

**HUD Purchase Goals and Crowd Out:
Do the GSEs Expand the Supply of Mortgage Credit?**

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October 4, 2007

Support for this research from National Association of Realtors is gratefully acknowledged. We thank Paul Bishop for helpful comments and Glenn Canner for assistance in acquisition of data. Michael Eriksen provided excellent research assistance. Any errors are our own.

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Do the GSEs Expand the Supply of Mortgage Credit?**

Abstract

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The U.S. government provides extensive support for the secondary mortgage market through both implicit and direct subsidization of the federally chartered GSEs, Fannie Mae and Freddie Mac. In exchange, under the 1992 GSE Act, Fannie Mae and Freddie Mac are obliged to purchase a substantial share of their loans in targeted, underserved neighborhoods. This study investigates two phenomena associated with this policy: the degree to which the GSEs respond to the loan purchase guidelines and the extent to which GSE activity crowds out purchases by private secondary market entities. A simple conceptual model suggests that crowd out could be pronounced when primary lenders retain few loans in portfolio. This is important because the share of conforming loans held in portfolio by primary lenders fell from roughly 40 percent in 1994 to nearly zero in 2004.

Evidence based on the 1994-2004 HMDA data confirms that the GSEs have been responsive to the HUD affordable housing goals. However, instrumental variable estimates suggest that crowd out associated with GSE activity increased over time as primary lenders held fewer loans in portfolio. In 2004, GSE crowd out was 100 percent, implying a sharply diminished impact of GSE activity on the supply of mortgage credit. To some extent, increased GSE crowd out is a natural consequence of the expansion and increasing sophistication of the secondary market. Nevertheless, our findings weaken the case for continued government support of these institutions.

I. Introduction

A defining innovation of the U.S. housing finance system has been the development of secondary markets and the related dominant role of the government-sponsored enterprises (GSEs), of which Fannie Mae and Freddie Mac are the most prominent (e.g. Gabriel and Rosenthal [2007]). The GSEs were established in part to help improve the efficiency of mortgage credit allocation, but also to enhance the supply of mortgage credit in lower-income and underserved housing markets.¹ This latter role is reflected in increasingly stringent Department of Housing and Urban Development (HUD) guidelines that oblige the GSEs to purchase an ever larger share of their loans in underserved communities. As of 2004, the GSEs were required to purchase over half of their loans from underserved segments of the population. While this degree of government intervention in the mortgage market is striking, little is known about the effect of GSE purchase activity on the supply of mortgage credit. That lack of knowledge is in contrast to the enormous size and potential impact of the GSEs. As of 2007, securitized home mortgage debt backed by the GSEs totalled \$4.0 trillion. This is close to the outstanding level of U.S. Treasury debt, almost double that of outstanding consumer debt, and roughly two-thirds the value of all outstanding household pension reserves.² The size of the secondary mortgage market along with the extensive level of government intervention heightens the need to better understand the impact of the GSEs on the supply of mortgage credit. This paper begins to fill that gap.

Our goal is to assess two phenomena associated with GSE activity including (1) the degree to which the intensity of GSE activity differs across low- and high-income communities in a manner consistent with the policy goals of the 1992 GSE Act, and (2) the extent to which GSE loan purchases crowd out private sector purchases on the secondary market. This latter issue is especially important

¹Secondary credit markets improve efficiency in several ways. They increase liquidity for primary lenders, smooth regional imbalances in the supply and demand for credit, and enhance opportunities to manage risk. All of these gains stem from economies of scale associated with the large size of the secondary market.

²See Table L.125, line 2, Federal Reserve Board Flow of Funds Accounts (2007) for data on outstanding mortgage debt. In 2007, Treasury debt outstanding equaled roughly \$4.9 trillion (Table L.4 line 3), outstanding consumer debt totaled \$2.4 trillion (L.222, line 1), and total pension fund reserves held by the household sector totaled \$5.8 trillion (Table L.118, line 1).

when evaluating the impact of GSE activity. If, for example, much of the GSE purchase activity is offset by crowd out of private sector purchases, then a simple count of the number of loans purchased by the GSEs would greatly overstate their impact on the supply of mortgage credit. Crowd out could also undermine policy goals of the 1992 GSE Act that seek to enhance the supply of credit and increase opportunities for homeownership in targeted and underserved areas. Some further background will help to put these ideas in context.

The 1992 Federal Housing Enterprise Financial Safety and Soundness Act of 1992 (GSE Act of 1992) raised the level of support that the GSEs are required to provide to lower-income and minority communities. The Act also authorized the Secretary of HUD to establish “affordable housing goals” for the GSEs. According to those goals, a minimum proportion of each GSE’s annual loan acquisitions must be purchased from disadvantaged borrowers and communities. These include lower-income borrowers (the “low-moderate income” goal), “very” low income borrowers or low-income borrowers residing in low-income census tracts (the “special affordable” goal), and borrowers residing in low-income census tracts or in relatively low income “high minority” neighborhoods (the “geographically targeted” or “underserved areas” goal).³ Over time, HUD has substantially increased the GSE purchase targets for borrowers belonging to one or more of these categories. The most recent HUD rules, set in November 2004 for purchase activity from 2005 through 2008, established the low-moderate income goal in a range from 52 to 56 percent of total GSE purchases, the geographically targeted goal in a range from 37 to 39 percent, and the special affordable goal in a range from 22 to 27 percent (U.S. Department of Housing and Urban Development [2004]).⁴ These requirements reflect a

³For the low-moderate income goal, the GSE Act defines lower-income borrowers as individuals with income below that of MSA (metropolitan statistical area) median income. For the special affordable goal, very low income borrowers are those with income less than 60 percent of the area median income. The special affordable goal also includes borrowers with income less than 80 percent of the area median income who reside in census tracts defined as low-income (tracts with median income less than 90 percent of MSA median income). Under the geographically targeted goal, low-income, underserved neighborhoods are defined as census tracts with median income less than 90 percent of MSA median income or tracts with over 30% minority population and median income less than 120% of area median income.

⁴These categories are not mutually exclusive, so a single loan purchase can count towards multiple goals.

stunning degree of government intervention in the allocation of mortgage credit, especially in comparison to other credit markets.

Most borrowers targeted by the GSE purchase goals reside in lower income census tracts. Partly for that reason, a natural first question concerns the nature of the GSEs response to the geographic purchase targets. Previous studies have taken an accounting approach to this question, adding up the number of GSE loan purchases. These studies have documented that the GSEs largely adhere to their obligatory purchase targets (e.g. Bunce and Scheessele [1996], Bunce [2002]). We examine a related but distinct measure here, the ratio of secondary market loan purchases relative to loan originations. Deflating purchases by originations controls for the size of the local market. That is important because homeownership rates and mortgage activity are much lower in low income communities. In that regard, purchase-to-origination ratios allow us to assess the intensity of secondary market activity relative to potential demand. That focus is closer in spirit to the policy goals implicit in the 1992 GSE Act and, as will become apparent, helps to illuminate crowd out arising from GSE activity. As a starting point, therefore, we ask whether the intensity of GSE activity is greater in underserved communities?

To address this question, we examine data from the Home Mortgage Disclosure Act (HMDA) for each even year from 1994 to 2004. These data are analyzed in conjunction with 1990 census tract information that allows us to group MSA census tracts into eight categories: those with average income 30 percent below the GSE income limit used to define a low-income census tract, 20 to 30 percent below the income limit, 10 to 20 percent below the income limit, 0 to 10 percent below the income limit, and an analogous set of bands for tracts above the income limit. For each group of census tracts and for each even year from 1994 to 2004, we then measure the ratios of loan purchases to originations for GSE and non-GSE entities. Moreover, these measures are computed separately for the conforming and non-conforming market segments, bearing in mind that the GSEs purchase primarily conforming loans. Summary measures are plotted in Figures 1a-1f for the conforming sector of the mortgage market, and 2a-2f for the non-conforming sector. Each figure corresponds to a

different year from 1994 to 2004, and values along the horizontal axis correspond to the different census tract groups above and below the underserved income cutoff. Several patterns are noteworthy.

First, for the conforming sector of the market (Figures 1a-1f), in all years there is a downward slope across tract income categories for the plots of GSE conforming loan purchase/origination shares, but an upward slope for non-GSE secondary market entities. This indicates that on average, the GSEs do more of their business (relative to originations) in lower income communities whereas the opposite is true for non-GSE loan purchasers. Second, in most years, the purchase/origination shares for the GSEs are relatively flat across income bands below the GSE underserved income limit, but then fall off markedly for census tracts above the GSE income limits. Third, in the non-conforming segment of the market (Figures 2a-2f), GSE purchase/origination shares are quite low indicating that the GSEs do not purchase many of these loans. Fourth, plots of the GSE purchase shares in this market segment are flat indicating no tendency for the GSEs to vary non-conforming loan purchase activity with neighborhood income. This is consistent with the absence of GSE purchase targets in the non-conforming sector, and in marked contrast to the patterns evident for the conforming sector.⁵

Together, these plots suggest that the GSEs have been responsive both to the letter and to the spirit of the HUD affordable housing goals. This is most apparent in the degree to which GSE purchases relative to originations are especially high for conforming loans in targeted, underserved communities, both relative to non-GSE purchases of conforming loans, and also relative to behavior in the non-conforming segment of the market. On the surface, therefore, the purchase goals seemingly achieve their objective of prompting more intensive secondary market activity in underserved communities, even taking into account the relatively small size of potential demand for mortgages in such neighborhoods. However, for two reasons, closer inspection of Figures 1a-1f suggests that such a conclusion may be premature.

⁵ Similarly, non-GSE purchase/origination shares in the non-conforming sector display little tendency to trend either up or down with an increase in neighborhood income, although there are some spikes in places: the patterns for 2004 are especially flat.

In Figures 1a-1f, notice that the plots of non-GSE purchase/origination shares of conforming loans display almost mirror image patterns to those of the GSEs. Specifically, whereas the GSE plots display a clear focus on lower income communities, the non-GSE plots indicate a focus on higher income neighborhoods. Such a result could be indicative of GSE crowd out non-GSE activity.

