---

[1] See, for instance, Pavlov and Wachter (2011).

same period, and $Cumulative\ Aggressive\ Share_{i,2002-2007}$ denotes the total

cumulative share of aggressive mortgage products as defined above over the $2002 - 2007$

period.

Table 2 reports the results of this estimation. The cumulative share of aggressive

mortgages predicts very strongly the total price decline during the $2008 - 2009$ real estate

bust. Not only highly significant, the estimated coefficient is large in magnitude. Each

percentage point of higher cumulative market share of aggressive mortgage products

before the crisis results in 40 basis points higher expected price decline during the crisis.

Loan Pricing and Mortgage Market Share

In order to decompose the negative impact of aggressive products on housing markets

during the crisis we estimate the following relationship between each product market

share and its pricing. We use four measures of loan pricing – the simple coupon, the total

cost of a loan, and the change in coupon or total cost relative to the change of mortgage

rates on prime loans. In computing the relative change we match fixed- and adjustable-

rate mortgages so that the comparison is to the same product type. Specifically, we

estimate the following models:

$$\Delta Market\ Share_{i,p,2002-2007} = \beta_{0,i,p} + \beta_{1,i,p} \Delta Coupon_{i,p,2002-2007}$$

$$(2)$$

and

$$\Delta Market\ Share_{i,p,2002-2007} = \beta_{0,i,p} + \beta_{1,i,p} \Delta Total\ Cost_{i,p,2002-2007}$$

$$(3)$$

where $\Delta Market\ Share$ denotes the total change in market share for product p in State i over the 2002-2007 period, $\Delta Coupon$ denotes the absolute or relative change in coupon for the same product and State over the same period, and $\Delta Total\ Cost$ denotes the absolute or relative change in total cost of the mortgage. The total cost includes the coupon and adds the opportunity cost of the down payment and a model-derived measure of the potentially underpriced credit risk.[2] Thus, if a particular product is offered at a lower down payment requirement, this product would have a declining total cost even if its coupon rate remains the same. In our base case we use 20% as the cost of the down payment to reflect its risk;[3] Tables 3, 4, 5, and 6 report the estimation results for models 2 and 3, using absolute and relative rate changes, respectively. Tables 3, 4, 5, and 6 include each aggressive product on its own. Tables 3 and 5 also include the results for all products combined. Tables 4 and 6 use changes relative to prime products, and thus do not include a column with all products. The number of observations for each regression represent the number of States plus the District of Columbia with available data times the products considered in each specification.

As evident from Tables 3 - 6, the change in coupon significantly impacts the market share of nontraditional mortgage products when all products are considered and for some of the products on their own. This suggests that in some cases nontraditional products gained market share precisely because of their pricing, and those products were to some extent substitutes to each other. However, an examination of all results suggests that the cases of

---

[2] The total-cost measure is reduced by the annualized credit loss rate predicted *ex-ante* using a Credit-OAS mortgage analysis system (using the information only available at the time of forecasting). See Levin and Davidson (2014) for details.

[3] Results are robust to a range of cost of capital assumptions.

significant impact of pricing are limited, and there are more cases in which pricing did not have a significant effect on the market share of a product.

While nontraditional mortgage product pricing is closely related to the overall market share of nontraditional mortgage products, it has less power as an explanatory variable across States. There are significant differences in the elasticity by State, so that pricing alone does not provide a complete explanation of the expansion of market share. That is, other State specific factors, rather than State level mortgage interest rates are responsible for the differences in the market share of nontraditional mortgage products by State. We address the variation in State-level elasticity in Section 4 below.

Explained and Unexpected Market Share and Home Prices

In what follows we extend Model (1) by decomposing the market share of alternative products into predicted (explained) by mortgage rate component and unexpected (residual) component. We do so by using the predicted and residual values from models (2) and (3). Specifically, we use the following specification:

$$\Delta HPI_{i,2008-2009} = \beta_0 + \beta_1 \Delta GDP_{i,2008-2009} + \beta_3 \Delta HPI_{i,2002-2007}$$
$$+\beta_3 \big(Predicted\ Aggressive\ Share_{i,2002-2007}\big) \qquad (4)$$
$$+\beta_4 \big(Residual\ Aggressive\ Share_{i,2002-2007}\big)$$

The predicted (explained) component captures the effect of aggressive product market share due to change in mortgage interest rates or total cost of those products. As the R-squared of the models was low, we do not expect this component to explain a significant portion of the differentials in market share. The residual (unexplained) component

captures the impact of other characteristics outside the loan costs. Such characteristics are related to underwriting requirements, sales force motivation, State specific institutional effects, etc.

