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Contagious Real Estate Cycle: Case of the US Subprime Related Crisis

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The recent U.S. financial crisis has been found to be unique compared with previous crises: it started when problems first appeared in the housing market and subprime lending, and then spread to the whole financial system and national economy. Through the securitization of structured private label mortgage products, its impact even reached the international capital markets. To explore the cause of the long and far-reaching effect of the current subprime-induced crisis, we review a series of events and government policies prior, during, and after the subprime and housing crisis. Using qualitative and quantitative models, we show that the low interest rate and passive market supervisory policies made by the U.S. government are among the main drivers of the housing boom. During the housing bust, despite a more aggressive regulatory environment, several conflicting policies that were implemented may have prolonged and deepened the recession. Based on these hypotheses, we argue that contagious real estate cycles can be prevented and/or controlled by more proactive counter-cyclical government intervention.

Keywords

Real Estate Cycle, Housing Bubble, Housing Finance Policy, Market Supervision

1. Introduction

Six years after the onset of the global financial crisis (GFC), we are still in the process of learning what went wrong in the run-up to the crisis, what can be done to recover and how we can prevent it from happening again. The consensus appears to be that the recent financial crisis is unique compared with previous crises. In the U.S., it started with problems that first appeared in the housing market and subprime lending, and then spread to the whole financial system and national economy. The mass scale of securitization expanded its impact even further to the global markets.

Various studies have been done to examine the factors that have led to housing cycles and the current subprime related crisis. Among these studies, several elements are considered as the main contributors to this crisis: a loose monetary policy, the Community Reinvestment Act (CRA), irrational expectations, credit expansion and securitization.

The effect of low interest rates was an increase in housing demand and thus house prices, which eventually created the housing bubble that put the world economy at risk. Bernanke (2010) discusses the role of the monetary policy in the current financial crisis, and contends that there is weak evidence that the loose monetary policy played a central role in the crisis. Instead, he contends that a better regulatory environment would have been a more “effective and surgical approach to constraining the housing bubble”. Similarly, by using a modified user cost model of house prices, Glaeser, Gottlieb and Gyourko (2012) (GGG) argue that the interest rate elasticity of house price is very limited and, by it alone, cannot fully explain for the increase of house prices during the boom period of the last decade. Their empirical results from utilizing a simple ordinary least square (OLS) estimation are also consistent with the prediction from their theoretical model. Their results also indicate that the impact of relaxed underwriting standards (such as high loan approval rates and high loan-to-value (LTV) ratios) is not adequate to create significant house price increases either.

However, the user-cost model only compares the cost of purchasing a house with renting. It may not be able to capture the impact of a low-interest-rate environment on encouraging refinancing. As we will demonstrate in the following sections, the increase of refinance loans had a much larger impact on house prices than home purchases between the years 2000–2008. Moreover, as much as GGG (2012) tried to make demand and other factors endogenous, their model is not a general equilibrium model. Rather, the interaction of different market components combined with expectations of the future housing market improvement could create a compounding effect and result in a larger impact on house prices than simply the additive effects of a number of factors.

The next suspect factor that contributed to the housing bubble is the CRA. Written into law in 1977, the CRA aimed to encourage banks and saving institutions to meet the needs of borrowers in all segments of their community and reduce discrimination in lending activity toward low-income and minority groups. The CRA not only allows qualified loans that directly originate from financial institutions but also the mortgages that underlie purchased mortgage backed securities (MBSs) to count as meeting the CRA goals. Both commercial banks and government sponsored enterprises (GSEs), i.e., Fannie Mae and Freddie Mac, are subject to CRA compliance. As a result, the CRA has been accused as one of the main contributors to the expansion of non-traditional mortgage products which target riskier borrowers and the increasing involvement of the GSEs in the non-prime mortgage sector by investing in private label MBSs (PLMBSs).

Various studies have addressed the role of the CRA, but came to opposite conclusions with regard to whether the CRA/affordable housing goals were responsible for the subprime security boom. For example, Agarwal et al. (2012) use data from the Home Mortgage Disclosure Act (HMDA) to show that lending activity increases around the period of CRA exams, and loans that originate during such time have a 15 percent higher probability of default. It is difficult, however, to rule out the alternative explanation that the banks increased risky lending simply to chase profits. The opposite conclusion is drawn by Hernandez-Murillo et al. (2012). Using loan-level data on non-prime securitized mortgages in California and Florida, they find no evidence that lenders increased subprime loan originations in order to meet the CRA mandates, or alter the pricing of loans around the cutoffs for the affordable housing goals of the GSEs or CRA. Ambrose and Thibodeau (2004) show that affordable housing goals increase the supply of credit to low- and moderate-income borrowers, but the increase primarily occurred before 1998.

When a policy or regulation targets to make homes more affordable by increasing the accessibility of credit to low/moderate-income borrowers, it is natural that the supply of credit to this population will increase. As low/moderate-income borrowers tend to be riskier than higher-income borrowers, it is reasonable to observe that these loans perform worse than loans taken by higher-income borrowers. The more relevant question is whether the trade-off is worthwhile, that is, whether we can improve the welfare of the overall population by these policies/regulations. This question is too complicated to be measured by any simple regression. Moreover, the increase of credit or the default rate does not necessarily lead to a subprime crisis. In considering that the CRA has existed for about 30 years, and there was no significant change in the CRA requirements during the 2000s, it is not easy to prove that the CRA had a major role in the recent crisis.

Irrational expectations about future house prices are another possible factor that causes house prices to deviate from the fundamental. Clayton (1997) uses data on Vancouver condominium prices to test the joint null hypothesis of rational

expectations on a risk-neutral and frictionless asset market assumption, and finds significant evidence against this null hypothesis. His empirical results indicate that housing demand responds not only to future fundamentals, but also to investor sentiment or noise where the future price projection is based on the past and buyers purchase homes when the price is rising. Case and Shiller (2004) (CS2004) examine whether excessive expectations of future house price appreciation (HPA) may cause temporary price elevation. Both the investment and consumption incentives of housing will have a strong impact on housing demand and push prices higher and higher. However, such an increase is very unstable and prices will fall once they can no longer support the high expected appreciation. CS2004 conclude that elements of speculative bubbles existed in some cities in 2003 even though the house price increase can mostly be explained by income growth.

Black, Fraser and Hoesli (2006) (BFH) study the UK housing market from 1978 to 2004, and estimate a 25 percent overvaluation of house prices at the end of their study period. They find that the deviation of house prices from the fundamental value is evenly contributed by rational and intrinsic bubbles. In their paper, rational bubbles are a result of bounded rationality and self-fulfilling expectations, i.e., a deviation of income from its long-term trend causes house prices to deviate from their fundamental values. On the other hand, BFH suggest that the house price growth momentum can also lead to inefficient pricing in the housing market through an intrinsic bubble. That is, expectations that the current HPA trend would continue encourage further housing demand and push prices up even more.

The difficulty of examining the impact of expectations on housing bubble formation is that expectations are subjective and difficult to measure. The other difficulty is that the effect of excessive expectations on house prices can be intertwined with credit expansion and subprime lending as well, which has been the focus of many researchers in terms of the current crisis.

Wheaton and Nechayev (2008) (WN) argue that the fast increase of house price in the 2000s cannot be explained by either income growth or low interest rates. WN find that since 1999, the origination of investor and second home loans has sharply increased. By forecasting Metropolitan Statistical Area (MSA)-level house prices with a time-series model, WN also show that MSAs with a large prediction error are associated with subprime lending activities. However, WN find it difficult to disentangle the causality of house price increases and subprime lending.