From Figures 1a-1f, it is also clear that the total share of conforming loans sold to the secondary market has increased sharply in recent years. In 1994 roughly 60 percent of originations were purchased by the secondary market. In 2002, for the first time, the purchase/origination share exceeded 90 percent in all eight income categories of census tracts. In 2004, the purchase/origination ratio was essentially 100 percent in all communities. In such a market environment, it will be difficult for primary lenders to increase the quantity of loans supplied to the secondary market.⁶ As a result, loan supply in the secondary market becomes very inelastic. Later in the paper we present a simple conceptual model of GSE crowd out of private sector purchases. In that model we show that as supply becomes more inelastic crowd out becomes more pronounced. Along with the plots in Figures 1a-1f, this suggests that GSE crowd out should have increased in recent years.

To assess potential crowd out effects, we estimate a series of Tobit models of private sector secondary market loan purchase/origination ratios. Covariates include MSA fixed effects as well as a rich set of 1990 census tract socioeconomic attributes; this controls for unobserved taste and risk factors that influence mortgage demand and supply. In addition, we control for GSE purchase/origination shares. Evidence of a negative coefficient on GSE purchase/origination shares would suggest that GSE purchases crowd out loan purchases by private secondary market entities; evidence of a -1 coefficient would be consistent with full crowd out.⁷

⁶Recent evidence from Gabriel and Rosenthal [2007] suggests that an increase in secondary market purchases does increase loan originations. However, the estimated effect is too small to mitigate crowd out effects when all loans are being purchased by the secondary market.

⁷In principle, agglomeration economies arising from the presence of the GSEs could enhance opportunities for private sector entities to purchase loans (e.g. Rosenthal and Strange [2004]). This might occur if GSE activity helped to establish information networks and other infrastructure necessary to support the entire market (e.g. Lang and Nakamura [1994]). Harrison et al [2002] suggest that Fannie Mae purchases have had such an effect in parts of

An important requirement of the analysis is to control for the endogeneity of GSE purchase activity: profitable opportunities to purchase loans on the secondary market will attract not only private sector purchases but also GSE purchases. This implies that GSE purchases are positively correlated with the model error term. Given that crowd out causes GSE purchase activity to have a negative impact on private sector purchases, failing to control for the endogenous character of GSE purchases would cause us to underestimate GSE crowd out. Importantly, this also suggests that non-IV estimates provide lower bounds on GSE crowd out; as will become apparent, these lower bound estimates are revealing in some instances.

In order to obtain more precise measures of crowd out, we use two instrument strategies to control for the endogenous character of GSE purchase/origination shares. In the first approach, we instrument for GSE purchase/origination shares using the census tract's undeserved status in 1990. Because HUD purchase targets mandate that the GSEs acquire a disproportionate share of their loans in undeserved tracts, a tract's underserved status is likely correlated with GSE purchase/origination shares. Of course, a tract's economic status is also a direct determinant of private sector purchase/origination shares. This is because tract income affects demand for originations and also the risk attributes of the applicant pool with a corresponding effect on the supply of credit. To address these concerns the model includes a long list of 1990 census tract socio-demographic (SES) attributes (e.g. age distribution of the population, education, race, etc.), as well as the tract's 1990 average income and income squared. These terms capture the underlying demand for credit and risk attributes of the applicant pool. These factors likely vary in a smooth continuous fashion with SES attributes, including income and income squared. Identification is then obtained by the discrete shift in GSE purchase activity associated with the income limit used by HUD to define underserved tracts.

It should be emphasized that having controlled for GSE purchase activity there is no particular reason why a tract's underserved status should appear directly in the second stage equation used to

Florida. In practice, however, evidence presented later in the paper suggests that crowd out – which implies that GSE purchases reduce private sector activity – dominates, and especially in recent years.

explain private sector purchases. On a priori grounds, therefore, a tract's underserved status satisfies three important conditions for a valid instrument: underserved status is correlated with GSE purchase activities, underserved tract status can legitimately be excluded from the structural model, and underserved tract status is likely exogenous. A fourth necessary condition is that underserved status is sufficiently correlated with GSE purchase activity to avoid concerns about weak instrument bias (e.g. Murray [2006], Cameron and Trivedi [2005], Stock and Yogo [2005]). On this point, evidence presented later in the paper indicates that for several of the earlier sample years underserved tract status fails the weak instrument test. This would be expected in years when HUD purchase targets were not binding. However, as purchase guidelines become more stringent one would expect the strength of the underserved status instrument to increase. Consistent with that view, underserved status overwhelmingly passes the weak instrument test in 2004. For that reason, we are especially confident of our results for 2004.

A second instrument strategy was also considered. In this case, we used 1980 SES attributes of the census tracts (coded to year-2000 tract geography) to instrument for GSE purchase activity. Diagnostic tests (Cragg-Donald [1993]) indicate that 1980 SES attributes likely pass the weak instrument tests in all sample years other than 1994. Additional results based on the non-conforming sector of the market are suggestive that 1980 SES attributes are excludable from the structural model. However, that evidence is indirect in nature and not conclusive. For that reason, the possibility remains that 1980 SES attributes may help to proxy for the local demand and supply for credit in the 1994-2004 period even after controlling for 1990 SES attributes in the model. If true, that would undermine the validity of the 1980 SES instruments, and for that reason, in most instances we emphasize results based on the underserved instrument strategy.

Results based on the variety of IV and non-IV regressions for both the conforming and non-conforming sectors of the market shed considerable light on GSE crowd out. First, estimates suggest that GSE crowd out of private secondary market conforming loan purchases has increased over time. Second, in 2004, the GSE purchase/origination coefficient is -1.12 when we instrument using

underserved status and -1.02 when we instrument using 1980 SES variables. In contrast, the non-IV estimate for this year is -0.54. The non-IV estimate confirms that GSE crowd-out in 2004 was substantial, while the IV estimates indicate that GSE crowd out was 100 percent.

The results in this paper have important implications. On the one hand, earlier in the 1990s GSE purchase activity may have extended credit to communities that would not otherwise have been served by the private sector. However, evidence suggests that by 2004 this was no longer the case. From a policy perspective, this does not imply improprieties on the part of the GSEs. Rather, the reduced impact of GSE purchases was likely a consequence of the growth and increasing sophistication of the private secondary market. Should market conditions change and the private sector become more reticent to purchase loans, conceptual arguments presented later in the paper suggest that GSE crowd out will become less pronounced and that would cause the impact of the GSEs to increase. We speculate that this may be characteristic of 2007 markets following the implosion of the subprime sector. Nevertheless, on the whole, our results weaken the case for government support of the GSEs.

To clarify these results, the plan of the paper is as follows. Section 2 provides additional background on the GSEs and related regulation. Section 3 presents a simple conceptual model of GSE crowd out of private sector loan purchases. Section 4 develops the empirical model. Section 5 presents data and summary statistics. Section 6 presents the results, and Section 7 concludes.

II. Background

As noted earlier, the GSEs have been obliged to secure a minimum share of their annual loan purchases from targeted communities and groups. Bunce and Scheessele [1996], Bunce [2002], and others provide evidence that in the years following enactment of the 1992 GSE Act, the GSEs increased the proportion of loan purchases from targeted populations. Between 1992 and 1995, for example, Fannie Mae doubled the share of loan purchases from lower-income borrowers while Freddie Mac increased its share by roughly 50 percent. Manchester [1998] documents that in 1995,

Fannie Mae and Freddie Mac both surpassed the affordable loan purchase housing goals established by HUD. Manchester, Neal, and Bunce [1998] reach similar conclusions.⁸ Collectively, these studies provide compelling evidence that the GSEs have largely met the administrative targets imposed by the regulating authorities. As emphasized above, our plots in Figures 1a-1f also demonstrate that upon controlling for the size of the local market for conforming loans, the GSEs are much more active in targeted, underserved communities, consistent with the goals of the 1992 GSE Act.

A different set of studies have sought to identify the impact of GSE purchase targets on mortgage loan originations between the mid-1990s and 2000. While not directly addressing the possibility that GSE activity may crowd out private sector loan purchases, evidence that the GSE purchase targets increase originations in underserved census tracts would be suggestive of less than full crowd out.⁹ Bearing that in mind, Ambrose and Thibodeau [2004] analyze the impact of the percentage of an MSA's census tracts defined by the 1992 GSE Act as underserved on MSA-level mortgage originations (including purchase and refinance loans that do and do not conform to GSE underwriting requirements). Ambrose and Thibodeau [2004] conclude that between 1995 and 1999, only in 1998 did GSE activity increase originations. An and Bostic [1996, forthcoming] restrict their attention to census tracts in 1996 and 2000 just below and just above 90 percent of an MSA's median income, the cutoff used to define underserved tracts for purposes of the GSE purchase targets. An and Bostic conclude that GSE purchases reduce subprime and FHA originations in underserved tracts close to the target cutoff. Although all three of these papers are suggestive of less than full GSE crowd out, none of these papers actually consider crowd out directly or offer any guidance as to the possible extent of the phenomenon. Moreover, the sample and econometric design used in each of these papers precludes such an attempt.¹⁰

⁸See also Listokin and Wyly [2000], Myers [2002], Case, Gillen, and Wachter [2002], and Galster [2004] for related discussion.

⁹Full crowd out would imply that in the absence of GSE activity, the private sector would provide services otherwise offered by the GSEs. Under such circumstances, GSE purchase targets would not affect loan originations.

¹⁰An and Bostic [2006] treat GSE and FHA purchases as exogenous when estimating the impact of changes in GSE and FHA purchase shares on changes in subprime loan origination shares between 1996 and 2000. This is

To our knowledge, no previous studies of the mortgage market have directly considered the crowd out effects of the GSEs. This is in contrast to other markets in which public sector crowd out of private sector activity has been carefully studied. This includes previous experimental research on crowd out associated with the provision of public goods (Andreoni [1993]), as well as studies that examine crowd out from publicly provided health insurance (Culter and Gruber [1996], Brown and Finkelstein [2004], Brown, Coe, and Finkelstein [2006], and Gruber and Simon [2007]), and public construction of low- and moderate-income housing (Murray [1982, 1999], Sinai and Waldfoegel [2005], and Eriksen and Rosenthal [2007]). A common theme across all of these studies is that public sector crowd out of private activity can be substantial, especially when a viable private sector alternative is present. Consider the following examples.