Tables 7, 8, 9, and 10 report the estimation results from Model 4 using absolute and relative coupon and total mortgage cost. Of all specifications and products tested, only Alt-A mortgages show significant relationship between predicted (explained) market share and house price declines during the crisis for all measures of mortgage cost. ARMs in general also show a significant relationship when the relative change in total cost is considered. In contrast, all unexplained (residual) market share variables are highly significant. This result indicates that even if an aggressive product gained market share because it became cheaper, the home price declines were marginally related to this component of market share. However, if an aggressive product gained market share because of other characteristics, such as looser underwriting requirements, or other State specific factors, this increase in market share was highly detrimental to the real estate market. These estimates are not only significant, but also very large. For instance, for each 1% unexplained increase in aggressive product market share the subsequent price decline during the crisis was 1.2% higher.

Robustness Analysis

The results reported above are highly robust to a number of alternative model specifications. Also, the results reported in Tables 7, 8, 9, and 10 are generally unchanged with the exclusion of any one of the product type/ARM combinations reported in those tables. Results are also robust to starting the sample period in 2001 ending the sample in

10

2010 or 2011, and changing the start point of the crisis to the beginning of 2007 through the middle of 2008. Finally, all our t-statistics are based on standard errors robust to heteroscedasticity.

4. State-level Elasticity

The results reported in Section 3 above demonstrate that on average across States' pricing was as significant a factor as one might expect in determining market share of nontraditional products. However, there are certainly some States in which pricing did play a significant role. In what follows, we measure price elasticity of nontraditional product share and relate our elasticity estimates to the home price behavior in those States.

Specifically, we first establish a simplified linear relationship between pricing of each mortgage product and its market share in a State:

$$\Delta Market\ Share_{i,p,t} = \beta_{0,i,p} + \beta_{1,i,p} \Delta Relative\ Coupon_{i,p,t}$$

(5)

where $\Delta Market\ Share_{i,p,t}$ denotes the change in market share of product p in State i at time t, and $\Delta Relative\ Coupon_{i,p,t}$ denotes the contemporaneous change in the relative coupon of the same product in the same State. The relative coupon is computed as the difference between the product coupon and the coupon on a prime loan with the same ARM/FRM characteristic. We estimate one time-series model per State per product.

All estimated slope coefficients, β_1, are negative, and many are statistically significant. However, as one might expect, the relationship specified in Model (5) holds very strongly in some States and less so in others.

Home prices 2008-2011 and slope estimates

In the second stage regression we take an average of the slope estimates for the above-defined aggressive mortgage products for each State. This produces an average slope for each State. We then use this average to predict the decline in home prices during the crisis. Specifically, we estimate the following model:

$$\overline{\beta_{1,\,i}} = \frac{1}{3} \sum_p \beta_{1,i,p}$$

$$\Delta HPI_{i,2008-2011} = \gamma_0 + \gamma_1 \Delta GDP_{i,2008-2011} + \gamma_2 \overline{\beta_{1,\,i}}$$

(6)

where $\overline{\beta_{1,\,i}}$ denotes the average of the slopes (mean3slopes) for all aggressive mortgage types within state i. $\Delta HPI_{i,2008-2011}$ and $\Delta GDP_{i,2008-2011}$ are the cumulative home price appreciation and GDP growth as defined above.

Table 11 provides the States and the average slope as estimated in Model 5, sorted by the average slope. Negative slope in the table implies a strong relationship between coupons and mortgage product market share. Average slope close to zero indicates a weak relationship.

Table 12 reports the estimated relationship specified in Model 6. The mean slope has a positive and significant coefficient estimate. This suggests that States where residents

were responsive to pricing of mortgages and took advantage of inexpensive mortgage products before the crisis were also the States that experienced large price declines during the crisis.

5. Discussion and Geographical Analysis

The above results show that the expansion of nontraditional mortgages across States was related to subsequent State-level house price declines. This result is consistent with Wheaton and Nechayev (2008) which concludes that house price changes were not explained by customary fundamental factors. We also show that borrowers were more likely to take up use of the lower priced nontraditional products although the elasticity of borrower response varied greatly across States. However, it was not the low pricing of nontraditional loans that was related to house price declines in the crisis period but rather other factors like underwriting requirements associated with these loans. Characteristics of nontraditional mortgage loans, other than mortgage rate, associated with growth in market share, explain subsequent price declines. This is consistent with Brueckner et al. (2014) which shows that characteristics associated with nontraditional mortgages, particularly the extent of mortgage "backloading," the postponement of loan repayment through various mechanisms, drove subsequent mortgage defaults and price declines across regions.[4]

---

[4] While the results point to nontraditional mortgage product other than price characteristics' significant impact on price declines in the crisis period, mispricing of risk enabled their growth (Levitin and Wachter, 2012; Davidson and Levin, 2014).

