

THREE EMPIRICAL ANALYSES OF THE HUD "AFFORDABLE HOUSING GOALS"
REGULATION OF FANNIE MAE AND FREDDIE MAC (THE GSES)

By

Chong Gao

Submitted to the

Faculty of the School of Public Affairs

of American University

in Partial Fulfillment of

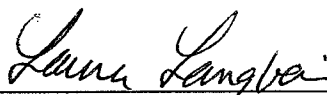
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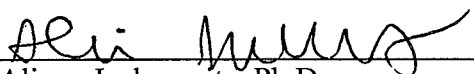
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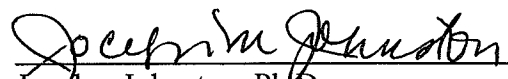
In

Public Administration

Chair:


Laura Langbein, Ph.D.


Alison Jacknowitz, Ph.D.


Jocelyn Johnston, Ph.D.


Dean of the School of Public Affairs

8-7-12
Date

2012

American University

Washington, D.C. 20016

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ABSTRACT

This dissertation studies one of the HUD’s regulations of Fannie Mae and Freddie Mac (collectively, the GSEs) -- the affordable goals, which governs the GSEs’ purchase of mortgages financing low- and moderate-income housing by setting a minimum percentage-of-business for affordable lending. The dissertation consists of three empirical studies, with the aim of contributing to the debate on overhauling the GSEs.

The first study assesses the effectiveness of the affordable goals in promoting homeownership for low- and moderate-income families. Although the economics literature indicates that the GSEs’ reaction to the affordable goals have the potential to reduce well known barriers to homeownership, it is unclear whether the expansion of mortgage credit to targeted borrowers would result in a discernible increase in the homeownership rate of the targeted group, due to the fact that the GSEs’ goal-compliance activities must be filtered through primary mortgage market institutions to ultimately affect targeted borrowers. Relating variation in the GSEs’ low- and moderate-income percentage-of-business in different MSAs to household homeownership status in those MSAs, the study finds evidence that the GSEs’ response to the policy has increased the likelihood of achieving homeownership for the households in the highest income quartile of the

lower-income group, but not for lower-income families as a whole, holding other determinants of homeownership constant.

The second study examines the effect of the GSEs' reaction to this regulation on the prices of the houses typically occupied by lower-income families. If the GSEs' intensified purchases of affordable-goals-qualified mortgages can increase demand for owner-occupied housing by the low- and moderate-income families, and the supply of housing is not perfectly elastic, then an important indirect consequence of the GSE affordable housing goals could likely be an increase in home prices for the targeted group, which constitutes a hidden cost to the intended beneficiary group of this policy. The study develops a reduced-form model where housing demand, housing supply, and mortgage supply are at equilibrium. Using this model, this study provides evidence that the low- and moderate-income housing price is lower in MSAs where the GSEs have a higher percentage-of-business for affordable lending, controlling for other important factors influencing housing price.

The third study explores the GSEs' loan-purchasing strategies to balance political and economic considerations as they comply with the affordable goal regulation. The GSEs have disincentives to purchase the affordable-goal-qualifying loans, because the economic return from purchasing those mortgages is lower. However, to retain the "implicit subsidy" from government, they had to respond to the requests of lawmakers. This study's results suggest that Senators' political ideology has a very limited impact on the GSEs' purchasing of affordable mortgages in the constituencies they represent, controlling for other factors that would likely affect the GSEs' purchases of affordable mortgages in different areas. The study's results also suggest that the

GSEs have a higher percentage-of-business for low- and moderate-income families in wealthier MSAs than in poorer ones, holding all else equal, for the GSEs may use this strategy to lower their economic loss associated with complying with this regulation.

ACKNOWLEDGMENTS

I thank my dissertation committee chair, Professor Laura Langbein, for her invaluable guidance to me for writing my dissertation. I also thank other committee members, Professor Alison Jacknowitz and Professor Jocelyn Johnston, for their excellent work of advising me in my dissertation writing process. I thank Dr. Robert Carroll who served on my committee when I defended my proposal. I am also grateful to Dr. Karen Baehler for convening my dissertation defense. I also thank Dr. Kurt Usowski and Dr. Alastair McFarlane of the U.S. Department of Housing and Urban Development for helpful comments.

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CHAPTER 1

INTRODUCTION

The U.S. government's regulation of the Federal National Mortgage Association (commonly known as Fannie Mae) and the Federal Home Loan Mortgage Corporation (commonly known as Freddie Mac), the two government-sponsored enterprises (GSEs), has two functions: ensuring that they fulfill their public purposes of promoting affordable housing as mandated by Congress, and ensuring their financial safety and soundness. This dissertation studies the policy that since 1993 has been performing the former function – the “affordable housing goals” regulation of the GSEs¹.

Federal Reserve Chairman Ben S. Bernanke, in a March 2007 speech, called for stronger regulation of the two GSEs. Bernanke (2007) advocated that “the GSE portfolios should be anchored to a clear and well-defined public purpose”, as a measure to “reduce the systemic risks posed by these organizations while increasing their institutional focus on promoting access to affordable housing”. In support of his opinion, Bernanke referred to past legislative and regulatory efforts in this regard: in 1992 the Congress enacted an act which required that the U.S. Department of Housing and Urban Development (HUD) set affordable housing goals, which governs the GSEs' purchase of mortgages financing low- and moderate-income housing by setting a minimum percentage-of-business for affordable lending. After several studies established the GSEs' disappointing effects on the mortgage market, HUD in 2004 raised the goal levels that the GSEs must reach to fulfill their affordable housing mission. Bernanke's

¹ Besides Fannie Mae and Freddie Mac, there is another big GSE in the U.S. housing finance market: the Federal Home Loan Banks (FHLB). The core business of FHLB is different from those of Fannie Mae and Freddie Mac. (Frame and White, 2004) Most studies on the housing GSEs focus on Fannie Mae and Freddie Mac and refer to them as “the GSEs”. The “affordable housing goals” regulation studied in this dissertation only applies to Fannie Mae and Freddie Mac. Therefore, the research of this dissertation will be limited to Fannie Mae and Freddie Mac, and in this dissertation they are referred to as the GSEs.

proposition of “*requir(ing) Fannie and Freddie to focus their portfolios almost exclusively on holdings of mortgages or mortgage-backed securities that support affordable housing*” essentially extends the “affordable housing goals” to the GSEs’ portfolio holdings as well, albeit setting the requirement for the affordable housing element of portfolio holdings at the highest possible level. Bernanke (2007) contended that “*The evolution of mortgage markets since the GSEs were created strongly suggests that a concentration on affordable-housing products would provide the greatest public benefit.*”

With U.S. government’s efforts to overhaul regulation of the two GSEs underway, it is well worth evaluating the effect of the “affordable housing goals”, the rationale for which is shared by Bernanke’s proposition of tying the businesses of the GSEs to affordable-housing products. Therefore, this dissertation will conduct empirical analyses to examine the effects of the “affordable housing goals” on the housing market and some related issues with policy implications, with the aim to provide public policy researchers and practitioners with useful information as they contemplate a better regulatory framework to induce/force the GSEs to well serve their mission of promoting homeownership, especially access to affordable housing.

Specifically, this dissertation will study three questions:

1. Has the HUD “affordable goals” regulation of the GSEs helped to make homeownership more attainable for low- and moderate-income families?
2. Are there hidden costs resulting from the regulation, in the form of higher home prices facing the target group of this regulation?

3. To what extent are the GSEs' activities of purchasing mortgages originated to low- and moderate-income families, in response to this regulation, determined by economic factors and political factors, respectively?

The purpose of the first study and the second study is to assess the extent to which the GSEs' responses to the affordable housing goals have had their intended effect: "are low- and moderate-income families now better off as a result of the affordable housing goals?" This is the question raised by the HUD-sponsored study on this issue (Ambrose, Thibodeau and Temkin, 2002). Ambrose et al (2002) investigated this question by studying this policy's effect on GSE market shares and effective borrowing costs, and most importantly, on low- and moderate-income homeownership rates. This dissertation approaches this question by directly studying the effect of the "affordable housing goals" on low- and moderate-income families' homeownership probability, because the ultimate purpose of this policy is to make homeownership more attainable for such families, and this ultimate policy effect encompasses intermediate policy effects, such as lowering effective borrowing costs and expanding the mortgage credit supply to the target group. This dissertation also adds another aspect to the assessment of whether the target families of this policy are better off as a result of it -- researching whether this policy has a side effect of raising the housing price for the target population, which is also important to their economic well-being. The first study of this dissertation aims to estimate the effect of the regulation on homeownership levels of low- and moderate-income families, a question already examined by Ambrose et al. (2002), with a different research design than theirs; the second study of this dissertation aims to examine the unintended consequence of the regulation on home prices

for the target group, a study necessary to complement the first one to form a comprehensive assessment of the impact of the regulation on the well-being of the target group.

The first study evaluates the effectiveness of the affordable housing goals in promoting homeownership of low- and moderate-income families, a central issue in assessing how well the GSEs are fulfilling their mission. The GSEs' public responsibilities include increasing access to mortgage credit for lower income borrowers and in underserved areas, among other things (HUD, 1996, P.8). The "affordable housing goals" regulation has caused the GSEs to improve their affordable lending performance relative to the primary market, and economics literature indicates that the types of activities the GSEs have implemented to meet past housing goal targets have the potential to reduce well-known barriers to homeownership (HUD, 2004, III-28). However, questions of ultimate impacts of raising the goals on market volumes of mortgages still need to be addressed (HUD, 2004, P. III-81). Research is needed to determine the extent to which market outcomes concerning the target group of this regulation, such as lower-income borrowers and minority borrowers, are realized in relation to the housing goals (HUD, 2004, P. III-81). Despite the unquestionable importance of this research question, only a small literature exists that has addressed this question. The prominent studies (Ambrose et al., 2002; Bostic and Gabriel, 2006) in the literature are either preliminary or restricted to a specific state in the nation; more importantly, they draw contrary conclusions on the regulation's effectiveness in increasing homeownership rates of the target group. This research attempts to add to this small literature by making improvements through the following features: a research design that can better isolate the effect of the regulation, a better measure of the GSEs' policy compliance performance, and the usage of newer national data.

The second study examines whether or not this regulation will incur higher home prices for its intended beneficiaries. Easier access to mortgage credit can increase low- and moderate-income families' demand for housing, which, in turn, is likely to boost house prices typically occupied by this group, especially since housing supply may not be perfectly elastic. Higher house prices can be regarded as a hidden cost to the intended beneficiary group of this policy. Therefore, the extent of this impact should be estimated to provide a further insight into this policy's implications. In addition, since the early years of this decade, the housing market has experienced a boom with rapid house price growth and recently a downturn with house price declines in many areas that were once at the center of the housing boom (OFHEO, 2007a). It will be useful to estimate how much the boom is attributable to the implementation of the affordable housing goals during that period, so that such information would help policymakers to decide if this policy has any material effect in magnifying the volatility of house prices.

The study of the third question will explore the GSEs' strategy of balancing economic risks and political risks as they comply with the "affordable housing goals" regulation. The GSEs intensified purchases of mortgages originated to low- and moderate-income families, as a reaction to the regulation. On the one hand this can lower the economic returns on their business, but on the other hand it can diminish the political risks of losing their federal charters and their special status as "government-sponsored enterprises", from which they derive almost all of their business advantages over any private financial institution in the secondary mortgage market. Since the GSEs are required to meet the affordable housing goals only at the national level, their affordable lending performance under the regulation in different metropolitan areas

varies. Also, the GSEs' performance varies through time. This study examines whether such variation is influenced by the economic conditions of the metropolitan areas covered by this study and the political ideology of the legislators representing those areas. This study has two purposes: First, to find out whether the GSEs engage in more intensified affordable lending activities in more liberal legislators' constituencies or as the Congress as a whole becomes more liberal. The finding from this inquiry may indicate whether the issue of the GSEs' affordable lending performance has generated enough public concern, thereby prompting legislators to exert substantial political pressure on the GSEs demanding better affordable lending performance, despite the GSEs' tremendous political power. Second, to find out whether the GSEs choose to buy a larger share of mortgages originated to low- and moderate-income borrowers in areas with higher median income, where the mortgage default risks are presumably lower. (The mortgage prepayment risks tend to be higher in high-income areas, though. It is assumed here that for the low- and moderate-income mortgages, the default risks outweigh the prepayment risks, resulting in the GSEs' mortgage purchase decisions dominated by the attempt to lower the default risks. However, whether this assumption is valid will be revealed by the empirical evidence.) The finding from this inquiry may reveal if the less wealthy areas in the nation receive less benefit brought by the affordable housing goals.

Overall, this dissertation can contribute to the understanding of the origin of the current housing market slump. The liberal mortgage financing environment in the late 1990s and the first half of this decade that the "affordable housing goals" helped to create, is widely believed to be a major factor causing the housing market boom in the early to mid-2000s, which is followed by a bust the nation is now going through. This dissertation seeks to find out to what extent the "affordable

housing goals” policy has helped to fuel that boom, measured by its effect on housing demand and housing price. This may help to inform policymakers about the side effect of the “affordable housing goals” in increasing the housing market’s vulnerability to greater cyclical fluctuations. However, this dissertation will not evaluate the effect of the “affordable housing goals” on subprime lending, although the ongoing subprime mortgage crisis is blamed for most of the turmoil in the nation’s housing market and credit market today. This decision is based on two reasons: first, the purchase of subprime mortgages does not account for a big share of the GSEs’ business, nor do the GSEs purchase a significant share of all the subprime mortgages; second, most of the subprime mortgage purchases the GSEs engage in are in the form of buying AAA-tranches of subprime mortgage-backed securities, but lenders usually do not disclose underwriting rules for the mortgages backing those securities, thereby prohibiting the assessment of the riskiness of those subprime mortgages. But this doesn’t mean that this dissertation will not address the subprime mortgage crisis at all; rather, the point is that this dissertation’s emphasis is on the effect of the “affordable housing goals” on initiating a boom-bust cycle instead of on its effect on the subprime market, which seems to be the most affected market segment during the ongoing housing market decline. By studying the housing market climate, this dissertation can shed light on the formation of the subprime mortgage crisis, since the high foreclosure rate of subprime mortgages is partly attributable to a bust market.

The plan of the dissertation is as follows. The following chapter introduces the GSEs, the HUD “affordable housing goals” regulation, and contemporary housing market conditions as a backdrop of the GSEs’ operations, to lay a foundation for the empirical analyses in this dissertation. Chapter 3, Chapter 4, and Chapter 5 each deals with one of the three research

questions described earlier in this chapter, according to the order specified. Chapter 6 provides concluding remarks and discusses policy implications of the results.

CHAPTER 2

BACKGROUND

This chapter provides the background information necessary for analyzing the determinants of the GSEs' reactions to the "affordable housing goals" and their influence on the housing market. The first part of this chapter briefly introduces the two GSEs' history, current issues in the spotlight and the major controversies surrounding them. The second part of this chapter explains the GSEs' operations in the secondary mortgage market, with a purpose of providing the basics for the analysis of the effect of the mission regulation of the two GSEs. The third part of this chapter describes the "affordable housing goals" and the target levels of the goals over the years. The fourth part of this chapter discusses the current problems in the U.S. housing market and how this dissertation may help to inform policymakers about the connection between the "affordable housing goals" regulation and the current housing market downturn.

Fannie Mae and Freddie Mac: the Past and the Present

Both Fannie Mae and Freddie Mac were established by specific acts of Congress. The National Housing Act of 1934 provided for chartering national mortgage associations as entities within the federal government. The only association ever formed was created in 1938, which eventually became the Federal National Mortgage Association (Fannie Mae). Fannie Mae was created because of the Great Depression, the collapse of housing markets, and lenders' reluctance to invest in the newly created Federal Housing Administration (FHA) loans. Fannie Mae functioned as a government-owned secondary market for FHA loans. Fannie Mae purchased FHA-insured residential mortgages from "mortgage banks" with funds gathered by issuing its own debt, and held those mortgages in its portfolio. Thus Fannie Mae expanded the available pool of financing

to support housing and also provided a degree of unification to mortgage markets. The former function was particularly useful during credit crunches when deposit rate ceilings limited the ability of savings and loans to raise funds. In 1968, Fannie Mae was converted into a private corporation with its shares publicly traded, although it retained a unique federal charter.

(Apparently one major reason for moving Fannie Mae off budget was to remove Fannie Mae's debt from the federal debt.) In the 1970s Fannie Mae switched its focus toward conventional (non-government-insured) loans.² Freddie Mac was created by Congress in 1970 to be a secondary market for the savings and loans (S&Ls), by securitizing mortgages originated by them. It launched the first mortgage-backed security (MBS) for conventional loans in 1971. Freddie Mac is a private company; but like Fannie Mae, it is also a Government-Sponsored Enterprise (GSE). Freddie Mac's equity shares were solely held by the twelve Federal Home Loan Banks (FHLBs) and S&Ls that were members of the FHLBs, during the 1970s and 1980s, before it was converted in 1989 into a publicly traded company. Despite Fannie Mae and Freddie Mac's different business activities in their early histories, by the 1990s the two companies' structures and strategies looked alike. (Frame and White, 2005; Van Order, 2000)

Both Fannie Mae and Freddie Mac have grown rapidly over the three decades before mid-2000s, and the share of the mortgages they held or securitized of the total residential mortgage debt has increased significantly during that period. In 2003, these companies held or securitized over \$3.6 trillion of the \$7.7 trillion in residential mortgage debt, or about 47 percent, in contrast to their share of about 7 percent in 1980.³ (Frame and White, 2005) It is well recognized that Fannie Mae

² Within the federal government the Government National Mortgage Association (Ginnie Mae) was created in 1968 to replace Fannie Mae to provide a secondary market for government-insured loans.

³ For more data on the two GSEs' residential mortgages held and mortgage-backed securities outstanding from 1980 to 2003, see Table 1 in Frame and White (2005).

and Freddie Mac have contributed to one of the most dynamic mortgage markets in the world (Cochran and England, 2001). One piece of evidence, as Cochran and England (2001) pointed out, is that at the end of June 2001, 67.7 percent of the U.S. population were homeowners, and that this homeownership rate was the highest ever in the United States by that time, and was among the highest in the world then.

The supporters of the two companies tout their contributions towards the secondary market for residential mortgages by providing stability and increasing liquidity in that market, especially their activities that promote homeownership opportunities for low- and moderate-income families. However, in recent years accounting and internal control problems of the two companies have been revealed, which resulted in remedy measures including restating their financial statements, being subjected to portfolio caps, and management shakeups. Prompted by the special examinations of their regulator, the Office of Federal Housing Enterprise Oversight (OFHEO), Fannie Mae restated its earnings from the end of 2001 to mid-2004, with the overall impact of its restatement as a total reduction in retained earnings of \$6.3 billion through June 30, 2004,⁴ and Freddie Mac also restated its financial results for 2002, 2001, and 2000. The accounting errors of the two companies were uncovered as of a total of \$11.3 billion (Shenn, 2008). As a result, in 2006, OFHEO imposed a cap on the “mortgage portfolio” assets Fannie Mae may hold, which is fixed at \$727.7 billion; and Freddie Mac entered into a voluntary agreement with OFHEO in the same year, which limits the annual growth of its retained mortgage portfolio to 2 percent (OFHEO, 2007b). In recognition of the progress being made by

⁴ The information is provided in Form 10-K that Fannie Mae filed with the U.S. Securities and Exchange Commission on December 6, 2006, for the period ending on December 31, 2004.

the two companies, OFHEO removed the portfolio growth caps for both companies in March 2008.

As the two GSEs are emerging from their accounting and internal control problems, they began to experience the turmoil caused by the subprime mortgage crisis of 2007. Both GSEs have suffered huge losses so far, as record home foreclosures and declining housing prices increased credit losses. Yet they are often relied upon as the mortgage buyer of last resort to provide stability and liquidity in the housing finance market at this tough time, when mortgage liquidity is drying up because worries about losses have driven investors to avoid buying mortgages or mortgage-backed securities to a large degree. At the present time, while mortgage originations have been declining significantly, the GSEs have increased their businesses. As of July 2008, the GSEs together hold or guarantee about \$5 trillion worth of mortgages, almost half the country's \$12 trillion in home mortgage debt. However, indications that the two companies will continue to lose much more as the housing downturn goes on and concerns about whether they might need a federal bailout have caused the prices of their shares to drop sharply from mid-2007 to mid-2008. In an effort to stabilize Fannie Mae and Freddie Mac and to provide crucial support for the housing market and, more broadly, the capital market, in July 2008 the U.S. government enacted the Housing and Economic Recovery Act of 2008, which provides the Treasury temporary authority to expand the GSEs' lines of credit with the government and to buy equity in the GSEs, among other things.

The U.S. government's recent move aiming at rescuing Fannie Mae and Freddie Mac, should they run into trouble, potentially entails using taxpayer money to bail out the two firms. This

possibility has long been warned of by the critics of the GSEs. (For example, see Wallison (2004) and Frame and White (2004).) This contingent liability for U.S. taxpayers is also one of the reasons for the most important controversy about the two GSEs – whether the federal sponsorship of the two GSEs is warranted. Another reason for this controversy is that federal sponsorship of Fannie Mae and Freddie Mac is a broad-based effort to encourage housing consumption, whose beneficiaries are not only the low- and moderate-income families, but also some higher-income families whose mortgages also fall within the conforming loan limit for the GSEs and are eligible to be purchased by them,⁵ while the logical policy for promoting homeownership and redistributing to lower-income people should target the low- and moderate-income households who are on the margin between renting and owning, and help them become first-time homeowners (Frame and White, 2005). Therefore, it is argued that federal sponsorship of the GSEs exacerbates the overinvestment in housing in the United States, which is encouraged by U.S. public policy. The largest encouragements are the favorable income-tax treatment for owner-occupiers through excluding their implicit income from housing and allowing the deduction of mortgage interest and local real estate taxes. Additional tax benefits include the exemption of much owner-occupied housing from capital gains taxation and accelerated depreciation on rental housing (Frame and White, 2005).

Many economists, such as W. Scott Frame and Lawrence J. White, have argued that privatizing Fannie Mae and Freddie Mac would be the best solution to the risks they pose to the U.S. economy. The Federal Housing Enterprises Financial Safety and Soundness Act of 1992 (FHEFSSA) required HUD to conduct a study evaluating the desirability and feasibility of

⁵ Moreover, the industries benefiting from such a broad-based mechanism to encourage housing consumption include the securities industry (important members of which reap huge profits by underwriting the two GSEs' securities), and the residential construction and sales industries (Wallison, 2004).

repealing the Federal charters of Fannie Mae and Freddie Mac, eliminating any Federal sponsorship of these enterprises, and allowing them to continue to operate as fully private entities (HUD, 1996, P. 7). The HUD study (1996, P. 7) “concludes that there is no compelling reason to fully privatize Fannie Mae and Freddie Mac” as of 1996, citing the finding that “the housing goals represent a promising approach to focusing the resources of these enterprises on the mortgage credit needs of these (underserved) homebuyers” as a main reason (HUD, 1996, Foreword). But the HUD study (1996) also recommends that “Congress should reexamine the privatization issue periodically”. Since this dissertation intends to examine how much public benefit has been produced by the changes in the GSEs’ business emphasis in response to the HUD “affordable housing goals” regulation, using data up to the recent years, the findings from this dissertation may provide some information to policymakers on whether the GSEs’ affordable lending business activities “represent an appropriate exchange for the benefits that they receive through their ties with the Federal government” (HUD, 1996, Foreword) at the current time.

Another important criticism of the GSEs is that they do not do an especially good job of helping low- and moderate-income families become homeowners. Again, this dissertation will help to shed light on this issue by examining how much they have contributed to increasing low- and moderate-income homeownership levels by complying with the affordable housing goals.

GSEs and the Secondary Mortgage Market

An adequate understanding of the GSEs’ role in the U.S. mortgage market is a prerequisite for assessing the effects of the “affordable housing goals” that governs the GSEs’ purchases of mortgages. This section will briefly introduce how the GSEs participate in the secondary

mortgage market and how their business activities can affect the primary mortgage market and consequently, the housing market outcomes.