Mian and Sufi (2009) examine ZIP-code-level loan performance and find that ZIP codes with a disproportionately high percentage of subprime borrowers (subprime ZIP codes) are much more likely to default than non-subprime ZIP codes. They find that these areas experience unprecedented growth of credit while relative income growth is sharply decreasing. They show that

securitization is closely related to the dissociation of credit expansion and income growth.

Coleman et al. (2010) investigate the hypothesis that subprime lending during 1998-2008 was the cause of the housing bubble and some other explanations. They find that until early 2004, house price dynamics were mostly in line with economic fundamentals. However, they find strong evidence of a regime shift in the credit markets as GSEs were displaced by private issuers of mortgage products. They conclude that subprimes may be the joint product of changing institutional, political and regulatory environments.

Other researchers, such as Taylor (2009), look at the broader picture of the market and show that the current financial crisis is the combined result of many different elements: loose monetary policy, securitization, GSE involvement and some government interventions that prolonged rather than shortened the crisis.

The brief summary of the literature above is not intended to be all-inclusive. Rather, we have selected studies to highlight the various possible explanations in isolation of the current subprime-related financial crisis. We take a different approach to disentangle the interactive drivers behind the recent U.S. subprime related financial crisis by reviewing a series of events and government policies prior, during, and after the subprime and housing crisis that began in early 2000. Using theoretical and empirical models, we show that the low interest rate and the passive market supervisory policies by the U.S. government are among the most important drivers of the housing boom. During the housing bust, despite a more aggressive regulatory environment, several conflicting policies that were implemented may have prolonged and deepened the recession. Based on these hypotheses, we argue that contagious real estate cycles can be prevented and/or controlled by more proactive counter-cyclical government intervention.

2. Recent U.S. Housing and Financial Cycle—Observations

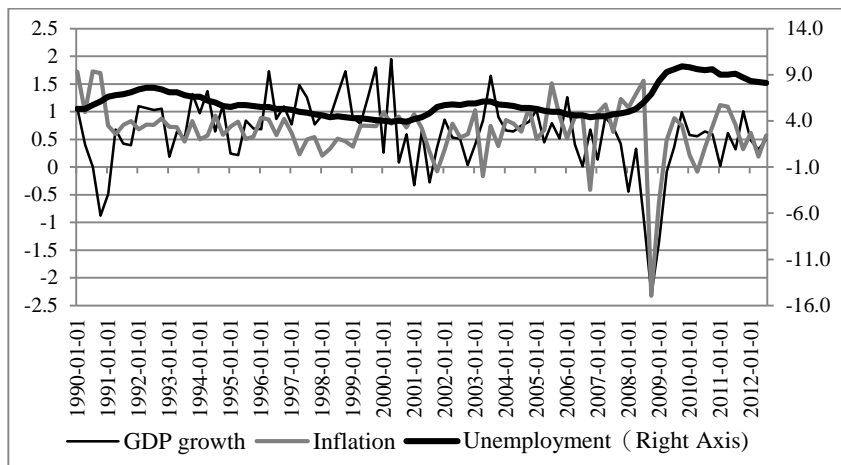
In order to understand the origin of the current real estate cycle in the U.S., we went back to the early 2000s and examined the possible roots of the crisis. Based on these observations, we divide the financial crisis into three phases. A timeline of the important events with regard to the housing market is shown in the Appendix.

2.1 Mortgage Origination Boom in 2000-2003

The first phase of our study period exhibits a rapid growth of the housing market caused by the easing of monetary policies that targeted to boost the economy. After almost a decade of boosted growth, the U.S. economy experienced a dramatic dot-com bubble burst which sank the NASDAQ index by 60 percent in 2000. Combined with the 911 event and the heightened concern of global

terrorist attacks, the economy fell into a period of low GDP growth and the unemployment rate started to rise in 2001.

Figure 1 Macroeconomic Indicators 1990-2012



Source: St Louis Fed. Unemployment rate is on the right axis.

In response, the Federal Reserve brought down the federal funds rate (FFR) target to a historical low in just three years. The monetary policy in this period has been widely criticized as being too loose. As shown by Taylor (2009), the interest rate target was well below what historical experience would suggest between 2002 and 2004, which is an unusual deviation from the Taylor rule.¹ The GDP picked up shortly after the downward adjustment of the FFR target, as did the housing market.

Figures 3 and 4 present the mortgage origination activities for purchase and refinance purposes after 1990. Both the volume and the number of home purchase mortgage originations consistently increased after 1991, which formed the longest housing boom in U.S. history. The pattern of refinance activity is even more striking: both the volume and the number of refinance

¹ The Taylor rule is a monetary policy rule which states that in order to stabilize the economy, the interest rate should be adjusted in response to the deviation of the GDP from the potential GDP and inflation from the target level:

$$i_t = \pi_t + r_t^* + \alpha_\pi(\pi_t - \pi^*) + \alpha_y(y_t - \bar{y}_t)$$

where π_t is the inflation rate, r_t^* is the equilibrium real interest rate, π^* is the target inflation rate and \bar{y}_t is the potential/trend real GDP. Taylor (1993) suggests a policy rule with $\alpha_\pi = \alpha_y = 0.5$, which implies that the interest rate should increase more than one-to-one with the inflation rate.

mortgage originations more than tripled from 2000 to 2003. This was mainly driven by borrowers who took advantage of the falling mortgage rate, which made mortgage payments less expensive. In the next section, we will use some simple calibrations to show the degree of impact that the low interest rate environment could have on housing affordability. For homeowners who already had outstanding fixed-rate mortgages (FRMs) at that time, refinancing could greatly help them to reduce their monthly interest payments. Meanwhile, as HPA started to accelerate, the rising house price allowed homeowners to cash out their home equity by refinancing into higher loan amounts.

Figure 2 Market Interest Rate and Rate Spread 2000-2012

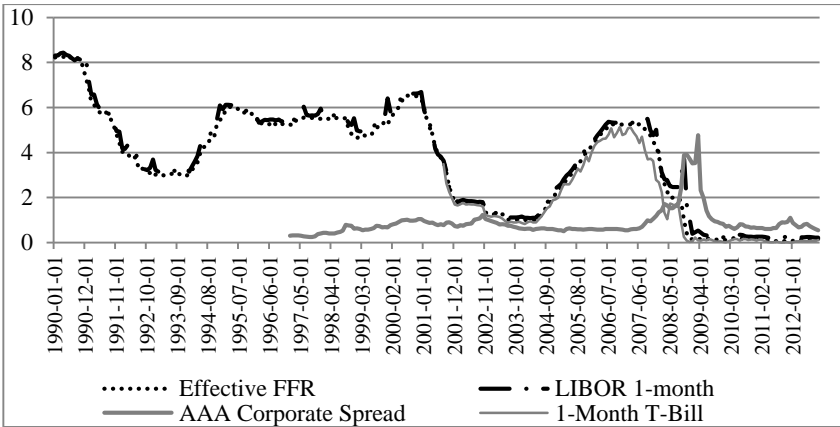
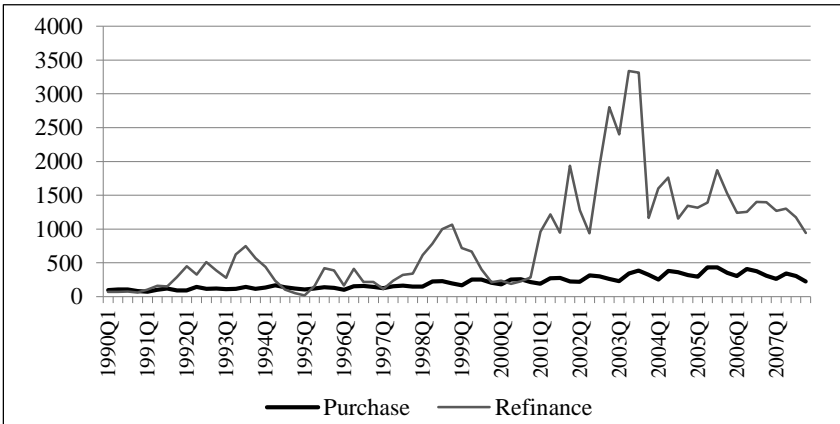
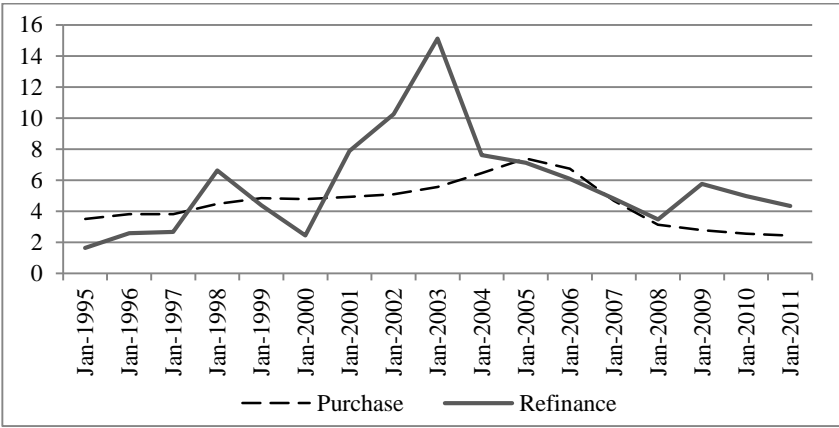