Our results show the importance of high use of nontraditional mortgage products to subsequent declines in house prices across states. The results point to the importance of differences in borrower take-up of nontraditional products to future price declines.

Maps for the US confirm these results, as illustrated in Figure 3 showing respectively, response size, house price declines, and nontraditional mortgage product shares (for 2007). The geographic patterns are consistent: the States with higher price declines in the aftermath of the crisis tend to be those States with higher demand response to nontraditional mortgage product pricing and with higher use of nontraditional mortgage products overall.

There are several possible explanations for the differences in higher borrower response to lower priced products in some States that could be the basis for further research.

   a. *Housing supply elasticity and demand dynamics*. The States with the lower responsiveness to lower priced mortgages are generally States with greater elasticity of supply (see the bottom records of Table 11) and lower population growth and lower constraint prior to the introduction of nontraditional mortgages. Without a run up in home prices, these borrowers had less reason to move outside of traditional products to meet their home financing needs. States such as Nevada and Arizona which would normally appear to have elastic supply faced demand that exceeded supply during this time period.[5]

---

[5] More generally, ARM borrowers are self-selectors with short horizons. States in the US where work employment was more volatile may favor ARMs over fixed rate loans.

b. *Regulatory and lending laws*. Some States, such as Texas, place restrictions on the types of mortgages that can be originated. Cato (2015) cites "several restrictions on mortgage lending that are intended to provide stability to the Texas real estate market in difficult times." Those include the 80% LTV maximum (including on refinancing), limitations of balloon (or payment shock) and negative amortization features. Recent adoption of the Qualified Mortgage regulations moves the US regulatory scheme into this landscape. Kumar and Skelton (2013) observe a relative stability of home prices in Texas during the latest national bubble/bust, but remind that a real-estate bust did take place in Texas in 1980s following the oil-price bust. This may prove the point: while the catalyst of home-price dynamics could be found in economic factors, it was the origination of nontraditional mortgage loans that propelled home prices up the last time around, followed by the decline – once those products stopped being offered.[6]

c. *Bank presence and lending practice*. WAMU, Countrywide, Ameriquest and some other lenders favored Option ARMs and other aggressive products. However, these firms may not have had a national presence during this period. The lack of these products from a lending point of view may have had a geographic impact on where supply was readily available and "pushed" to borrowers. Moreover, borrowers in same States may be more risk averse due to cultural differences or standard financial practices. For example, the high cost of real estate in California has long been the driver of innovations in mortgage products including the variable-rate mortgage, the cost of funds (COFI) mortgage and the option-ARM.

---

[6] See Bostic et al (2008; 2012) for discussion of how state law affects product choice.

Borrowers in other States may have been less aware of these products and thus less likely to consider them in their decision set despite their pricing advantages.

6. Conclusion

In this paper we investigate to what extent the real estate price declines during the bust of 2008 and 2009 were due to lower rates on nontraditional mortgage products originated during the boom and to what extent the price declines were due to other aspects of nontraditional mortgages. While aggressive pricing played a role in expanding the market share of nontraditional products, their main impact on subsequent price declines was based on their other aspects. Such aspects include lax underwriting requirements or aggressive marketing or other State specific institutional factors. In this paper we focus on the mechanism that links nontraditional mortgage product share to price declines.

Origination of lower-cost risky loans, particular subprime ARMs, led to the home-price bubble followed by its collapse– once those products stopped being offered. We demonstrate a strong statistical significance in the relationship between home-price changes and geographical nontraditional products' proliferation. We also show that those products gained their market share while responding to their low coupon rates and underpriced credit risk. While some States took the bait of cheap, high-LTV loans, others stayed almost immune. The demand response to lower priced nontraditional mortgage product is far greater where those loan products were more salient. We discuss some explanations related to elasticity of demand and supply resulting in higher priced housing (and greater constraint prior to the introduction of nontraditional mortgages),

16

cultural risk aversion, lending laws and lending practice. However, full geographical

analysis of these phenomena may be a subject of future research.

References

Acolin, A., An, X., Bostic, R. & Wachter, S. (2015). *Credit Market Innovations and Sustainable Homeownership: The Case of Non-Traditional Mortgage Products.* Working Paper.

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.

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

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*(3), 273-294.

Bostic, R. W., Engel, K. C., McCoy, P. A., Pennington-Cross, A., & Wachter, S. M. (2008). State and local anti-predatory lending laws: The effect of legal enforcement mechanisms. *Journal of Economics and Business*, *60*(1), 47-66.

Brueckner, J. K., Calem, P. S., & Nakamura, L. I. (2012). Subprime mortgages and the housing bubble. *Journal of Urban Economics*, 71(2), 230-243.

Cato, J. (2015). Texas Mortgage Lending Laws. *EHow*.
(http://www.ehow.com/list_6827711_texas-mortgage-lending-laws.html)

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*, (514).