“Fannie Mae and Freddie Mac are shareholder-owned, Government-Sponsored Enterprises (GSEs), chartered by Congress to make a national secondary market for residential mortgages in the United States.” (HUD, 2004, I-1) “The Congress chartered these two companies with the goal of expanding the amount of capital available to the residential mortgage market, thereby promoting homeownership, particularly among low- and middle-income households.”

(Bernanke, 2007) Fannie Mae and Freddie Mac “have led the way in dramatic changes that have taken place in the structure of the U.S. residential mortgage markets since the 1970s”. (Frame and White, 2005) The changes were primarily because of the rise of the secondary markets.

“This rise has come about largely because of standardization of pools of mortgages brought on by three secondary market agencies: Fannie Mae, Ginnie Mae (the Government National Mortgage Association)⁶, and Freddie Mac.”⁷ (Van Order, 2000) Both Fannie Mae and Freddie Mac “fund residential mortgages by purchasing loans directly from lenders, such as mortgage bankers and depository institutions, and holding these loans in portfolio or by issuing mortgage-backed securities (MBS) that are sold to a wide variety of investors in the capital markets”.(HUD, 2006) The growth of mortgage sales to the GSEs (and Ginnie Mae) “has been accompanied by a decline in the market share of the traditional lenders, thrift institutions (e.g., savings and loans).” (Van Order, 2000) “The mortgage market was originally a local one.”

However, “through the secondary market, lenders have access to investors across the country, as

⁶ Ginnie Mae is not a GSE, but a government agency. “Because Ginnie Mae is on budget its securities have a full faith and credit federal guarantee.” (Van Order, 2000)

⁷ “The GSEs played a major role in the development of the secondary market, although important roles were also played by Ginnie Mae and the conduits for “jumbo” mortgages.” (HUD, 1996, P53)

well as the world, and are not dependent on the availability of local funds.” (HUD, 1996, P53-54) “The secondary market now provides an efficient, stable, and dependable source of liquidity for mortgage credit markets.” (HUD, 1996, P53)

“Broadly speaking, Fannie Mae and Freddie Mac each run two lines of business. Their first line of business involves purchasing mortgages from primary mortgage originators, such as community bankers; packaging them into securities known as mortgage-backed securities (MBS); enhancing these MBS with credit guarantees;⁸ and then selling the guaranteed securities. Through this process, securities that trade readily in public debt markets are created. This activity, known as securitization, increases the liquidity of the residential mortgage market. In particular, the securitization of mortgages extended to low- and middle-income home purchasers likely has made mortgage credit more widely available.” “The GSEs’ second line of business ... involves the purchase of mortgage-backed securities and other types of assets for their own investment portfolios. This line of business has raised public concern because its fundamental source of profitability is the widespread perception by investors that the U.S. government would not allow a GSE to fail, notwithstanding the fact that--as numerous government officials have asserted--the government has given no such guarantees. The perception of government backing allows Fannie and Freddie to borrow in open capital markets at an interest rate only slightly above that paid by the U.S. Treasury and below that paid by other private participants in mortgage markets.” (Bernanke, 2007)

⁸ The credit guarantees provided by the GSEs work as such: “Monthly mortgage payments from homeowners are passed through by the GSEs to purchasers of MBS. Fannie Mae and Freddie Mac provide credit enhancement, guaranteeing that investors will receive their payments in full and on time. For this guarantee of timely payment, the GSEs charge a guarantee fee generally about 22 basis points (on the remaining principal).” (HUD, 1996, P54)

The business advantages of Fannie Mae and Freddie Mac and the controversy caused by them mostly stem from their status as government-sponsored enterprises. Fannie Mae and Freddie Mac “were created by Congress and maintain exclusive federal charters. These charters, in turn, confer a number of rights and responsibilities on these companies.” (Frame and White, 2005)

“Fannie Mae and Freddie Mac enjoy special privileges that provide them with significant cost advantages over other secondary market conduits, and over banks and thrifts with respect to certain forms of portfolio holdings. In particular, these implicit subsidies derive from: (1) Lower borrowing costs, because the market perceives an implicit Federal guarantee of GSE securities. (2) Exemption from all state and local taxes (other than property taxes). (3) Exemption from registration requirements for their securities, including SEC (Securities and Exchange Commission) registration and reporting requirements and state registration requirements. (4) Higher demand for their securities, which are qualified investments for regulated financial institutions. (5) A conditional \$2.25 billion line of credit from the Treasury for each enterprise. In addition, the GSEs generally have had regulatory capital requirements that were lower than those of other financial institutions.” (HUD, 2004, I-2)

Fannie Mae’s and Freddie Mac’s federal charters also bring about special limits on their activities. (1) Their charters restrict Fannie Mae and Freddie Mac to residential mortgage finance, and they are restricted to the secondary market, which means that they cannot originate mortgages directly. (2) They are subject to a maximum size of mortgage that they can finance, linked to an index of housing prices. These mortgages are usually described as “conforming”

mortgages; (larger mortgages are usually described as “jumbos”).⁹ For 2005, the limit for a single-family home is \$359,650. (3) The mortgages that they finance must also either be supported by a 20 percent down payment or have an external credit enhancement like mortgage insurance. (4) Fannie Mae and Freddie Mac are subject to federal safety-and-soundness regulation, including minimum leverage and risk-based capital requirements and supervisory examinations, by the Office of Federal Housing Enterprise Oversight (OFHEO), an independent agency within HUD. (5) They are subject to “mission oversight” by HUD, which approves new housing finance programs and sets percent-of-business housing finance goals that mandate that they serve low- and moderate-income households (The percent-of-business housing finance goals are the “affordable housing goals” regulation studied by this dissertation). (Frame and White, 2005, 2004).

The roles of Fannie Mae and Freddie Mac in the secondary mortgage market are best described in the context of the market segment in which they are allowed to operate. “The secondary market effectively functions as three distinct markets: government-insured, conventional conforming, and conventional nonconforming (or jumbo).”¹⁰ “The GSEs operate primarily in the

⁹ “Other nonconforming mortgages (besides jumbos) are those that do not meet the credit-quality standards of the two companies. Also, this limit applies only to a single-unit residence; higher limits apply to two-unit, three-unit and four-unit residences and to multifamily housing.” (Frame and White, 2005)

¹⁰ “Conventional loans are those without insurance or guarantee from any agency of the Federal Government, such as Federal Housing Administration (FHA), the U.S. Department of Veterans Affairs (VA), or the Rural Housing Service (formerly the Farmers Home Administration). Conforming loans are conventional loans that conform to the loan size and loan quality conditions.” (HUD, 1996, P49) More specifically, in terms of the loan size limit, “Conforming loans are those with an unpaid principal balance less than or equal to a specified amount, referred to as the conforming loan limit, which is based on home prices as measured by the Monthly Interest Rate Survey.” (HUD, 2004, I-2) In terms of loan quality conditions, the GSEs “may not purchase mortgages with loan-to-value (LTV) ratios that exceed 80 percent unless such mortgages have private mortgage insurance (PMI), the seller retains a participation of at least 10 percent, or there is recourse to the primary lender in the event of default”; Additionally, the charters of Fannie Mae and Freddie Mac “state that each GSE’s operations shall be confined, so far as practicable, to mortgages which are deemed by the corporation to be of such quality, type, and class as to meet, generally, the purchase standards imposed by private institutional mortgage investors”. (HUD, 1996, P44-45)

conventional conforming market.”¹¹ (HUD, 1996, P53) The special privileges that Fannie Mae and Freddie Mac enjoy give them “a significant competitive advantage in the secondary market.” *“This competitive advantage has essentially made Fannie Mae and Freddie Mac the only firms in the business of creating MBS for conventional conforming loans.”* (HUD, 2004, I-2) In other words, “the benefits embedded in the federal charters of Fannie Mae and Freddie Mac act as a barrier to entry in the secondary conforming mortgage market. In that market, Fannie Mae and Freddie Mac can be characterized as duopolists.” (Frame and White, 2005)

Although Fannie Mae and Freddie Mac are duopolists in the secondary market for conventional conforming mortgages, some researchers argue that the two companies do not raise antitrust concerns, for the reason that instead of raising prices, the two companies cause mortgage interest rates to be below those that the private market would otherwise provide. (Frame and White, 2005) However, as Frame and White (2005) forcefully put it, “an examination of market power in the context of a government subsidy should not offer comparisons with an unsubsidized market, but instead should ask whether the subsidy is completely passed through by competing firms to customers.” “Some theoretical research has examined various equilibrium outcomes arising from interactions between a perfectly competitive primary mortgage market and a less than perfectly competitive secondary mortgage market. Such studies examine issues related to mortgage guarantee pricing as well as the distribution of mortgage credit risk (by risk

¹¹ In the paragraph that describes the limits on the GSEs’ activities, it was mentioned that they are only permitted to buy mortgages of size not exceeding the conforming loan limit. So they can’t participate in the conventional nonconforming market. Also, it is not practical for the GSEs to participate in the government-insured market: “Although both Fannie Mae and Freddie Mac are allowed to purchase Government-backed loans, in practice they cannot compete with the price advantage that Ginnie Mae’s explicit Government guarantee allows. Thus the GSEs focus almost exclusively on the conventional market.” (HUD, 1996, P53)

classification) between mortgage originators and Fannie Mae and Freddie Mac.” (Frame and White, 2005)

Frame and White (2005) argue that “the empirical evidence suggests that Fannie Mae and Freddie Mac do retain some portion of their federal benefits and hence are not acting in a perfectly competitive manner. One piece of casual evidence is the extraordinary profitability of these two firms.” For the years 1998-2003, for example, Fannie Mae earned an average return on equity of 26.4 percent while Freddie Mac earned an average of 28.7 percent.¹² The industry return on equity for all FDIC-insured commercial banks for the same six years was 13.6 percent, significantly lower than that of either GSE. Frame and White (2005) also point out that “a second piece of evidence is from studies of using Fannie Mae and Freddie Mac as conduits for a mortgage interest rate subsidy.” Studies on this issue usually estimate the subsidy in one of the two ways: (1) They estimate the spread between the interest rates the GSEs borrow at and those the GSEs would borrow at if investors did not perceive them as backed by the U.S. government. For example, Van Order (2000) estimates that “a reasonable range (of the spread) ... is something like 20 to 40 or 50 basis points (bp).” (A basis point is equal to a hundredth of a percentage point.) Frame and White (2004) state that “it appears that about two-thirds of the borrowing advantages of Fannie Mae and Freddie Mac are passed on to borrowers in the form of lower interest costs – about 25 basis points lower – on conforming mortgages”, though they also point out that that figure is the subject of much debate. (2) They estimate the dollar amounts of the subsidy. Frame and White (2005) summarize the recent analyses offered by U.S. Congressional Budget Office (2001, 2004) and Passmore (2003): “the U.S. Congressional

¹² These statistics are calculated based on the two companies’ financial disclosures after they restated their earnings. The source data for deriving these statistics are provided in OFHEO (2008).

Budget Office (2004) estimated that in 2003 the two companies received gross benefits of \$19.6 billion accruing from their federal charters, of which they passed through \$13.4 billion to homebuyers through lower mortgage rates and retained \$6.2 billion for their shareholders. ... Passmore (2003) estimates the median after-tax present value of Fannie Mae's and Freddie Mac's net federal benefits at \$72 billion, accounting for 60 percent of the companies' combined market capitalization."

The "Affordable Housing Goals" Regulation

The GSEs' charters require them to carry out public purposes, providing secondary market assistance relating to mortgages for low- and moderate-income families. (HUD, 2006) Therefore, they are subject to unique regulatory provisions conferred by the Congress. (Frame and White, 2005) "The regulatory framework under which the GSEs operate has two principal objectives: first, to support the GSEs' mission of promoting homeownership, especially access to affordable housing; and second, to ensure that these two companies operate in a financially prudent manner." (Bernanke, 2007) The "affordable housing goals" regulation studied in this dissertation serves the first principal objective.

The "affordable housing goals" were adopted as part of the Federal Housing Enterprises Financial Safety and Soundness Act (FHEFSSA) of 1992, "to establish incentives for Fannie Mae and Freddie Mac to increase their service to low- and moderate income families and neighborhoods". "The legislation required that the U.S. Department of Housing and Urban Development (HUD) set affordable housing goals. Under FHEFSSA, HUD established (1) a low- and moderate-income goal which mandates that a certain proportion of units in properties

mortgaged with loans purchased by the GSEs be owned or rented by occupants with an income less than or equal to area median; and (2) a geographically targeted goal, which requires that a percentage of units mortgaged by loans bought by the GSEs be located in metropolitan-area census tracts with a median family income less than or equal to 90 percent of area median, or with a minority population proportion of at least 30 percent and a tract median income less than or equal to 120 percent of area median (slightly different rules apply in nonmetropolitan areas). The act also sets a special affordable goal for mortgages where family income is less than or equal to 60 percent of area median or less than or equal to 80 percent of area median and located in low-income areas.” (Ambrose et al, 2002, vii)

Housing units financed by a GSE’s mortgage purchases may count towards more than one housing goal category. In addition, both purchase and refinance mortgages count toward the housing goals. (HUD, 2006)

In 1993, HUD first established the housing goal levels for the transition period 1993-1994, and then the interim goal levels were extended through 1995. Subsequently, HUD published three regulations under FHEFSSA, each setting new levels for the housing goals: the “1995 Regulation” for the years 1996-2000; the “2000 Regulation” for the years 2001-2004; and the “2004 Regulation” for the years 2005-2008. (HUD, 2006) (The goal levels in each year from 1996 to 2008 are provided in Table 1)

Table 1: the GSEs’ Housing Goals for 1996-2008

	1996	1997- 2000	2001- 04	2005	2006	2007	2008
Goal							
Low- and Moderate-Income:	40%	42%	50%	52%	53%	55%	56%
Geographically Targeted:	21%	24%	31%	37%	38%	38%	39%
Special Affordable:	12%	14%	20%	22%	23%	25%	27%

Source: “Profiles of GSE Mortgage Purchases in 1999 and 2000” Table 1, U.S. Department of Housing and Urban Development, April 2002; and “Regulatory Analysis for the Secretary of HUD’s Final Rule on HUD’s Regulation of Fannie Mae and Freddie Mac”, Table 3.1, U.S. Department of Housing and Urban Development, October 2004.

The housing goal levels were increased each time a new regulation was enacted. Moreover, the “2004 Regulation” established new Home Purchase Subgoals under each of the housing goals. “The Home Purchase Subgoals are expressed as percentages of the total number of mortgages purchased by the GSEs that finance the purchase (not refinance) of single-family, owner-occupied properties located in metropolitan areas.” “HUD established Home Purchase Subgoals to encourage the GSEs to facilitate greater financing and homeownership opportunities for families and neighborhoods targeted by the housing goals.” (HUD, 2006) (The subgoal levels in each year from 2005 to 2008 are provided in Table 2.)

Table 2: the GSEs’ Home Purchase Subgoals for 2005-2008

	2005	2006	2007	2008
Goal				
Low- and Moderate-Income:	45%	46%	47%	47%

Geographically Targeted:	32%	33%	33%	34%
Special Affordable:	17%	17%	18%	18%

Source: U.S. Department of Housing and Urban Development, 2006.

The benefits of the “affordable housing goals” are claimed as such: “facilitating homeownership, especially among lower-income families; reducing affordability problems; reducing search and transaction costs; overcoming credit shortages in underserved areas;” and etc.. “These benefits have long been recognized as contributions of the secondary market justifying Federal charters for the GSEs.” (HUD, 2004, IV-2)

The GSEs’ housing goal performance data from 2001 to 2007 show that both GSEs have met the “affordable housing goals” requirements set for that period.¹³ (HUD, 2008b, Table 1a) “Under the housing goals, the GSEs have increased their purchases of loans for low-income families and underserved neighborhoods.” (HUD, 2004, IV-2) HUD (2004, IV-2) claims that there is growing evidence that the housing goals have encouraged some affordable lending initiatives, which has contributed to the rapidly increased lending to underserved borrowers and neighborhoods in the early 2000s.

Table 3: Overview of the GSEs’ Housing Goals Performance, 2001-2007

Goal	2001	2002	2003	2004	2005	2006	2007
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¹³ The only exception is that Freddie Mac’s performance on the underserved areas goal in 2002 was slightly short of the 31% goal level. (HUD, 2004, Table 2.1)

Low- and Moderate-Income							
Fannie Mae	51.5%	51.8%	52.3%	53.4%	55.1%	56.9%	55.5%
Freddie Mac	53.2%	50.3%	51.2%	51.6%	54.0%	55.9%	56.1%
Geographically Targeted							
Fannie Mae	32.6%	32.8%	32.1%	33.5%	41.4%	43.6%	43.4%
Freddie Mac	31.7%	31.0%	32.7%	32.3%	42.3%	42.7%	43.1%
Special Affordable							
Fannie Mae	21.6%	21.4%	21.2%	23.6%	26.3%	27.8%	26.8%
Freddie Mac	22.6%	20.5%	21.4%	22.7%	24.3%	26.4%	25.8%

Source: U.S. Department of Housing and Urban Development, 2008b.

“However, both HUD’s analysis and other studies have shown that the GSEs generally have lagged the overall market in providing funding for first-time homebuyers and those groups who suffer low levels of homeownership and who would benefit from the low-cost financing offered by the secondary market.” “The higher targets for the housing goals and the new home purchase subgoals (in the “2004 Regulation”) are intended to encourage the GSEs to further increase their purchases of affordable loans and to move into a leadership position in the single-family conventional conforming market.” (HUD, 2004, IV-2)

The Potential Value of This Dissertation to Understanding the Current Housing Downturn

The U.S. housing market slump caused by the problems of subprime mortgages manifested itself in 2007, with house price growth already decelerating since late 2005. By nearly all measures, the housing market is currently experiencing a downturn that many people consider the worst

one since the Great Depression: house prices have declined significantly, home sales and housing starts have fallen sharply, home sales inventories are up, and the high delinquency rate and foreclosure rate of subprime mortgages have worsened, which has driven the deterioration of the overall poor performance of all single-family mortgages and threatens to further depress the housing market. Yet by mid-2008, home prices are expected to continue weakening for an uncertain period of time.

The mortgage market also began to experience turmoil in 2007. Single-family mortgage delinquencies and home foreclosures increased dramatically throughout the year. In the fourth quarter of 2007, 1.48 percent of single-family mortgages were seriously delinquent (90 days or more past due) or in foreclosure, up from 0.96 percent one year earlier. The most important reason for this jump was the deterioration in the performance of subprime mortgages – loans intended for borrowers perceived to have high credit risk. The serious delinquency rate for subprime mortgages rose from 3.13 percent in the final quarter of 2006 to 5.42 percent one year later, and subprime loans entering the foreclosure process increased sharply from 2 percent in the fourth quarter of 2006 to 3.44 percent in the fourth quarter of 2007 (OFHEO, 2008). The performance of subprime adjustable-rate mortgages (ARMs) exhibited the worst deterioration trend, whereas subprime mortgages with fixed rates have had a more stable performance. The fraction of subprime ARMs seriously delinquent or in foreclosure rose to nearly 15 percent in July 2007, roughly tripling the low in mid-2005. For alt-A mortgages (those made to borrowers who typically have higher credit scores than subprime borrowers but still pose more risk than prime borrowers), the serious delinquency rate increased to 3 percent in mid-2007 from 1 percent only a year ago (Bernanke, 2007b). In the second half of 2007, the continued deterioration of the

performance of subprime mortgages triggered growing investor awareness of the extent of poor underwriting in subprime lending, and led to a virtual collapse of the primary and secondary markets for subprime, alt-A, and other non-traditional mortgages (OFHEO, 2008). The decline of prices for private-label securities backed by subprime mortgages resulted in sizable losses at many financial institutions. These losses and heightened uncertainty about further credit losses led to a sharp reduction in liquidity in the markets for securities backed by subprime mortgages in August 2007, which was soon followed by a sharp tightening in overall credit conditions and turbulence in broader financial markets. By mid-2008, losses at financial institutions have shown no sign of abating, though measures taken by the U.S. government have mitigated liquidity pressures. The housing recession and the associated mortgage market turmoil still pose significant challenges to the U.S. economy and financial system (Bernanke, 2008).

The housing market and the mortgage market have facilitated each other's rise and fall in recent years. During the boom years, the house prices acceleration was fueled by buyers' easier access to mortgage credit, promoted by the proliferation of innovative and riskier mortgages; and the house price appreciation in turn helped to mask the higher risks of subprime mortgages, thereby allowing those mortgages to gain in volume and market share. During the bust years, declining house prices have caused more and more families' property values to be less than their outstanding mortgages, thereby increasing foreclosures and investors' credit losses, which ultimately increased credit spreads and reduced mortgage credit supply; and the reduced supply of credit for all types of residential mortgages, especially those that carry no government insurance or guarantee, in turn intensified the downward pressure on single-family housing demand and prices.

The problems in the subprime-mortgage market are widely believed to be the origin of the housing slump and the associated turmoil in the mortgage market. Most importantly, the “originate-to-distribute” model that allows mortgage originators to pass much or all of the risks on to loan purchasers is blamed for the lack of incentives for originators to keep underwriting standards sound. The fragmented market structure of mortgage originators in the subprime-lending industry makes monitoring brokers and lenders difficult, and therefore may also have contributed to the loosening of underwriting standards (Bernanke, 2007b). However, it shouldn’t be ignored that the remarkable house price increase that happened before the collapse of subprime mortgage market provided conditions that made the rapid expansion of subprime mortgages and other non-traditional mortgages possible and may have helped to set up the situation for the turmoil in the mortgage market.

Therefore, when considering the connection between the affordable housing goals and the current housing slump, one has to take at least two aspects into account: first, to what extent the affordable housing goals have encouraged the GSEs to engage in purchasing subprime mortgages and securities backed by them and therefore exacerbated the subprime mortgage crisis; second, to what extent the affordable housing goals have helped to promote the housing boom from 2001 to 2005.

The former aspect’s importance is limited by the fact that the GSEs’ charters set minimum quality standards for the mortgages they can buy or securitize, so that the subprime mortgages their business activities have involved are among the least risky subprime mortgages or subprime

MBS. Also, neither the GSEs' purchases of subprime mortgages and MBS constitute a major share of the GSEs' book of business nor the subprime mortgages and those backing MBS purchased by them account for a large proportion of the subprime mortgage sector. However, in the past few years the GSEs had more exposure to loosely underwritten mortgages than before, and that has been evidenced by large losses related to subprime mortgages incurred by them and the fact that both GSEs have pulled back from the purchase of certain types of subprime mortgages and MBS since the subprime crisis emerged. Whether the GSEs' purchases of subprime mortgages and MBS has contributed to the weakening of underwriting standards for subprime mortgages would be a worthwhile research question related to the affordable housing goals, as the need to meet these goals and the desire to increase profit are the two main incentives for them to do more business in the subprime segment of the mortgage market. But research on this aspect is hindered by the lack of reliable data on the quality of the subprime and alt-A mortgages the GSEs' business activities involved.

This dissertation is well suited for studying the latter aspect of this issue. Both homeownership rates and house prices are key barometers of the housing market. By examining the affordable housing goals' effect on these two measures of the housing market conditions, this dissertation will help to shed light on how much this policy has helped to push house prices up during the period from 2001 to 2005 and thus contributed to the origin of this worst housing slump since the Great Depression. At a time when policymakers scramble to draw policy lessons from this crisis, this dissertation will furnish empirical evidence on whether the mission regulation of the two largest housing finance companies in U.S. has had an unintended consequence of increasing the

housing market's vulnerability to losses caused by cyclical fluctuations. Research from this perspective has been hard to find but it is necessary.