Gruber and Simon [2007] estimate that 60 percent of the expansion in public health insurance during the 1996-2002 period was offset by crowd out of private market insurance.¹¹ Sinai and Waldfoegel [2005] and Eriksen and Rosenthal [2007] estimate that crowd out rates associated with publicly subsidized construction of low- and moderate income housing are roughly one-third after controlling for broader MSA effects.¹² Given evidence of such large rates of crowd out in these studies, it is likely that similarly large crowd out effects may arise from government sponsored GSE

problematic because originations affect supply on the secondary market and have a direct impact on GSE and other secondary market activity. In addition, FHA and subprime originations respond to common unobserved attributes causing FHA activity to be endogenous. An and Bostic [forthcoming] instrument for GSE purchases using census tract underserved status and homeownership rate, along with other local neighborhood and MSA-level control measures. This is also problematic because tract income is omitted from the model specification even though tract income affects mortgage demand and underserved tract status. This implies that underserved status in their specification is not excludable. In addition, homeownership is sensitive to access to mortgage credit and is likely correlated with the model error term. Ambrose and Thibodeau [2004] adopt a switching regression model based on Fair and Jaffee [1972] in which they treat the switching mechanism as exogenous. Increases in MSA-level mortgage rates are treated as indicative of excess demand and as a signal that the local market is on the supply curve. Stratifying their sample on this basis, Ambrose and Thibodeau estimate the supply of loan originations including controls for the share of census tracts in an MSA that meet underserved status. Results from this approach are sensitive to the veracity of the sample stratification scheme.

¹¹Brown and Finkelstein [2004] and Brown, Coe, and Finklestein [2006] provide related evidence that Medicaid may crowd out private health insurance for up to two-thirds of the wealth distribution.

¹²Murray [1982, 1997] also examines crowd out of subsidized construction of lower income housing. In both studies, Murray uses aggregate time series data in contrast to Sinai and Waldfoegel [2005] and Eriksen and Rosenthal [2007] who use micro data. Murray reports finds little crowd out from public construction of very low income housing – a market segment that sees little unsubsidized construction – but more pronounced crowd out in the moderate income portion of the market. Murray’s results confirm the general principle that crowd out will be greater when government provides services that would otherwise have been provided by the private sector.

loan purchases in the secondary market. The extent to which that occurs is considered in the remaining sections of this paper, both on conceptual and empirical grounds.

III. Conceptual Model

This section outlines a simple model that clarifies market conditions under which GSE loan purchases are likely to crowd out private sector purchases in the secondary market. As a starting point, we treat the supply of loans in the secondary market as exogenous to GSE purchases. Moreover, as shown in Figure 3, the loan supply function is initially relatively elastic as higher purchase prices induce primary lenders to supply additional loans to the secondary market. The increase in supply is made possible because primary lenders originate more loans, but also because primary lenders sell a greater share of the stock of loans held in portfolio. However, once all possible loans have been originated and all previously originated portfolio loans have been sold into the secondary market, the loan supply function becomes perfectly inelastic.

In the context of this simple depiction of the secondary mortgage market, we examine two cases. In the first case, demand intersects supply on its elastic portion, and government prompted GSE purchase activity pushes demand out and up along the supply function. This pushes up the price of loans on the secondary market, inducing primary lenders to supply additional loans to the secondary market.¹³ As a result, only partial crowd out of private entity loan purchases occurs.

In the second case, secondary market loan demand intersects loan supply on its inelastic, vertical portion. In this instance, government prompted GSE purchases expand demand for loans, pushing the loan demand function up the supply curve. The price of loans traded on the secondary market rises to clear the market, but the number of loans sold on the secondary market remains unchanged. As a result, GSE purchases are fully offset by a corresponding decline in private sector

¹³For our purposes here, it is not necessary to distinguish whether that increase in supply is generated by a reduction in the number of loans held in portfolio, or because primary lenders originate a greater share of applications received. Gabriel and Rosenthal [2007], in contrast, model the impact of secondary market purchases on the share of applications originated. They estimate that secondary market purchases increase origination shares by an amount roughly comparable to the prevailing loan denial rate, about 15 percent of applications.

purchases of loans on the secondary market. The general principle highlighted in Figure 3 is that crowd out increases as supply of loans to the secondary market becomes more inelastic.

As noted in the Introduction, in the early part of the 1990s a larger share of originated conforming loans were retained by primary lenders in portfolio. During this period it is likely that the loan supply function in the secondary market was relatively elastic, and that would serve to mitigate GSE crowd out effects. However, by 2004 as shown in Figure 1f, purchase/origination shares were essentially 100 percent in all census tract income categories. This suggests that by 2004 it would have been more difficult for primary lenders to supply additional GSE-conforming loans to the secondary market, implying that markets were operating on a much more inelastic portion of the loan supply function. Under those conditions, the model in Figure 3 suggests that we should anticipate close to full crowd out in 2004. We will return to these predictions shortly.

IV. Empirical Model

4.1 Specification

As discussed above, the supply of GSE-conforming loans in the secondary market is directly related to primary market originations and to the number of loans held in portfolio by primary lenders. Bearing that in mind, the number of loans originated by primary lenders in period t (L_t) equal applications (A_t) minus denials (D_t),

$$L_t \equiv A_t - D_t \quad . \quad (4.1)$$

Applications are simply another name for demand and depend on mortgage rates (r_t) and the attributes of the applicant pool (Z_t),

$$A_t = A(r_t, Z_t) \quad . \quad (4.2)$$

The number of applications denied also depends on r_t and Z_t where in this case, Z proxies for applicant credit risk. Gabriel and Rosenthal [2007] provide evidence that a more active secondary market reduces the share of applications that are denied. This occurs because active secondary markets manage risk more

efficiently and provide opportunities for primary lenders to shift risk to that sector. We denote the level of secondary market purchases as P_t . If GSE loan purchases are not fully offset by crowd out of private sector activity, then P_t is sensitive to GSE activity, or $P_t = P_t(P_t^{GSE})$. Denials are then represented by,

$$D_t = D_t(r_t, P_t(P_t^{GSE}), Z_t) \quad . \quad (4.3)$$

Substituting (4.2) and (4.3) into (4.1), the equilibrium number of loans originated is,

$$L_t^* = L(r_t, P_t(P_t^{GSE}), Z_t) \quad . \quad (4.4)$$

This says that the number of loans originated depends on market mortgage rates, the level of secondary market activity, and attributes of the potential pool of applicants. Of these loans, a fraction (θ_t) are held in portfolio by primary lenders, while the remaining portion, $1-\theta$ is sold on the secondary market.

If all originations were sold ($\theta = 0$), then L^* would equal the number of loans supplied to the secondary market in Figure 3. This is certainly the case for non-financial lenders (e.g. mortgage brokers) who do not hold loans in portfolio. More generally, however, depository institutions tend to hold some of their originations in portfolio and that affects supply in the secondary market. It is sufficient here to note that θ depends on loan applicant attributes, Z , and market interest rates, r . Accordingly, supply in the secondary market is given by,

$$S_t^{Supply} = S(r_t, P_t(P_t^{GSE}), Z_t) \leq L_t^* \quad . \quad (4.5)$$

where the inequality is provided as a reminder that primary lenders can sell loans only up to the number originated.

Demand for loans in the secondary market is sensitive to interest rates, conditions in global capital markets (Ω_t), government policy that affects GSE purchases, and attributes of the loan applicant pool,

$$S_t^{Demand} = S(r_t, \Omega_t, P_t^{GSE}, Z_t) \quad . \quad (4.6)$$

Equilibrium mortgage rates are determined in the secondary market by the supply and demand for residential loans. We represent this as,

$$r_t^* = r(\Omega_t, P_t(P_t^{GSE}), Z_t) \quad . \quad (4.7)$$

Bearing in mind that secondary market purchases equal the sum of private and GSE purchases, we substitute (4.7) into (4.5) and (4.6) and solve for the private sector level of secondary market loan purchases,

$$P_t^{private} = P(\Omega_t, P_t^{GSE}, Z_t) \quad . \quad (4.8)$$

This expression says that the level of private sector secondary market loan purchases depends on global capital market conditions at time t , GSE purchases, and attributes of the applicant pool.

In the empirical work to follow, we assume a linear specification for (4.8) and treat each census tract as a separate observation. The model is then estimated separately for each even year from 1994 to 2004. The estimating equation is,

$$P_{t,i}^{private} = \lambda_t + b_{z,t} Z_{t,i} + b_{GSE,t} P_{t,i}^{GSE} + u_{t,i} \quad . \quad (4.9)$$

In (4.9), the subscript i denotes the individual census tract. The term λ_t captures broader capital market conditions common to all neighborhoods in period t (i.e. Ω_t). The coefficients on $Z_{t,i}$ are reduced form in nature as they reflect the influence of Z on both the local demand and supply for credit.¹⁴ The coefficient on $P_{t,i}^{GSE}$ has a clear interpretation as GSE crowd out of private sector activity implies that $b_{GSE,t}$ is negative. Full crowd out would imply that $b_{GSE,t}$ equals -1.

4.2 Identification

An important feature of (4.9) is that $P_{t,i}^{GSE}$ is endogenous. This arises for two reasons. The first is that unobserved factors that affect originations also directly affect the supply of loans in the secondary market. That in turn affects both private and GSE loan purchases and causes $P_{t,i}^{GSE}$ to be positively correlated with the model error term. Under the null that GSE activity crowds out some portion of private

¹⁴For that reason, in the discussion to follow, we do not focus on those terms.

sector purchases, failing to control for this issue would bias estimates of $b_{GSE,t}$ upwards towards zero, understating the true level of crowd out. To help address this issue, we normalize private and GSE loan purchases by the number of loans originated in a given tract and period. The estimating equation becomes,

$$\frac{P_{t,i}^{private}}{L_{t,i}} = \lambda_t + b_{z,t} Z_{t,i} + b_{GSE,t} \frac{P_{t,i}^{GSE}}{L_{t,i}} + u_{t,i} . \quad (4.10)$$

Adjusting private and GSE purchases in this fashion differences away the influence of unobserved factors that have a common effect on originations and secondary market loan purchases.