Figure 3 Quarterly Mortgage Origination (Volume)



Source: Mortgage Banker Association. Unit: Billions.

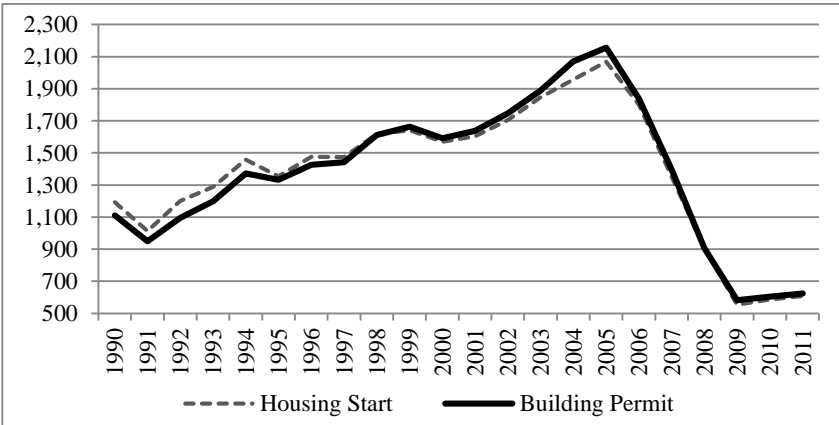
Figure 4 Mortgage Originations (# of Loans)



Source: U.S. Federal Financial Institutions Examination Council (FFIEC): Home Mortgage Disclosure Act (HMDA). Unit: Million

A similar prolonged boom was observed on the supply side: home starts and building permits continued to rise until 2005 as shown in Figure 5, but not as much as loan originations. As shown by many studies (such as Topel and Rosen (1988) and Saiz (2008)), housing supply is inelastic in the short run due to regulatory constraints, planning time, availability of land, and construction time. As a result, the increasing in housing demand pushed home price to rise further.

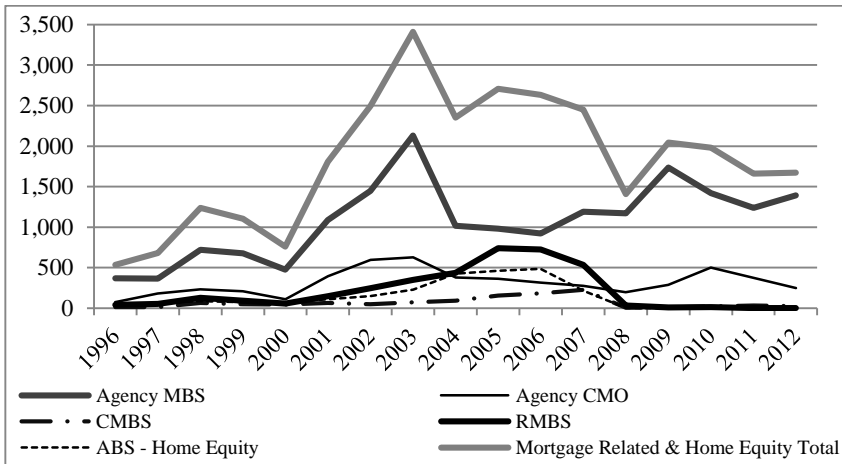
Figure 5 Supply of Housing



The explosion in the expansion of mortgages provided the opportunity for financial institutions such as banks to enter various mortgage related businesses. Mortgage securitization became the main engine for many institutions to generate profit, and its volume skyrocketed in the early 2000s as shown in

Figure 6. Complicated securitization products were invented to cater to the increasing appetite of the market for high yield. From 2000 to 2003, the issuance of PLMBSs drastically increased. However, the market share of the private sector (residential plus commercial) still decreased as GSEs expanded at an even faster rate.

Figure 6 Mortgage Security Issuance by Category (in \$Billion)



Source: Securities Industry and Financial Markets Association (SIFMA)

2.2 Subprime Expansion from 2004 to 2007

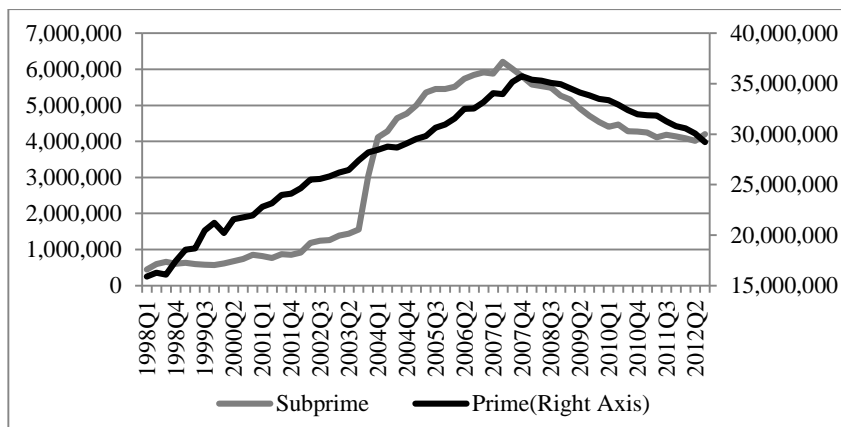
The second phase of our study period exhibits the fast expansion of subprime mortgages as a result of HPA and interest rate increases, which led to the eventual market crash later.