CHAPTER 3

ASSESSING THE EFFECTIVENESS OF THE “LOW- AND MODERATE-INCOME GOAL” IN PROMOTING HOMEOWNERSHIP FOR LOW- AND MODERATE-INCOME FAMILIES

Fannie Mae and Freddie Mac, the government sponsored enterprises (GSEs) in the secondary mortgage market, are the two largest sources of housing finance in the United States (HUD, 2001). Both Fannie Mae and Freddie Mac are chartered by Congress, and have a mission of helping more American families achieve homeownership. The underlying hypothesis on how they can accomplish their missions is that they promote a stable secondary mortgage market to ensure that banks and other lending institutions have a constant supply of money to lend to homebuyers, and more money means more opportunities for Americans to buy homes. However, much controversy has existed over how well the GSEs have served their public purpose -- promoting homeownership, particularly among low- and middle-income households. For example, Passmore (2003) estimated the effect of the GSEs' operations on lowering the mortgage rates on conforming mortgages to be substantially smaller than many studies suggested, and has argued that there appears to be no substantial effects of the GSEs' business activities on increasing homeownership, though he didn't provide a specific estimate or back his argument with empirical evidence. However, even without considering the difference in the mortgage rates reduction estimation, a counter-argument to Passmore's (2003) would be that the GSEs' business activities can increase the mortgage credit flow to borrowers, which may significantly increase homeownership rates.

One of the most important concerns over the GSEs' contribution to increasing homeownership has been about how well the GSEs have performed in financing affordable housing for disadvantaged borrowers. A study conducted by HUD concludes that “the shares of the GSEs'

business going to lower income borrowers and underserved neighborhoods typically fall short of the corresponding shares of other market participants” (Bunce and Scheessele, 1996). This view is shared by other studies researching the GSEs’ performance of serving low- and moderate-income households compared to other types of lenders during the 1990s (Passmore, 2003). The gaps between low-income and minority families and average families in access to mortgage credit concerned Congress and largely prompted it to pass the Federal Housing Enterprises Financial Safety and Soundness Act (FHEFSSA) of 1992 requiring that HUD set affordable housing goals for the GSEs (HUD, 2004).

Since 1993 Fannie Mae and Freddie Mac have been subject to the affordable housing goals -- the “quantitative goals for the portion of their business that represents mortgages on housing for lower income families and families in underserved areas” (Ambrose et al, 2002). Though the affordable goals have been in effect, “questions have been raised concerning the ultimate effects of the goals on low- and moderate-income families and underserved neighborhoods” (Ambrose et al., 2002). This study will focus on one of the three “affordable housing goals”, the low- and moderate-income goal, which requires that “a certain proportion of units in properties mortgaged with loans purchased by the GSEs be owned or rented by occupants with an income less than or equal to area median” (Ambrose et al., 2002). This essay will assess the effect of the low- and moderate-income housing goal in helping to make homeownership more attainable for low- and moderate-income families.

Although the low- and moderate-income housing goal states that GSEs’ purchases of mortgages on housing occupied by low- and moderate-income families can count toward this goal, no

matter whether the occupants are homeowners or renters, policymakers' main purpose in establishing this goal is to promote homeownership among the low- and moderate-income families (HUD, 2004), since the purchase of mortgages on owner-occupied single-family housing is the emphasis of the GSEs' business (Green and Malpezzi, 2003). Therefore, this essay will only study the effect of the GSEs' affordable lending performance on homeownership. As discussed later, the GSE data used for the empirical test are on the GSEs' purchases of single-family owner-occupied home purchase mortgages. Moreover, HUD's "2004 Regulation" established new Home Purchase Subgoals under each of the housing goals for 2005-2008. The Home Purchase Mortgage Subgoals require that the goal-qualifying percentages of the GSEs' total purchases of mortgages that finance purchases of single-family, owner-occupied properties located in metropolitan areas not be lower than the level set for the corresponding goal category of the subgoals. For example, the home purchase subgoal under the low- and moderate-income housing goal requires that 45% of home purchase mortgages purchased by each GSE in metropolitan areas qualify under the Low- and Moderate-Income Housing Goal in 2005, 46% in 2006, and 47% in 2007 and 2008 (HUD, 2004, III-13). Evaluating the effect of the GSEs' past purchases of mortgages financing owner-occupied single-family housing for low- and moderate-income homebuyers will help to assess whether the new home purchase subgoal is a meaningful policy initiative.

To date Ambrose et al (2002) and Bostic and Gabriel (2006) have conducted the major published studies evaluating the affordable housing goals' effect on homeownership among target families. Ambrose et al's (2002) empirical analysis, "though preliminary in nature, suggests that the GSE affordable goals help to make homeownership more attainable for target families". Bostic and

Gabriel's (2006) study, with a focus on underserved areas rather than low- and moderate-income families, however, "suggest little efficacy of the GSE home loan purchase goals in elevating the homeownership and housing conditions of targeted and underserved neighborhoods (in California during the 1990s)." These different conclusions, together with the various limitations of the published studies, indicate that more evidence is needed to help policymakers determine the effectiveness of the affordable housing goals in promoting homeownership among the target group.

This research seeks to provide evidence on the effectiveness of the low- and moderate-income goal in promoting homeownership among low- and moderate-income families. It will add to the small literature that has empirically examined this issue. As elaborated in later sections, two distinct features of this research are likely to enable it to overcome the major weaknesses of previous studies and therefore make it a meaningful addition to the existing literature: (1) Unlike Ambrose et al.'s (2002) research, which relates metropolitan area homeownership rates to GSE activity at the MSA level, this research uses household as the unit of analysis and examines how the probability of homeownership varies with household characteristics and GSE affordable lending performance in different MSAs, with controls for MSA fixed effects. This research design can help control unobservable variables that may cause a bias in the coefficient estimate of the GSE affordable lending performance variable. This is an important advantage, because it is widely recognized that researching market outcomes realized in relation to the housing goals would be challenging, given the difficulty of isolating impacts in a general market context. (HUD, 2004) (2) This research will use the GSEs' percentage-of-business for low- and moderate-income families to measure the GSEs' affordable lending performance under the low-

and moderate-income goal, which is the very measure that HUD uses to determine if the GSEs meet the requirement of this regulation. No published study on this topic has used this measure. For instance, Ambrose et al. (2002) use GSE market share, measured as the number of loans purchased by the GSEs, as an indicator of the intensity of the GSEs' loan purchasing activities. This study has an advantage over the previous ones in that it will directly reveal the association between the housing market outcomes and the regulation, since it uses the official measure defined in HUD's affordable housing goals regulation. Furthermore, this study will adopt the GSEs' affordable lending performance under the low- and moderate-income goal's home purchase subgoal, because the availability of home purchase mortgages directly affects the target group's homeownership probability, while the effect of refinance mortgages on homeownership probability is not significant, considering that the data examined in this study are mostly for a boom period of the housing market.

Finally, it should be pointed out that most empirical studies that evaluate the effect of the affordable housing goals on housing market outcomes examine the effect of the geographically targeted goal, that is, the effect on lower-income and minority census tracts targeted by that goal. Important studies in this category that use homeownership rate as the outcome variable include: Bostic and Gabriel's (2006) one described earlier, and An, Bostic, Deng and Gabriel's (2007) that follows the work of Bostic and Gabriel (2006), but analyzes data on census tracts of interest across the U.S. during the 1990s. Since Ambrose et al.'s (2002) work, except this dissertation, the only research studying the low- and moderate-income goal's impact on this goal's target families seems to be Moulton's (2010). Because Moulton (2010) uses a regression discontinuity design to analyze whether the affordable housing goals affected mortgage lending or purchasing

decisions, his estimate of treatment effect is only reliable for loans near the goal satisfaction cutoff, i.e. the income eligibility standard for each MSA under the low- and moderate-income goal. However, the majority of the GSEs' purchases of single-family owner-occupied mortgages that qualify under the low- and moderate-income goal are for borrowers with an income away from the goal satisfaction cutoff. (See Table 5 in HUD (2008a) and Table 5 in HUD (2008b) for proportions of Fannie Mae's and Freddie Mac's single-family owner-occupied mortgage purchases by mortgagor's income from 2001 to 2007.) Therefore, this dissertation fills an important gap by examining the low- and moderate-income goal's effectiveness for its entire target group, using national data preceding and at the beginning of the most recent housing slump.

Literature Review

Capital Market Literature Review

The purpose of the GSEs' low- and moderate-income goal is to expand conventional mortgage credit to low- and moderate-income borrowers. However, the GSEs are restricted to the secondary market, which means that they cannot originate mortgages directly. Thus, any steps initiated by the GSEs to comply with the affordable housing goals must be filtered through other mortgage market institutions to ultimately convey any benefit to the targeted borrowers. "Therefore, it is important to understand the relationship between the GSEs and primary mortgage market institutions in order to assess exactly how the activities of the GSEs (in

response to the affordable housing goals) change the behavior of these institutions, and how these changes ultimately affect targeted borrowers.” (Ambrose et al, 2002)

This section summarizes the literature that is relevant for analyzing the effects of the GSEs’ affordable housing goals on capital market outcomes. A survey of the literature on the GSEs’ influence on the primary mortgage market reveals two types of opinions: one set of analysts contends that the affordable housing goals can have positive effects on disadvantaged borrowers, through the interaction between the GSEs and the primary mortgage market; another set emphasizes that, even if such positive effects do exist, the impacts are very limited.

Among the representative analyses that suggest that the affordable housing goals can have positive effects are HUD’s (2004) regulatory analysis and Ambrose et al.’s (2002) study.

HUD’s regulatory analysis of the affordable housing goals provides “a qualitative discussion of how the GSEs respond to the housing goals, referring to the types of activities the GSEs have implemented to meet past housing goal targets.” “In summary, the GSEs have introduced targeted programs, made adjustments to their underwriting standards, moved into new market areas (e.g., subprime lending), and employed various methods (e.g., partnerships with local governments and non-profit groups) to reach out to low-income borrowers and their communities—and as a result, they have improved their affordable lending performance relative to the primary market.” (HUD, 2004, P. III 28)

More specifically, the GSEs have adopted several strategies to meet the affordable housing goals: First, over the last decade the GSEs have increased flexibility in their mortgage underwriting guidelines, and these liberalizations of their guidelines played a significant role in the increase in affordable lending since the 1990s. (HUD, 2004, III-29) The GSEs can influence the behavior of primary mortgage market institutions because “the GSEs’ guidelines are used by almost all mortgage originators, even if they do not plan to sell the mortgages they originate to the enterprises.” Thus, almost all conventional mortgage loans are written using the GSEs’ guidelines to evaluate mortgage applications. (HUD, 2004, III-29) Echoing this point, Bostic and Gabriel (2006) cited Myers’ (2002)¹⁴ argument that lenders have a greater incentive to approve those loans most likely to be purchased by the GSEs, because increased liquidity is realized only if the GSEs purchase the originated loans,¹⁵ and that Myers finds supporting evidence for this argument. Second, “The GSEs have recently been introducing low-downpayment programs aimed at wealth-constrained borrowers.” In this way they can help to remove an important impediment to homeownership for disadvantaged borrowers – lack of sufficient resources to make the down payment (HUD, 2004, III-30). Finally, the GSEs purchase seasoned mortgages (mortgages originated in a year prior to the year of purchase) which qualify for the affordable housing goals from portfolio lenders, thereby increasing the availability of credit in the primary mortgage market. In other words, the GSEs’ purchases of CRA¹⁶-type loans from bank and thrift portfolios of seasoned mortgages, in which high shares of the mortgages are goal-qualifying,

¹⁴ S. Myers, Government-sponsored enterprise secondary market decisions: Effects on racial disparities in home mortgage loan rejection rates, *Cityscape* 6 (2002) 85-113.

¹⁵ Fannie Mae and Freddie Mac are duopolists in the secondary market for conventional conforming mortgages, because the special privileges that they enjoy give them “a significant competitive advantage” in that segment of the secondary market which no other player can compete with. (Frame and White, 2005)

¹⁶ Community Reinvestment Act

provide additional capital and liquidity for these institutions to re-invest in their local market (HUD, 2004, III-30).

The regulatory analysis argues that, “the economics literature indicates that the types of programs the GSEs have introduced and the nature of their underwriting changes both have the potential to reduce well known barriers to homeownership, such as lack of downpayment and income and poor credit history. Thus, in that sense, the GSEs have been moving in the right direction.” (HUD, 2004, P. III 28) However, the analysis also acknowledges that, “there remain questions about how far and how aggressive they have been in reaching out to lower income families and underserved neighborhoods.” (HUD, 2004, P. III 28)

HUD’s regulatory analysis also points out that, “the GSEs historically have not been leading the market in purchasing single-family, owner-occupied loans that qualify for the housing goals.... evidence suggests that there is a significant population of potential homebuyers who are likely to respond well to increased homeownership opportunities produced by increased GSE purchases (of single-family home purchase mortgages)”. (HUD, 2004, P. III 13)

Ambrose et al (2002) review the impact of GSEs on mortgage operations, and point out that “the size of the GSEs’ respective mortgage operations, together with the ‘implicit’ Federal guarantee arising from their Federal charters, results in a significant cost advantage over other private institutions”, and they also cited a study whose evidence suggests that such a cost advantage, in the form of mortgage interest rates reduction brought by the GSEs, resulted in less stringent underwriting standards. So the GSEs’ mortgage purchase activities have a direct impact on the

supply of credit to lower income borrowers. It can be inferred from this line of reasoning that if more disadvantaged borrowers are made eligible to receive mortgages qualified to be purchased by the GSEs, then those borrowers could also benefit from the cost savings brought by the GSEs' secondary market operations. Ambrose et al (2002) cited some other studies which argue that the GSEs' underwriting changes, as a result of the affordable housing goals, make it easier for income and wealth constrained borrowers to qualify for standard conventional loans, and this has made homeownership more obtainable. However, Ambrose et al (2002) point out that "the competitiveness of the primary market determines the extent to which savings resulting from GSE secondary market actions are transmitted to borrowers. ... Competition in targeted areas may be significantly less than in non-targeted areas. Thus, primary market institutions, in targeted areas with few competitors, could potentially capture the cost reductions resulting from GSE secondary market actions." They also argue that, "similarly, the effect of changes in GSE underwriting guidelines must be viewed in conjunction with mortgage insurer underwriting standards." This is because while mortgage originators are concerned with borrower default risk, the majority of credit risk is borne by the mortgage insurer. In the case of conventional mortgages, private mortgage insurance (PMI) companies carry this risk. Since it is the bearer of credit risk that is the critical participant in the mortgage market, the underwriting standards of PMIs are important determinants of the decisions made by lenders in the primary market. In 2000, about 41 percent of the home-purchase mortgages purchased by Fannie Mae and about 43 percent of the home-purchase mortgages purchased by Freddie Mac were backed by PMIs.

Ambrose et al (2002) put forward a main rationale for the affordable housing goals — to mitigate the effects of credit rationing in the conventional mortgage market. As they said, "implicit in the

creation of the affordable housing goals is the notion that the mortgage markets are not meeting the demands for credit from all potential borrowers, specifically lower income and minority borrowers. As a result, the affordable housing goals are designed to ensure that credit is being extended to those areas that otherwise might not have access to conventional mortgage credit.”

“Credit rationing occurs when the demand for mortgage credit exceeds the supply of funds for any given interest rate quoted by the lender. Consequently, mortgage credit is allocated to borrowers via some non-price mechanism. With mortgage credit, the rationing mechanisms include down payment (e.g. wealth) constraints, required payment to income ratios, and other underwriting standards.” Echoing the opinion in HUD’s (2004) regulatory analysis, Ambrose et al (2002) cited a study which estimated that a considerable portion of lower income renter households were actually qualified for homeownership, therefore suggesting that a significant number of lower income households exist for which the GSE affordable housing programs could help make homeownership possible. However, this rationale may be vulnerable to the criticism that those borrowers who are “rationed out” of the conventional conforming mortgage market can usually get government insured mortgages (e.g., FHA mortgages) or subprime mortgages, albeit at higher borrowing costs, which means that they are not “rationed out” of the whole mortgage market. The borrowers “rationed out” of the conventional mortgage market are rated by market as more risky, so pricing based on credit risk would lead them to receive loans with higher interest rates. In this view, the claim that a certain group of borrowers who do not meet the minimum underwriting qualifications set by the conventional mortgage market should be given access to credit in that market is arbitrary, and there is no justification for policy intervention to expand conventional mortgage credit to people who otherwise cannot obtain it. While more evidence is needed to determine whether the claimed “credit rationing” is a market

failure, the implication for this research is apparent: to the extent that the affordable housing goals will only help the borrowers who would otherwise take out more costly mortgages to obtain conventional mortgages, there will be no net effect of the affordable housing goals in increasing homeownership.

Based on their survey of literature, Ambrose et al (2002) conclude that, “GSE purchasing activity may influence the primary mortgage market in (at least) two ways. First, by increasing the supply of mortgage credit to (either targeted or non-targeted) borrowers, GSE purchases may lower effective borrowing costs. Second, if credit rationing exists in the primary mortgage market, then housing goals that require GSEs to alter the quantity of targeted loans purchased may simply increase the supply of mortgage credit available for targeted borrowers without having any effect on mortgage interest rates. Consequently, ... fewer targeted households would be “rationed-out” of the primary mortgage market. In this environment, the observable implication of the GSE affordable housing goals would be an increase in homeownership rates for targeted households.” However, regarding the first effect, they caution that to the extent that GSE purchase activity increases the risk profile of borrowers in the conventional mortgage market, a corresponding increase in PMI premiums would be expected. As a result, it is unclear whether the expansion of mortgage credit to targeted borrowers would result in lower borrowing costs.

Some studies question the positive effects of the GSE purchase activities on homebuyers. They include Heuson, Passmore and Sparks (2001) and Passmore (2003).

Heuson et al (2001) develop “a model of the interactions between borrowers, originators, and a securitizer in primary and secondary mortgage markets.” It is important to note that they treat the securitizer as a price-taker in the primary mortgage market but a monopolist in the secondary market. Also, “the securitizer here is assumed to have the status of a government-sponsored enterprise, which can convert one dollar of mortgages into one dollar of assets and still create the liquidity premium.” Their model holds that, “in the secondary market, the securitizer adds liquidity and plays a strategic game with mortgage originators. The securitizer sets the price at which it will purchase mortgages and the credit-score standard that qualifies a mortgage for purchase.” Heuson et al investigate two potential links between securitization and mortgage rates. First, they analyze whether a portion of the liquidity premium gets passed on to borrowers in the form of a lower mortgage rate. The theoretical result of their model “suggests that the liquidity premium from securitizing mortgages may have little or no effect on mortgage rates.” “The model sheds light on the economic conditions under which securitization is likely to have an impact on mortgages rates and access to mortgage credit. If the demand for credit is relatively high in the model, then securitization has no effect on the mortgage rate and loan volume. If conditions are at the opposite extreme, then securitization lowers the mortgage rate and improves credit access. These results suggest that securitization may exacerbate fluctuations in mortgage rates, lowering rate only when they would otherwise be low.” Second, and consistent with recent empirical results, Heuson et al derive an inverse correlation between the volume of securitization and mortgage rates. However, the causation is reversed from the standard rendering. In their model, a decline in the mortgage rate causes increased securitization rather than the other way around.

Heuson et al's (2001) study has an important implication for assessing the rationale for the affordable housing goals. If the two GSEs together act as a monopolist in the secondary mortgage market, then mortgage securitization may have little or no effect on the mortgage rate and loan volume. This means that the affordable housing goals (which are supposed to lead to an increased level of securitization of mortgages originated to the lower-income households) will have virtually no effect on the targeted households' borrowing costs and access to credit, thus having no effect in increasing the homeownership rate of the targeted group.

However, since Fannie Mae and Freddie Mac are duopolists in the secondary market for conventional conforming mortgages, it remains to be examined whether or not their combined effect on the primary mortgage market resembles the one produced by a monopolist.

In a related study, Passmore, Sparks and Ingpen (2002) "find that GSEs (compared with private firms) generally – but not always – lower mortgage rates, particularly when the GSEs behave competitively."

The GSEs' effect of lowering mortgage rates of conventional conforming mortgages is heavily studied and debated. Though the GSEs' borrowing advantage should be relatively straightforward to measure, it is controversial whether the GSEs' borrowing advantages benefit the homebuyers through lower mortgage rates. Passmore (2003) makes an important contribution to the debate by estimating the GSEs' influence on the differences between jumbo and conforming mortgage rates. He points out that, "the GSEs' implicit subsidy mainly takes the form of lower funding costs. To pass these lower costs on to homeowners requires that GSE

shareholders not capture this subsidy in the form of increased profits. Even if a mechanism exists that forces the GSEs to transmit this subsidy on to mortgage originators, these originators may also capture some or all of the subsidy and not pass it on to homeowners. ... (Therefore), the GSEs' presence may or may not change mortgage rates very much." While many studies have focused on the differences in mortgage rates observed on mortgages that exceed the size limit imposed on GSE mortgage purchases (jumbo mortgages) and mortgages below this size limit (often referred to as conforming mortgages), Passmore (2003) believes that the jumbo-conforming difference is a poor measure of the GSEs' influence on rates paid by the average mortgage borrower, because other factors besides GSEs influence the differences between jumbo and conforming mortgage rates. Controlling for such factors (for example, the credit risk), Passmore (2003) estimates that "the activities of the GSEs seem to typically account for about 6.6 basis points of the difference between jumbo and conforming mortgage rates". He concludes that "the GSEs' implicit subsidy does not appear to have substantially increased homeownership or homebuilding because the estimated effect of the GSEs on mortgage rates is small".

Since the earlier analyses by HUD (2004) and Ambrose et al. (2002), studies on the affordable housing goals rarely engage in a detailed theoretical analysis of this regulation's effect on the primary mortgage market. One exception is Avery and Brevoort's (2011), which depicts three possible outcomes in the mortgage market resulting from the implementation of the affordable housing goals: First, the GSE goals may have little or no effect on the activities of the GSEs, and there would be at most minimal changes in the volume, pricing, or sources of credit in market; Second, the GSEs may be able to purchase more from goal-rich sources without having to alter their underwriting standards or pricing. In this scenario, the GSEs would purchase a higher

percentage of goal-satisfying loans, but produce little or no impact on the volume of lending in a market; Third, the GSEs may be motivated by the affordable housing goals to pay lenders more for qualifying loans or to buy loans they otherwise would not. If lenders respond by reducing loan prices to borrowers or by improving their underwriting to more effectively identify applicants who are creditworthy but not obviously so, mortgage credit supply will increase, potentially raising home values. However, if lenders also react by lowering their credit standards, higher rates of default could result. Avery and Brevoort (2011) examined outcomes in the mortgage market in underserved geographic areas defined by the geographically targeted goal. Their tests show little evidence that the GSE goals caused excessive or less prudent lending than otherwise would have taken place, nor do their tests support the view that the GSE goals contributed to house prices growth during the 2001-2006 subprime expansion. All their findings are against the third possibility conjectured. However, they caution that since their tests are indirect, the test results can't *prove* that the GSE goals did *not* cause or contribute to the subprime crisis.

In summary, the studies reviewed in this literature survey have several implications for empirical analysis. Given that the GSEs' impact on borrowers' access to mortgage credit and borrowing costs is indirect, it is unclear whether the affordable housing goals will achieve their policy objectives. If the affordable housing goals are effective, then the effect of this regulation will be lower mortgage rates or increased access to mortgage credit for the targeted homebuyers of this policy, or both. Either way, the effect will be reflected in increased homeownership rates for the targeted households, if the supply of owner-occupied housing is elastic.

Yet another possible outcome, already mentioned in the critique of Ambrose et al.'s (2002) "credit rationing" theory, should be noted about the GSEs' improved affordable lending performance under the affordable goals: intrasecondary-market and intraprimaries-market substitution effects as suggested by Freeman, Galster and Malega (2006). They point out the possibility that HUD purchasing requirements for the GSEs may merely result in the same supply of mortgages but a substitution from non-GSE to GSE purchasers. A related intraprimaries-market effect may transpire. Borrowers may simply switch from close substitute products, particularly FHA loans, but with little net increase in aggregate liquidity. HUD's regulatory analysis of the affordable goals also recognizes such a substitution from non-GSE to GSE purchases. It states that homebuyers who purchase homes with FHA or subprime (non-GSE) financing could with proper outreach benefit from a less costly GSE mortgage. However, HUD's regulatory analysis holds that the affordable housing goals can lead to a net increase in the homeownership rate, because net new homebuyers could be added through greater outreach or accelerated transitions. (HUD, 2004, P.III 34) This issue also testifies to the importance of examining the housing market outcomes of this regulation.