Correlation between the GSE purchase-to-origination ratio and the model error term could still remain, however. This is because additional unobserved factors may affect θ , the share of originations that primary lenders hold in portfolio and do not sell to the secondary market. Such factors likely have a similar qualitative effect on private and GSE purchases, and once again, cause the GSE purchase variable to be positively correlated with the model error term. Failing to control for this issue would also bias estimates of $b_{GSE,t}$ upwards towards zero, causing one to understate the true level of crowd out.

To address this second source of correlation we use two different instrument strategies. The first, and our preferred method, is to instrument for GSE purchases using the underserved status of the census tracts. The motivation behind this instrument is as follows. First, the GSEs are obliged to purchase a minimum share of their loans in underserved census tracts. In years when the HUD purchase guidelines are binding, this suggests that a tract's underserved status will be correlated with $P_{t,i}^{GSE}$. Because HUD purchase guidelines have become more stringent over time, it is likely that the correlation between $P_{t,i}^{GSE}$ and a tract's underserved status would be stronger in more recent years as well. This suggests that the underserved instrument may have ample power in the latter years in our sample, but could be weak for early years of the 1990s when HUD purchase goals were less demanding. This is something that can be tested.

A further consideration is whether a tract's underserved status can legitimately be excluded from the estimating equation in (4.10). To address that concern, we include a long list of 1990 tract socioeconomic attributes in the model, including average income and average income squared. These are the Z attributes in (4.10) and serve to control for the continuous and smooth change in demand and supply in response to marginal changes in Z . In the presence of these controls, there is no natural role for a tract's underserved status in the model. Identification is then based on the discrete shift in GSE purchase goals as one transitions across the income border between "served" and "underserved" tracts. Drawing on guidelines from the 1992 GSE Act, we specify that border as 90 percent of the MSA median income.

Our second instrument strategy is to use lagged socioeconomic tract attributes, Z , from 1980 as instruments for GSE purchases. The advantage of this approach is that lagged Z_{1980} values are likely to be well correlated with GSE loan purchases in all years of the sample horizon regardless of how stringent the HUD GSE purchase guidelines may be. The disadvantage of this approach is concern that Z_{1980} and GSE loan purchases may be correlated because Z_{1980} helps to explain unobserved demand and credit risk attributes of the loan applicant pool that are not captured by the covariates included in the model, including Z_{1990} . If true, this would imply that Z_{1980} should be included directly in (4.9) and would not, therefore, be excludable as an instrument. In the empirical work to follow, estimates from both instrument strategies are presented and compared.

V. Data and Summary Measures

5.1 Data

Data for the analysis were obtained from the Home Mortgage and Disclosure Act (HMDA) and the decennial Census. Specifically, we drew upon the HMDA data files for every even year from 1994 to 2004 and census tract socio-demographic attributes obtained from 1980 and 1990 decennial censuses. The census tract data were obtained from Geolytics, Inc. and were coded to year 2000 census tract boundaries for each of the decades we draw upon. All of the HMDA data was initially reported by financial institutions. For years up through 2002, the HMDA data are reported based on

1990 census tract geography. For years beyond 2002, the HMDA data are reported based on year-2000 census tract geography. In all cases, we converted the HMDA and earlier census tract data to year-2000 census tract geography. This ensures that we follow the same neighborhoods over time and facilitates proper matching of the HMDA and Census files across years.

Mortgage market variables included in the models are as defined above. Census controls include tract-level measures of socio-demographic and economic variables. Among these are tract racial composition, educational characteristics, income, gender, unemployment, poverty status, the presence of female-headed families with children, population density, and characteristics of the housing stock.¹⁵ For all years of the HMDA data (from 1994 through 2004), we used year-1990 census tract attributes as control measures.

To further clean the data, certain observations were dropped. First, in calculating tract-level mortgage attributes (e.g. purchases, originations), individual loan records from the HMDA data were dropped if the type or purpose of the loan could not be determined. Second, we run the analysis separately for conforming and non-conforming conventional home purchase loans. The former were defined as those conventional, home purchase loan records for which the dollar magnitude of the loan requested was less than the conforming loan limit stipulated by Fannie Mae and Freddie Mac in each given year.¹⁶

5.2 Sample Means

Tables 1a and 1b present sample means across census tracts in MSAs for the key mortgage market variables for each even year of the HMDA data from 1994 to 2004. Values for the conventional conforming loan sector are presented in Table 1a while values for the conventional non-

¹⁵Recall also, as noted in the Introduction, the HMDA data do not provide information on individual loan applicant wealth or credit score (credit history). However, as described earlier, our focus on secondary market behavior largely mitigates this limitation in the data because secondary market purchases are based on broad features of the pooled mortgages rather than on the characteristics of specific borrowers.

¹⁶We thank Glenn Canner of the Federal Reserve Board for assisting us in identifying the relevant conforming loan size limits.

conforming sector are provided in Table 1b. The format of both tables is the same. Year and number of census tracts in the sample are reported in the first two columns. The remaining columns present four sets of values. In the first set (the next four columns), counts are reported for the average across tracts of the number of originations, secondary market purchases, GSE purchases, and private sector secondary market purchases. In the second set of measures (the following three columns), secondary market purchases, GSE purchases, and private sector secondary market purchases are each divided by average originations so as to present the purchase counts in ratio form. The third set of measures (in the last three columns) reports these ratio measures once again. This time, however, the ratios were first formed for each census tract and then averaged across tracts. It is those tract average ratios that are reported in the final columns of the tables.

Reading down the rows, it is apparent that the overall level of mortgage market activity grew considerably in both the conforming and non-conforming sectors between 1994 and 2004. Moreover, growth was especially dramatic between 2000 and 2004. During that period, the number of conforming loans (Table 1a) originated increased by roughly 57 percent. In the non-conforming sector (Table 1b), growth in originations between 2000 and 2004 equaled 58 percent.¹⁷

Also striking is the largely monotonic upward trend in the ratio of secondary market purchases to originations in the conforming sector over 1994-2004. Based on ratios of aggregate mortgage activity, the purchase/origination ratio in the conforming sector was 60.7 percent in 1994 but rose to 1.02 in 2004. In the non-conforming sector, the corresponding values are 51.4 percent in 1994 and 84.1 percent in 2004. The upward trend in securitization rates is consistent with the well-known expansion in conventional secondary market activity, both in the conforming and non-conforming sectors of the market. The values for 2004 in particular suggest that by that year, primary lenders were

¹⁷ The rapid growth in originations in recent years has coincided with the surge in popularity of new mortgage designs, including interest-only, payment option, sub-prime and related instruments.

selling nearly all of their conforming loans and the great majority of their non-conforming loans in the secondary market.¹⁸

A further pattern to note is the very large GSE purchases/origination ratio in the conforming sector as compared to the non-conforming sector. Based on aggregate activity ratios, in 2000 those values were 47.6 percent and 10.0 percent in the conforming and non-conforming sectors, respectively. That difference reflects the well known focus of the GSEs on the conforming segment of the market. Perhaps less well known is that the GSEs have purchased as much as 10 percent of originations in the non-conforming market in recent years.

VI. Estimation Results

6.1 Overview

This section presents estimates of the regression model outlined in Section IV for the conforming conventional sector (Table 2a) and the non-conforming conventional sector (Table 2b). In all cases, the estimation is based on a Tobit specification that restricts the range of the private sector purchase/origination ratio to be non-negative. All models are estimated three times. In the first instance (Panel A of Tables 2a and 2b), estimates are based on IV methods treating GSE purchase/origination ratios as endogenous and using the underserved status of the census tract as the instrument.¹⁹ In the second case (Panel B of Tables 2a and 2b), IV methods are used once again but this time 1980 SES variables are used as instruments. In the third case (Panel C of Tables 2a and 2b), GSE purchase/origination ratios are treated as exogenous. In each case, separate models are estimated and reported for each even year from 1994-2004. It is also important to note that in all cases, sixteen 1990 SES tract attributes are included in the model. In addition, all of the models include 5 fixed

¹⁸ Some of the purchase/origination ratios in Tables 1a and 1b exceed 1. This is possible for two reasons. First, some loans are sold in a year subsequent to the one in which they are originated. Second, some loans are sold from one lender to another, and it is the latter of those entities that then sells the loan (or loan pool) to established players in the secondary market. Both practices can shift the timing of when loans are securitized relative to their origination date, and cause purchase/origination ratios to exceed 1.

¹⁹ The IV models were estimated using Newey's [1987] two-step procedure in Stata9 SE.

effects for MSA size categories for the smaller MSAs and 25 MSA-specific fixed effects for the largest MSAs. To maintain focus on the impact of GSE purchases, only the coefficients on the GSE purchase/origination variables are presented.²⁰

6.2 Conforming sector

Consider now Panel A of Table 2a. This panel reports two-step Tobit IV estimates using the tract underserved status as an instrument. We begin by examining diagnostic tests that help to identify years in which the IV strategy appears to be valid. The specific coefficient estimates on GSE purchase/origination shares will be examined shortly. With that in mind, note that Wald tests reported in the table confirm that except for 2000, the IV estimates in Panel A differ significantly from the corresponding non-IV values in Panel C. This suggests that the GSE purchase/origination shares are correlated with the model error term and that an IV strategy is desired. Cragg-Donald tests indicate that in 1994 and 1996, tract underserved status is barely correlated with GSE purchase/origination ratios: the test statistics are 0.08 and 0.67 for 1994 and 1996, respectively. Accordingly, IV estimates for those years are not reliable. From an economic and policy perspective, this finding is of interest: the limited correlation between tract underserved status and GSE purchase/origination shares in 1994-1996 suggests that the HUD GSE purchase targets may not have been binding in the mid-1990s.

Moving forward in time, Cragg-Donald test statistics in Panel A increase markedly after 1996. For the even years from 1998 to 2004, the test statistic equals 25.5, 7.0, 14.6, and 639.4, respectively. For these years, GSE purchase/origination ratios are significantly correlated with a census tract's underserved status, and dramatically so in 2004. This is consistent with increases in mandated GSE loan purchases in underserved communities during this period. The dramatic jump in the test statistic for 2004 is also consistent with the patterns discussed in Figures 1a to 1f. Recall that in 2004 nearly all conforming originations were sold to the secondary market. Under such market conditions, HUD

²⁰ As noted earlier, the SES variables proxy for both supply and demand factors making their coefficients difficult to interpret. Partly for that reason as well, the SES coefficients are not reported.

purchase guidelines would have a tendency to push more of the GSE activity into underserved communities and this would serve to increase the correlation between a tract's underserved status and GSE purchases.