In 2003, the Federal Open Market Committee (FOMC) adjusted its view on the economy; they believed that the economy was growing slowly, so the monetary policy was accommodating enough to ensure future economic growth. Therefore, the FOMC decided to take a “wait-and-see” policy stance and held the FFR target at the level of the previous month without any further decrease. As the decrease in interest rate stopped, refinance activity quickly shrank by more than 60%. Suffering from the loss of profits as one of their main businesses dried up, mortgage banks started to look for alternative business sources to keep utilizing the work force that was expanded during the refinance wave. Based on the relatively good historical performance and high profit margin, subprime loans became the new star of the mortgage market.² In no

² For example, Ashton (2009) states that in the early wave of the subprime expansion (around 1997), the premium charged on subprime mortgages over prime mortgages doubled what risk accounting would require. The mortgage performance data from the Mortgage Bankers Association (MBA) also show that the delinquency rate of subprime

more than half a year, the number of conventional subprime loan serviced increased from 1.5 to 4 million in the first quarter of 2004 (Figure 7). The unprecedented boom in subprime loans dramatically shifted the mortgage market. A study by Chomsisengphet and Pennington-Cross (2006) indicates that the subprime market share of the top 25 subprime originating firms increased from 39.3% in 1995 to over 90% in 2003. They also point out the high percentage (over 50 percent) of cash-out refinance among subprime loan originations. Meanwhile, the number of prime mortgages has maintained a steady rate of growth since 2000.

Figure 7 Conventional Loans Serviced (Seasonally Adjusted)



Source: Mortgage Banker Association

The share of adjustable rate mortgages (ARMs) also increased from 2003 to 2006, but the contract interest rate did not rise as much as the FFR target (Figure 8). This could have been the result of the low teaser rate in the first few years of the ARM contract. This below the market initial teaser rate, as will be explained in the next section, increased the risk of ARM loans.

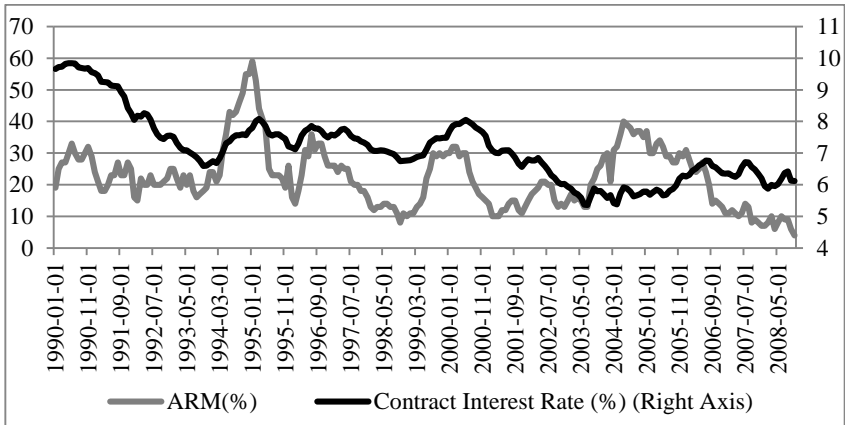
At the same time, structured securities became increasingly more complicated. Investors appeared to rely on the evaluation of market and product risk by rating agencies, and regulators chose to rely on the self-discipline of the market in risk taking. As Yang and Zhang (2012) indicate, over-reliance on credit rating agencies led to a substantial concentration of systematic risk so that a mistake made by a rating agency would have significant impact on numerous market participants. The apparent failure of the market to truly understand the risk made self-discipline very difficult.

During this period of time, regulators did not require an extra capital buffer when the systematic risk was building up. Their outdated risk-based capital

mortgages was below 2 percent before 1999.

requirements provided little control on the stability of the financial system, and there were even loopholes that allowed the system to increase their risk-taking behavior while reducing the capital requirement at the same time. For example, according to the Notice of Proposed Rule Implementing the Basel II Standardized Risk-Based Capital Framework, special provisions are required for residential mortgages with PMI coverage to reflect the risk mitigating effects. A bank can reduce the loan exposure up to the amount covered by the loan-level PMI, and therefore is allowed to hold less capital. The rule does not differentiate between mortgage insurance companies with AA and AAA ratings. However, since mortgage insurance companies can only protect credit losses up to a level that is consistent with their rating, in a catastrophic event, insurance companies will not be able to fulfill their commitments.

Figure 8 Share of ARMs and the Average Mortgage Contract Interest Rate



Another more pervasive loophole is capital arbitrage which arises from the difference of the capital requirements among industries including banks, GSEs, private mortgage insurance companies, and government agencies. Capital arbitrage would therefore mean that the total capital reserved for a particular risk to be lower than expectation of every regulator and increases the risk of a government bailout when extreme conditions occur in the future.³

³ For instance, under traditional Basel I, banks have a required capital ratio of 8%. For Qualified Residential Mortgages (QRMs), this ratio is reduced to 4%. The requirement is further reduced to 1.6% if the holding is in the form of QRM based-MBSs. The minimal capital requirement of GSEs imposed by Congress is 2.5% for whole loans and 0.45% for guarantees. Private mortgage insurance companies are regulated by individual states and face different sets of capital requirement rules. Due to the different standards imposed by supervisors among different industries, participants in the mortgage industry tend to push the risk into the entities with the lowest capital requirement. For example, if a bank swaps a pool of QRM qualified whole loans with a GSE in exchange for MBSs, the combined required capital reserve on this pool of mortgage products will be 0.45%

As the subprime market expanded, the non-agency private sector finally took part of the market share away from the GSEs. As shown in Figure 9, the combined market share of Fannie Mae and Freddie Mac dropped from over 45% to less than 40% from 2003 to 2006. Private label MBS issuance more than doubled during the same period of time (Figure 10).

Figure 9 Market Share of GSEs

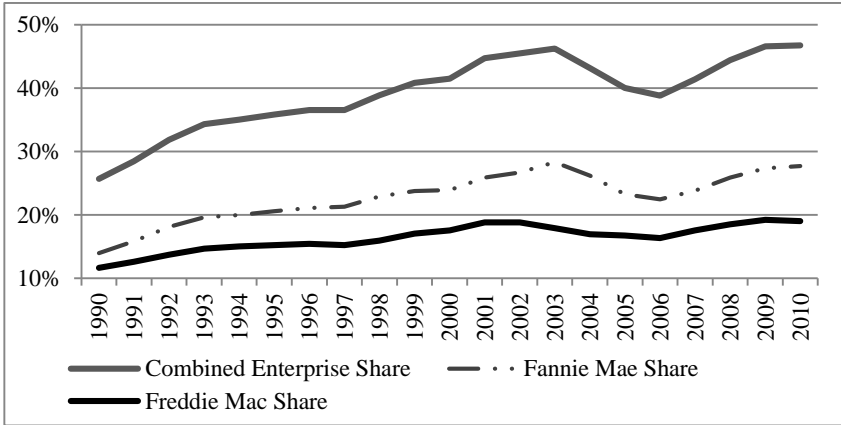
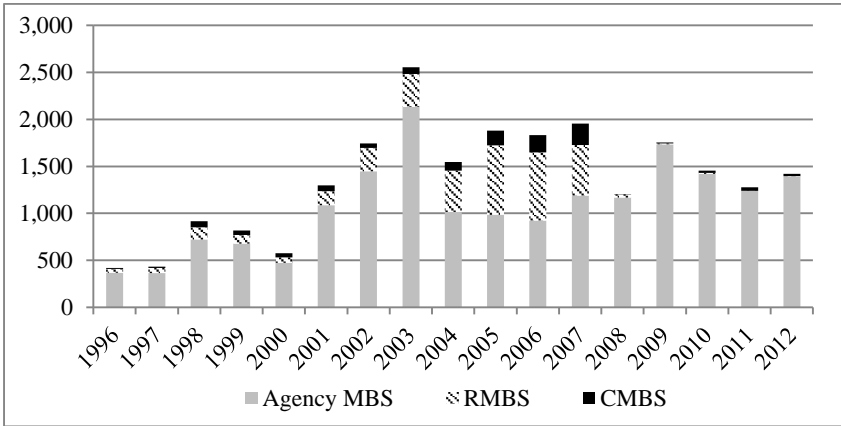