Housing Market Outcomes Literature Review

HUD's regulatory analysis (2004) asserts that "the goals could have homeownership impacts with net additions ... Despite the difficulty in coming to any precise quantification, it should be clear that the resulting impacts are nevertheless, real and significant" (HUD, 2004, III 34). In

contrast, Frame and White (2005) cite three studies¹⁷ and state that it does not appear that the GSEs' activities have appreciably affected the rate of homeownership in the United States. HUD (2004, P. III-81) also points out that "there are few studies that have estimated the effectiveness of different policy approaches, largely due to the challenges of isolating program impacts in a market context. The economics literature on estimating the impacts of specific programs on homeownership is thin. Those studies that exist often do not find much impact." (However, HUD argues that this probably reflects more about the adequacy of the data and studies than it does about programs' impact on homeownership) (HUD, 2004, III 34).

HUD's regulatory analysis (2004) points out that research is needed to determine the extent to which market outcomes are realized in relation to the affordable housing goals, and that a promising start in such research is Ambrose et al's (2002) study. (HUD, 2004, III 81)

Ambrose et al (2002) test such a hypothesis: "Fannie Mae and Freddie Mac, after FHEFSSA, made significant changes to their business practices ... By purchasing loans originated with more flexible underwriting guidelines related to downpayment and debt-to-income ratio requirements, Fannie Mae and Freddie Mac lower effective borrowing costs ... Consequently, a higher proportion of borrowers should be able to qualify for such loans, which should create attendant higher homeownership rates for target groups." They conduct national analysis of GSE market shares and homeownership rates, "to examine whether the observed spatial variation in rates of

¹⁷ Feldman, Ronald. 2002. "Mortgage Rates, Homeownership Rates, and Government-Sponsored Enterprises." *Federal Reserve Bank of Minneapolis, The Region*. 16:1, pp. 4-24.

Painter, Gary and Christian L. Redfearn. 2002. "The Role of Interest Rates in Influencing Long-Run Homeownership Rates." *Journal of Real Estate Finance and Economics*. September/December, 25, pp. 243-67.

Freeman, Lance, George Galster and Ron Malega. 2003. "The Impact of Secondary Mortgage Market and GSE Purchases on Underserved Neighborhood Housing Markets: A Cleveland Case Study." Mimeo, Report to the U.S. Department of Housing and Urban Affairs, January.

homeownership during the 1990s is related to spatial variation in GSE purchasing activity.” In the model, GSE market share is measured as the number of loans purchased by the GSEs. They “estimate metropolitan area rates of homeownership for all households and for low- and moderate-income households using the 1991 and 1997 National American Housing Survey (AHS). ... then relate homeownership rates, changes in homeownership rates, and spreads between the all-household and the low- and moderate-income household homeownership rates to GSE purchasing activity, controlling for other variables likely to influence homeownership.” Ambrose et al “find no statistical relationship relating changes in rates of homeownership between 1991 and 1997 to GSE purchasing activity or to other socio-economic variables. (They) find some statistical evidence that GSE purchases of low- and moderate-income mortgages reduced the disparity in homeownership rates between low- and moderate-income and all households.”

Ambrose et al (2002) point out that “(their) statistical results are weak” and that their empirical analysis, which “suggests that the GSE affordable goals help to make homeownership more attainable for target families”, is “preliminary in nature”. In my view, these comments are mostly based on the fact that among the five models tested in their research, only the fifth model seems to provide evidence that the GSE affordable goals have a favorable effect. The first four models, which relate spatial variation in homeownership rates for all households in 1997, 1997 spatial variation in homeownership rates for low- and moderate-income households, changes in homeownership rates over the 1991-1997 period for all households, and changes in homeownership rates for low- and moderate-income households to GSE market shares, show that the variable “GSE market shares” is not statistically significant at conventional levels. The

fifth model relates variation in the spread between the all household and the low- and moderate-income household homeownership rates to GSE market shares. In this model the variable “GSE market shares” is statistically significant, and there is an inverse relationship between the GSEs’ market share of conventional loans originated to low- and moderate-income borrowers and the change in homeownership disparities between low- and moderate-income and higher income households. In my opinion, the results from the fifth model are questionable, because the observed effect of reduced homeownership disparities may be due to the influence of other factors rather than the GSE purchase activities. Though Ambrose et al (2002) have controlled for some economic and institutional factors in the fifth model, the problem of omitted variable bias may still exist: for example, the model doesn’t control for the changes in low- and moderate-income household income or the changes in low- and moderate-income household income relative to all household income, which may have caused low- and moderate-income families to achieve homeownership rate gains relative to higher income families. Ambrose et al (2002) also point out that “it is difficult to sort out the separate effects of simultaneous, multiple economic forces and public programs within urban areas, and data sources are limited”.

Bostic and Gabriel’s (2006) paper adds to this small literature that has focused on GSE purchases and housing market outcomes. Their research seeks direct evidence of the effects of GSE loan purchase activity on California housing markets. “To identify GSE effects, the test framework (of this paper) exploits differences in the definition of lower-income and underserved neighborhoods under the 1992 GSE Act, which specifies loan purchase goals for the GSEs, and the 1977 Community Reinvestment Act, which governs loan origination activity among the federally-insured depository institutions.” Bostic and Gabriel identify a set of census tracts which

fall only under the regulatory attention of the GSEs (namely, the neighborhoods with median incomes between 80 and 90 percent of the area median income), and they use changes in measures of neighborhood and housing market activity in this set of census tracts, compared to changes in similar census tracts not covered by GSE regulation or CRA (namely, the neighborhoods with median incomes between 90 and 100 percent of the area median income), as an indication of the impact of GSE loan purchase activities. Their research finding “suggests little efficacy of the GSE home loan purchase goals in elevating the homeownership and housing conditions of targeted and underserved neighborhoods (during the 1990s).” But Bostic and Gabriel point to two possibilities that could explain the lack of an observed effect: the obvious one is that the incentives do not have a material impact on housing market outcomes, the other one is that California’s position as a high cost market limits the efficacy of GSE purchase activity.

Another related paper worth noting is Ambrose and Thibodeau’s (2004) study. Though this paper does not evaluate the effects of GSE purchases on homeownership rates, its research methodology and results will shed some light on this question. Ambrose and Thibodeau (2004) empirically estimate the effect that the Affordable Housing Goals had on the primary mortgage market. The central question examined is whether the GSE Affordable Housing Goals increased the supply of mortgage credit in so-called geo-targeted areas. In this study, the percentage of the population that resides in underserved census tracts is used as a measure of whether an MSA is geo-targeted. The study finds that the Affordable Housing Goals had a limited effect after controlling for other supply and demand factors. And the analysis suggests that this effect results primarily from the mortgage activity in 1998. However, this study can’t distinguish the effects of

the GSE affordable goals from those of other policies. A full interpretation of the results is, as the authors put it: “This empirically supports the hypothesis that the various programs designed to promote greater credit availability (e.g. CRA and GSE Affordable Housing Goals) have had a positive impact on the supply of mortgage credit.”

Additionally, Freeman, Galster and Malega’s (2006) study on the impact of secondary mortgage market and GSE purchases on home prices in underserved neighborhood markets in Cleveland should be mentioned because they posit a lagged relationship between secondary-market activity and housing-market response, which will be tested in this study. Freeman, Galster and Malega (2006) suggest two reasons for positing the lagged relationship: First, in the case of prospective loans which do not clearly meet all underwriting criteria, the primary lender cannot have a clear-cut expectation about their marketability in the secondary market, and such loans perhaps will need to be seasoned in portfolio before they can be sold. Freeman et al. (2006) believe that a primary lender’s expectations about the probability of the secondary market’s eventually purchasing a prospective loan in a certain area will be related to the latter’s recent past performance in this regard. Second, the marginal increases in liquidity generated when a loan is purchased by the secondary market at time t may not be lent by the lenders in the primary market immediately; but rather, sizeable shares of the marginal liquidity may remain to be lent as potential additional mortgages many months after t , so that the impacts on housing market should be measured with a lag. However, it is not sufficient to solely estimate the lagged effects of the GSEs’ purchasing activities on the housing market, because the GSEs do not only purchase the seasoned mortgages, and arguably, the mortgage supply available to the disadvantaged borrowers is sometimes exceeded by demand rather than the other way around.

For these reasons and the fact that most primary lenders in the conventional conforming market adopt the GSEs' underwriting standards immediately and the GSEs' new product offerings are offered by major lenders in that market (HUD, 2004, III-35), the effect of the GSEs' purchasing activity may manifest itself soon after the purchases occur. Therefore, unlike Freeman et al.'s (2006) model which examines the impact of the intensity of secondary-market purchasing activity in the prior two years on housing-market outcome, this study will test the effect of the GSEs' affordable lending performance in the prior one year and in the same year on housing-market outcome.

The Empirical Approach of This Study and This Study's Contributions to Literature

The preceding discussion of the prominent empirical analyses on the affordable housing goals' effect in increasing homeownership for lower-income households lays the foundation for explaining the feasibility and desirability of the empirical approach used in this paper. The following four paragraphs will first describe the hypothesis and empirical approach of this study. The regression model of this study is described in a subsequent section.

The purpose of this paper is to assess the effectiveness of one of the affordable housing goals -- the "low- and moderate-income goal" -- in promoting homeownership for low- and moderate-income families. As discussed earlier in this paper, literature suggests that the "affordable housing goals" regulation is expected to increase homeownership rates for targeted households, but the extent of the effect is unclear. Therefore, in this study, the null hypothesis is that the low- and moderate-income goal has no impact on the likelihood of American low- and moderate-

income families achieving homeownership. The alternative hypothesis is that the goal has a favorable impact of increasing that likelihood.

Similar to Ambrose et al's (2002) study, this paper relates variation in the GSEs' affordable lending performance under the affordable housing goals in different MSAs to variation in housing market outcomes in those MSAs. However, unlike the existing studies which use either MSA or census tract as the unit of analysis, this study uses household as the unit of analysis. The study is intended to assess the impact of the GSEs' purchasing mortgages for low- and moderate-income borrowers in a certain MSA on the likelihood of homeownership by individual low- and moderate- income households in this MSA, controlling for household-level factors and other MSA-level factors that theory and literature have suggested are important determinants of homeownership. This design has three main advantages over the approach of previous studies: (1) the obvious advantage is an increase in sample size and statistical validity of the analysis; (2) This study's regression model controls for each household's socio-economic and demographic characteristics, so it can pick up the nuances averaged out by models using aggregate data; (3) Using household as the unit of analysis allows controlling for fixed effects among different MSAs, which can help control unobservable variables that may cause a bias in the coefficient estimate of the GSE affordable goals variable. Given the difficulty in sorting out the separate effects of simultaneous, multiple economic forces and public programs within urban areas, this feature is an important advantage.

Another important feature of this study is that it uses the GSEs' percentage-of-business for low- and moderate-income families as the measure of the GSEs' affordable lending performance.

Because the question examined is the effect of the low- and moderate-income goal, the proper measure of this policy intervention would be “what percent of the loans purchased by the GSEs are originated to low- and moderate- income families?”, which is the very measure HUD uses to judge whether the GSEs’ performances meet the requirements of the affordable goals. In contrast, previous studies did not use this measure of percentage-of-business for low- and moderate-income families, and thus they cannot directly reveal the association between the housing market outcomes and the regulation. For example, Bostic and Gabriel’s (2006) paper seeks to establish whether GSE attention to the low-moderate income and special affordability goals is associated with improved housing market outcomes. To do so, they compute the proportion of households in each sample tract that (if they were to receive a mortgage that was purchased by a GSE) would qualify under the low-moderate income or special affordability GSE home loan purchase goals. For each goal, they rank tracts on that basis and then create a categorical variable indicating those tracts which comprise the top 25 percent of the ranking. This method could possibly fail to link the GSEs’ affordable lending performance across census tracts and the housing market outcomes in those tracts. It is important to note that “the Housing Goals are defined on a national level. The GSEs are not required to meet the Housing Goals in individual MSAs (or census tracts)” (HUD, 2002, Table 9 footnotes). Therefore, the tracts with a high proportion of the targeted households are not necessarily the ones where the GSEs’ percentage-of-business for low- and moderate-income borrowers is relatively high. As a result, their empirical results are open to interpretations in different ways. Their results may suggest little efficacy of the GSE home loan purchase goals, as they claim; or, their results may rather suggest that there is geographic imbalance in receiving the benefit of the affordable housing goals.

Moreover, this study will use the GSEs' performance under the low- and moderate-income goal's home purchase subgoal as the measure of the GSEs' affordable lending activities.¹⁸ This is because both home purchase and refinance mortgages can qualify under the low- and moderate-income goal, but only more home purchase mortgages are expected to increase homeownership.¹⁹ HUD established subgoals for home purchase loans that qualify for the affordable housing goals to encourage the GSEs to take a leadership position in creating homeownership financing opportunities for the target groups of this regulation (HUD, 2004, III-13). Because this study intends to examine the low- and moderate-income goal's effectiveness in increasing homeownership for this regulation's target group, the GSEs' home-purchase subgoal performance is used to assess the low- and moderate-income goal's impact on the target group's homeownership probability.

Besides assessing the overall effectiveness of the low- and moderate-income goal's home-purchase subgoal on increasing the homeownership probability of the targeted group, this study also examines whether or not the low- and moderate-income goal has affected the homeownership probability of its targeted households with different income levels differently. This is because the use of performance measures (like the measures used to determine the GSEs' affordable lending performance under the affordable housing goals) may induce behavior that may improve measured performance, but diverge from the performance measures' purpose. Such

¹⁸ Although the home purchase mortgage subgoal was not in effect until 2005, this study will use the data of what the GSEs' performance under the home purchase subgoal would be in the years before 2005, calculated according to the subgoal's counting rules.

¹⁹ Refinance loans may have some effect in making homeownership sustainable at the household level. However, the period examined in this study, 2001 to 2007, is mostly a boom period for the U.S. housing market. For this reason, the effect of refinance loans on maintaining the overall homeownership rate for the target group would be negligible during this period. Therefore, this study will only evaluate the effect of the GSEs' purchases of low- and moderate-income home purchase mortgages in promoting homeownership.

unintended effects include cream-skimming and “parking” (Koning and Heinrich, 2011). With respect to the affordable housing goals, cream-skimming refers to the GSEs’ picking the best from the targeted group, and “parking” refers to the GSEs’ leaving out the worst of the targeted group. Very little research of the affordable housing goals has examined these potential unintended effects.

The methodological features of this study, together with its use of data of more recent years and its examination of whether the GSEs have cream-skimmed higher-income targeted families, make it possible to be a meaningful addition to the existing literature on this research question.

Data

The data on the percentage of the total number of single-family owner-occupied home-purchase mortgages purchased by the GSEs which are for low- and moderate-income borrowers (X_j) are provided by HUD by metropolitan areas for each year from 2000 to 2007. The data on the policy variable (X_j) are provided for Fannie Mae and Freddie Mac separately, and the weighted average of the percentages of the two GSEs is taken as the index measuring the overall GSE percentage-of-business for low- and moderate-income families in an MSA (the weight is computed as the share of number of mortgages purchased by each GSE in the total number of mortgages purchased by both GSEs in an MSA). So far there is no literature on the construction of a composite index for both GSEs’ performance under the affordable housing goals. The method adopted in this study is based on the idea of treating the two GSEs as if they were one entity and applying the same method as applied by HUD to each of the two GSEs to compute what this combined entity’s goal performance is.

The household-level data for this study are from the American Housing Survey (AHS) national data, for year 2001, 2003, 2005 and 2007. “The AHS is the largest, regular national housing sample survey in the United States” (U.S. Census Bureau, 2004). The U.S. Census Bureau conducts the AHS through personal visits and telephone interviews to obtain up-to-date housing statistics for the Department of Housing and Urban Development (HUD). The AHS provides data on apartments, single-family homes, mobile homes and vacant homes, and it contains a wealth of information on family composition, income²⁰, and recent movers, just to name a few categories which are relevant to this study. National data are collected every other year, from a fixed sample of about 50,000 homes, plus new construction each year. The survey has had the same fixed sample since 1985, which provides a panel data series on homes and changes of the households living in those homes over the years.²¹ The 2001 AHS national survey has a 90-percent overall response rate²²; The 2003 AHS national survey has an unweighted overall

²⁰ It should be noted that “the approach for obtaining household and family income prior to 2005 AHS resulted in reported income that was generally lower than in other surveys” (HUD, 2005). As revealed by a study conducted for the Census Bureau and the HUD, average household income in 1999 is 9 percent lower in the AHS than in the Current Population Survey (CPS); but family earnings are almost the same (Susin, 2003). However, as far as this study is concerned, there is no study showing to what extent the household and family incomes were underreported in the 2001 and 2003 AHS. The 2005 AHS adopted new income questions intended to increase the amount of income reported. Comparisons of median household income from the 2005 AHS, the 2005 CPS Annual Social and Economic Supplement (ASEC, 2004 income), and the 2004 American Community Survey (ACS) (2004 inflation adjusted income) indicate that neither median household income from the 2005 ASEC nor median household income from the 2004 ACS was statistically different from the 2005 AHS median household income (HUD, 2005). Anyway, this issue shouldn’t be a reason of concern for this study, because its regression analysis controls for year fixed effects.

²¹ For more information on AHS, see HUD’s introduction of it at <http://www.huduser.org/datasets/ahs.html> and “Codebook for the American Housing Survey, Public Use File: 1997 and later”, and U.S. Census Bureau (2004).

²² American Housing Survey for the United States:2001, Current Housing Reports
<http://www.census.gov/prod/2002pubs/h150-01.pdf>

response rate of 91 percent²³; and the 2005 AHS national survey has an unweighted overall response rate of 89 percent²⁴.

This study selects all the households in the AHS national data whose incomes are at or below area median family income, the criterion established by the low- and moderate-income goal, and who reside in the 66 largest MSAs in the nation, as the sample for analysis. The former criterion serves to ensure that only the households targeted by the low- and moderate-income goal are included. (The median family income data (by MSA) are obtained from HUD.) The latter criterion is intended to exclude the MSAs without adequate sample sizes from the analysis, because metropolitan area sample sizes can be rather small (e.g. less than 40 observations) in the national AHS dataset. As a result, the sample of the households that meet both criteria contains 45990 observations, and within that sample, the sample size for each MSA in a certain year ranges from 35 to 1843.

The MSA-level data sources are selected following Ambrose et al (2002), because this study adopts the MSA-level control variables except the MSA fixed effects from that study. The specific data sources for each MSA-level control variable are identified in the table explaining the variables.

²³ The weighted overall response rate was 92 percent.

American Housing Survey for the United States:2003, Current Housing Reports
<http://www.census.gov/prod/2004pubs/H150-03.pdf>

²⁴ The weighted overall response rate was 90 percent.

American Housing Survey for the United States:2005, Current Housing Reports
<http://www.census.gov/prod/2006pubs/h150-05.pdf>

The dataset analyzed in this study has a sample size of 40375. Table 1 provides the descriptive statistics of this sample, which show adequate variance of key variables. Among this low- and moderate-income group, about 48% of the households own their homes. The GSE percentages-of-business for low- and moderate-income families in the same year when the household homeownership status is observed range from 8.47% to 66.07%. The descriptive statistics of household income broken down by income quartiles are provided in Table 2.

Regression Model and Estimation Technique

The regression model assessing the goal's effectiveness for the whole target group expressed in the concise form is:

$Y_{ijt} = A + BX_{jt} + CX_{j(t-1)} + DZ_{ijt} + EY_{ijt'} + FW_{jt} + GM_j + HT_t + \mu_{ijt}$, where i denotes an individual household, j denotes an MSA, and t denotes a year. (t' denotes the time up to two years prior to t .)

The dependent variable (Y_{ijt}) is the status of homeownership, which equals 1 if a household owns the home, and equals 0 otherwise. This is to follow the practice that “tenure choice is usually examined as a dichotomous choice, where households either rent or own” (Green and Malpezzi, 2003).

X_{jt} is the policy intervention variable. As discussed earlier, the GSEs’ percentage-of-business for low- and moderate-income families in MSA is used as the measure of the GSEs’ affordable lending performance under the affordable goals. It is hypothesized that this variable is positively

associated with the dependent variable. $X_{j(t-1)}$ is included in the model to test the effect of the GSEs' low- and moderate-income percentage-of-business in MSA in the previous year.

Z_{ijt} represents the group of controlled variables which account for the household's socioeconomic and demographic characteristics, except that the household's previous homeownership status is separately denoted by Y_{ijt} . The household-level control variables are selected according to literature modeling household tenure choice (Freeman and Hamilton, 2002; Green and Malpezzi, 2003).

Freeman and Hamilton's (2002) paper provided a methodological framework in predicting tenure choice. They used separate logistic models of homeownership for blacks and whites. The controls Freeman and Hamilton (2002) adopted "can be grouped into three broader categories: financial resources, life-cycle factors, and social-status factors". "In modeling tenure choice," Freeman and Hamilton (2002) "use income, educational attainment, age, marital status, presence of children under 18, nativity status, and a measure of occupational status defined by Robert M. Hauser and John Robert Warren's (1997) index of occupational prestige as independent variables". Freeman and Hamilton were unable to include information on wealth and credit history, due to data limitations.

Drawing on Freeman and Hamilton's paper, this study includes all the control variables in their study, except the measure of occupational status. The exclusion of the measure of occupational status is because such data are not available in the American Housing Survey. Some variables already included in this study's model, such as income and educational level, may collectively

serve as a proxy for this variable. Compared to Freeman and Hamilton's, this study controls for household wealth by proxy variables.

Green and Malpezzi (2003) reviewed studies on determinants of tenure choice, and have found that many studies used "models where the probability of homeownership was found to vary with income, household composition, and so on", and that "other papers focused particularly on the role finance and tax preferences play in tenure". They concluded that the remarkably robust findings are: "First, ..., higher income households have higher probabilities of homeownership". "Older households are more likely to own, all other things being equal, as are more educated households. However, the relationship between these variables and the probability of homeownership is non-linear." "Blacks are generally found to have lower probability of homeownership, even after controlling for differences in income and other measures of socioeconomic status." In light of Green and Malpezzi's findings, this study incorporates many strengths of previous studies in terms of constructing regression model and selecting controlled variables. This study models the probability of homeownership with controls of household characteristics; it also takes into account of the role finance plays in tenure, as the paper's purpose is to assess the impact of a housing finance policy aimed at making homeownership more attainable to the target group. This study also includes in the model all the control variables whose relevance to the study of tenure choice has been proven robust.

Of great importance in selecting the household-level control variables is the selection of variables that can measure, or serve as a proxy for, the household's wealth and credit history. From the available resources in the American Housing Survey, I have selected "Food Stamp

recipient status” and “household’s previous homeownership status” to serve this purpose. Food Stamp Program’s eligibility criteria have a maximum wealth limit as well as a maximum income limit. Therefore, “Food Stamp recipient status” can be an indicator of the absence of household wealth, identifying those households with few resources. However, this variable can not distinguish households by different wealth levels among the non-Food-Stamp-recipient households, who constitute the majority of the sample. The inclusion of the variable “previous homeownership status” (Y_{ijt}) in the regression model can not only mitigate the problem of lacking a variable identifying households with relatively more wealth among the low- and moderate-income group, but also significantly increase the validity of the estimate of program impact by upgrading the research design from a Post-Test Only Comparison Group design to a Pretest-Posttest Comparison Group design. Without controlling for baseline (pretest) data, the variation in posttest data (the households’ homeownership status after the policy intervention takes place) may arguably be due to variation in pretest data (the households’ homeownership status before the policy intervention takes place). The use of the pretest score as a baseline makes the estimate of program impact, over and above the pretest, a better measure of the value added by the public policy program examined. (Langbein and Felbinger, 2006) Moreover, “previous homeownership status” can also be a proxy for a household’s credit history, in part.

This study also uses MSA-level controls (denoted by W_{jt} and M_j). Theoretically, the MSA-level control variables should include: change in housing affordability (housing price), enforcement of the Community Reinvestment Act, enforcement of the Fair Housing Act (HUD, 2001), prevalent mortgage interest rates (because of the relatively high interest elasticity of demand) (Smith et al, 1988), and etc. This study chooses to control for the various MSA-level factors for which

adequate data can be obtained (W_{jt}), and to use MSA fixed effects (M_j) to control for the variation in other important determinants of homeownership across MSAs that are difficult to measure.