Before turning to the coefficient estimates, a final econometric issue must be discussed. Recent work on weak instruments (e.g. Stock and Yogo [2005], Murray [2006]) has demonstrated that IV estimates suffer from substantial bias when the instruments are only “weakly” correlated with the endogenous variable, even if level of correlation is statistically significant. Stock and Yogo [2005] suggest that when the first-stage partial F-statistic on the instrument is below 10, IV estimates may suffer from considerable bias. In our case, estimates from 2000 are rather far from that target and so, the IV estimate from 2000 is not reliable.²¹ On the other hand, estimates from 1998 and 2002 do satisfy the weak-instrument test, although by a relatively small margin in 2002. In 2004, the Cragg-Donald test is 639 as noted above; for this year, we can set aside any concerns about weak instrument bias.

Consider now the coefficients on GSE purchase/origination ratios in Panel A. For reasons just noted, we focus primarily on those estimates from 1998, 2002, and 2004. It is also worth recalling that a coefficient of 0 indicates the complete absence of GSE crowd out, whereas a coefficient of -1 implies complete crowd out. Bearing that in mind, in 1998 and 2002, the estimated coefficients are both roughly equal to -1.78. On the surface, these estimates appear implausible in that they suggest more than complete crowd out. Note, however, that the 95 percent confidence bands for the 1998 and 2002 estimates range from roughly -1 to -2.5 and -0.3 to -3.3, respectively. Especially for 2002, the coefficient estimate is too imprecise to be confident of the degree of crowd out. We also, of course, cannot rule out the possibility that model misspecification or lurking weak instrument bias may account for the elevated coefficient estimates in these years.

²¹ Indeed, the coefficient is -3.03. That estimate is implausibly large. In addition, the corresponding t-ratio is just 0.39, indicating that the confidence band around the point estimate is huge.

Focusing on 2004, our estimate is highly robust. In this case, the instrument is overwhelming strong, both on conceptual and statistical grounds. For this year, the coefficient is -1.12 with a t-ratio of 17.92 and a corresponding 95 percent confidence interval of roughly -1 to -1.25. We view this result as indicating that in 2004, GSE purchases of conforming loans were fully offset by crowd out of private sector purchases.

Consider next Panel B of Table 2a. In this panel 1980 tract SES variables (16 in all) were used as instruments. As anticipated, these instruments are more highly correlated with GSE purchase/origination shares in the early years of the sample as compared to the tract's underserved status. In 1994 and 1996, the Cragg-Donald test statistic is 3.82 and 18.14, respectively. From 1998 to 2004, the test statistic varies between 12 and 50. In every year except for 1994 the test statistic exceeds 10, suggestive that weak instrument bias may be limited. In 1996, 1998, 2002, and 2004, the point estimates have large t-ratios and small confidence bands. For those years, the coefficients are -0.44, -0.58, -0.74, and -1.02, respectively.²² Conditional on the validity of the 1980 SES instruments, this pattern of coefficients suggests that crowd out has increased over time, consistent with the decline in portfolio lending over the period. The estimate for 2004 is of particular interest. As above, economic theory and market conditions suggest that in 2004 we should anticipate close to full crowd out, and once again, our IV estimate is consistent with that prediction.

It is also revealing to examine the non-IV estimates in Panel C. Recall that we anticipate that GSE purchase/origination shares will be positively correlated with the model error term, and as a result, non-IV estimates will be less negative. That prior is confirmed in the table: for each year in which the diagnostic tests suggest that the instruments are not weak, the IV estimates are more negative than the non-IV measures. The non-IV estimates, therefore, provide a lower bound on the degree of crowd out associated with GSE activity. In Panel C, note that the non-IV coefficients are roughly -0.13 in the 1994 and 1996, -0.35 in 1998, positive 0.31 in 2000, -0.10 in 2002, and -0.54 in

²² As before, the estimate from 2000 is too imprecise to be of much interest (the t-ratio is 1.18 and the coefficient is positive 1.59).

2004. Except for the year 2000, all of these estimates have very large t-ratios and extremely small confidence bands. Moreover, as a lower bound, the 2004 estimate of -0.54 signals once again that in 2004 crowd out was extensive.

Summarizing, results from Table 2a are consistent with a variety of priors. We anticipated that tract underserved status would be weakly correlated with GSE purchase/origination shares in the mid-1990s, and that prior is supported by the data. In latter years, the correlation is much stronger, and dramatically so in 2004 as anticipated. We expect that for those years in which IV estimates do not suffer from weak instrument bias the non-IV estimates should be lower in magnitude, and this also is confirmed in the data. Crowd out should have increased over time with the decrease in portfolio lending; results from the 1980 SES instrument regressions support that prior. Finally, and most important, our theory and market conditions imply that in 2004 there should be close to full crowd out. That prior is strongly confirmed in the data based on both instrument strategies.

6.2 Non-Conforming sector

Table 2b presents estimates of the models using data from the non-conforming sector of the mortgage market. This serves in part as a falsification check and a further opportunity to consider robustness. In the non-conforming sector, we do not expect tract underserved status to be correlated with GSE purchase/origination shares: there is no policy motive for such behavior. Consistent with that prior, in Table 2b, the Cragg-Donald test statistics in Panel A are all small. Given that result, if 1980 SES attributes are to be correlated with GSE purchase/origination shares it must be because they belong in the structural model. However, results in Panel B of Table 2 indicate that the 1980 SES attributes are at most weakly correlated with GSE purchase/origination shares. This is suggestive that the 1980 SES attributes are excludable. Moreover, to the extent that this inference carries over to the conforming sector, this lends credibility to the 1980 SES instrument results in Table 2a. Although this argument is indirect, it suggests that both instrument strategies may be valid for the conforming sector.

On the other hand, the Cragg-Donald test results in Table 2b indicate that we do not have a viable instrument strategy for the non-conforming sector.

In Panel C of Table 2b, non-IV estimates of GSE purchase/origination shares are generally negative but often quite insignificant.²³ The primary exception is for 2004. In Panel C that estimate is -0.25 with a t-ratio of 16.44. In this year, the GSEs purchased roughly 10 percent of non-conforming originations and the overall level of purchases relative to originations reached 84 percent (see Table 1b). It is likely, therefore, that in this year, a portion of GSE activity would have crowded out private sector purchases, even in the non-conforming sector. That is because even in the absence of policy pressure, all secondary market entities compete for market share. As primary lenders hold increasingly few non-conforming loans in portfolio, purchases by one secondary market entity must come at the expense of market shares enjoyed by competitor entities. On balance, therefore, evidence in Panel C of Table 2b suggests that in 2004, GSE crowd out in the non-conforming sector was at least 25 percent.

VII. Conclusion

The housing government sponsored enterprises (GSEs), most notably Fannie Mae and Freddie Mac, occupy a unique and important position in U.S. mortgage markets. These are enormous federally-chartered private corporations that have attained substantial market shares, recently accounting for up to 60 percent of purchases of conforming home loans in the secondary market. The GSEs enjoy direct and implicit government subsidies that enhance their profitability.²⁴ In exchange for that support, the GSE federal charters along with the 1992 GSE Act require that Fannie Mae and Freddie Mac purchase a disproportionate share of their loans from low-income families and low-

²³Although the estimate from 1994 has a high t-ratio the point estimate is unrealistically large (-4.4). Moreover, recall from Table 1b that the level of GSE purchases in the non-conforming sector were tiny in 1994. For both reasons, we view the 1994 estimate in Panel C with a great deal of caution.

²⁴Most important, this includes an implicit guarantee from the Federal Government to back Fannie Mae and Freddie Mac should they run into financial difficulty. The implicit guarantee reduces the risk of investing in Fannie and Freddie securities, giving these companies a cost-of-funds advantage in the marketplace.

income, underserved communities. Moreover, those purchase guidelines have become increasingly stringent over the course of recent years, obliging the GSEs to purchase over 50 percent of their loans from disadvantaged groups. This paper has examined the degree to which the GSEs focus more intensively on markets targeted by the purchase goals, and also the extent to which GSE purchase activity has served to crowd out private sector loan purchases.

Evidence in the data confirms that relative to the size of the local market (as measured by the number of loan originations) the GSEs do indeed have a more intensive presence in underserved communities. However, a simple conceptual model suggests that when primary lenders hold few loans in portfolio, a large portion of the GSE purchases are likely to be offset by crowd out of private sector activity. Moreover, data indicate that primary market lenders greatly reduced the share of originations held in portfolio throughout the 1990s; by 2004, primary lenders were selling nearly all of their conforming loan originations to the secondary market. Accordingly, our model predicts that GSE crowd out should have increased over time, and that high levels of crowd out are likely to have prevailed in 2004.

Using two different instrument strategies, our estimates support the proposition that GSE crowd out increased over time. Moreover, in 2004, our estimates indicate that in the conforming loan segment of the market, crowd out arising from GSE loan purchases was essentially 100 percent. Changing market conditions of course, could allow for less crowd out and a greater influence of the GSEs. This may have been the case in the immediate aftermath of the implosion in residential capital markets in 2007, when numerous reports indicated that private market investors became reticent to purchase mortgage-backed debt. Nevertheless, high levels of GSE crowd out are a natural consequence of the expansion and increasing sophistication of the secondary market and this is likely to be the case going forward. For that reason, our findings weaken the case for continued government support of the GSE institutions.