He C., R. Wright, and Y. Zhu. 2014. Housing and Liquidity. Working Paper.

Kumar, A. and E.C. Skelton. 2013. Did Home Equity Restrictions Help Keep Texas Mortgages from Going Underwater? Southwest Economy, Federal Reserve Bank of Dallas, Third Quarter 2013.

Davidson, A. and A. Levin. 2014. Mortgage Valuation Models: Embedded Options, Risk and Uncertainty, Oxford University Press.

Davidson, A., A. Levin and S. Wachter. 2014. Mortgage Default Option Mispricing and Borrower Procyclicality, in E. Belsky, C. Herbert and J. Molinsky (eds.) Homeownership Built to Last, The Brookings Institutions.

Levin, A. 2010. HPI Modeling: Forecast, Geography, Risk and Value, June 2010 Conference, AD&Co,

Mian, A., & Sufi, A. (2011). House Prices, Home Equity–Based Borrowing, and the US Household Leverage Crisis. *The American Economic Review*, *101*(5), 2132-2156.

Pavlov, A. and S. Wachter. 2011. Subprime Lending and Real Estate Prices. *Real Estate Economics.* 39(1): 1 - 17.

Pavlov, A. and S. Wachter. 2009. Mortgage Put Options and Real Estate Markets. Journal of Real Estate Finance and Economics. 38(1): 86-103.

Wheaton, W., and G. Nechayev. (2008). The 1998-2005 Housing "Bubble" and the Current "Correction": What's Different This Time? *Journal of Real Estate Research*, 30(1), 1-26.

Figure 1. Non-Agency Origination Volumes (Purchase Loans)
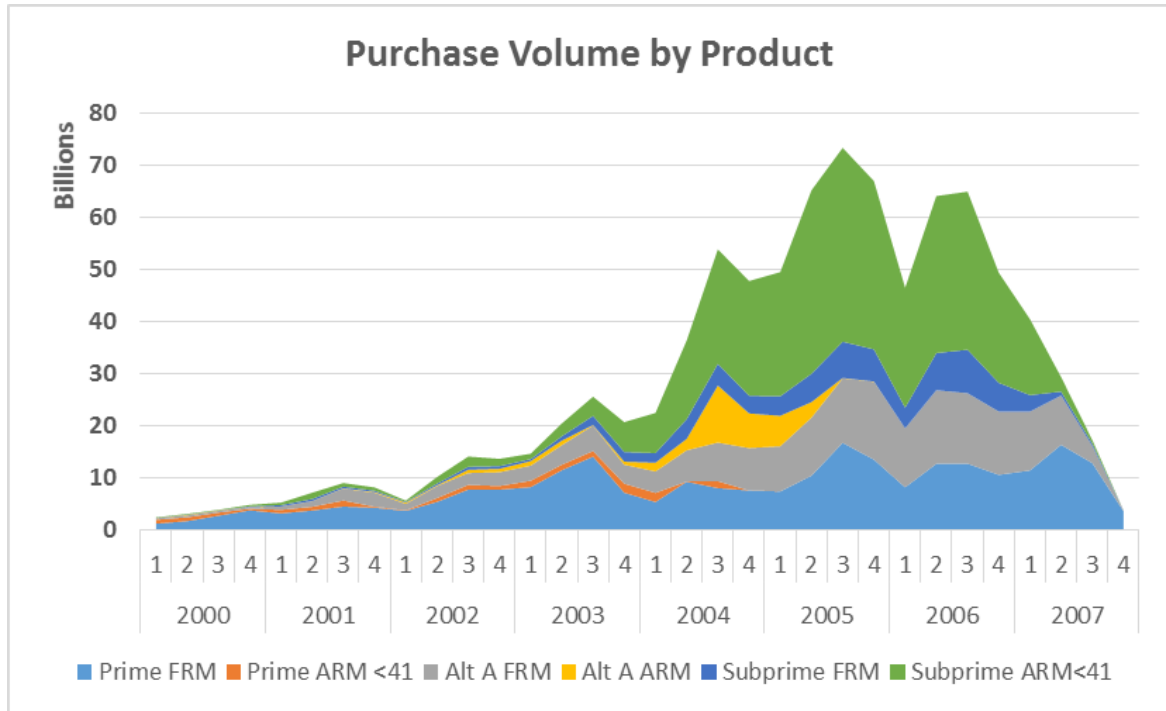
Figure 2. Historical Coupon Rates
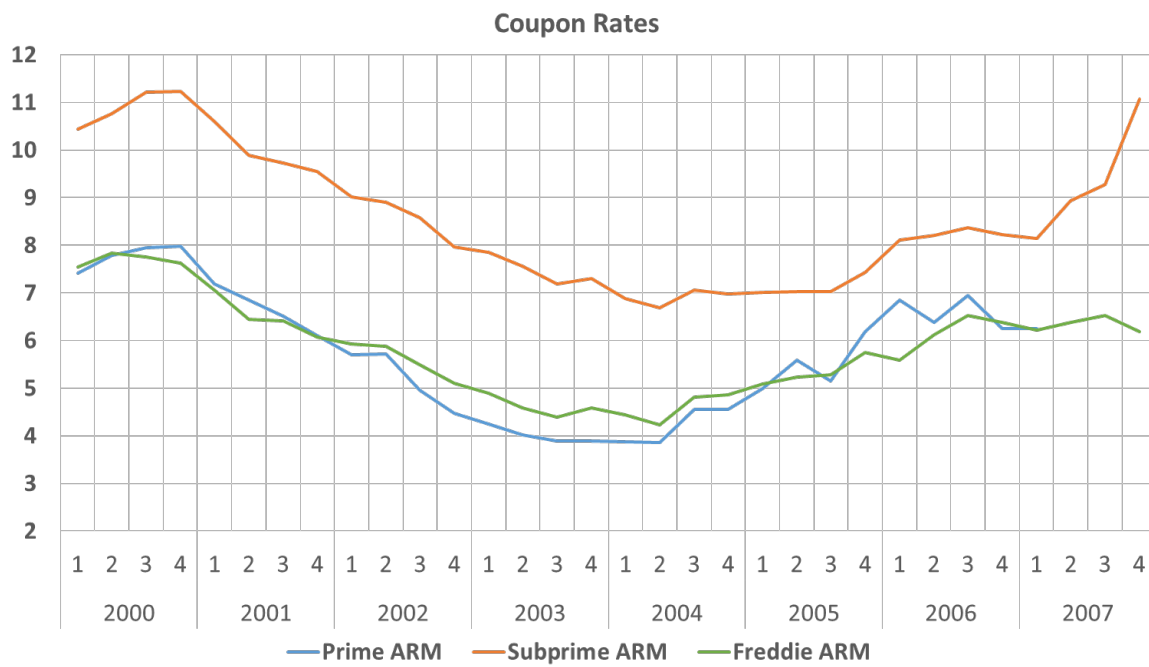
Figure 3. Response size, price declines, and nontraditional aggressive mortgage share