Figure 10 Agency and Non-Agency Mortgage Issuance

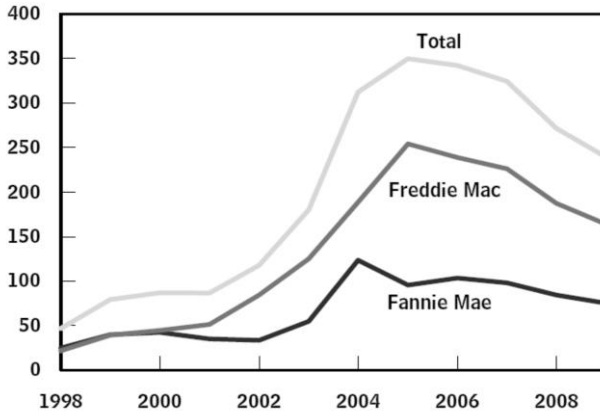


As Fannie and Freddie were quickly losing market shares to the private-label security market, they also started to search for new channels of profit, such as

by the GSE and 1.6% by the bank. The new reserve ratio is much lower than the 4% capital requirement when the bank holds these whole loans in portfolio. The bank can also sell these mortgages to the GSE without receiving MBSSs. Under such a scenario, these loans will be solely backed by the 2.5% capital requirement of the GSE.

investing in risky private-label subprime and Alt-A MBSs (Figure 11). A report by the Congressional Budget Office (CBO) shows that these private-label holdings and other nontraditional loans became the source of their initial losses later.⁴

Figure 11 GSE Holdings of PLMBSs



Source: Congressional Budget Office report “Fannie Mae, Freddie Mac and the Federal Role in the Secondary Mortgage Market,” 2010 based on data from the Federal Housing Finance Agency

Note: The amounts shown here are based on the unpaid principal balance of mortgages that underlie a security. They cover all of the holdings of the non-agency mortgage-backed securities of Fannie Mae and Freddie Mac, including jumbo, subprime, and Alt-A securities issued by private institutions.

On the borrower side, a direct consequence of lowered underwriting standards and innovation of mortgage products is the expansion of consumer credit. Figure 12 shows that the volume of all types of consumer credit rapidly prior increased to the market crash and the scale of the increase for mortgages surpassed all other types combined.⁵ This speed of credit expansion was beyond the support of economic fundamentals such as income growth, and heavily depended on the growth of house prices. Indeed, the national house price index increased at an annual rate of 8-10% from 2003 to 2005 according to different sources (Figure 13), which was far above the long-term historical average rate of 3-4%.

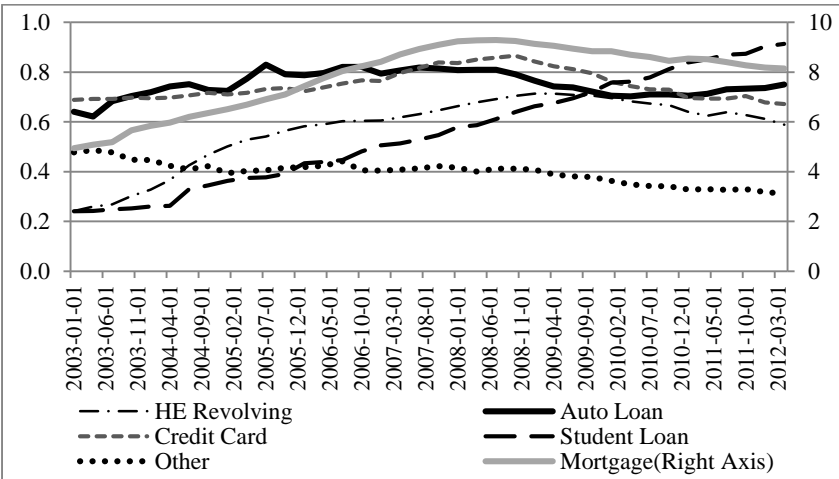
As HPA surpassed the rate of increase of income, housing affordability dropped. The Housing Affordability Index (HAI) of the National Association of Realtors (NAR) in Figure 14 indicates that, in mid 2006, a household with median income did not have enough income to qualify for a median-priced house (based

⁴ Congressional Budget Office, “Fannie Mae, Freddie Mac and the Federal Role in the Secondary Mortgage Market,” 2010, <http://www.cbo.gov/publication/21992>.

⁵ Note that mortgage credit is on the right axis.

on 80 percent LTV).⁶ Housing demand lost its momentum and began to drop in the beginning of 2006, and home price appreciation started to slow down as well. The mortgage volume continued to grow but at a slower pace. In fact, the Surveys of Consumers conducted by the University of Michigan indicated that consumer sentiment about the housing market conditions had changed long before 2006. Figure 15 shows that the relative good time to buy (GTB) index already took an abrupt downturn immediately after 2003 and continued to drop through to 2006.⁷ It is worth noting that the rate of the decrease of the GTB index accelerated from 2004 to 2006, with a significant drop that occurred in early 2005. Since the relative GTB index is jointly affected by the interest rate, current home prices and the expectation of future home prices, the initial drop of the GTB was likely the result of the increase in the mortgage rate, and later on, this effect was compounded by the expectation of uncertain future home prices.

Figure 12 Consumer Credit Expansion (\$Trillion)



Combining the information reflected in both the HAI and GTB indices, it is likely that the market felt the over-pricing of houses in 2005, which was also reflected in the slowdown of the housing supply as shown in Figure 5. A study

⁶ The HAI measures whether a typical family could qualify for a mortgage loan on a typical home where a typical home is defined as the national median-priced, existing single-family home and the typical family is defined as one that earns the median family income. A value of 100 means that a family with the median income has exactly enough income to qualify for a mortgage on a median-priced home.

⁷ The GTB and GTS indexes are part of the monthly Survey of Consumers conducted by the University of Michigan. It is a nationally representative survey based on approximately 500 telephone interviews. The good time to buy index is a score equal to the percentage of consumers who think that it is a good time to buy a home plus the percentage who reported buy-in-advance rationale.

by Croce and Haurin (2009) also finds that the consumer sentiment measure performs relatively well in predicting turning points in the housing market. The continuing house price increase after 2005 could be the effect of subprime cash-out refinancings, which supported the price appreciation for another year, but eventually lost its momentum in 2006. The sentiment of a relative good time to sell heavily depends on the home price; therefore, it did not start to decrease until almost 2006 when national house prices began to drop.