In this aspect, Ambrose et al.'s (2002) paper also provides a set of control variables. One of their models relates spatial variation in homeownership rates for low- and moderate-income households to GSE market shares controlling for changes in relevant socio-economic/demographic variables. These MSA-level control variables include: household income in the MSA, the predicted conventional mortgage loan-to-value (LTV) ratios estimated via an instrumental variables regression²⁵, the percentage of underserved²⁶ census tracts, the level of and yearly change in local unemployment rate, effective interest rate²⁷, the percentage change in local house prices over the last year, the overall volatility in the local housing market, and variables that control for state laws regarding borrower rights²⁸. (They also point out that none of these control variables except “the percentage of underserved census tracts” are statistically significant at conventional levels in their empirical analyses.)

²⁵ See Ambrose and Pennington-Cross (2000) for a detailed description of the regression method.

²⁶ “Underserved” is the term introduced by HUD to describe geographically targeted census tracts as defined by the “underserved areas housing goal” (also known as the “geographically targeted goal”). Within metropolitan areas, an “underserved” census tract is one with a median family income less than or equal to 90 percent of area median, or with a minority population proportion of at least 30 percent and a tract median family income less than or equal to 120 percent of area median (slightly different rules apply in nonmetropolitan areas) (HUD, 2004).

²⁷ “Effective interest rates will vary across MSAs in response to systematic differences in risk associated with local economic factors as well as variations in legal default protections afforded lenders.” (Ambrose et al., 2002)

²⁸ To control for differences in state foreclosure laws, Ambrose et al. (2002) classify states based on judicial versus non-judicial foreclosure laws and deficiency versus non-deficiency judgment states. (Judicial foreclosure requires lenders seek a court order to foreclose on property while non-judicial laws create a more expedited foreclosure process. Anti-deficiency statutes are state laws that limit the ability of lenders to seek deficiency judgments against borrower assets or income to cover default losses.) All the states are classified into four categories. The classification is provided in Ambrose et al.'s (2002) paper.

Besides some MSA-level control variables used by Ambrose et al (2002) which are applicable to this study, this study will also adopt an additional one: the subprime share of the mortgage market. This variable is necessary because the time period covered in this study experienced a booming subprime mortgage market, which made mortgage credits much more available to the relatively risky borrowers than before, and that boosted demand for housing. For example, the growth in the volume of subprime mortgages helped propel the homeownership rate to a record 69 percent in 2004 (Andrews, 2005). It is evident by now that, many subprime lenders took on undue risks before the subprime mortgage crisis broke out, so the variables in this study's model that measure the aggregate mortgage lending risks in an MSA won't adequately proxy for the volume of mortgage supply in that market. Furthermore, although the GSEs were involved in purchasing the subprime mortgages and subprime-backed securities, the subprime market's liquidity is predominantly provided through the issuance of private label mortgage backed securities (Temkin, Johnson and Levy, 2002). So the variables measuring the GSEs' performance under the affordable housing goals can not indicate the subprime mortgage market's volume, either. Therefore, a measurement of the subprime market volume must be included in this study's model.

T_t denotes a group of dummy variables to measure year fixed effects.

The regression model assessing the goal's effectiveness by household income quartiles is the same as the overall effectiveness model, except that $CX_{j(t-1)}$ is dropped, BX_{jt} is replaced by $B_1X_{jt}I_{1ijt} + B_2X_{jt}I_{2ijt} + B_3X_{jt}I_{3ijt} + B_4X_{jt}I_{4ijt}$, where $I_{1ijt} - I_{4ijt}$ are dummy variables indicating which

income quartile a household belongs to, and household income is also dropped from the control variables.

Tables for Explaining the Variables

Table A: The Dependent Variable and Policy Intervention Variable

<u>Variable type</u>	<u>Variable name</u>	<u>Interpretation of variable value</u>	<u>Data source</u>
Dependent variable	homeownership	1: the household owns the home 0: the household does not own the home	the American Housing Survey (AHS) national data, for year 2001, 2003, 2005 and 2007
Policy intervention variable	gse_subgoal_performance gse_subgoal_pe	the percent of the home-purchase loans purchased by the GSEs that are originated to low- and moderate- income families in MSA in the same year when the household homeownership status is observed; the GSE low- and moderate-income percentage-of-	the US Department of Housing and Urban Development (HUD), year 2000-2007

	performance_1yearago	business for home-purchase mortgages in MSA one year before the homeownership status is observed	
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Table B: Household-Level Control Variables

<u>Factors</u>	<u>Variable name</u>	<u>Interpretation of variable value</u>	<u>Data source</u>
Household income	income_42 income_43 income_44	All are dummy variables. 1 means belonging to that income quartile and 0 means not. A greater number in the suffix denotes a higher income bracket. The reference group is income_41.	the American Housing Survey (AHS) national data, for year 2001, 2003, 2005 and 2007
Householder race	Black Asian Otherrace	All are dummy variables. 1 means “yes” and 0 means “no”. The reference group is “white”.	
Householder’s education level	Edu1 Edu2 Edu3	“below high school graduate”; “high school graduate”; “above high school graduate and below Bachelor’s degree”;	

	Edu4 Edu5	<p>“Bachelor’s degree”; “above Bachelor’s degree”.</p> <p>All are dummy variables. 1 means “yes” and 0 means “no”. The reference group is “edu1”.</p>	
Number of children in a household	children	Number of children	
Householder’s marital status	Nevermarried Widowed Divorced	<p>Never married; Widowed; Divorced or separated;</p> <p>All are dummy variables. 1 means “yes” and 0 means “no”. The reference group is “married”.</p>	
Householder age	lnage	Natural logarithm of householder age	
Householder nativity status	nativeuscit natuuscit nonuscit	<p>Dummy variables which equal 1, when the householder is a—</p> <p>Native US citizen</p> <p>US citizen by naturalization</p> <p>Non-US citizen</p> <p>, and equal 0 otherwise.</p>	

		The reference group is “native US citizen”.	
Food stamps recipient or not	foodstamps	Received food stamps in last 12 months? 1 means “yes” and 0 means “no”.	
Previous homeownership status	previous_tenure_2year	1: has owned a home within the last two years 0: has never owned a home within the last two years	

Table C: MSA-Level Control Variables

<u>Factors</u>	<u>Variable name</u>	<u>Interpretation of variable value</u>	<u>Data source</u>
change in housing price	hp_change_1y	The percentage change in local house prices over the last year	calculated using the Office of Federal Housing Enterprise Oversight (OFHEO) MSA Repeat Sales Index
	hp_change_10y	The percentage change in local house prices over the last 10 years	
the overall volatility in the local housing	hp_volatility	the standard deviation of the percentage change in local house prices over the last 10	calculated using the Office of Federal Housing Enterprise

market		years	Oversight (OFHEO) MSA Repeat Sales Index
effective interest rate	effective_interest_rate	Average annual effective interest rate at MSA level when the MSA information is available and state level otherwise.	Federal Housing Finance Board's Monthly Interest Rate Survey (MIRS) ²⁹
Subprime lending	subprime_share	the subprime share of the mortgages originated to low- and moderate- income families	Calculated from Home Mortgage Disclosure Act (HMDA) database and the US Department of Housing and Urban Development (HUD)'s subprime lender list
MSA fixed effects	smsa160-smsa8960	All are dummy variables. 1 means "yes" and 0 means "no". The reference group is smsa4480 (Los Angeles-Long Beach, CA).	The MSA where a household resides in can be identified in AHS

Table D: Year Fixed Effects Control Variables

²⁹ "The FHFB's MIRS covers approximately three percent of all conventional, single family, purchase money mortgages granted.... 33 MSAs are reported quarterly and for each state." (Ambrose et al., 2002)

Factors	Variable name	Interpretation of variable value	Data source
Year fixed effects	Year2003 Year2005 year2007	All are dummy variables. 1 means “yes” and 0 means “no”. The reference group is year 2001.	The year when the homeownership status is observed can be identified in AHS

The regression equation is estimated for a sample of housing units occupied by low- and moderate-income families living in the 66 largest MSAs surveyed by the AHS in year 2001, 2003, 2005 and 2007. Because the dependent variable is dichotomous, an econometric procedure appropriate for it (Probit) is used, and marginal effects will also be calculated. The estimation sample contains combined cross-sectional time-series data, so a cross-sectional time-series analysis with year and MSA fixed effects is conducted, with clustered estimates of standard errors for each MSA obtained.

Results

Table 3 reports the marginal effects of Probit regression of the homeownership probability model with the variables of interest as the GSE low- and moderate-income percentage-of-business for home-purchase mortgages (the GSEs’ home-purchase subgoal performance) in the same year when the homeownership status is observed and one year before that. This model assesses the overall effectiveness of the low- and moderate-income goal’s home-purchase subgoal on

increasing the homeownership probability of the low- and moderate-income families. A variation of this model that doesn't include the GSE low- and moderate-income percentage-of-business for home-purchase mortgages one year before the homeownership status is observed is also examined, but its regression result has no substantial difference from that reported in Table 3. Therefore, its result is not reported. Table 4 reports the marginal effects of Probit regression of the homeownership probability model with the variables of interest as the GSE low- and moderate-income percentage-of-business for home-purchase mortgages in the same year when the homeownership status is observed interacted with the four dummy variables indicating which income quartile the household belongs to. This model tests whether or not the low- and moderate-income goal has affected the homeownership probability of its targeted households with different income levels differently.

While the statistical significance test results exhibited in Table 3 and Table 4 are from a two-tailed test, for some independent variables in this study, a one-tailed test is more suitable, because theory and literature have clearly indicated that these variables are expected to affect households' likelihood of homeownership in a certain direction. For example, since theory and literature have clearly stated that the GSEs' higher percentage-of-business for low- and moderate-income families is expected to increase the homeownership probability of the target group, if it has any effect at all, the one-tailed statistical significance test should be applied to the coefficient estimate of the GSE variable. Therefore, the critical value of the Z-statistic for a statistical significance test at the 5% level applicable to the GSE variable should be 1.65 (corresponding to a P-value of 0.05 in a one-tailed test), rather than 1.96 (corresponding to a P-value of 0.05 in a two-tailed test).

As shown in Table 3, the model's pseudo R^2 is 0.5545, adequate for a model of its kind. In this model, *neither coefficient estimate of the GSE low- and moderate-income percentage-of-business variables is statistically significant at the 5% level for a one-tailed test.* The result of this model shows no evidence that the Low- and Moderate-Income Housing Goal has discernibly increased the likelihood of homeownership for this policy's target group as a whole.

The coefficient estimates of the household-level control variables are all statistically significant at the 5% level, and the signs and magnitudes of the marginal effects of these variables are not against expectation. Compared to being in the lowest income quartile, on average being in the third highest income quartile leads to a 7.39-percentage increase in homeownership probability, being in the second highest income quartile leads to a 13.48-percentage increase, and being in the highest income quartile leads to a 23.50-percentage increase. The higher a householder's educational attainment is, the higher the household's homeownership likelihood becomes.

Householder being minority corresponds to lower homeownership likelihood. As householder's age increases, the household's probability of achieving homeownership rises. Householder being never married, widowed, or divorced (including separated) lowers the household's homeownership likelihood. An increase in the number of children corresponds to an increase in homeownership probability. Compared to householder being a native US citizen, householder being a US citizen by naturalization is positively associated with homeownership likelihood, while householder being a non-US citizen is negatively associated with homeownership likelihood. Being a Food Stamp recipient in last 12 months is associated with a 19.23-percentage

reduction in homeownership probability. Having owned a home within the last two years raises a household's likelihood of owning a home now by 74.79 percentages.

None of the coefficient estimates of the MSA-level control variables is statistically significant at the 5% level, except that average annual effective interest rate is statistically significant at the 5% level for a one-tailed test. An increase in effective interest rate above 6.24 percent, the mean for the sample, decreases homeownership probability.

Almost all the MSA fixed effects dummy variables are statistically significant at the 5% level. Only the year fixed effect dummy variable for 2007 is statistically significant at the 5% level. Compared to the reference year 2001, homeownership likelihood in 2007 is 7.54 percentages lower, holding all else in the regression model constant.

The regression results of the model exhibited in Table 4 are similar to those of the model reported in Table 3. Therefore, only the substantial differences between them are noted below. In the model reported by Table 4, the four interaction terms each takes on the value of the GSEs' low- and moderate-income percentage-of-business for the households belonging to one of the four income quartiles, and takes on the value of 0 for households in all the other three income quartiles. Among them *only the coefficient estimate for the GSE percentage-of-business interacted with the highest income quartile is positive and statistically significant at the 1% level. One percentage increase above the sample mean in GSEs' percentage-of-business for low- and moderate-income families is associated with 0.25 percentage increase in the homeownership likelihood of a low- or moderate-income household in the highest income quartile, holding all*

else in the regression model constant. The result provides evidence that the Low- and Moderate-Income Housing Goal has increased the likelihood of homeownership for the highest income quartile of this policy's target group. This result suggests that the GSEs have cream-skimmed the highest income quartile of the low- and moderate-income families. It is rational for the GSEs to do so, because directing as many affordable lending efforts as possible towards benefiting the higher-income families among the target group instead of the lower-income ones reduces the cost of meeting the goal to them, since the economic return of buying mortgages with higher borrower income tends to be higher than that of buying mortgages with lower borrower income. This phenomenon is consistent with cream-skimming in other settings. For example, Koning and Heinrich (2011) found evidence that private social welfare providers engaged with performance-based contracts cream-skimmed workers with better job placement prospects to maximize placement rates and keep costs down.

Conclusion

The econometric analysis results of this study indicate that, during the period examined in this study, among the 66 largest MSAs in U.S., where the GSEs purchase a higher percentage of home-purchase mortgages originated to low- and moderate-income families, the probability of homeownership among the families in the highest income quartile of the low- and moderate-income group is higher, controlling for individual household's socioeconomic and demographic characteristics and MSA-level factors. This finding suggests that the GSEs have cream-skimmed the highest income quartile of the target group and families in the highest income quartile of the intended beneficiaries of the low- and moderate-income goal have actually benefited from this policy, while the families in the lower-income quartiles have not. But if the mortgagors cream-

skimmed by the GSEs are also more likely to benefit from the GSEs' affordable lending activities, the efficiency costs of cream-skimming in this condition may be low (Koning and Heinrich, 2011). However, the findings of this study don't support the argument that the low- and moderate-income goal has helped to make homeownership more attainable for American low- and moderate-income families as a whole.

Tables

Table 1. Descriptive statistics of the variables in the homeownership probability model.

Variable	Obs	Mean	Std. Dev.	Min	Max
homeownership status	40375	0.481	0.500	0	1
GSEs' low- and moderate-income percentage-of-business	40375	40.35	12.90	8.47	66.07
GSEs' low- and moderate-income percentage-of-business one year ago	40375	41.21	11.75	15.62	69.36
being in the third highest income quartile	40375	0.25	0.43	0	1
being in the second highest income quartile	40375	0.26	0.44	0	1
being in the highest income quartile	40375	0.26	0.44	0	1
householder is a high school graduate	40375	0.28	0.45	0	1
householder education: above high school graduate and below Bachelor's degree	40375	0.27	0.44	0	1
householder has Bachelor's degree	40375	0.16	0.37	0	1
householder education: above Bachelor's degree	40375	0.07	0.26	0	1
householder is Black	40375	0.20	0.40	0	1
householder is Asian	40375	0.05	0.23	0	1
householder race is other than White/Black/Asian	40375	0.04	0.19	0	1
natural logarithm of householder age	40375	3.82	0.40	2.64	4.53
householder is never married	40375	0.28	0.45	0	1
householder is widowed	40375	0.14	0.35	0	1
householder is divorced or separated	40375	0.22	0.42	0	1
number of children in the household	40375	0.62	1.09	0	12
householder is US citizen by naturalization	40375	0.10	0.30	0	1
householder is non-US citizen	40375	0.12	0.32	0	1
received food stamps in last 12 months	40375	0.07	0.25	0	1
householder's owner/renter status two years ago	40375	0.46	0.50	0	1
the percentage change in local house prices over the last year	40375	7.22	6.86	-11.00	36.04
the percentage change in local house prices over the last 10 years	40375	86.16	49.06	-5.25	210.49
standard deviation of percentage change in local house prices over last 10 years	40375	4.09	2.47	0.68	10.91

Variable	Obs	Mean	Std. Dev.	Min	Max
effective interest rate	40375	6.24	0.55	5.43	7.13
the subprime share of mortgages originated to low- and moderate- income families	40375	11.46	8.31	0	35.22

Table 2. Descriptive statistics of household income by quartiles³⁰.

	Obs	Mean	Std. Dev.	Min	Max
household income of the lowest income quartile	9492	7530.49	5062.39	-39716	15000
household income of the third highest income quartile	9994	22685.66	3937.54	15001	29500
household income of the second highest income quartile	10506	36771.97	4728.54	29501	45000
household income of the highest income quartile	10383	61676.33	23492.42	45001	1353442

³⁰The descriptive statistics on the household income data reveal that there are some unusually high values. This is because when selecting low- and moderate-income families, family income (zinc) is compared to the median family income to decide which observation qualifies as a low- and moderate-income family; but in the regression analysis, household income (zinc2) is used, because household income can better measure the overall purchasing power of the people living in the same housing unit. This should not be a reason for concern because in only a small fraction of the sample, household income (zinc2) is not equal to family income (zinc). The descriptive statistics of household income of this small fraction of the sample is as follows: the number of observations is 4055, the mean is 57990.22, the standard deviation is 41032.18, the minimum is -9703, and the maximum is 1353442 (The negative household income values indicate loss).

Table 3. Marginal effects estimates of Probit regression of the homeownership probability model with no interactive term.

	homeownership status
GSEs' low- and moderate-income percentage-of-business	-0.0003 [0.00073]
GSEs' low- and moderate-income percentage-of-business one year ago	0.00014 [0.00062]
being in the third highest income quartile	0.074 [0.013]**
being in the second highest income quartile	0.135 [0.012]**
being in the highest income quartile	0.235 [0.013]**
householder is a high school graduate	0.034 [0.010]**
householder education: above high school graduate and below Bachelor's degree	0.046 [0.010]**
householder has Bachelor's degree	0.069 [0.011]**
householder education: above Bachelor's degree	0.085 [0.012]**
householder is Black	-0.062 [0.009]**
householder is Asian	-0.047 [0.021]*
householder race is other than White/Black/Asian	-0.036 [0.017]*
natural logarithm of householder age	0.196 [0.015]**
householder is never married	-0.117 [0.013]**
householder is widowed	-0.05 [0.014]**
householder is divorced or separated	-0.142 [0.010]**
number of children in the household	0.026 [0.005]**
householder is US citizen by naturalization	0.058 [0.018]**

	homeownership status
householder is non-US citizen	-0.045 [0.018]*
received food stamps in last 12 months	-0.192 [0.014]**
householder's owner/renter status two years ago	0.748 [0.006]**
the percentage change in local house prices over the last year	-9.2E-05 [0.000815]
the percentage change in local house prices over the last 10 years	-9.7E-05 [0.000123]
standard deviation of percentage change in local house prices over last 10 years	0.0014 [0.0038]
effective interest rate	-0.091 [0.052]
the subprime share of mortgages originated to low- and moderate- income families	0.00098 [0.00063]
homeownership status is observed in 2003	-0.13 [0.069]
homeownership status is observed in 2005	-0.101 [0.063]
homeownership status is observed in 2007	-0.075 [0.030]*
Observations	40375

Notes: (1) Robust standard errors are in brackets. * denotes significance at 5% level; ** denotes significance at 1% level. (2) MSA fixed effects are included, but not reported. (3) Estimates of standard errors are adjusted for 66 clusters (MSAs).

Table 4. Marginal effects estimates of Probit regression of the homeownership probability model with the GSEs' affordable lending performance interacted with household income.

	homeownership status
(GSEs' low-/moderate-income %-of-business)*(in the lowest income quartile)	-0.003 [0.0007]**
(GSEs' low-/moderate-income %-of-business)*(in the 3rd highest income quartile)	-0.0013 [0.0007]
(GSEs' low-/moderate-income %-of-business)*(in the 2nd highest income quartile)	0.00013 [0.00070]
(GSEs' low-/moderate-income %-of-business)*(in the highest income quartile)	0.0025 [0.0007]**
householder is a high school graduate	0.036 [0.011]**
householder education: above high school graduate and below Bachelor's degree	0.048 [0.010]**
householder has Bachelor's degree	0.072 [0.011]**
householder education: above Bachelor's degree	0.087 [0.013]**
householder is Black	-0.061 [0.009]**
householder is Asian	-0.046 [0.021]*
householder race is other than White/Black/Asian	-0.036 [0.018]*
natural logarithm of householder age	0.194 [0.016]**
householder is never married	-0.117 [0.013]**
householder is widowed	-0.051 [0.014]**
householder is divorced or separated	-0.142 [0.010]**
number of children in the household	0.026 [0.005]**
householder is US citizen by naturalization	0.058 [0.018]**

	homeownership status
householder is non-US citizen	-0.045 [0.018]*
received food stamps in last 12 months	-0.193 [0.015]**
householder's owner/renter status two years ago	0.748 [0.006]**
the percentage change in local house prices over the last year	-0.00014 [0.00078]
the percentage change in local house prices over the last 10 years	-5.6E-05 [0.000127]
standard deviation of percentage change in local house prices over last 10 years	0.00049 [0.00384]
effective interest rate	-0.086 [0.052]
the subprime share of mortgages originated to low- and moderate- income families	0.00089 [0.00068]
homeownership status is observed in 2003	-0.123 [0.069]
homeownership status is observed in 2005	-0.093 [0.062]
homeownership status is observed in 2007	-0.071 [0.029]*
Observations	40375

Notes: (1) Robust standard errors are in brackets. * denotes significance at 5% level; ** denotes significance at 1% level. (2) MSA fixed effects are included, but not reported. (3) Estimates of standard errors are adjusted for 66 clusters (MSAs).

CHAPTER 4

HAVE THE GSE AFFORDABLE HOUSING GOALS INCREASED HOME PRICES FOR THE LOW- AND MODERATE-INCOME FAMILIES?

If it is true that the enhanced GSE affordable lending performance, as a result of the affordable housing goals, can increase demand for single-family owner-occupied housing by the low- and moderate-income families, (manifested by increased homeownership rates for this group), then an important indirect consequence of the GSE affordable housing goals could likely be an unintended increase in home prices for this group. This essay, therefore, will examine whether the GSEs' intensified purchases of affordable-goals-qualified mortgages have caused the home prices for the low- and moderate-income families to rise.

Though the major purpose of the affordable housing goals is to make homeownership more attainable to the target beneficiary group of this regulation, the indirect effect of this policy on house prices may also affect the welfare of the target group measurably. If the affordable housing goals cause the prices of the houses that low- and moderate-income families normally choose to buy to rise, then at least part of the benefits the low- and moderate-income families have received from the affordable housing goals are offset by the hidden cost of higher house prices. For this reason, the effect that the affordable housing goals has on home prices for low- and moderate-income families should be studied, and the findings should be taken together with the affordable goals' effectiveness in promoting homeownership to form a fairer evaluation of the policy's impact on the welfare of the low- and moderate-income families.

The values of studying the impact of the affordable housing goals on low- and moderate-income housing price are twofold: to examine whether there is a hidden cost imposed on the beneficiary

group, as discussed earlier; and, more importantly, to explore whether this policy has helped to cause the house price bubble, whose consequence is a housing market meltdown which the nation is now going through. If the evidence suggests that the affordable housing goals have helped to trigger the most recent housing market boom-bust cycle, then this unintended effect will be worth policymakers' serious consideration as they seek to improve this policy, given the substantial negative effect the current housing market collapse has had on the U.S. economy.

Literature Review

The theories and studies on house price dynamics and determinants of house prices are the foundation for this study. The literature in these areas which is especially relevant to this study is reviewed in this section. The theories on the house price dynamics serve to establish the connection between the GSE affordable housing goals and the volatility of the housing market; and the theories on the determinants of house price, are the basis for inferring the impact of the GSE affordable housing goals on house prices; these theories, especially the ones addressing the housing price differences among metropolitan areas, are also the principles for designing this study's methodology. Additionally, empirical studies that have specifically examined the effect of the GSE affordable housing goals on house price are also reviewed for comparison with this study.