HPI Decline
- -58.4% - -30%
- -29.9% - -10%
- -9.9% - -5%
- -4.9% - 0%
- 0.1% - 9.7%

Aggressive NTM
% PLS (2007)
- 20.3% - 25%
- 25.1% - 30%
- 30.1% - 35%
- 35.1% - 40%
- 40.1% - 52.1%
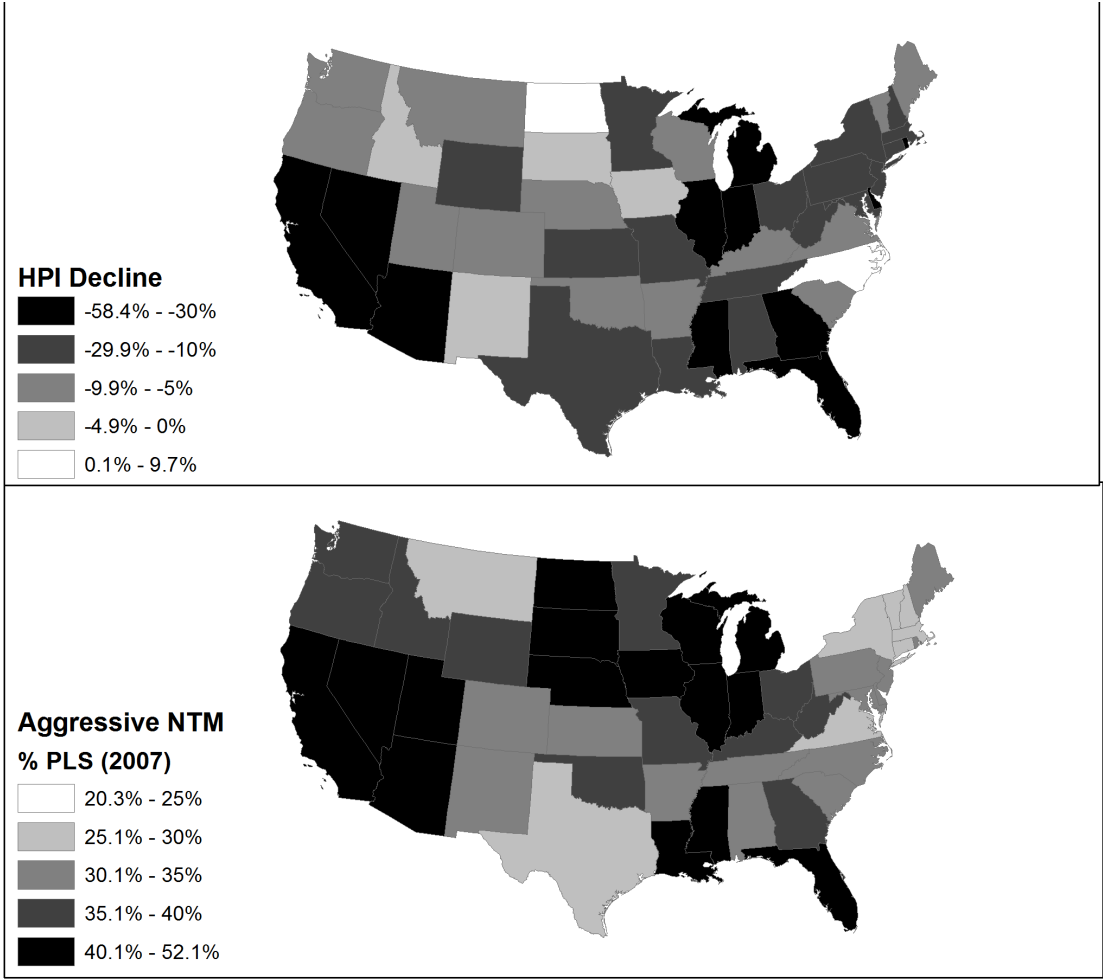
VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Change in coupon 2002 - 2006	231.000	-0.245	0.981	-3.919	2.466
Origination Share by Product, 2002-2007	260.000	2.676	2.120	0.000	10.198
Change in house price index, 2002-2007	261.000	0.470	0.233	0.045	1.041
Change in GDP, 2002-2007	261.000	0.168	0.081	-0.011	0.353
Change in house price index, 2007_2009	261.000	-0.091	0.086	-0.379	0.040
Change in GDP, 2007-2009	261.000	-0.024	0.043	-0.147	0.088