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Table 1a: Conforming Loans
Sample Means for Mortgage Market Variables from the HMDA Data

Year	Tracts	Average Level of Activity Per Census Tract				Aggregate Activity Ratios ^a			Average Activity Ratios Across Tracts ^b		
		Originations	All Secondary Market Purchases	GSE Secondary Market Purchases	Private Secondary Market Purchases	All Purchases/ Originations	GSE Purchases/ Originations	Private Sector Purchases/ Originations	All Purchases/ Originations	GSE Purchases/ Originations	Private Sector Purchases/ Originations
1994	50352	38.97	23.68	14.68	9.00	0.607	0.377	0.231	0.580	0.358	0.222
1996	50459	43.21	30.49	18.76	11.73	0.706	0.434	0.271	0.683	0.404	0.279
1998	50708	53.45	46.20	26.67	19.53	0.864	0.499	0.365	0.840	0.430	0.410
2000	50402	56.36	47.92	26.85	21.07	0.850	0.476	0.374	0.836	0.429	0.408
2002	50382	64.83	61.22	35.82	25.40	0.944	0.552	0.392	0.914	0.509	0.405
2004	50590	88.65	90.08	34.34	55.74	1.016	0.387	0.629	0.990	0.368	0.622

^aValues were calculated by forming ratios based on aggregate values of activity counts.

^bValues were calculated by averaging ratios for individual census tracts for all tracts with originations.

Table 1b: Non-Conforming Loans
Sample Means for Mortgage Market Variables from the HMDA Data

Year	Tracts	Average Level of Activity Per Census Tract				Aggregate Activity Ratios ^a			Average Activity Ratios Across Tracts ^b		
		Originations	All Secondary Market Purchases	GSE Secondary Market Purchases	Private Secondary Market Purchases	All Purchases/ Originations	GSE Purchases/ Originations	Private Sector Purchases/ Originations	All Purchases/ Originations	GSE Purchases/ Originations	Private Sector Purchases/ Originations
1994	24121	8.56	4.40	0.234	4.17	0.514	0.027	0.487	0.605	0.053	0.552
1996	24873	8.53	5.02	0.193	4.83	0.589	0.023	0.566	0.795	0.051	0.744
1998	26402	10.95	9.19	0.465	8.73	0.840	0.042	0.797	1.168	0.057	1.111
2000	28584	12.86	8.36	1.28	7.08	0.650	0.100	0.550	0.855	0.214	0.642
2002	27976	12.95	9.91	1.57	8.34	0.765	0.121	0.644	0.839	0.203	0.636
2004	31251	20.51	17.24	1.64	15.60	0.841	0.080	0.761	0.728	0.110	0.618

^aValues were calculated by forming ratios based on aggregate values of activity counts.

^bValues were calculated by averaging ratios for individual census tracts for all tracts with originations.

Table 2a: Conforming Loans

**Private Sector Secondary Market Purchases Relative to Originations
of Conventional Home Purchase (CHP) Loans**

**Dependent Variable: Purchases/Oriinations
(Absolute value of t-ratios in Parentheses)**

Panel A: Two-Step Tobit IV With Underserved Tract Status as the Instrument

	1994	1996	1998	2000	2002	2004
GSE Purchases/Oriinations	-8.32 (0.28)	-5.74 (-0.83)	-1.786 (4.81)	-3.03 (0.39)	-1.780 (2.44)	-1.124 (17.92)
1990 SES Controls ^a	16	16	16	16	16	16
MSA/MSA-Size Fixed Effects	30	30	30	30	30	30
Observations	49,970	50,082	50,338	50,025	50,027	50,278
Left Censored Observations	4,031	2,319	766	854	843	463
Wald test of exogeneity: P-Value ^b	0.0000	0.0000	0.0000	0.6586	0.0040	0.0000
Cragg-Donald (1993) Test	0.08	0.67	25.50	7.00	14.63	639.39

Panel B: Two-Step Tobit-IV With 1980 SES Variables as the Instruments

	1994	1996	1998	2000	2002	2004
GSE Purchases/Oriinations	-0.2911 (6.07)	-0.4406 (8.05)	-0.5818 (13.41)	1.5921 (1.18)	-0.7373 (4.40)	-1.020 (18.71)
1990 SES Controls ^a	16	16	16	16	16	16
MSA/MSA-Size Fixed Effects	30	30	30	30	30	30
Observations	48,865	48,935	49,183	48,881	48,876	49,135
Left Censored Observations	3,704	2,286	752	839	825	456
Wald test of exogeneity: P-Value ^b	0.0004	0.0000	0.0000	0.3441	0.0001	0.0000
Cragg-Donald (1993) Test	3.82	18.14	50.79	14.14	12.15	49.99

Panel C: Tobit Non-IV

	1994	1996	1998	2000	2002	2004
GSE Purchases/Oriinations	-0.1359 (27.13)	-0.1318 (28.90)	-0.3511 (64.66)	0.3136 (3.48)	-0.1020 (10.18)	-0.5436 (79.97)
1990 SES Controls ^a	16	16	16	16	16	16
MSA/MSA-Size Fixed Effects	30	30	30	30	30	30
Observations	49,970	50,082	50,338	50,025	50,027	50,278
Left Censored Observations	4,031	2,319	766	854	843	463

^aThe SES controls included the percent of the tract population that is Hispanic, percent African American, average age of the tract population, percent of adults that are male, average income and income squared, percent of adults with high school degree, percent with some college, percent with college or more, unemployment rate, poverty rate, percent of female headed households with children, average age of the housing stock, percent of housing stock that is single family.

^bWald test of the difference between estimates from the IV and non-IV models.

Table 2b: Non Conforming Loans

**Private Sector Secondary Market Purchases Relative to Originations
of Conventional Home Purchase (CHP) Loans**

**Dependent Variable: Purchases/Oriinations
(Absolute value of t-ratios in Parentheses)**

Panel A: Two-Step Tobit IV With Underserved Tract Status as the Instrument

	1994	1996	1998	2000	2002	2004
GSE Purchases/Oriinations	6.324 (0.81)	31.02 (0.71)	167.0 (1.21)	2.240 (0.91)	12.98 (0.32)	2.450 (2.18)
1990 SES Controls ^a	16	16	16	16	16	16
MSA/MSA-Size Fixed Effects	30	30	30	30	30	30
Observations	23,888	24,636	26,145	28,330	27,735	31,051
Left Censored Observations	6,391	6,343	5,150	6,837	5,656	6,303
Wald test of exogeneity: P-Value ^b	0.0031	0.0416	0.0229	0.1483	0.0683	0.0005
Cragg-Donald (1993) Test	2.46	0.5813	2.15	1.39	0.1039	11.09

Panel B: Two-Step Tobit-IV With 1980 SES Variables as the Instruments

	1994	1996	1998	2000	2002	2004
GSE Purchases/Oriinations	-2.069 (0.87)	0.9679 (0.37)	0.7519 (0.07)	-0.3825 (0.43)	-1.099 (1.09)	-1.216 (4.18)
1990 SES Controls ^a	16	16	16	16	16	16
MSA/MSA-Size Fixed Effects	30	30	30	30	30	30
Observations	23,539	24,143	25,540	27,699	27,131	30,441
Left Censored Observations	6,241	6,156	4,962	6,604	5,445	6,129
Wald test of exogeneity: P-Value ^b	0.2592	0.6901	0.7384	0.6652	0.2257	0.0004
Cragg-Donald (1993) Test	0.45	1.110	6.55	0.2715	0.3974	5.59

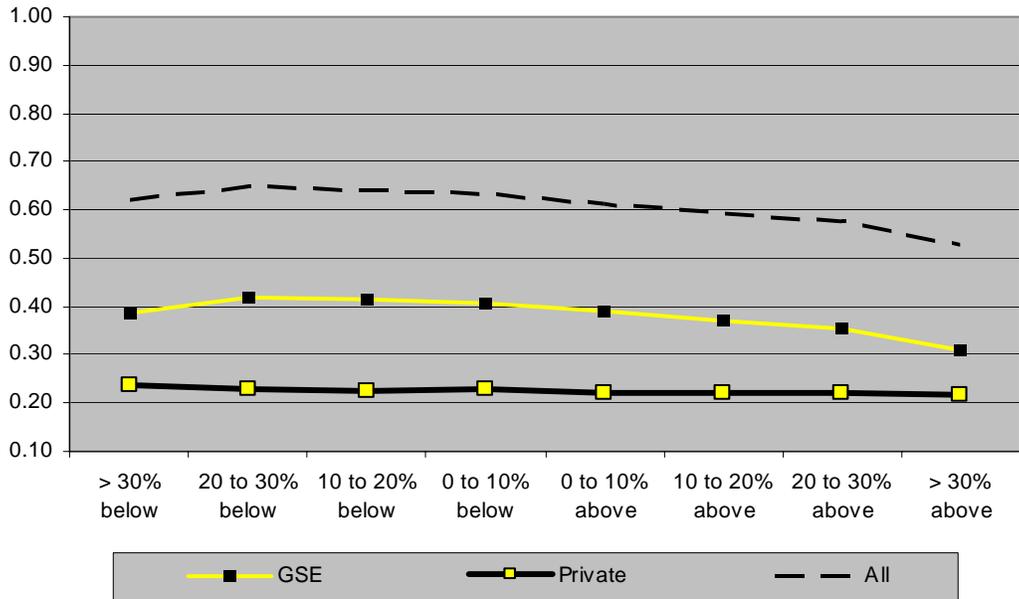
Panel C: Tobit Non-IV

	1994	1996	1998	2000	2002	2004
GSE Purchases/Oriinations	-4.449 (9.00)	-0.0910 (0.99)	-2.790 (3.91)	-0.0035 (0.30)	0.0019 (0.14)	-0.2561 (16.44)
1990 SES Controls ^a	16	16	16	16	16	16
MSA/MSA-Size Fixed Effects	30	30	30	30	30	30
Observations	23,888	24,636	26,145	28,330	27,735	31,051
Left Censored Observations	6,391	6,343	5,150	6,837	5,656	6,303