Figure 13 House Price Indexes from Different Sources

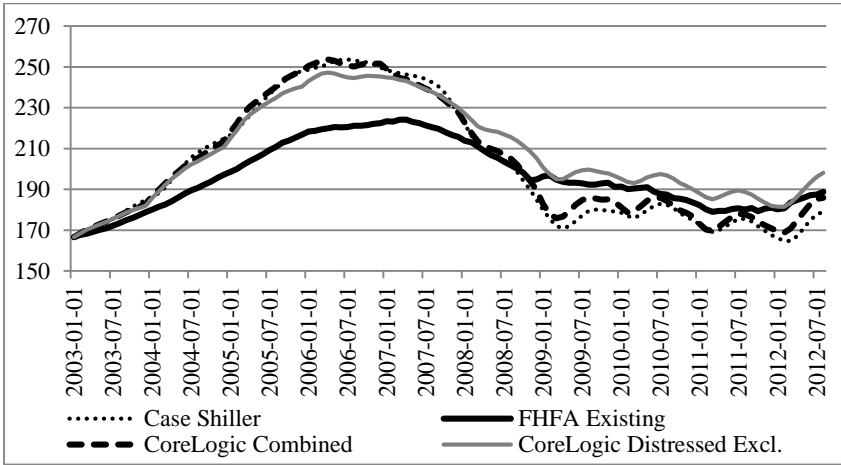


Figure 14 NAR Housing Affordability Index

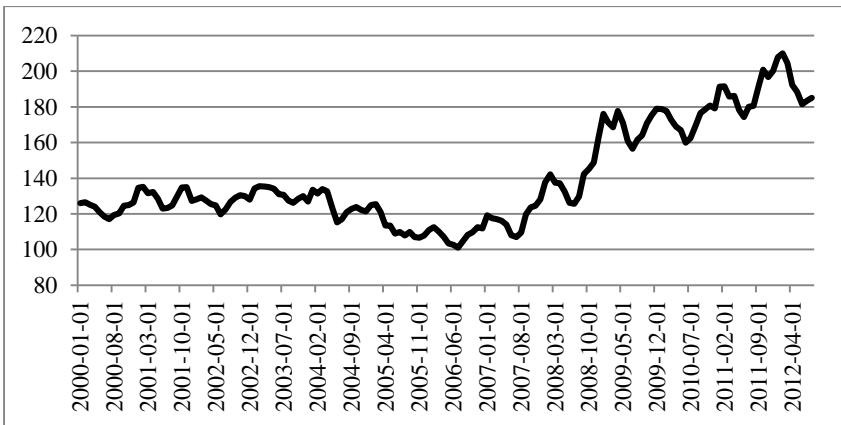
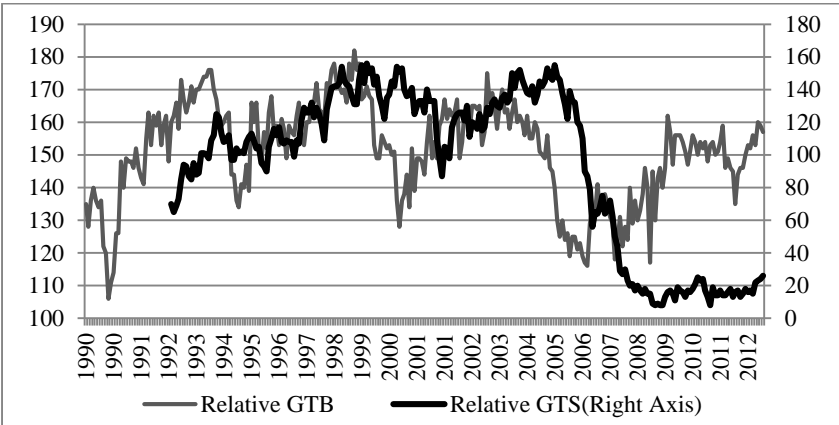


Figure 15 Consumer Sentiment Indices: Good Time to Buy (GTB) and Good Time to Sell (GTS)



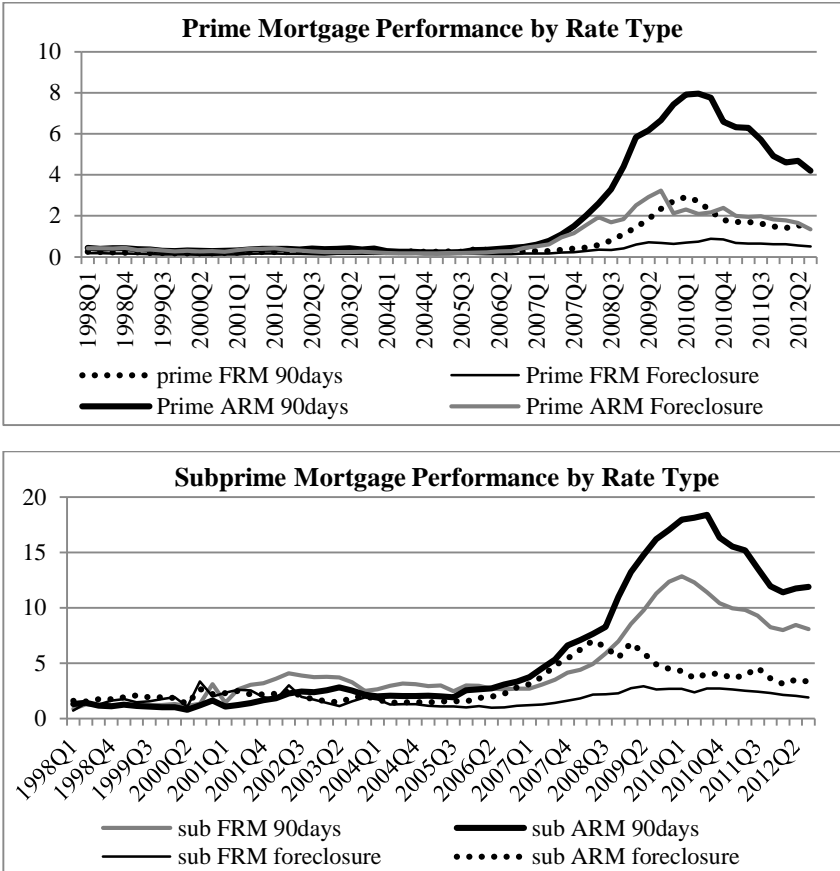
2.3 Market Crash and Rescue: 2007 and After

The impact of home price decreases was devastating to the U.S. economy. Many mortgages, especially subprime loans, went underwater. The delinquency rate began to rise in 2007, as did the foreclosure rate. Figure 16 presents the loan performance statistics of subprime and prime mortgages by rate type. We observe that the subprime mortgages started to show problems two to three quarters before prime mortgages, which is related to the higher LTV ratio of the subprime loans and lower credit score of the borrowers, compared with prime loans. We also notice that ARM loans showed a higher risk than FRM loans in general. For the prime loans, the delinquency rate of ARM loans has been more than double that of FRM loans since 2009.

The evolution of mortgage securitization during the early 2000s practically connected every sector of the economy together. As a result, the failure of a few financial institutions would trigger the domino effect. In 2007, the number of financial institutions that were filing for bankruptcy started to increase. The scale of delinquency and foreclosure became so severe in 2008 that it finally brought down a few of the major investment and commercial banks. By the end of 2008, the government took the two housing GSEs under conservatorship to prevent potential damage to the financial system if these two largest institutions failed. By mid-2008, funding of any form of credit was almost dried up. As the liquidity problem became serious, the Federal Reserve System (Fed) and the Treasury took a series of actions to save the crashing market. For example, the Trouble Asset Relief Program (TARP) was signed into law in October 2008, which allowed the Treasury to purchase illiquid, difficult-to-value assets from financial institutions to ensure market liquidity. The Fed also rolled out a series of programs, such as the Term Asset-Backed Security Loan Facility (TALF), to

support the issuance of asset-backed securities so that the credit needs of households and small business could be met.