Table 1

The table shows the summary statistics for the GDP, HPI, and loan originaltion data.

VARIABLES	(1) Subprime & Alt-A	(2) Subprime	(3) Alt-A	(4) ARM
Change in house price index, 2002-2007	-0.206***	-0.216***	-0.174***	-0.186***
	(-17.05)	(-11.56)	(-9.99)	(-9.92)
Change in GDP, 2007-2009	1.176***	1.217***	1.071***	1.041***
	(17.99)	(11.87)	(12.30)	(10.06)
Origination Share by Product, 2002-2007	-0.004***	-0.002	-0.010***	-0.008***
	(-2.66)	(-0.93)	(-3.93)	(-4.18)
Constant	0.043***	0.044***	0.041***	0.058***
	(6.58)	(3.85)	(5.11)	(5.43)
Observations	260	107	153	102
R-squared	0.745	0.749	0.757	0.772

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2

Dependent variable is Change in HPI, 2007-2009. The table reports the results of regressing house price decline during the crisis on the contemporeneous GDP change, change in house prices before the crisis, and origination share of alternative products before the crisis. The origination share of all alternative originations as well as Alt-A and all ARM products are highly significnat even when controlled for previous home price changes and concurrent GDP changes.

	(1)	(2)	(3)	(4)	(5)	(6)
		ALT_A	ALT_A	ALT_A	Subprime	Subprime
VARIABLES	All products	FRM	ARM	Option	FRM	ARM
Change in coupon, 2002-2006	-0.223**	-1.212**	-0.073	0.100	-0.193	-2.232***
	(-2.25)	(-2.14)	(-0.18)	(0.42)	(-1.59)	(-3.18)
Constant	2.495***	2.408***	2.856***	1.683***	1.303***	5.079***
	(23.87)	(10.89)	(8.32)	(2.93)	(17.28)	(18.73)
Observations	360	51	50	28	51	51
R-squared	0.014	0.085	0.001	0.007	0.049	0.171

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3

Dependent variable is Change in Market Share, 2002-2007. The table shows the results from regressing each product market share on the change in coupon for that product over the 2002 - 2007 period. We use the predicted share and residual from these regressions to test if the negative impact of alternative products on price declines during the crisis were due to the pricing of the mortgages or to their other characteristics.