Within the literature on house price changes or dynamics, understanding how the financial accelerator impacts the sensitivity of house prices to credit constraints also helps understanding the likely impact of the affordable housing goals on house price fluctuations. Rodda, Abt

Associates Inc., and Goodman (2005) cited the finding from a financial accelerator model developed by Ortalo-Magne and Rady (2002)³¹ that “a relaxation of the down payment constraint can initiate a boom-bust cycle”, and this finding is also implicitly in agreement with that from Stein’s (1995)³² financial accelerator model. Rodda et al (2005) stated that Ortalo-Magne and Rady (2002) studied housing market fluctuations through a life-cycle model, with households varying in income and preferences, and the underlying assumption of the model is that there is a property ladder characterized by house qualities that households are trying to ascend by trading up with the capital gains from their houses. One of the important assumptions is that supply is relatively inelastic. Otherwise, a small increase in prices would lead to expanded supply, so that homeowner equity would not increase. As in the Stein (1995) model, Ortalo-Magne and Rady (2002) find that an income shock can cause housing prices to overshoot; they also find that liberal underwriting may exacerbate house price overshooting. Ortalo-Magne and Rady’s (2002) model also shows that adjustments to the house price overshooting are made at the lowest quality level, and as a result, either a big wave of new homeowners gets stuck on the bottom rung of the property ladder or many new homeowners fall off the bottom of the ladder. These scenarios have already been seen in the US recently, as the housing market started correcting earlier overreactions to economic conditions. Rodda et al (2005) cited Ortalo-Magne and Rady’s (2002) opinion that the proliferation of low-down payment loan products has made it possible for wealth-constrained households to become homeowners, and the government has promoted this trend, but this will lead to an increased vulnerability to greater cyclical fluctuations.

³¹ Ortalo-Magne, Francois, and Sven Rady (2002) “Housing Market Dynamics: On the Contribution of Income Shocks and Credit Constraints.” Mimeo, February 2002.

³² Stein, Jeremy C. (1995) “Prices and Trading Volume in the Housing Market: A Model with Down-Payment Effects.” *Quarterly Journal of Economics*, 110: 379-406.

Rodda et al (2005) also cited Stein's (1995) model, from which a similar conclusion about the effect of liberal underwriting can be inferred. Stein's (1995) model holds that the highly leveraged homeowners, often in starter homes, rely heavily on an increase in their house value to provide the equity necessary for moving up to a nicer home. If a large fraction of owners have high LTV ratios, then a small increase in price can trigger a wave of moving and house buying that compounds the initial price increase. Rodda et al (2005) stated that, the amplifying effect, sometimes referred to as the financial accelerator in literature, can also compound a fall in house prices.

It can be inferred from the findings of both these types of financial accelerator model that the GSE affordable housing goals are likely to have an unintended effect of promoting the initiation of a boom-bust cycle. HUD (2004) stated that some of the major strategies that the GSEs have adopted to meet the affordable housing goals include increasing flexibility in their mortgage underwriting guidelines and introducing low-downpayment programs aimed at wealth-constrained borrowers³³. Since the GSEs' guidelines are used by almost all mortgage originators, even if they do not plan to sell the mortgages they originate to the GSEs, almost all conventional mortgage loans are written using the GSEs' guidelines to evaluate mortgage applications. Therefore, these liberalizations of their guidelines played a significant role in the increase in affordable lending since the 1990s (HUD, 2004, III-29). Echoing this point, Ambrose et al (2002) cited Temkin, Quercia and Galster (2001) and Listokin and Wyly's (2000)³⁴ finding that

³³ Introducing low-downpayment programs is often viewed in literature as one form of liberalization of mortgage underwriting guidelines.

³⁴ Temkin, Kenneth, Roberto Quercia and George Galster. 2001. "The Impact of Secondary Mortgage Market Guidelines on Affordable and Fair Lending: A Reconnaissance from the Front Lines." *Review of Black Political Economy*. Vol. 28(2): 29-49.

Listokin, David and Elvin Wyly. 2000. "Making New Mortgage Markets: Case Studies of Institutions, Home Buyers and Communities." *Housing Policy Debate* 11(3): 575-644.

the GSEs altered their underwriting guidelines significantly after 1992, when FHEFSSA was enacted, which required that HUD set affordable housing goals. For example, in contrast to GSE standards of the late 1980s, the GSEs' standard guidelines in the early 2000's allow borrowers to qualify for a 95 percent LTV mortgage (up from a maximum LTV of 90 percent); allowable house payment-to-income (28 percent) and total debt-to-income ratios (36 percent) are higher as well, up from 25 and 28 percent respectively; the GSEs also have started purchasing loans from borrowers who do not have a formal or perfect credit history. On the one hand these underwriting changes make it easier for income and wealth constrained borrowers to qualify for standard conventional loans and make homeownership more obtainable, which is intended by policymakers; but on the other hand, as pointed out by the findings from the financial accelerator model, these liberalizations of underwriting guidelines add to the price volatility of a housing market.

The theories on the determinants of house price provide the basis for determining the impact of the GSE affordable housing goals on house prices. Theoretically, the impact of the GSEs' intensified purchases of affordable-housing-goals-qualified mortgages on home prices can be readily derived from economic theory on demand and supply – increased access of the low- and moderate-income families to mortgage credits, as a result of the GSEs' compliance with the “affordable goals” regulation, can stimulate the demand for owner-occupied housing by this group, which will cause the prices of the housing serving this group of consumers to rise. This inference is implicitly based on two assumptions: 1) the GSEs' intensified purchases of affordable-housing-goals-qualified mortgages can increase demand for owner-occupied housing by the low- and moderate-income families; 2) the supply of housing is not perfectly elastic.

This inference is in agreement with the argument of Rodda, Abt Associates Inc., and Goodman (2005, P.46): “Aggressive mortgage financing can boost demand for housing, and that demand can drive up house prices.” They think that one of the reasons for the easier mortgage financing in the late 1990s and the early 2000s is that “HUD encouraged increased lending to low-income and minority households through the Community Reinvestment Act (CRA) and GSE Housing Goals designed to promote homeownership and community development.”

Except Rodda et al.’s (2005) paper, little literature has indicated the likely effect of the GSE affordable goals on housing prices. But the literature on housing demand and supply factors provides the foundation for examining the validity of the two assumptions on which this study’s hypothesis is based. There is a consensus in literature that lower mortgage interest rates and less stringent mortgage underwriting standards can stimulate demand for owner-occupied housing. The GSE affordable housing goals are intended to achieve at least one of the effects – reducing borrowing costs for and expanding mortgage credit supply to targeted homebuyers, and hence are expected to increase owner housing demand by the target group.

However, there are inconsistent findings from literature that examines the elasticity of housing supply, a key condition that determines whether “most of the impact of increased demand will be observed in house prices rather than in the quantity of housing supplied” (as in the case of inelastic supply) or the other way around (as in the case of elastic supply) (Rodda et al., 2005). For example, Blackley and Follain’s (1991) study provides evidence that “the overall picture of the metropolitan housing market ... shows supply to be quite elastic and housing prices largely

determined by input prices”. But they also point out that “perhaps housing supply is inelastic for short time intervals or within smaller submarkets”. Rodda et al. (2005) reviewed the literature about supply elasticity, based on national time series. They stated that, “some of the earliest studies found evidence for elastic supply, though their methods and data are considered simplistic by today’s standards”. After reviewing more recent studies, Rodda et al. (2005) concluded that “high house prices seem in many instances to be attributable to inelastic supply, but it has been quite difficult to derive a consistent measure.” They further pointed out that supply elasticity may vary by market, and that “most of the evidence and analysis to date examine short run supply elasticity, and typically at the top end of the market, where most new construction occurs”.

Given the lack of consistent evidence on housing supply elasticity, especially the elasticity of the supply of middle- and lower-quality housing, it is difficult to infer whether an increase in demand for housing by low- and moderate-income households will have any discernible effect on prices of housing typically occupied by such households. The empirical test in this study will serve to provide some evidence on this issue.

There have been efforts to assess the effects of the GSE loan purchase goals on housing prices. Freeman, Galster and Malega’s (2006) paper and Bostic and Gabriel’s (2006) paper are among the most important ones on this subject. Neither study has revealed a statistically significant effect of the GSE affordable housing loan purchase targets in increasing house prices in underserved³⁵ neighborhoods in their respective study areas during the 1990s. However, these

³⁵ The “underserved” neighborhoods are those traditionally underserved by financial institutions. In the literature of the GSE affordable housing goals research, the “underserved” neighborhoods are defined by one of the GSE

two studies examine the GSE affordable housing goals' impact on home prices in the "geographically targeted" census tracts defined by this regulation (the "underserved" neighborhoods), so they treat housing price growth in those neighborhoods as a good sign for revitalization. This study, however, has a different focus, which is researching the impact of the affordable housing goals on the welfare of low- and moderate-income families. Therefore, the house price issue is studied from the perspective of housing affordability.

Though the vast majority of theoretical models on housing price have treated mortgage rate as an important demand factor, most of the studies on housing price, especially the empirical ones, do not take into account the role that mortgage credit supply plays in determining demand for owner-occupied housing, let alone the implications of secondary mortgage market underwriting standards. The lack of research on this subject, against the backdrop of the US housing bubble burst and credit crunch which are caused by imprudent lending practices, warrants serious studies examining the effect of the extent of the easiness in obtaining a mortgage on housing price levels. This study will be helpful in unraveling to what extent the GSE affordable housing goals regulation, which is intended to make mortgage credit more accessible to lower-income families, has promoted the formation of the latest US housing bubble. Although this study does not focus on the subprime mortgages, where most problems occur, its usefulness shouldn't be underestimated, because the regulation under study affects the conventional conforming mortgage market, which constitutes a major share of the total residential mortgage market.

affordable housing goals -- the geographically targeted goal, which specifies that metropolitan-area census tracts with a median family income less than or equal to 90 percent of area median, or with a minority population proportion of at least 30 percent and a tract median income less than or equal to 120 percent of area median are underserved (slightly different rules apply in nonmetropolitan areas).

Because this study attempts to examine how much the variation in the GSEs' performance under the affordable housing goals among metropolitan areas has influenced the variation in housing price levels among those areas, the body of literature crucial to constructing this study's model for empirical estimation is on cross-city housing price determination. The existing literature on this subject usually develops a system of equations, with one specifying the factors determining demand for owner-occupied housing, another specifying the factors determining supply for owner-occupied housing, and other equations specifying the demand and supply factors for the rental sector and positing relationships between the renter and homeowner sectors, and then solves it for a reduced-form equation for owner housing price. The reduced-form housing price equation varies from study to study, but it invariably includes income and demographic variables, and other demand-side variables such as racial composition of the MSA, mortgage rates and property tax are also often included in the equation, while the supply-side variables in the equation typically include some measures of at least one of the following: input prices, geographic constraints, and regulatory stringency. The adoption of the explanatory variables, especially the supply-side ones, largely depends on the specific research need. Some studies directly estimate a reduced-form housing price equation, with selected explanatory variables of interest to the researchers. In the following paragraphs, three important studies on this subject will be reviewed.

Ozanne and Thibodeau's (1983) study is widely believed to be one of the best studies of cross-MSA prices. They constructed a model analyzing long-run supply and demand in the entire metropolitan housing sector, and used this model to identify the sources of intermetropolitan price variation among 54 metropolitan areas. Their model specified the demand and supply

equations for the renter subsector and the homeowner subsector separately, and related the renter and homeowner subsectors through the tenure choice of households and through the market for urban land. They derived separate reduced-form equations explaining rental housing service prices and homeowner real estate prices and estimated them using the seemingly unrelated regressions technique. The real estate price index used in their study was constructed by estimating consistent hedonic value equations for owner-occupied houses in each SMSA and then predicting SMSA values for the average dwelling among the SMSAs. (The rent index was constructed in a parallel fashion.) Independent variables for the homeowner equation include average income per household, the number of households, the fraction of them nonelderly and single, the fraction headed by a black or Hispanic, an MSA-specific nonhousing price index, effective mortgage interest rates, a dummy indicating whether an SMSA is bounded by an ocean or a large lake, the number of municipal governments per 100000 households, construction costs, the price of agricultural land, the median property-tax payment, and an index of wages and utility costs. This reduced-form equation explained 58% of the variation in house prices. In the real estate price equation only three coefficients were statistically significant at the 10% level or better, and they had the expected sign: a higher proportion of nonelderly single households raised the price of real estate; dispersion of municipal powers was found to lower the price of housing; and the price of agricultural land had a positive effect on house price.

Blackley and Follain's (1991) paper develops an econometric model of the metropolitan housing market. "The basic theoretical framework is represented by a five-equation static model. It includes demand and supply equations for the rental and owner-occupied sectors and an equation that explains the probability of homeownership. A dynamic extension that incorporates vacancies

is also developed, (to study what role vacancies play in clearing the housing market).” (Blackley and Follain, 1991) Their model is estimated using aggregate data for 34 large metropolitan areas surveyed both in 1974-1975 and in 1977-1978. Blackley and Follain (1991) conclude that supply in the metropolitan housing market is quite elastic and the key reason for housing prices differences among cities appears to be variations in the cost of land and construction inputs, and that another important determinant is the number of governments, presumably because more governments lead to more competition, which makes it difficult to restrict output and raise prices.

Malpezzi, Chun and Green’s (1998) study is regarded as one of the best examples of integrating hedonic-type price models with a reduced-form equilibrium model that includes both demand and supply factors (Rodda et al., 2005). Malpezzi et al.’s (1998) approach is suitable for comparisons between cities, with the purpose of finding out the determinants of house prices. Malpezzi, et al. (1998) used 1990 Census PUMS data (Public Use Microdata Samples) to estimate separate hedonic price equations for 272 MSAs in order to produce price level indexes that control for house quality; and in the second stage, they used the hedonic prices as the dependent variable in the reduced-form equation to determine what factors influence house prices significantly. The reduced-form house prices equation, which is derived when housing demand equals housing supply, has such explanatory variables: demand factors including income and wealth, demographics and population, and fiscal and local public goods variables; and supply factors including topographical constraints and regulatory constraints. A distinct feature of their study is that they recognized that the variable of regulatory constraints is endogenous in the price equation, and used the predicted value estimated from an instrumental variable equation

for it in the house price equation. It should also be noted that not all the factors that appeared in the theoretical house price model were included in the estimation model. There were two second stage house price models estimated. The small model included the following explanatory variables: household income, annual change in household income in the past ten years, MSA population, annual change in MSA population in the past ten years, persons per household, metropolitan median age of household head, a dummy variable indicating whether an MSA is located adjacent to a coastline, a large park or a military base, percentage of Black households, and the instrumental regulatory index. The large model included additional demographic control variables plus a variable of property tax per dollar income. This study's major findings regarding the owner price are: income, income growth and population have positive effects on house prices; larger households tend to raise house prices; The performances of metropolitan median age of household heads and the percentage Black are inconsistent between different specifications of the model; The percentage of married couples, the percentage under 18 years, and the percentage 65 or older all have negative effects on house prices, though the impact of married couples is counter-intuitive; And, more restrictive regulation and the presence of topographical constraints both increase prices.

Finally, it should be noted that this study cannot directly adopt the methods utilized in the previous studies on the impact of the GSE affordable housing goals on house prices, largely because this study aims to assess this regulation's effect on prices of housing occupied by low- and moderate-income families, while the purposes of the previous ones are to examine its effect on house prices in underserved census tracts. Bostic and Gabriel (2006) evaluated the effects of the GSE affordable housing goals on housing market outcomes in underserved neighborhoods by

comparing the housing market measures for a treatment group and a control group of census tracts, classified by whether a census tract qualifies as an underserved neighborhood under the GSE affordable housing goals.³⁶ Though Freeman et al.'s (2006) research method bears some relevance to this study, their estimation equation is not suitable for studying the cross-city housing price determination. Their unit of analysis is the individual home that is sold, which they observe annually during a seven-year period in the 1990s in a particular city with annually updated data on census tracts in which sales occur. To model the relationship between the secondary mortgage market and single-family housing prices in underserved neighborhoods, they specify a set of functions, each respectively modeling housing-stock supply, housing-stock demand, and mortgage-supply. Then they derive a reduced-form equation from this set of functions for empirical estimation.

The Empirical Approach of This Study

Because the purpose of this study is to assess whether the affordable housing goals have increased the burden of housing costs for a segment of the population – the low- and moderate-income families, the empirical analysis is conducted exclusively for this group. In this test, the null hypothesis is that the GSEs' affordable lending performance has no effect on the median price of houses occupied by the low- and moderate-income homeowners; the alternative hypothesis is that the GSEs' better affordable lending performance increases that median price.

If the results of the foregoing test suggest that where the GSEs have better affordable lending performance, the median house price for low- and moderate-income families is higher, then the

³⁶ For a more detailed review of this paper, please see Chapter 3.

results can be interpreted in two ways: one is that the GSEs' affordable lending activities may have enabled low- and moderate-income homebuyers to have more buying power to raise the offer price on home purchases, as pointed out by Rodda et al. (2005) (P. 46), and hence an increase in the price of housing typically purchased by this group; the other is that, (as argued by HUD's regulatory analysis), the GSEs' affordable lending activities have lowered the effective borrowing costs for the target group or enabled them to obtain a mortgage of a larger amount, so that the target group can buy larger and better houses.

Data

The house price index data for this study are obtained from the American Housing Survey (AHS) national data, for year 2001, 2003, 2005 and 2007. "The AHS is the largest, regular national housing sample survey in the United States" (U.S. Census Bureau, 2004). The AHS national survey is conducted every other year by the Census for the U.S. Department of Housing and Urban Development (HUD). The national AHS has surveyed a fixed sample of about 50,000 homes throughout the U.S. since 1985, but each time newly constructed housing units are added to supplement the original fixed sample, and the total number of housing units surveyed each time is about 55,000 (U.S. Census Bureau, 2004).³⁷ The use of the AHS national data is based on two considerations: first, it is one of the major housing price data sources from which MSA-level housing price index is available; second, the household income information contained in the AHS enables the separation of housing price data for the low- and moderate-income households from those for the other households, and as such enables the construction of a low- and moderate-income housing price index. These reasons combined make the AHS the only available

³⁷ See the "data" section of Chapter 3 for more information about AHS.

data source for obtaining housing price data needed by this study for the period intended to be examined. The analysis will be restricted to the 62 largest MSAs in the nation which have adequate sample sizes in the AHS. For each MSA in this study, a housing price index is constructed for single-family owner-occupied housing units owned by families with an income at or below area median, the criterion for the target group established by the low- and moderate-income goal.

The variable selected from the AHS for measuring housing price is the “current market value of a housing unit”. The house value reported in the AHS is the owner’s estimate of how much the property (house and lot) would sell for if it were for sale. (For vacant units, the value reported is the property’s sale price at the time of the interview, and may differ from the price at which the property is sold.)

The data on the percentage of the total number of single-family owner-occupied home-purchase mortgages purchased by the GSEs which are for low- and moderate-income borrowers are provided by HUD by metropolitan areas for each year from 2000 to 2007. The data on the policy variable are provided for Fannie Mae and Freddie Mac separately, and the weighted average of the percentages of the two GSEs is taken as the index measuring the overall GSE percentage-of-business for low- and moderate-income families in an MSA (the weight is computed as the share of number of mortgages purchased by each GSE in the total number of mortgages purchased by both GSEs in an MSA).

This study will use variables on MSA population and median family income as control variables. The population data are obtained from the U.S. Census Bureau. Median family income data are obtained from HUD.

Table 1 provides the descriptive statistics of the sample analyzed, which shows adequate variance of key variables.

Regression Model and Estimation Technique

This study builds on the existing literature on house price determination at the metropolitan level, and its emphasis is on tailoring the well-accepted cross-MSA house price determination models to the need of examining the effect of the “affordable goals” regulation of the GSEs on house price levels. Therefore, this study will directly choose a reduced-form house price equation in the literature, and develop one incorporating the influence of the secondary mortgage market based on that.

The reduced-form equation used as the basis for the one in this study is provided in Malpezzi’s (1996) paper. Malpezzi (1996) analyzed the determinants of housing prices, with a particular focus on the effects of land and housing markets regulations. He modeled house prices in a simple supply-and-demand framework focusing on incomes, population changes, and supply conditions including topographical constraints and measures of the regulatory environment. This study, with a different focus on the effect of the affordable lending environment, will have a reduced-form house price equation with one set of explanatory variables that are the determinants of the supply of mortgage credits to lower-income families, and this equation will

have one measure of the regulatory regimes in different markets rather than a set of them as in Malpezzi (1996). In summary, this study will modify Malpezzi's (1996) reduced-form housing price equation into the following equation that is one of the two structural equations from which this study's reduced-form equation will be derived:

$$PO_{it} = f [POP_{it}, POP_CHANGE_{it}, MINC_{it}, MINC_CHANGE_{it}, MORTGAGESUPPLY_{it}, GEO_i, REGULATION_{it}] \quad (1), \text{ where } PO_{it} \text{ is the}$$

low- and moderate-income housing price, POP_{it} is the MSA population, POP_CHANGE_{it} is the annual growth in MSA population, $MINC_{it}$ is the MSA median family income, $MINC_CHANGE_{it}$ is the annual growth in MSA median family income, $MORTGAGESUPPLY_{it}$ is the aggregate dollar supply (adjusted by population size) of home-purchase mortgages originated to low- and moderate-income families in an MSA, GEO_i is the geographic constraints on land development for an MSA, and $REGULATION_{it}$ is the stringency of land use and housing markets regulations in an MSA. Because of the addition of the mortgage supply variable to Malpezzi's (1996) reduced-form housing price equation, this study's house price equation becomes a structural equation and this study also needs to establish the mortgage supply equation, which is the other structural equation needed to obtain the reduced-form house price equation in this study. After specifying the determinants of mortgage supply to lower-income families (denoted as $MORTGAGESUPPLY_{it}$), all the exogenous explanatory variables in the mortgage supply function can be substituted for the mortgage supply term in the housing price equation, and after some manipulation, the reduced-form housing price equation for this study's estimation will be obtained.

The key part of this section is to discuss how the secondary mortgage market activities, particularly those of the GSEs, are expected to affect the housing market outcomes. Mortgage supply is an important determinant of the demand for single-family owner-occupied housing. Freeman et al. (2006) argue that demand for a stock of single-family, owner-occupied dwellings is influenced by the degree to which prospective buyers are constrained by inability to obtain credit. “This constraint is determined by mortgage supply: dollar flows reflecting the willingness of primary lenders to approve mortgage-loan applications from a given profile of applicants trying to purchase homes (in a certain area). It is through loan supply that secondary mortgage market activity creates a potential impact (on housing market outcomes).” This view is in agreement with one hypothesis proposed by Ambrose et al. (2002): they argue that one of the two most important ways in which “GSE purchasing activity may influence the primary mortgage market” is that, “if credit rationing exists in the primary mortgage market, then housing goals that require GSEs to alter the quantity of targeted loans purchased may simply increase the supply of mortgage credit available for targeted borrowers without having any effect on mortgage interest rates. Consequently, ... fewer targeted households would be “rationed-out” of the primary mortgage market. In this environment, the observable implication of the GSE affordable housing goals would be an increase in homeownership rates for targeted households.”

Before further discussion of the secondary mortgage market’s effect on mortgage supply, it is useful to first consider how mortgage supply is determined. As stated by Megbolugbe and Cho (1993), “Mortgage supply responses arise from a two-level decision that involves the accept/reject decision and a nonprice mortgage term offer that includes the loan-to-value ratio and various fees and charges. At the local level, the prevailing mortgage rate can be treated as

exogenously determined. Mortgage lending decisions are thus influenced by both economywide and borrower-specific default risk factors.”³⁸ (Ambrose et al. (2002) identify the primary sources of mortgage risk as default and prepayment. Since the risk of prepayment is closely associated with changes in interest rates, it can largely be regarded as an economywide risk.) Ambrose et al. (2002) point out that “institutions use mortgage underwriting to ensure that default risk is below maximum acceptable levels. Underwriting is the process of evaluating ... collateral quality, borrower capacity (ability to repay the loan), and borrower credit (willingness to repay the loan).” Not only the underwriting decision, but also the mortgage-pricing decision (because the interest rate is negotiated for a given mortgage product given an exogenously determined prime rate undergirding it) is made on the basis of assessed risk (Freeman et al., 2006). Megbolugbe and Cho (1993) state that “the risk-based credit rationing used by lenders to clear the mortgage market can result in either outright application rejection or steering to a mortgage type unwanted by the applicant.”³⁹ They also argue that other factors, such as appraisal practices and loan marketability in the secondary market, also affect supply decisions.