Figure 16 Mortgage Performance by Rate Type



Source: Mortgage Bankers Association delinquency data

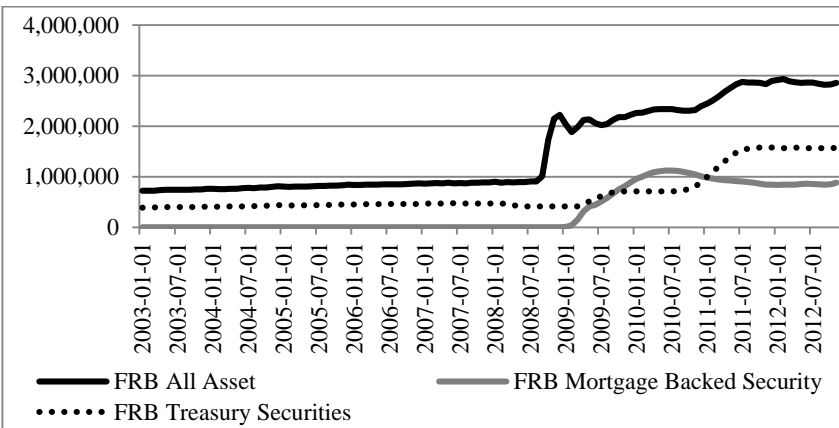
These immediate actions taken by the Fed and the Treasury at least to some degree mitigated the liquidity problem in early 2009 from spreading. However, whether it was necessary to continue expanding these rescue programs has been questioned by many studies.⁸ Even after the liquidity problem was under control in 2009, the balance sheet of the Fed kept growing. As Figure 17 shows, by the end of 2010, the size of the assets of the Fed was four times that of its pre-crisis level, and even higher in 2012. After the second half of 2007, the Fed also substantially reduced the interest rate. Then, in 2011 and 2012, the Fed further affirmed its strategy of keeping the interest rate at historically low levels

⁸ For example, Taylor (2009).

through an extended time period. The low interest rate policy may have not achieved the expected goal of reviving the economy either, and the market had already become rather insensitive to macroeconomic policies. Given the already low interest rate target, there was not much room left for the policy tools of the Fed. At the same time, inflationary pressure had become a growing concern.

Looking back to the origin of this subprime financial crisis, the macroeconomic policy played an important role in the complete picture and its impact was quite far-reaching. Even though it did not directly lead to the mass scale mortgage defaults, it paved the way to the growth of high-risk mortgage products and sloppy underwriting processes and the risk-taking behavior of the whole system. Unlike fiscal policies, the effect of the monetary policy could last for a decade. Its failure to rein in the market from getting too hot while trying to boost the economy led to the market crash even after the market easing policy ceased. Moreover, the policymakers may not have chosen the most effective way to mitigate the loss after the crash.

Figure 17 Assets of the Federal Reserve System



Next, we will use some simple calibration to illustrate the drivers of home prices and how the interest rate policy may have created the systematic problem. Understanding the mechanism of this home price cycle can help us to evaluate the policies that were imposed during the crisis and suggest possible improvements.

3. Home Price Drivers

3.1 Affordability Impact

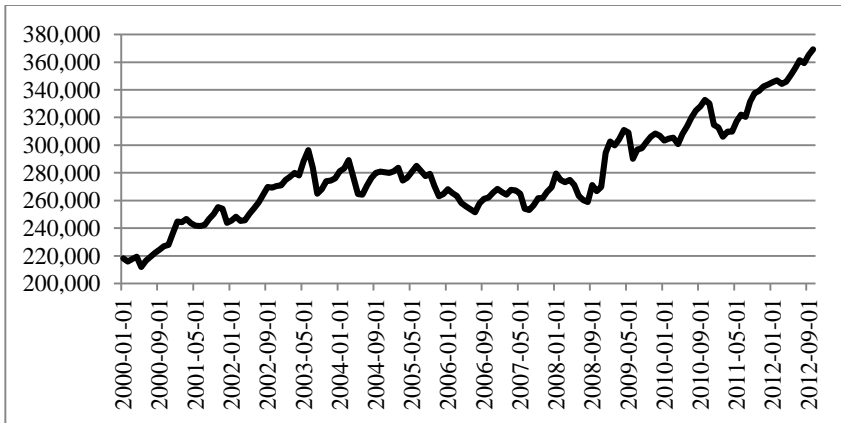
Homebuyers face both income and wealth constraints when purchasing a house. The maximum allowed LTV ratio establishes a minimum down payment

requirement. Households that do not have enough wealth to pay the down payment cannot afford to buy a home. The maximum allowed payment-to-income ratio establishes a minimum family income requirement. In order to qualify for a mortgage loan, the monthly payment of the mortgage can be no more than a certain percentage of the family income of a household. For example, the conforming loan standard of GSEs requires a front-end ratio of 28% and a back-end ratio of 36%.⁹ By focusing only on the income constraint, we have:

$$\text{Monthly Income} \times \text{Front-End Ratio} \geq \text{Loan Amount} \times \left(\frac{i[(1+i)^n]}{(1+i)^n - 1} \right) \quad (1)$$

where i is the monthly mortgage interest rate and n is the length of the mortgage loan. For a 30-year FRM loan, n equals 360. The right-hand side of Equation (1) is the monthly mortgage payment. When the Freddie Mac 30 Year Fix Rate Mortgage Commitment Rate is used as the mortgage rate for a household with an annual income of \$70,000 that is applying for loans, with an 80% LTV ratio and front-end ratio of 28% for the mortgage, we get the house value that this household can afford from 2000 to 2012. Figure 18 indicates that from 2000 to 2003, the decrease in mortgage rates greatly increased the affordability of homeownership. The maximum affordable house value increased by more than 35% during this period of time.

Figure 18 Affordable House Value



In this simple analysis, we exclude the wealth constraint that restricts the minimum required downpayment. For a downpayment-constrained household, if there is no relaxation on the LTV requirement, the low interest rate would have a very limited effect since this household may have difficulty in meeting

⁹ The front end ratio refers to the ratio of monthly housing expense and monthly income. The back end ratio is the ratio of total monthly debt expense and monthly income.

the downpayment requirement even if it can afford a higher monthly payment. On the other hand, for households that do not face the downpayment constraint, the impact of the interest rate is much more significant. This could also apply to households that took out a mortgage before 2000 with a higher mortgage contract rate, as the rising house value and reduced interest rates allow them to refinance into more affordable loans and cash-out equity from their house. This could explain for the rapid rise of refinance activity from 2000 to 2003.

Even though refinancing does not directly impact house prices, it will indirectly affect them depending on where borrowers spend the money when they cash out the equity. A study conducted by the Fed in 2000 indicates that the recent wave of cash-out refinance households tend to spend more of the funds on home improvement compared to consumption. As a result, the quality of houses on average may increase, and when these properties are sold, it will be reflected in the increased house price.

To summarize, we have illustrated the impact of interest rate on the house price if there is no substantial change in the underwriting standards or income growth. The increase of affordable house value could have quite a significant influence on the demand and hence home prices before 2003. After 2003, as we explained in the previous section, the mortgage rate stopped its downward movement, and refinance activity lost its momentum. However, the credit market continued its expansion through relaxed underwriting standards and creative affordable mortgage products. The growing size of non-prime loans kept housing demand increasing after mortgage rates hit bottom.

3.2 Expected Housing Capital Gain

The expectation about future capital gains from HPA affects expected returns from investing in housing. A higher expected housing appreciation rate implies a higher reservation price that a perspective buyer is willing to pay.

From the perspective of the homeowner, the reservation price of a property is determined by the relative cost of owning compared to renting the same unit based on the standard user cost model of homeownership (Hendershott and Shilling 1982). The user cost is usually defined as:

$$\text{User Cost of Owning} = \frac{P_{Own}}{P_{Rent}} [(1-t_i)(i+t_p) + TC/N + d - \Delta] \quad (2)$$

where $\frac{P_{Own}}{P_{Rent}}$ is the relative price of owning to renting the same unit, t_i and t_p are the rates of income and property tax respectively, TC is the transaction cost of owning a house, N is the expected length of staying in that property, d is the depreciation of the property and Δ is the home price appreciation rate. Holding the user cost constant, we see that the price that a buyer is willing to pay for a property (P_{Own}) increases with the expected home price appreciation rate. If we

assume P_{Rent} increases at the same rate of the HPA, then the reservation price of owning this property will grow at the same rate as well.