VARIABLES	(1) ALT_A FRM	(2) ALT_A ARM	(3) ALT_A Option	(4) Subprime FRM	(5) Subprime ARM
Coupon change relative to prime, 2002 - 2006	-0.490	0.377	0.051	-0.179	-0.078
	(-1.34)	(0.96)	(0.31)	(-1.67)	(-0.17)
Constant	2.893***	2.953***	1.783***	1.387***	5.588***
	(23.39)	(9.32)	(2.98)	(13.26)	(10.33)
Observations	51	50	24	51	51
R-squared	0.035	0.019	0.004	0.054	0.001

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4

Dependent variable is Change in Market Share, 2002-2007. The table shows the results from regressing each product market share on the change in coupon for that product relative to the change in prime rate over the 2002 - 2007 period. We use the predicted share and residual from these regressions to test if the negative impact of alternative products on price declines during the crisis were due to the pricing of the mortgages or to their other characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)
		ALT_A	ALT_A	ALT_A	Subprime	Subprime
VARIABLES	All products	FRM	ARM	Option	FRM	ARM
Change in total cost, 2002-2006	-0.024	0.014	-0.156	-0.292	-0.256**	0.253
	(-0.29)	(0.16)	(-0.51)	(-1.08)	(-2.56)	(0.99)
Constant	2.758***	2.884***	2.865***	1.469*	1.357***	5.800***
	(21.39)	(18.30)	(4.56)	(1.91)	(18.37)	(25.21)
Observations	305	48	38	14	47	50
R-squared	0.000	0.001	0.007	0.088	0.127	0.020

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5

Dependent variable is Change in Market Share, 2002-2007. This table is analogous to Table 3, except it uses the change in total cost of the mortgage products to explain the market share of each product. The total cost includes the coupon payments plus the cost of downpayment.

VARIABLES	(1) ALT_A FRM	(2) ALT_A ARM	(3) ALT_A Option	(4) Subprime FRM	(5) Subprime ARM
Total cost change relative to prime, 2002-2006	-0.030	-0.030	-0.225	-0.105**	0.207
	(-0.37)	(-0.37)	(-0.70)	(-2.14)	(1.12)
Constant	2.907***	2.907***	2.045**	1.440***	5.927***
	(25.97)	(25.97)	(3.19)	(14.26)	(23.31)
Observations	46	46	9	44	46
R-squared	0.003	0.003	0.065	0.098	0.028

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6

Dependent variable is Change in Market Share, 2002-2007. This table is analogous to Table 3, except it uses the change in total cost of the mortgage products relative to the change in prime rate to explain the market share of each product. The total cost includes the coupon payments plus the cost of downpayment.

6

| | (1) | (2) | (3) | (4) |
VARIABLES	Subprime & Alt-A	Subprime	Alt-A	ARM
Change in house price index, 2002-2007	-0.189***	-0.213***	-0.168***	-0.169***
	(-15.74)	(-12.12)	(-9.65)	(-9.56)
Change in GDP, 2007-2009	1.109***	1.124***	1.048***	0.909***
	(17.00)	(10.99)	(12.14)	(9.08)
Explained Origination Share (Mortgage Coupon)	-0.000	0.001	-0.005*	-0.001
	(-0.29)	(0.63)	(-1.66)	(-0.57)
Unexplained (Residual) Origination Share	-0.012***	-0.015***	-0.014***	-0.017***
	(-5.14)	(-3.49)	(-4.39)	(-6.27)
Constant	0.026***	0.031***	0.026**	0.017
	(3.42)	(2.77)	(2.29)	(1.26)
Observations	261	108	153	102
R-squared	0.762	0.772	0.765	0.809

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7
Dependent variable is change in HPI, 2007-2009. The table shows reports the results from regressing house price appreciation during the crisis (2007-2009) on explained and unexplained market share of alternative products. The explained and unexplained vlues are given by the regression results reported in Table 3 and based on change in mortgage coupon.

VARIABLES	(1) Subprime & Alt-A	(2) Subprime	(3) Alt-A	(4) ARM
Change in house price index, 2002-2007	-0.190***	-0.212***	-0.170***	-0.161***
	(-15.50)	(-11.91)	(-9.62)	(-8.97)
Change in GDP, 2007-2009	1.100***	1.099***	1.050***	0.899***
	(16.72)	(10.71)	(12.09)	(9.03)
Explained Origination Share (Relative Coupon Change)	-0.001	0.001	-0.006**	-0.001
	(-0.44)	(0.62)	(-1.98)	(-0.23)
Unexplained (Residual) Origination Share	-0.012***	-0.015***	-0.013***	-0.017***
	(-5.03)	(-3.66)	(-4.07)	(-6.46)
Constant	0.026***	0.030**	0.028**	0.010
	(3.44)	(2.62)	(2.52)	(0.67)
Observations	260	107	153	102
R-squared	0.762	0.777	0.763	0.812

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8

Dependent variable is change in HPI, 2007-2009. This table is analogous to Table 7, except it uses the explained and unexplained origination shares based on relative change in coupon as reported in Table 4.