The preceding discussion suggests that it is necessary to control for the primary mortgage market’s evaluation of mortgage lending risks in an area, in order to assess the effect of the GSEs’ affordable lending activities on the mortgage supply to lower-income families. Because the target group of the policy under study is the low- and moderate-income families, the empirical analysis will control for the fundamental economic conditions that influence the

³⁸ According to Megbolugbe and Cho (1993), “The main factors identified by Munnell et al. (1993) for the mortgage lending decision include the individual’s ability to carry the loan (e.g., ratio of housing expense to income, ratio of total debt payment to income, net wealth, monthly income, liquid assets), the risk of default (e.g., percent with poor credit history, probability of unemployment, percent self-employed, ratio of loan to appraised value), the potential loss associated with default and foreclosure (e.g., rent-to-value ratio in tract, percent applied for private mortgage insurance, percent denied private mortgage insurance), and racial bias in mortgage lending.”

³⁹ This point is originally put forward by Stiglitz and Weiss (1987).
Stiglitz, Joseph E., and Andrew Weiss. 1987. Credit Rationing: Reply. *American Economic Review* 77(1):228-31.

primary mortgage market's evaluation of the risks of mortgage lending to low- and moderate-income families in a certain area. The measures of economic conditions adopted in this study include median income, annual growth in real median income, and population growth, which collectively serve as a proxy for the risks of affordable lending in a particular area. These control variables are also among the ones which measure the housing demand factors in the adopted reduced-form equation for estimating house prices. So the selection of these measures can result in parsimony of the estimation equation.

Additionally, recent years have seen the rise and fall of the subprime mortgage market. The reckless lending practices during the subprime mortgage boom years clearly show that the volume of mortgage supply may well deviate from the amount justified by the risks of mortgage lending. Given that this study attempts to examine the determinants of house prices in 2001, 2003, 2005 and 2007, the important role that subprime lending played in the expansion of mortgage credit to relatively risky borrowers during those periods must also be taken into account. The high level of popularity and significant market share of subprime mortgages fueled demand for owner-occupied housing, which may have helped to boost house prices. Therefore, the subprime share of the mortgage market should be controlled for as an explanatory variable for mortgage supply, and ultimately, house prices.

Of central importance for the current research is how secondary-market purchases (especially those made by the GSEs) of mortgages may influence mortgage supply in the primary market. Ambrose et al. (2002) provide a valuable literature review on the interaction between the GSEs and the primary mortgage market. The GSEs have a significant impact on the availability of

credit in the mortgage market. Although the GSEs do not determine whether an individual borrower receives a mortgage, they set guidelines that determine the types of mortgages acceptable for purchase, indirectly influencing the lender's decision on whether to extend credit (Ambrose et al., 2002). Ambrose et al. (2002) also cite recent studies on the impact of the GSEs on mortgage interest rates. For example, Van Order (1996)⁴⁰ points out that the secondary mortgage market increases the flow of funds to the primary mortgage market. Some other studies argue that the GSEs' mortgage operations reduce the interest rates of conventional conforming mortgages, which can be regarded as direct evidence of the benefits of the GSEs in providing greater liquidity to the mortgage market. (For a more comprehensive literature review on the GSEs' impact on mortgage interest rates and on the rationale for the affordable housing goals, see Chapter 3.) As explained in Chapter 3, the GSEs' enhanced affordable lending performance under the affordable housing goals may lower mortgage rates or increase access to mortgage credit for the targeted homebuyers of this policy, or achieve both; however, given that the GSEs' impact on borrowers' access to mortgage credit and borrowing costs is indirect, it is unclear whether such effects will transpire.

Another possible effect of the affordable housing goals is that some homebuyers who would have purchased homes with FHA or subprime financing could benefit from a less costly GSE mortgage now that the GSEs have made their underwriting standards more flexible and introduced targeted programs to make those borrowers qualify for a GSE mortgage. (See Chapter 3 for more explanation.) This factor suggests that the GSEs' impact on mortgage supply in the primary market should be viewed in the context of how the mortgage purchase activities of other

⁴⁰ Van Order, Robert. 1996. Discrimination and the Secondary Mortgage Market. In John Goering and Rondald Wienk, eds. *Mortgage Discrimination, Race, and Federal Policy*. The Urban Institute Press, Washington, D.C.: 335-363.

secondary market participants, e.g., Ginnie Mae, are affected by the GSEs' response to the affordable housing goals.

In summary, the aggregate dollar supply (adjusted by population size) of home-purchase mortgages originated to low- and moderate-income families by profit-maximizing financial institutions in MSA i in year t can be expressed as:

$$\text{MORTGAGESUPPLY}_{it} = M_{it}^s [\text{MR}_{it}, \text{PO}_{it}, \text{RISKS}_{it}, \text{CAPITALCOST}_t, \text{SUBPRIME}_{it}, \text{GSE}_{it}, \text{GSE}_{i(t-1)}] \quad (2)$$

where MR_{it} is a vector of mortgage interest rates for different types of loans for lower-income borrowers; PO_{it} is the prevailing price of owner-occupied homes for lower-income families.

RISKS_{it} denotes a group of variables that represent area economic risk factors which are likely to influence the aggregate supply of mortgage credit for lower-income families in an MSA, including median income, annual growth in real median income, and population growth.

CAPITALCOST_t refers to the financial institutions' costs of borrowing, which are primarily determined by the macroeconomic factors, and for which the most important indicator is the federal funds interest rate set by the Federal Reserve. This indicator can be proxied for by year fixed effects since it's cross-sectionally invariant. SUBPRIME_{it} is the subprime share of the mortgage market. GSE_{it} denotes the percentage of the GSEs' purchases of home-purchase mortgages that are originated to low- and moderate-income families. This measurement of the GSEs' affordable lending performance can directly reflect how the GSEs' reaction to the affordable housing goals affects the mortgage supply in the primary mortgage market, and thus affects the housing prices for low- and moderate-income families.

A final point to make about the mortgage supply equation is the reason for using the observations of secondary-market institutions' performance in the year prior to the year (t) the housing market outcome variable's values are for. (The subscript (t-1) denotes one year beforehand.) As explained by Freeman et al. (2006), a primary lender will be more likely to originate any given loan with given terms if it can pass its risks on to the secondary market at an acceptable price. Although in many circumstances, the primary lender can be virtually certain that a prospective loan to the applicant in question can be sold readily in the secondary market because it clearly meets all underwriting criteria, in other cases the expectation is probably less clear-cut. Perhaps the prospective loan will need to be seasoned in portfolio before it can be sold. They argue that "a primary lender's expectations about the probability of the secondary market's eventually purchasing a prospective loan (in a certain area) will be related to the latter's recent past performance in this regard."

To form the estimation equation for this study, all the exogenous explanatory variables (i.e. all the explanatory variables except MR_{it} and PO_{it} , which are price variables) in the foregoing mortgage supply equation (equation 2) will be substituted for $MORTGAGESUPPLY_{it}$ in a housing price equation (equation 1). The resulting equation is a reduced-form housing price equation which includes mortgage supply factors. After some rearrangement, it takes the form of equation 3 below. It can be easily verified that if this study starts with a model which consists of a housing demand equation, a housing supply equation, and a mortgage supply equation, then after substitution of the mortgage supply equation into the housing demand equation and solving an equation when housing demand equals supply, housing price at equilibrium can be obtained, and the equilibrium housing price can be expressed as a function of all the exogenous variables

in the model. Following this method will result in the same reduced-form equation as equation 3 which simply adds the additional exogenous variables explaining mortgage supply in an existing reduced-form equation that doesn't take account of mortgage supply.

In short, this study's reduced-form housing price equation can be expressed as:

$$PO_{it} = f [GSE_{it}, GSE_{i(t-1)}, POP_{it}, POP_CHANGE_{it}, MINC_{it}, MINC_CHANGE_{it}, SUBPRIME_{it}, GEO_i, REGULATION_{it}, CAPITALCOST_t], \text{ where } i \text{ denotes an MSA and } t \text{ denotes a year.}$$

(3)

The variables in the reduced-form equation and their data sources are summarized in the following table in the sequence that they appear in the equation:

Variable	Data Source
<i>Dependent variable</i>	
The low- and moderate-income housing price index	the American Housing Survey (AHS) – National Data, for year 2001, 2003, 2005 and 2007
<i>Independent variables of interest</i>	
the percent of the home-purchase loans purchased by the GSEs that are originated to low- and moderate- income families in MSA in the same year the housing price indexes are for	the US Department of Housing and Urban Development (HUD), year 2001, 2003, 2005 and 2007
the percent of the home-purchase loans	the US Department of Housing and Urban

purchased by the GSEs that are originated to low- and moderate- income families in MSA one year prior to the year the housing price indexes are for	Development (HUD), year 2000, 2002, 2004 and 2006
<i>Control variables</i>	
Log MSA population	the U.S. Census Bureau
Annual growth in MSA population	the U.S. Census Bureau
Log MSA annual median family income	the US Department of Housing and Urban Development (HUD)
Annual growth rate in MSA median family income	the US Department of Housing and Urban Development (HUD)
the subprime share of the mortgages originated to low- and moderate- income families in an MSA	Calculated from Home Mortgage Disclosure Act (HMDA) database and the US Department of Housing and Urban Development (HUD)'s subprime lender list
Adjacent to coast or major lake (proxied for by MSA fixed effects)	The MSA can be identified from AHS
Index of the restrictiveness of land use regulatory constraints (proxied for by MSA fixed effects)	The MSA can be identified from AHS
Financial institutions' cost of borrowing (proxied for by year fixed effects)	The year can be identified from AHS which indicates the year the house price data are for

The empirical approach involves estimating an OLS regression of the reduced-form equation wherein a log-linear functional form is assumed (which means that the natural logarithm of the price index of low- and moderate-income owner-occupied housing in MSA i is regressed on the independent variables). This functional form is frequently employed in this type of equation, given its theoretical advantages and ease of interpretation (Green and Malpezzi, 2003; Freeman et al., 2006).

Results

Table 2 presents results from the reduced-form equation regression estimation, with robust standard errors obtained to correct for heteroskedasticity, which has been detected.

The independent variable of interest, the GSEs' low- and moderate-income percentage-of-business for home-purchase mortgages, is statistically significant at the 1% level. One percentage increase in this percentage-of-business is associated with approximately 1.2% decrease in the median price of houses occupied and owned by low- and moderate-income families, holding all else in the model constant. This result is apparently against the hypothesis that the GSEs' increased business share serving low- and moderate-income borrowers will drive up house prices for them. The effect of the GSEs' better affordable lending performance on lowering low- and moderate-income owner-occupied housing price is also practically significant. This result suggests that the GSEs' compliance of the low- and moderate-income goal, unlike some analysts have expected, has not caused the cost of buying a home to rise for this policy's target group;

instead, it has helped to make the housing bubble less likely to form in the segment of the housing market for low- and moderate-income homebuyers. Because this study's purpose is to find out the ultimate effect of this policy on housing price for the target group, the results don't reveal which market forces, in reaction to the GSEs' affordable lending business activities, have caused this outcome. However, as presented in the theory and model-building part of this study, any demand- or supply-side factor determined by market participants' behavior can make this outcome possible (for example, homebuyers whose mortgages qualified to count towards the affordable housing goals did not stretch their budgets to buy higher-priced homes as much as homebuyers with other types of mortgages did, or, supply of housing for lower-income families is quite elastic.)

The other independent variable of interest, the lagged term of the GSEs' low- and moderate-income percentage-of-business, is not statistically significant at the 10% level. Including it in the model has virtually no effect on the regression estimates. Therefore, the model including this variable is not reported.

The estimates for other variables seem plausible. The model has an R-squared of 0.93.⁴¹

Robustness tests of the findings from the OLS regression of the model discussed above show that the results for the GSE affordable lending performance variable still hold when the model is estimated using OLS regression with standard errors clustered by MSA, or when the model is

⁴¹ This R-squared seems high, but it may just be because the data analyzed is for 62 MSAs but only 4 years, so that MSA fixed effects account for much of the variation in housing price data. Removing MSA fixed effects variables from the model decreases the R-squared to 0.69.

estimated using cross-sectional time-series FGLS regression allowing for within panels AR(1) autocorrelation.

Conclusion

The finding of this study provides evidence that the GSEs' higher percentage of purchases of home-purchase mortgages originated to low- and moderate-income borrowers leads to lower housing price for low- and moderate-income homeowners. It suggests that this affordable housing goal regulation didn't bring any hidden cost to its target group by inflating the price of homes they buy. It also suggests that the implementation of this policy is not to blame for helping to cause the housing bubble and its subsequent burst. Rather, this policy has made low- and moderate-income housing price appreciation smaller during the 2001-2007 period. Avery and Brevoort (2011) and Amromin, Huang, Sialm and Zhong (2011), find that affordable housing mandates didn't play a role in the recent housing bubble, in their respective research subjects. This study, examining a different subject, also provides evidence to exonerate the low- and moderate-income housing goal for the GSEs from the blame for fueling the housing bubble.

Tables

Table 1: Descriptive statistics of the variables in the reduced-form housing price equation regression model

Variable	Obs	Mean	Std. Dev.	Min	Max
the natural logarithm of the low- and moderate-income housing price index	230	11.92	0.58	11.08	13.51
GSEs' low- and moderate-income percentage-of-business	230	41.79	11.25	8.47	66.07
GSEs' low- and moderate-income percentage-of-business one year ago	230	42.38	10.13	15.62	69.36
log MSA population	230	14.51	0.61	13.39	16.27
annual growth in MSA population	230	1.30	1.43	-1.37	11.85
log MSA annual median family income	230	11.01	0.19	10.51	11.57
annual growth rate in MSA median family income	230	1.61	5.66	-17.36	26.38
the subprime share of mortgages originated to low- and moderate- income families	230	11.38	8.32	0	35.22

Table 2. OLS estimates of the reduced-form housing price equation regression

the natural logarithm of the low- and moderate-income housing price index	
GSEs' low- and moderate-income percentage-of-business	-0.0125 [0.0028]**
log MSA population	0.368 [0.598]
annual growth in MSA population	-0.0092 [0.0284]
log MSA annual median family income	0.236 [0.473]
annual growth rate in MSA median family income	0.0039 [0.0021]
the subprime share of mortgages originated to low- and moderate- income families	0.000069 [0.003627]
the house price data are for 2003	0.151 [0.097]
the house price data are for 2005	0.332 [0.121]**
the house price data are for 2007	0.38 [0.118]**
Constant	4.195 [11.369]
Observations	230
R-squared	0.93

Notes: (1) Robust standard errors are in brackets. * denotes significance at 5% level; ** denotes significance at 1% level. (2) MSA fixed effects are included, but not reported.

CHAPTER 5

BALANCING THE ECONOMIC RISK AND THE POLITICAL RISK: AN ASSESSMENT OF THE GSES' RESPONSIVENESS TO THEIR POLITICAL PRINCIPALS

Fannie Mae and Freddie Mac, the government sponsored enterprises (GSEs) in the secondary mortgage market, are the two largest sources of housing finance in the United States. Both Fannie Mae and Freddie Mac are chartered by Congress, and have a mission of helping more American families achieve homeownership. Before the two GSEs were put into federal conservatorship on September 7, 2008,⁴² they benefit significantly from the “implicit subsidy” from government in the form of special privileges, especially the lower borrowing costs they enjoy because the market perceives an implicit Federal guarantee of GSE securities. (HUD, 2004, I-2)

Controversies have existed for a long time over how effectively the implicit subsidy has helped to promote the public purposes. For example, based on a much smaller estimate of the GSEs' effect of lowering interest rates on conventional conforming mortgages than that by many other studies, Passmore (2003) has suggested that there appears to be no substantial effects of the GSEs' business activities on increasing homeownership. Over the years, the federal government has been pressing for stronger regulation of the housing GSEs to ensure their accountability to the public.

In 1992, Congress passed the Federal Housing Enterprises Financial Safety and Soundness Act (FHEFSSA). “The legislation required that the US Department of Housing and Urban Development set affordable housing goals”. Since 1993 Fannie Mae and Freddie Mac “have

⁴² This study examines data in a period before 2008.

been subject to quantitative goals for the portion of their business that represents mortgages on housing for lower income families and families in underserved areas”. It is reported that “the GSEs have more-or-less steadily increased their performance under the goals”. (Ambrose et al., 2002)

This essay will study how the GSEs incorporate economic and political factors into their decisions of engaging in more affordable lending activities, while they are fulfilling the requirements of the affordable housing goals. While HUD established three affordable housing goals, this study will focus on one of them, the low- and moderate-income goal, which requires that each year a minimum percentage of housing units financed by a GSE’s mortgage purchases be occupied by families with incomes at or below the area median income. (“Area median income” is defined as the median income of the metropolitan area for properties in metropolitan areas, or the greater of county or state nonmetropolitan median income for properties outside metropolitan areas.)⁴³ (HUD, 2006)

Literature Review

Although the affordable goals will benefit the low- and moderate-income families, the economic effects of them on the GSEs will be mostly negative. The HUD analysis of this regulation states that, “It is recognized that affordable lending can be more labor-intensive and costly than other

⁴³ The other two affordable housing goals are: the special affordable housing goal, which requires that a minimum percentage of housing units financed by a GSE’s mortgage purchases in a particular year be occupied by very low income families (at or below 60% of area median income) or low-income families (at or below 80% of area median income) located in low-income areas; the underserved areas housing goal (this is also called the “geographically targeted goal”), which mandates that a minimum percentage of housing units financed by a GSE’s mortgage purchases in a particular year target families living in low-income census tracts or in low- or middle-income census tracts with high minority populations. Housing units financed by GSEs’ mortgage purchases may count towards more than one housing goal category. (HUD, 2006)

types of lending. It is also recognized that low-income borrowers generally have limited assets and less ability to deal with financial adversity—factors that could lead to higher mortgage default rates.” (HUD, 2004) The higher credit risk associated with affordable lending means that the GSEs will earn a lower economic return from purchasing the mortgages on housing for low- and moderate-income families than for relatively higher-income families. Thus, solely considering the economic returns, the GSEs have disincentives to purchase the affordable-goal-qualifying loans.

However, the GSEs have to take into consideration political factors as well as economic factors when they make decisions. The “implicit subsidies” they receive from government derive from the special privileges they enjoy, which “provide them with significant cost advantages over other secondary market conduits, and over banks and thrifts with respect to certain forms of portfolio holdings”. (HUD, 2004, I-2) The largest source of cost savings arises from their charter attributes, which “strongly suggest to the financial markets that, in the event that either company experienced serious financial difficulties, the federal government would likely not allow their creditors to suffer financial losses”. “Known as the financial markets’ belief in an ‘implied guarantee,’ this belief has allowed Fannie Mae and Freddie Mac to borrow huge sums at rates that are more favorable than their stand-alone credit rating would warrant.” (Frame and White, 2004) Their charters function like a “franchise” (Van Order, 2000). If it is possible for them to be shut down or for management and shareholders to lose the benefits associated with the charters, they will have incentives to respond to the requests of lawmakers so as to maintain access to future benefits. The GSEs’ accounting scandals in recent years have not only heightened their regulator’s scrutiny of them and incurred stricter regulation of them, but may also have elevated

the possibility of their being deprived of the “franchise”. All of these suggest that the GSEs do have strong incentives to meet the demands of their regulators and lawmakers. Regarding the GSEs’ affordable lending business, “the legislative history of FHEFSSA indicates Congress’ strong concern that the GSEs need to do more to benefit low- and moderate-income families and residents of underserved areas that lack access to credit.” (HUD, 2004, III-25)

Despite Congress’ legislative efforts to exert stronger regulation over the two GSEs, some researchers have expressed their pessimism about the likelihood of effective regulation. For example, Wallison (2004) argues that “in a broader sense, ... Fannie and Freddie – like the S&L industry in the 1980s – can get Congress to protect them against tougher regulation”.⁴⁴ Wallison (2004) made an important point: “When politically powerful forces exert their pressures on Congress, it gives way, and in turn uses its power to compromise the efficacy of regulation.” He also points out that, “the political power of Fannie and Freddie is legendary.” Their political power derives from having former political insiders in their management, hiring powerful lawyers and lobbyists, spending more than entire industries on lobbying activities each year, regularly employing former congressional staff to maintain contact with important lawmakers for whom they previously worked, and making substantial political contributions, either through a PAC or through individual contributions by their management. “Perhaps even more important as sources of political power are the constituency groups both companies can call upon to influence Congress. The securities industry, homebuilders, and realtors are three groups that can be

⁴⁴ The Savings and Loans (S&L) debacle of the 1980s occurred because the Federal Home Loan Bank Board (FHLBB) – then the regulator of savings and loans – failed to take the actions necessary to close down insolvent S&Ls until the problems of the industry had grown to monstrous proportions. The real reason for all these is that Congress, pressed by the powerful lobby then known as the U.S. League of Savings Associations -- as well as homebuilders, realtors, and others who benefited from imprudent S&L lending – brought pressure on the FHLBB to adopt a policy known as forbearance. As a consequence, the S&L debacle took place, and American taxpayers were required to bail out S&L losses of about \$150 billion. (Wallison, 2004)

counted on to press Congress and the White House to adopt positions favored by and favorable to Fannie and Freddie.” Therefore, he argues that, “regulation is no solution at all”. (Wallison, 2004) This also illustrates a point that improving affordable lending performance is not the only way (perhaps even not the most important way) by which the GSEs can diminish their political risk of losing their special status.

In terms of the principal-agent theory, the shareholders of the GSEs can be regarded as their economic principal, and the lawmakers are the GSEs’ political principal. Thus, the purpose of this article can also be put in this way: to assess the responsiveness of the GSEs to their political principal compared with their responsiveness to their economic principal, when they balance the economic and political risks.

The research method of this study is to examine whether the degree of liberalism of the legislators’ political ideology has an impact on the GSEs’ purchasing of affordable mortgages in the constituencies they represent, controlling for other factors (mostly economic risk factors) that would likely affect the GSEs’ purchases of affordable mortgages in different areas. In addition, this study can also test whether the GSEs devote a higher share of their business to affordable lending in higher-income areas, as a strategy to minimize the economic loss caused by meeting the affordable housing goals at the national level. The findings from this study may provide an insight into whether the variation in the GSEs’ affordable lending performance across the nation and over time is more political-pressure-driven or economic-interests-driven. Until now, no empirical research has been done from this perspective. Therefore, the findings of this study have the potential to direct policymakers’ attention to this topic.

Though no study in literature has examined the same question as this essay does, the findings of this study may help to answer a question that has long been the focus of debate among researchers of the regulation of the GSEs: whether or not any regulation mechanism can achieve the purpose of effectively reining in the GSEs' business activities so that they satisfactorily meet their public objectives, given the political reality in the U.S..

This study will provide empirical evidence on whether or not lawmakers' political positions will make a difference in the GSEs' activities of purchasing mortgages for low- and moderate-income families. If, no matter how liberal a legislator's political position is (the Democrats tend to advocate affordable housing), it does not make any difference in the GSEs' affordable lending performance in the area he/she is elected to represent, or, no matter how liberal the Congress as a whole becomes, it does not have any material impact on the GSEs' overall affordable lending performance, then it suggests that pressure from voters is not strong enough to get even the liberal legislators to require the GSEs to substantially improve their affordable lending performance, which further suggests two things: 1) the current affordable goal targets will be increased by no more than a moderate amount in the foreseeable future (if they are going to be increased again), meaning that "requiring Fannie and Freddie to focus their portfolios almost exclusively on mortgages or MBS that support affordable housing" (Bernanke, 2007) is almost impossible to happen; 2) the legislators' actions will mostly be driven by the GSEs, rather than the interests of the public, which can be seen as an example illustrating how the special interests get their way since their interests are concentrated whereas the public in general can't generate

enough political power since their interests are dispersed. In this sense, regulation wouldn't truly serve the public interests.