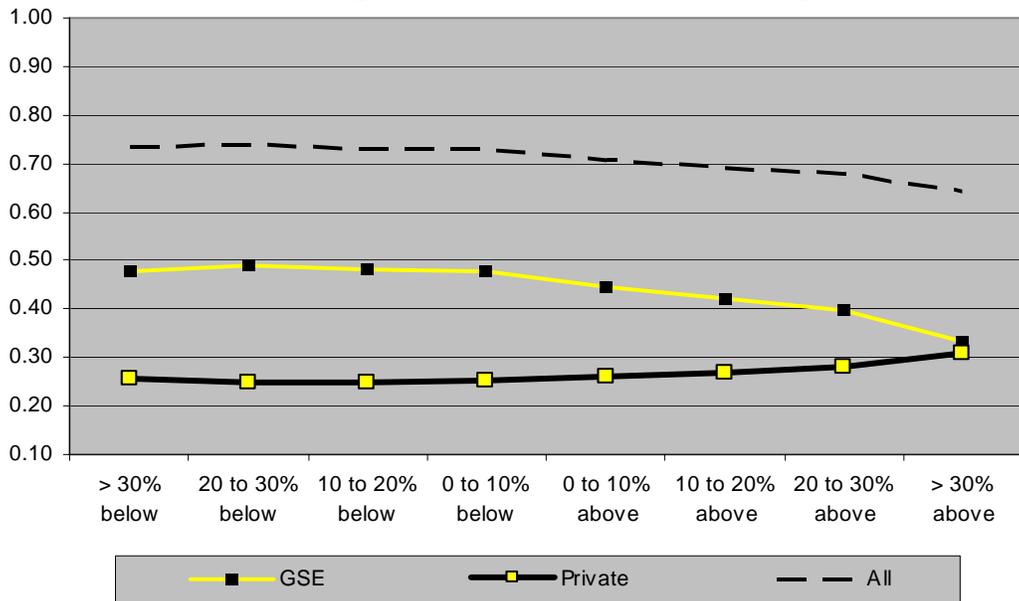
^aThe SES controls included the percent of the tract population that is Hispanic, percent African American, average age of the tract population, percent of adults that are male, average income and income squared, percent of adults with high school degree, percent with some college, percent with college or more, unemployment rate, poverty rate, percent of female headed households with children, average age of the housing stock, percent of housing stock that is single family.

^bWald test of the difference between estimates from the IV and non-IV models.

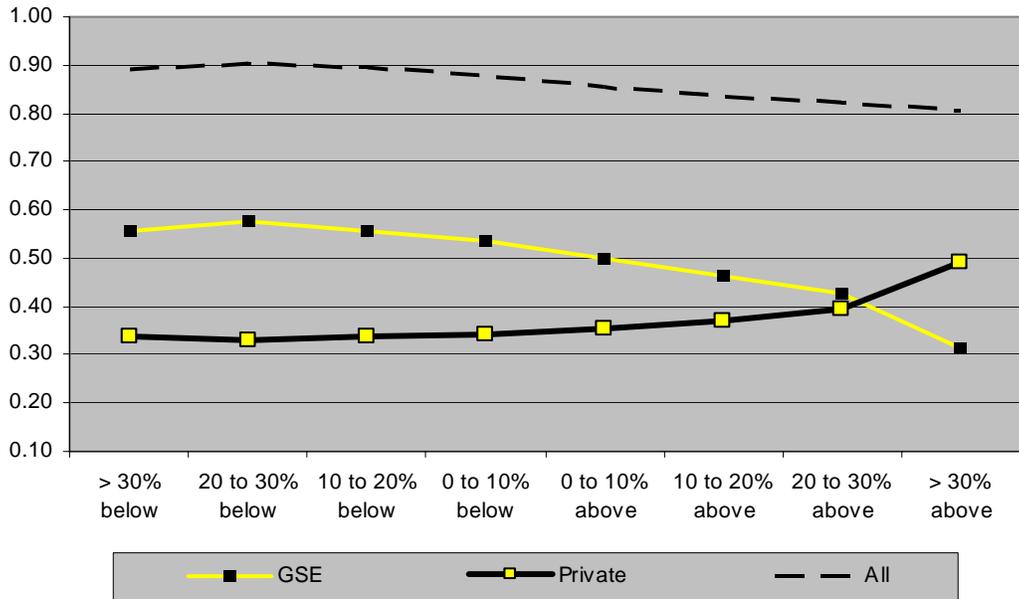
**Figure 1a: 1994 Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



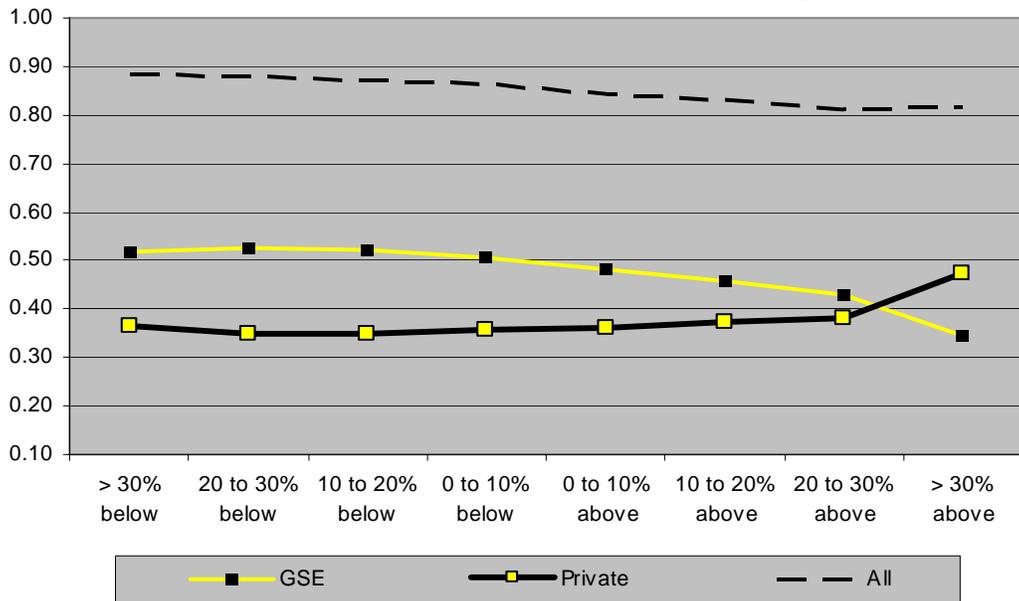
**Figure 1b: 1996 Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



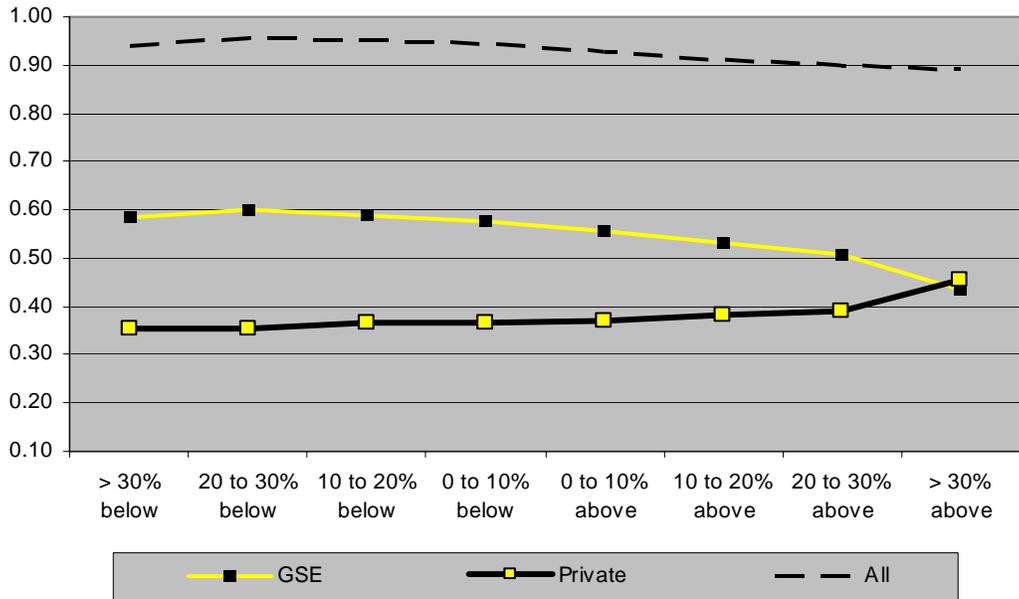
**Figure 1c: 1998 Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



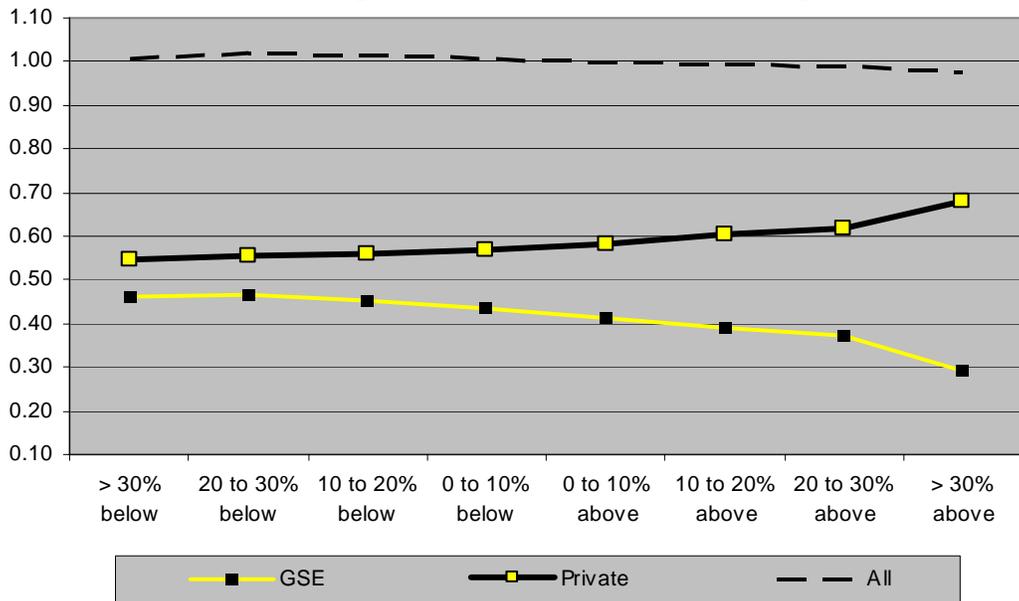
**Figure 1d: 2000 Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