VARIABLES	(1) Subprime & Alt-A	(2) Subprime	(3) Alt-A	(4) ARM
Change in house price index, 2002-2007	-0.191***	-0.207***	-0.176***	-0.168***
	(-15.93)	(-11.82)	(-10.41)	(-9.42)
Change in GDP, 2007-2009	1.138***	1.157***	1.059***	0.968***
	(17.80)	(11.77)	(12.39)	(9.92)
Explained Origination Share (Total Mortgage Cost)	-0.001	0.001	-0.007***	-0.002
	(-0.96)	(0.71)	(-2.82)	(-1.23)
Unexplained (Residual) Origination Share	-0.012***	-0.015***	-0.013***	-0.016***
	(-5.01)	(-3.70)	(-3.97)	(-6.10)
Constant	0.029***	0.029**	0.031***	0.022*
	(4.10)	(2.57)	(3.27)	(1.83)
Observations	261	108	153	102
R-squared	0.761	0.776	0.766	0.807

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9

Dependent variable is change in HPI, 2007-2009. This table is analogous to Table 5, except it uses the explained and unexplained origination shares based on total mortgage cost as reported in Table 5.

VARIABLES	(1) Subprime & Alt-A	(2) Subprime	(3) Alt-A	(4) ARM
Change in house price index, 2002-2007	-0.194***	-0.214***	-0.179***	-0.168***
	(-16.37)	(-12.14)	(-10.74)	(-9.67)
Change in GDP, 2007-2009	1.134***	1.149***	1.101***	0.959***
	(17.83)	(11.63)	(13.14)	(9.98)
Explained Origination Share (Relative Total Cost Change)	-0.001	0.000	-0.004*	-0.003*
	(-0.92)	(0.17)	(-1.73)	(-1.84)
Unexplained (Residual) Origination Share	-0.013***	-0.016***	-0.013***	-0.018***
	(-5.27)	(-3.87)	(-3.95)	(-6.61)
Constant	0.031***	0.035***	0.028***	0.026**
	(4.58)	(3.36)	(3.10)	(2.57)
Observations	260	107	153	102
R-squared	0.764	0.780	0.761	0.816

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10

Dependent variable is change in HPI, 2007-2009. This table is analogous to Table 5, except it uses the explained and unexplained origination shares based on relative total mortgage cost as reported in Table 6.

Table 11: Loan Pricing and Home Price Declines

state	mean 3 slopes	HPI decline	MT	-0.00866	-0.0891608
DC	-0.02122	-0.0799737	OR	-0.008476667	-0.2516445
MI	-0.019478333	-0.2230542	ME	-0.008348333	-0.1113608
RI	-0.019226667	-0.2312877	HI	-0.008174333	-0.1766379
IN	-0.017280333	-0.0551746	WA	-0.007762	-0.2412332
IL	-0.016853333	-0.1934326	VT	-0.007676667	-0.0377642
NV	-0.0165	-0.5836905	VA	-0.007516667	-0.1537219
AZ	-0.01632	-0.4614424	CO	-0.007506667	-0.0833194
GA	-0.015783333	-0.2176117	NM	-0.007302667	-0.1419515
MS	-0.015572	-0.0734417	ID	-0.007178	-0.2554238
FL	-0.014476667	-0.4406379	IA	-0.00664	-0.0066185
CA	-0.014334333	-0.3741799	AK	-0.006058667	-0.0011981
DE	-0.014053333	-0.1833889	SD	-0.005372333	0.0115057
OH	-0.013503333	-0.101198	NC	-0.004321	-0.1059489
KS	-0.013413333	-0.0293858	ND	-0.003698	0.0970191
PA	-0.012903333	-0.0803667			
MN	-0.012593333	-0.1844214			
NJ	-0.012363	-0.1874954			
LA	-0.012294	-0.0264152			
TX	-0.012103333	-0.0157337			
NY	-0.012096667	-0.1168018			
WV	-0.011964667	-0.0532004			
TN	-0.011770667	-0.0783497			
MA	-0.011604	-0.1175599			
MD	-0.011186667	-0.2321544			
AL	-0.011034667	-0.080884			
NH	-0.01078	-0.1660205			
CT	-0.010761	-0.1591209			
MO	-0.010585333	-0.0964918			
WY	-0.010011333	-0.0569758			
WI	-0.009900333	-0.1019474			
KY	-0.009796667	-0.0311075			
OK	-0.009549667	-0.0053011			
NE	-0.009419	-0.0104887			
SC	-0.009353333	-0.1085932			
AR	-0.009292333	-0.0571014			
UT	-0.008673333	-0.2124348			

Table 12: Loan Pricing and Home Price Declines

Variables	
GDP Decline	.765***
	(.284)
Mean 3 Slopes	9.417**
	(4.227)
Constant	-.046
	(.052)
R-Squared	0.281
Observations	51

Robust standard errors in parenthesis
*** p>0.01, ** p<0.05, * p<0.1