In short, this study will furnish some empirical evidence on whether or not, given the U.S. political system, government regulation is a viable way to ensure that the GSEs adequately fulfill their mission of promoting homeownership, especially access to affordable housing.

Theoretical Considerations: A Model of the GSEs' Performance under the Low- and Moderate-Income Goal

In this theory, the GSEs have to weigh political pressure against economic risks associated with affordable lending: the economic factor drives them to purchase more loans on housing for higher-income families or in higher-income communities, whereas the political factor drives them to purchase more loans on housing for lower-income families and in lower-income communities. The most important hypothesis tested in this study is that the GSEs will devote a higher percentage of their business to serve lower-income families as the ideological preferences of their political overseers become more liberal. Specifically, this study will examine: whether the more liberal a legislator is, the higher the GSEs' percentage-of-business for low- and moderate-income families is in the area the legislator is elected to represent; and, whether the more liberal Congress as a whole becomes, the better the GSEs' performance under the low- and moderate-income goal gets.

On a related matter, although the GSEs are subject to a percentage goal of purchasing mortgages financing housing for low- and moderate-income families, they do have some discretion over to

which subgroup of this target group they can serve more. However, such discretion is limited, because one of the three “affordable housing goals” – the “special affordable goal” -- requires the GSEs to devote a minimum percentage of their business to purchasing mortgages financing housing for very low income families (at or below 60% of area median income) or low-income families (at or below 80% of area median income) in low-income areas. Thus the GSEs can not fulfill the low- and moderate-income goal by concentrating their purchases on mortgages originated to moderate-income borrowers, which tend to be of lower economic risks compared to the ones originated to low-income borrowers. Therefore, the GSEs need to resort to other strategies if they want to minimize their exposure to economic risks brought by complying with the low- and moderate-income goal. Given the framework of the affordable housing goals, it will be rational for the GSEs to exploit the difference among areas in the nation to avoid unnecessary exposure to higher economic risks associated with purchasing the goal-qualifying mortgages. Since the affordable goals use the area median income as a criterion to determine if a loan purchased is qualified, the general income profile of low- and moderate-income families in a wealthier MSA tend to be better than that in a poorer MSA, presumably resulting in less economic risk associated with affordable lending in a wealthier MSA compared to that in a poorer MSA.⁴⁵ Therefore, a second hypothesis is that, all else equal, the GSEs will have a higher

⁴⁵ Whether or not the GSEs perceive the low- and moderate-income mortgages in higher-income areas to be less risky than those in lower-income areas is not certain. A counterargument to this study’s one is that high-income areas tend to be high-price areas, which could make low- and moderate-income loans in high-income areas more risky, and that higher-income families refinance their mortgages more frequently, so the prepayment risk of mortgages originated to them is higher. This study hypothesizes that the low- and moderate-income mortgages in higher-income metropolitan areas are less risky. There are two main sources of mortgage risks to the lender – default and prepayment. The default risk associated with making residential mortgages comes from two sources: the volatility in house prices over time (and the associated probability that the property will be worth less than the debt) and borrowers’ capacity to pay back the mortgage debt (Ambrose et al, 2002). While it is true that prepayment risk is higher in higher-income areas, default risk is probably lower in those areas. Because the mortgages of interest to this study are originated to low- and moderate-income families, it is held in this study that the GSEs are more concerned with the default risks of the mortgages than with the prepayment risks (and for the default risks, the GSEs are more concerned with the aspect of the borrowers’ ability to repay the debt than with the aspect of house price volatility). Therefore, their mortgage purchasing strategy will be dominated by lowering the mortgage default risks

percentage-of-business for low- and moderate-income families in wealthier MSAs than in poorer ones.

The two hypotheses proposed above will be tested simultaneously in one model. This study adopts a non-experimental design. And the data are multi-year cross-sectional data, with MSA as the unit of analysis. Since evidence suggests that Fannie Mae and Freddie Mac may react differently to public policy pressures and have different practices of purchasing loans in risky locations (Ambrose and Pennington-Cross, 2000), this study analyzes Fannie Mae and Freddie Mac purchase activity separately.

Data

The data on the percentage of the home-purchase loans acquired by the GSEs which are for low- and moderate-income borrowers (Y_{it}) (by metropolitan areas) for each year from 2001 to 2007 are obtained directly from HUD. The number of home-purchase mortgages purchased by the GSEs in each MSA comes from the same data source. The data are provided for Fannie Mae and Freddie Mac separately.

The political ideology of Senators and Congressmen (X_{it}) is measured by the DW-NOMINATE scores, which are developed by political scientists Keith T. Poole and Howard Rosenthal.⁴⁶ Their

as much as possible, which will be exhibited in a pattern of higher percentages of low- and moderate-income mortgage purchases in higher-income metropolitan areas. The empirical test results will provide some evidence on whether this study's hypothesis is valid regarding this question.

⁴⁶ **W-NOMINATE** is a scaling procedure that performs parametric unfolding of binary choice data. Given a matrix of binary choices by individuals (for example, Yes or No) over a series of legislative votes, W-NOMINATE produces a configuration of legislators and outcome points for the Yea and Nay alternatives for each roll call using a probabilistic model of choice. DW-NOMINATE is a dynamic version of W-NOMINATE, which means the DW-NOMINATE scores are comparable over time.

work on the method for generating the data and their analyses of the data have resulted in well-accepted publications, for example, an article in the *American Journal of Political Science*.⁴⁷ The GSE data for year 2001 and year 2002 corresponds to the 107th Congress; the GSE data for year 2003 and year 2004 corresponds to the 108th Congress; and so on.

In Congress, the Senate Committee on Banking, Housing, and Urban Affairs, and the House Committee on Financial Services have jurisdictions over the GSEs. The data on these committees (for example, membership of the committees) needed by this study are obtained from the data set Stewart and Woon (2011) prepared according to the Congressional Record. This data set also contains all legislators' seniority data.

If an MSA is in more than one jurisdiction (state or congressional district), the share of that MSA's population living in each component jurisdiction is needed as the weight for each jurisdiction's legislator(s)' political ideology. The MABLE-Geocorr software supported by the Missouri Census Data Center is used to get the percentages of Census 2000 population living in different states for an MSA and the percentages of Census 2000 population living in different congressional districts for an MSA.

MSA median family income data are obtained from HUD.

The data are available at www.voteview.com, where description of the data and other related information can also be found.

⁴⁷ Poole, Keith T. and Howard Rosenthal. 1985. "A Spatial Model for Legislative Roll Call Analysis." *American Journal of Political Science*, Vol. 29, No. 2: pp. 357-384

The following book extensively analyzed the data and provided the technical details of the [W-NOMINATE](#) procedure in Appendix A:

Poole, Keith T., and Howard Rosenthal. Congress: A Political-Economic History of Roll Call Voting. New York: Oxford University Press, 1997.

The summary statistics are provided in Table 1.

Empirical Operationalization of the Model

The regression model expressed in the concise form is:

$Y_{it} = A + BX_{it} + CI_{it} + DP_{it} + EZ_{it} + \mu_{it}$, where i denotes an MSA, and t denotes a particular year.

Y_{it} is the GSEs' percentage-of-business for low- and moderate-income families' home-purchase mortgages in a certain MSA in a particular year.

X_{it} is the political ideology of Senators and Congressmen, measured by the DW-NOMINATE scores. The DW-NOMINATE scores have two dimensions, with the first one measuring government intervention in the economy or liberal-conservative. Only the first dimension is relevant to this study, so it is included in the model. It is hypothesized that the first dimension DW-NOMINATE score is negatively associated with the dependent variable.⁴⁸ The impacts of Senators and Representatives' political ideology are separately estimated. That means, X_i represents a vector of two variables: X_{1i} denotes the political ideology of two Senators from the same state, measured as the mean DW-NOMINATE scores of the two Senators; X_{2i} denotes the political ideology of a Representative.

I_{it} denotes the MSA median family income. This is an economic risk variable. Theory suggests that this factor is an important determinant of the GSEs' loan-purchasing activities. The

⁴⁸ DW-NOMINATE scores range from negative values to positive ones, with more extreme negative values representing higher level liberalism, and more extreme positive values representing higher level conservatism.

coefficient estimate of this variable will serve to test the second hypothesis of this study. It is hypothesized that this variable is positively associated with the dependent variable. Moreover, it should be noted that the prevalent income level is an indicator of the strength of economy in an area, which is likely to be associated with the local politicians' degree of political liberalism. Despite the possible collinearity of the two variables, both of them need to be included in the regression equation for hypothesis testing purposes.

P_{it} denotes a group of control variables that are meant to reveal to what degree the political power of the legislators regarding overseeing the GSEs affects the importance of the legislators' political ideology. These variables include:

a) the interaction terms between the legislators' political ideology and their memberships of the committees that have jurisdiction over the GSEs. Since the presence of a Senator or Congressman on those committees makes them more influential in determining the regulation of the GSEs, his/her political position may count more to the GSEs than that of a legislator not on such a committee. The addition of these interaction terms serves to test this hypothesis. For example, $X_{1i} * T_{1i}$ denotes the interaction term between the political ideology of a Senator in a state and his/her membership of the Senate's committee that oversees the GSEs. $T_{1i}=0$ means that the Senator does not serve on the committee; $T_{1i}=1$ means that the Senator serves on the committee.

b) the interaction terms between a legislator's political ideology and whether he/she is a chairman or ranking member of the committees that oversee the GSEs. For example, $X_{1i} * L_{1i}$

denotes the interaction term for a Senator. $L_{1i}=0$ indicates a non-leadership status; $L_{1i}=1$ indicates the status of a chairman or ranking member of the oversight committee. These interaction terms are intended to test the hypothesis that the political ideology of the chairmen and ranking members of the oversight committees matters more than that of any legislator who does not hold such a position, because the leadership of these committees is supposed to be most powerful in shaping the regulatory policies over the GSEs.

c) the interaction terms between a legislator's political ideology and his/her seniority. For example, $X_{1i}*S_{1i}$ denotes the interaction term between the political ideology of a Senator and his/her years in office. Senior legislators are usually more powerful than junior ones, so it is hypothesized that senior legislators' ideology is more likely to influence the GSEs' affordable lending performance in their constituencies than that of junior legislators.

Z_{it} represents the group of control variables that are not directly related to the legislators' political influence. One such variable is the number of home-purchase mortgages purchased by the GSEs in an MSA. This needs to be controlled for, because it measures the GSEs' involvement in an area and an area's importance to the GSEs' business. MSA and year dummy variables are also included to control for unobserved regional and time effects.

The variables in the regression equation and their data sources are summarized in the following table:

Variable	Data Source
<i>Dependent variable</i>	
Fannie Mae's percentage-of-business for low- and moderate-income families' home-purchase mortgages	HUD (data are for each year from 2001 to 2007)
Freddie Mac's percentage-of-business for low- and moderate-income families' home-purchase mortgages	HUD (data are for each year from 2001 to 2007)
<i>Independent variables of interest</i>	
Political ideology of Senators and Congressmen	DW-NOMINATE scores, which are provided by www.voteview.com . The use of this scale is accepted by the American Political Science Review.
MSA median family income	The median family income (by MSA) for each year from 2001 to 2007 is from HUD.
<i>Control variables</i>	
the interaction terms between the legislators' political ideology and their memberships of the committees that have jurisdiction over the GSEs	Computed from an existing variable and data from Stewart and Woon (2011)
the interaction terms between a legislator's political ideology and whether he/she is a chairman or ranking member of the committees	Computed from an existing variable and data from Stewart and Woon (2011)

that oversee the GSEs	
the interaction terms between a legislator's political ideology and his/her seniority	Computed from an existing variable and data from Stewart and Woon (2011)
MSA fixed effects	
Year fixed effects	
the number of home-purchase mortgages purchased by the GSE in the MSA	HUD (data are for each year from 2001 to 2007)

The study analyzes multi-year cross-sectional data, with MSA as the unit of analysis. The regression equation is estimated using a sample of 60 MSAs observed annually for 7 years. Because the dependent variables are measured as percentages, feasible generalized least squares (FGLS) is used to estimate the regression equations, with each of the two GSEs' performance under the goal as the dependent variable. The FGLS estimation corrected for heteroskedasticity across panels and panel-specific AR(1) autocorrelation. Since percentages have a lower limit of 0 and an upper limit of 1, a tobit regression is also run to check the robustness of the results from the FGLS estimation.

Results

Table 2 presents feasible generalized least squares (FGLS) estimates of the influence of legislators' political ideology and MSA median family income on the GSEs' percentage-of-business for lower-income homebuyers.

The coefficient estimate of Senators' DW-NOMINATE score is -0.042 for Fannie Mae, which is statistically significant at the 1% level. This implies that a one standard deviation decrease in the Senators' DW-NOMINATE score leads to a 1.58 percentage point increase in Fannie Mae's low- and moderate-income percentage-of-business for home-purchase mortgages. This effect is not practically significant. By contrast, this variable's coefficient estimate is not statistically significant at the 5% level for Freddie Mac. Moreover, Congressmen's DW-NOMINATE scores are not significant at the 5% level for either Fannie Mae or Freddie Mac.

The coefficient estimates of the interaction terms between the Senators' political ideology and their memberships of the Senate committee that have jurisdiction over the GSEs are negative and statistically significant at the 1% level for both GSEs. This implies that the GSEs' affordable lending activities are more responsive to the political ideology of the Senators on the Banking, Housing, and Urban Affairs committee than that of those not on this committee. This translates into a 3.46 percentage point increase in Fannie Mae's low- and moderate-income percentage-of-business for home-purchase mortgages and a 3.68 percentage point increase in Freddie Mac's, for a one standard deviation decrease in the DW-NOMINATE score of a Senator on the GSEs' oversight committee, as compared to a Senator not on the oversight committee. Against expectation, the coefficient estimate of the interaction term between the Congressmen's political ideology and their memberships of the House committee that have jurisdiction over the GSEs is positive and statistically significant at the 1% level for Fannie Mae. But the coefficient estimate of this variable is not statistically significant at the 5% level for Freddie Mac.

None of the coefficients for the interaction terms between a legislator's political ideology and whether he/she is a chairman or ranking member of the committees that oversee the GSEs is statistically significant at the 5% level.

As for the interaction terms between a legislator's political ideology and his/her seniority, only the coefficient estimates for Congressmen are statistically significant at the 5% level, but both estimates are positive, implying that the GSEs are less responsive to the political ideology of senior Congressmen. This is also against expectation.

The coefficient estimates on MSA median family income are statistically significant at the 1% level. A \$10,000 increase in MSA median family income leads to a 6.34 percentage point increase in Fannie Mae's low- and moderate-income percentage-of-business for home-purchase mortgages and 4.11 percentage point increase in Freddie Mac's.

The number of home-purchase mortgages purchased by a GSE in an MSA also has a positive effect on their affordable lending performance and this effect is statistically significant at the 1% level.

The results from a tobit regression are similar to the FGLS estimation results, except that none of the coefficients for the interaction terms between ideology and oversight committee membership is statistically significant at the 5% level.

Conclusion

This study provides evidence that Senators' political ideology affects the GSEs' purchases of home-purchase mortgages originated to low- and moderate-income families, although the effect appears to be very limited. The Senators on the committee overseeing the GSEs have much more influence on the GSEs' affordable lending performance. This seems to support the argument that the GSEs respond to their political principals' ideological preferences. However, the two GSEs exhibit somewhat different patterns in doing so. An important finding is that while the GSEs have to fulfill Congress' mandate to them of promoting homeownership among lower-income families, they utilize their discretion in allocating affordable lending activities to buy a higher share of low- and moderate-income mortgages in higher-income areas, to reduce their likelihood of economic loss associated with buying such mortgages.

Tables

Table 1: Summary statistics of variables in the political-economic analysis model

Variable	Obs	Mean	Std. Dev.	Min	Max
Fannie Mae's low-moderate-income %	420	0.4391	0.1134	0.079	0.6973
Freddie Mac's low-moderate-income %	420	0.4163	0.1110	0.0915	0.6847
Senators' DW-Nominate Score	420	-0.082	0.376	-0.636	0.818
Congressmen's DW-Nominate Score	420	0.041	0.302	-0.579	0.668
MSA median family income	420	64038.3	10468.5	43800	105500
(Sen.' ideology)*(committee membership)	420	-0.019	0.142	-0.275	0.314
(Rep.' ideology)*(committee membership)	420	-0.001	0.109	-0.256	0.471
(Sen.' ideology)*(chairman/ranking member)	420	0.001	0.060	-0.261	0.310
(Rep.' ideology)*(chairman/ranking member)	420	-0.002	0.014	-0.166	0.000
(Sen.' ideology)*seniority	420	-1.177	4.847	-17.084	12.342
(Rep.' ideology)*seniority	420	0.105	3.979	-13.424	13.486
number of mortgages bought by Fannie Mae	420	13945.3	10094.7	924	65953
number of mortgages bought by Freddie Mac	420	9341.74	7274.89	704	51703

Table 2: Feasible Generalized Least Squares (FGLS) estimates of the political-economic analysis regression equations

	(1)	(2)
Dependent Variable:		
low- and moderate-income percentage-of-business for home-purchase mortgages		
	Fannie Mae	Freddie Mac
Senators' DW-Nominate Ideology Score	-0.042 [0.014]**	0.012 [0.017]
Congressmen's DW-Nominate Ideology Score	-0.035 [0.026]	-0.011 [0.028]
MSA median family income	6.34E-06 [5.490e-07]**	4.11E-06 [4.962e-07]**
(Senators' DW-Nominate Score)*(the GSEs' oversight committee memberships)	-0.092 [0.032]**	-0.098 [0.025]**
(Congressmen's DW-Nominate Score)*(the GSEs' oversight committee memberships)	0.078 [0.027]**	0.037 [0.028]
(Senators' DW-Nominate Score)*(whether being a chairman or ranking member of GSEs' oversight committee)	-0.008 [0.043]	0.038 [0.039]
(Congressmen's DW-Nominate Score)*(whether being a chairman or ranking member of GSEs' oversight committee)	0.291 [0.171]	0.147 [0.296]
(Senators' DW-Nominate Score)*seniority	0.001 [0.001]	-0.002 [0.001]
(Congressmen's DW-Nominate Score)*seniority	0.003 [0.002]*	0.003 [0.002]*
the number of mortgages purchased by Fannie Mae in the MSA	4.61E-06 [5.167e-07]**	
the number of mortgages purchased by Freddie Mac in the MSA		7.56E-06 [7.419e-07]**
Constant	-0.309 [0.041]**	-0.174 [0.032]**
Observations	420	420
Number of msa	60	60

Notes: (1) Standard errors are in brackets. * denotes significance at 5% level; ** denotes significance at 1% level.
(2) MSA fixed effects and year fixed effects are included, but not reported.

CHAPTER 6

CONCLUSIONS ABOUT POLICY IMPLICATIONS OF FINDINGS

At this time, the two GSEs are major tools used by the U.S. government to stabilize the mortgage market. Recently, policymakers have paid more attention to the post-conservatorship form of the two companies, albeit the timing of terminating that conservatorship is unknown now. The Housing and Economic Recovery Act of 2008 retained the “affordable housing goals” regulation of the GSEs, although revisions have been made to the specific requirements of the regulation, including establishing separate single-family housing goals for the GSEs’ purchase of purchase-money mortgages and refinancing mortgages, and narrowing the previous target group of low- and moderate-income families to low-income families only. However, the policy implications of the findings of this dissertation will be well beyond just about improving this policy itself. Policy lessons can be learned from past experience of implementing this regulation to help answer a more fundamental and overarching question of whether the federal government’s policies of promoting homeownership should be largely targeted towards the lower-income population, as opposed to serving a larger group of homebuyers that also include a significant portion of higher-income families. This also suggests what amount of homeownership subsidies are appropriate. Policymakers’ decision on this issue, as asserted by the then Secretary of Treasury Henry Paulson in an early 2009 speech, would be the foundation for shaping the U.S. mortgage market of the future, particularly for overhauling the two GSEs. Despite the uncertainty as to the future of the two companies, the U.S. government’s efforts to support the housing market by lowering the effective mortgage costs will continue existing in some old or new ways for the foreseeable future. This dissertation attempts to provide empirical evidence on the effect of a policy targeting low- and moderate-income families on those families, for whom the case for government intervention is strongest.

The findings from the first study of this dissertation can provide some quantitative evidence on the effectiveness of increasing the target level of the low- and moderate-income goal in expanding homeownership, to inform the policy debate regarding whether the affordable housing goals target levels should be raised further. The finding of positive effect of higher target levels may buttress the argument for increasing the goal levels. Furthermore, the affordable housing goals requirements only apply to the GSEs' purchases of mortgages, but not the GSEs' holdings of mortgages in their portfolios. In early 2007, Federal Reserve Chairman Bernanke called for stronger regulation of the GSEs that requires them to almost exclusively hold in their portfolios mortgages or mortgage-backed securities that support affordable housing. The finding of a positive relationship between the GSEs' low- and moderate-income percentage-of-business and the highest income quartile of low- and moderate-income families' homeownership likelihood will support Bernanke's opinion that the GSEs' concentration on affordable-housing products would provide the greatest public benefit. Thus it can be extrapolated that regulating the GSEs' portfolio holdings by establishing a minimum percentage for affordable-housing products will make them better fulfill their public purposes. The findings can also suggest for which income bracket among this lower-income target group the policy's effect is greatest. This will help policymakers to determine the income eligibility criteria for the GSEs' affordable lending activities. Moreover, the substitution effect between the GSEs and FHA-Ginnie Mae and between the GSEs and subprime lenders is of increasing interest to housing policy analysts. The income bracket identified by this study as the one that the GSEs can most effectively help achieve homeownership can be compared to that of the borrowers who took out FHA or subprime mortgages. If supplemented by other studies that compare other characteristics, such as

credit scores, of these groups, the information provided by this study can help determine if the GSEs' competition with FHA and subprime lenders is substantiated. If that's the case, further studies can be done to decide the proper scope of the GSEs' activities in this regard. Also importantly, this study may provide a rough estimate of the effective-interest-rate-reduction-equivalent effect of an increase in the GSEs' low- and moderate-income percentage-of-business, and this estimate will provide a key piece of information for any cost-benefit analysis that evaluates whether the GSEs' operations justify the federal government's subsidy to them.

The finding from the second study of this dissertation is that the GSEs' compliance with the affordable housing goals did not help to push home prices up for the low- and moderate-income population during the period from 2001 to 2007, which is for the most part when the most recent housing bubble occurred. A possible cause of this finding is that the GSEs' affordable lending products were provided with less lax credit standards, compared with those of some other lenders, probably particularly subprime lenders. That would suggest that the GSEs' response to the affordable housing goals did not exacerbate the imprudent lending activities which caused the mortgage market crisis.

The finding from the third study of this dissertation would suggest that strong oversight of the GSEs with regard to how well they have fulfilled their public purposes would be difficult to achieve. It follows that strong oversight of them with regard to financial safety and soundness would also be difficult to accomplish in the absence of severe situations in which the two companies are at risk of collapse. The recent history of the GSEs is consistent with these two points. This claim stems from the inherent conflict between public purpose and private gain

unresolved by the GSEs' structure before they were taken over by the government. The finding from the third study would suggest that any future structure to replace the two firms had better minimize that conflict. Options of remaking the GSEs that can achieve this purpose and have been under consideration by policymakers include: establishing a public utility-like mortgage credit guarantor, which would not have investment portfolios; consolidating the firms into one government agency, leaving mortgage finance to private banks; etc. However, policymakers may decide to maintain a hybrid model that is similar to the GSEs' current form, if concerns about other aspects of reforming the GSEs outweigh the ones on this factor. Should that happen, the finding of this study would suggest that, in order to reduce the conflict of interest between the GSEs' public mission and shareholders' gain, changes should be made to curb their political power that influences government's oversight of them, such as restraining their lobbying activities and political contributions.

All the three studies taken together, the findings of this dissertation would recommend that any future form or replacement of the GSEs should have a stronger emphasis on promoting mortgage credit availability to the lower-income population; play a role as a major policy tool that stabilizes the market (a role that the GSEs are now playing by carrying out the Obama administration's housing recovery program), rather than magnifies the market fluctuations; have a more clearly defined role to prevent the pursuit of maximizing profits from interfering with fulfilling the public mission.

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