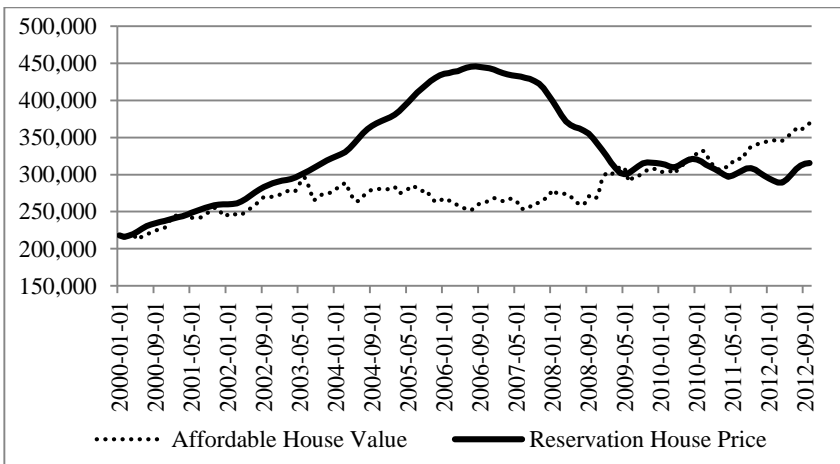
Under the adaptive expectation assumption, the expectation for the HPA during the next period equals the realized appreciation rate of the previous period. That is,

$$E_t(\Delta_{t+1}) = \Delta_t \quad (3)$$

By using the maximum affordable price level calibrated in Equation (1) as the base, and the Case-Shiller 20-city composite index as the HPA rate, the reservation price for the same property is computed from 2000 to 2007 by using the adaptive expectation assumption. Figure 19 shows that from 2003, the reservation price started to deviate from the affordable price level. This is because our calibration of affordable house value does not include the impact of the investment-driven buying incentive and the availability of super affordable financing products through the non-prime mortgage markets.

Even though our simple model isolates all the interactions of other related factors, we clearly see that if buyers form their expectation of future house price purely based on historical information, their reservation price level will continue to increase until the price increase can no longer be supported by the investment-driven demand. The expansion of subprime loans helped to extend the upward trend of the housing demand induced by the expectation of high HPA rates. This led to the longest housing boom in the U.S. history followed by the sharpest drop in house price.

Figure 19 Evolution of Reservation House Price



4. Policies to Mitigate the Financial Crisis

4.1 Counter-Cyclical Actions

Some post-crisis policies are counter-cyclically oriented and have been shown effective in the mitigation of crises. For example, the Fed reverted its interest rate target quickly after the initial signs of a liquidity problem. Interest rates were brought down to historically low levels within a short period of time and have been kept low by various quantitative easing (QE) and Operation Twist programs. The TARP program of the Treasury also aimed to provide liquidity and help financial institutions to survive the biggest turmoil in decades.

The Federal Housing Agency (FHA) took counter-cyclical policies. For example, the FHA gradually expanded into higher-value housing markets by raising its loan size limit, promoted lenders to provide loss mitigation solutions to distressed mortgages on the market, and enacted procedures to reduce the foreclosure and real estate owned (REO) operational costs.

4.2 Pro-Cyclical Actions

However, some policies during the post crisis era aimed to control the risk-taking behavior of investors and prevent potential future financial crises. For example, the Dodd-Frank Wall Street Reform and Consumer Protection Act (the Act) imposed a higher capital requirement for loans that did not meet the Qualified Residential Mortgage (QRM) standard. The specifics for the QRM standard is still under design, but the goal is to increase the “skin in the game” in lending to constrain the risk-taking behavior of lenders. Likewise, the new BASEL III has rolled out a series of requirements on banks to have risk-based capital ratio. These policies would have been useful if they were carried out before the market became over-heated, but at the current stage of the market recovery, these policies tend to reduce available funding and delay market recovery.

A similar effect is found as a result of the criticism from the media. The pressure of drawing negative attention has made lenders overly conservative during the crisis, and thus lending criteria have been greatly tightened. This has prolonged the revival of housing demand and the market recovery. The exposure of robo-signing is another incidence that is related to the media influences. After the settlement of five banks with the Fed, major lenders suspended their foreclosure process across the U.S. in fear of the potential cost due to less-than-perfect foreclosure practices.¹⁰ After this incident, lenders are still overly cautious and

¹⁰ In February 2012, 49 state attorney generals and the federal government announced a historic joint state-federal settlement with the five largest mortgage servicers in the country: Ally/GMAC, Bank of America, Citi, JPMorgan Chase, and Wells Fargo. This settlement will provide as much as \$25 billion in:

- relief to distressed borrowers in the states who signed on to the settlement, and
- direct payments to the signing states and the federal government.

very slow in their foreclosure process. The lengthy foreclosure process has prevented investors from getting into the distressed property market, and further delayed the clearance of the distressed property inventory.

As a major mortgage insurer in the current market condition, the FHA has also taken a few pro-cyclical policies in response to the mandate by Congress to quickly rebuild the capital of the FHA. These policies include the tightening of underwriting rules and increasing of insurance premiums. These actions imply lower housing finance supported by the FHA during the most severe housing recession since the Great Depression. It also resulted in confusion about the role of the FHA in the housing market. The mission of the FHA was to provide housing finance to low- and moderate-income families and help first-time homebuyers to achieve homeownership. If the FHA successfully restores its capital back to the targeted 2 percent level, this means that the FHA is making a profit even during an AAA-equivalent stress environment, while all of the private mortgage lenders/insurers are losing money. This is equivalent to saying that the FHA program may be making more profit than the private market entities. In essence, it may no longer be a social welfare program.

These pro-cyclical policies not only reduced the effectiveness of the counter-cyclical policies, but also caused confusion to lenders and borrowers. Due to the unclear policy direction, lenders tend to hold back in their actions due to the uncertainty. The conflict among policies have led to a substantial waste of resources and may have delayed the pace of the economic recovery after the market crash in 2007.

5. Conclusions

We contend that the large cyclical amplification of the housing market needs more proactive regulation. Without proper regulations, a normal housing cycle could be magnified into a systematic risk that eventually brings down the whole economy. The evidence from the current mortgage crisis demonstrates passive government regulation in both the prime and secondary markets. The lack of regulation in subprime origination built up an inventory of mortgages with high systematic risk. On the other hand, the lack of regulation in the secondary market allowed complicated financial products to be created that imposed a great challenge for risk management. More rigorous and counter-cyclical principles of asset rating, accounting standards and capital regulation are necessary to prevent a build-up of systematic risk. For example, the sustainability of a mortgage should be rigorously reviewed. Critical investors such as pension funds, insurance companies and small investors should be prevented from investing in high-risk or complicated products to ensure the stability of the markets.

It is the largest consumer financial protection settlement in U.S. history.

Moreover, when designing policies, a clear and consistent goal should be maintained since inconsistent policies offset the effectiveness against one another and introduce waste of national resources. The recent U.S. financial crisis provided important empirical lessons toward our understanding of the policy impacts on the dynamic interactions among housing, mortgage, banking, and capital markets. It has demonstrated the necessity of counter-cyclical and preventive policies to ensure a sustainable and stable economy.

The views expressed herein are the views and opinions of the authors and do not reflect or represent the views of Charles River Associates or any of the organizations with which the authors are affiliated.

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Appendix Timeline of the Recent U.S. Housing and Financial Cycle