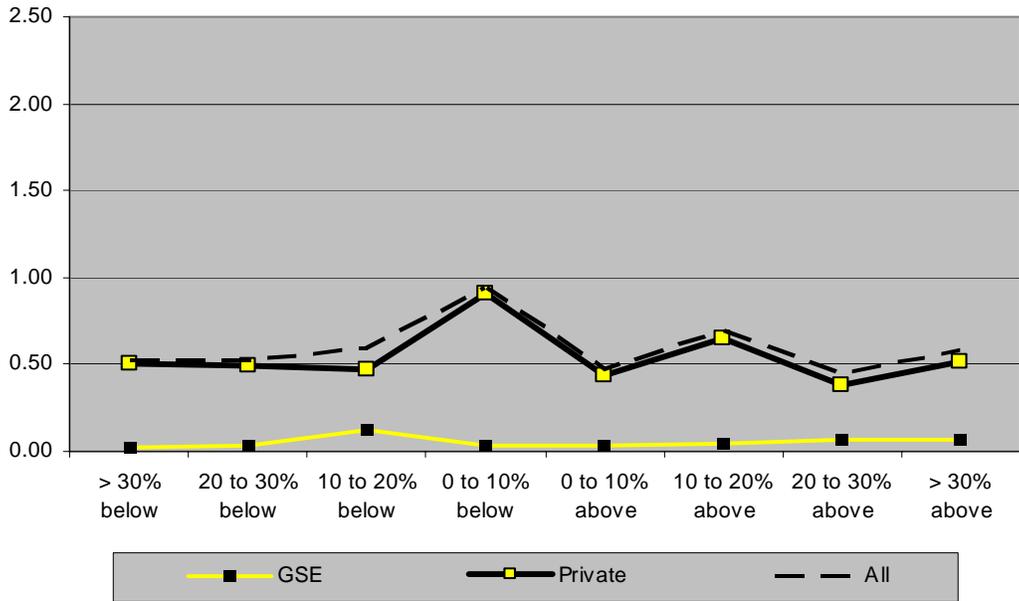
**Figure 1e: 2002 Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



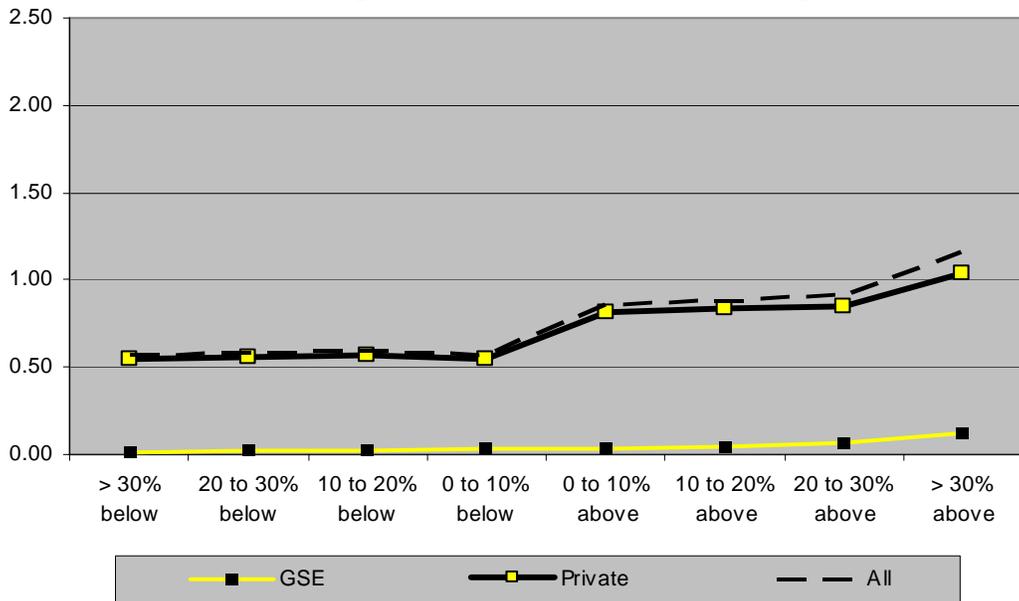
**Figure 1f: 2004 Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



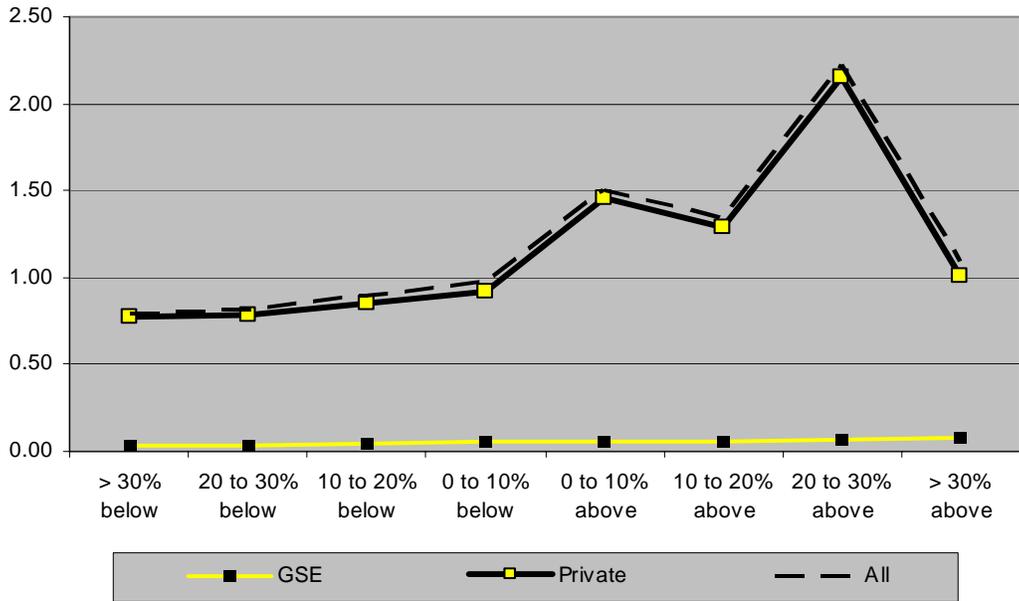
**Figure 2a: 1994 Non-Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



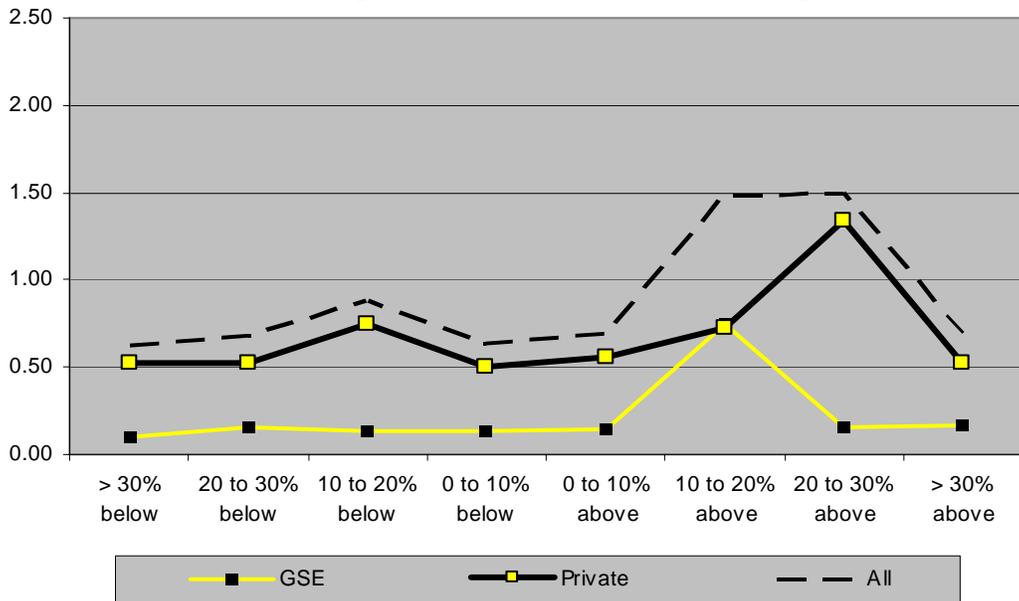
**Figure 2b: 1996 Non-Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



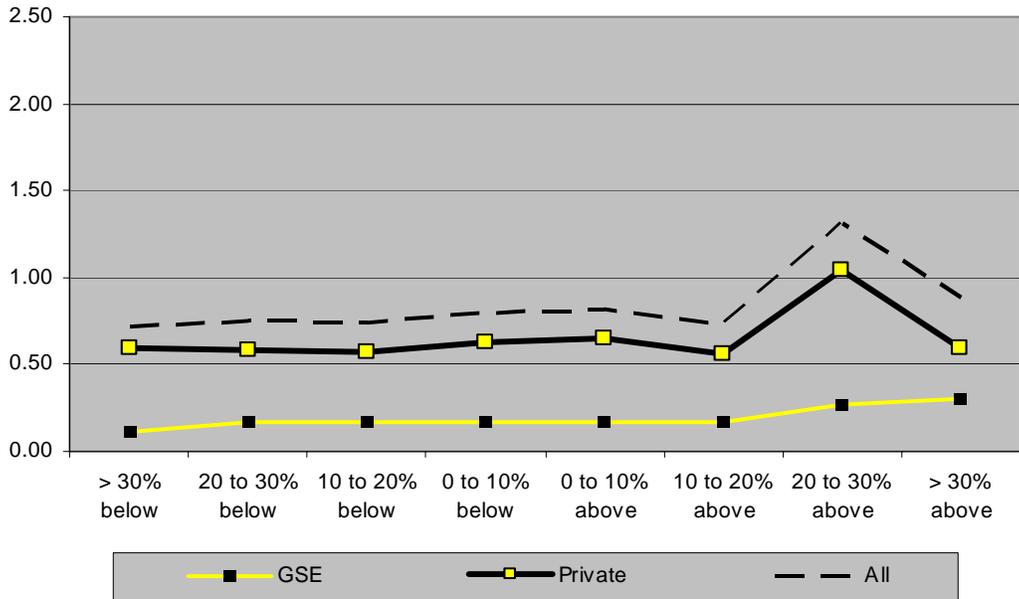
**Figure 2c: 1998 Non-Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



**Figure 2d: 2000 Non-Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



**Figure 2e: 2002 Non-Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**



**Figure 2f: 2004 Non-Conforming Purchase/Origination Ratios
Tract Average Income Relative to GSE Target**

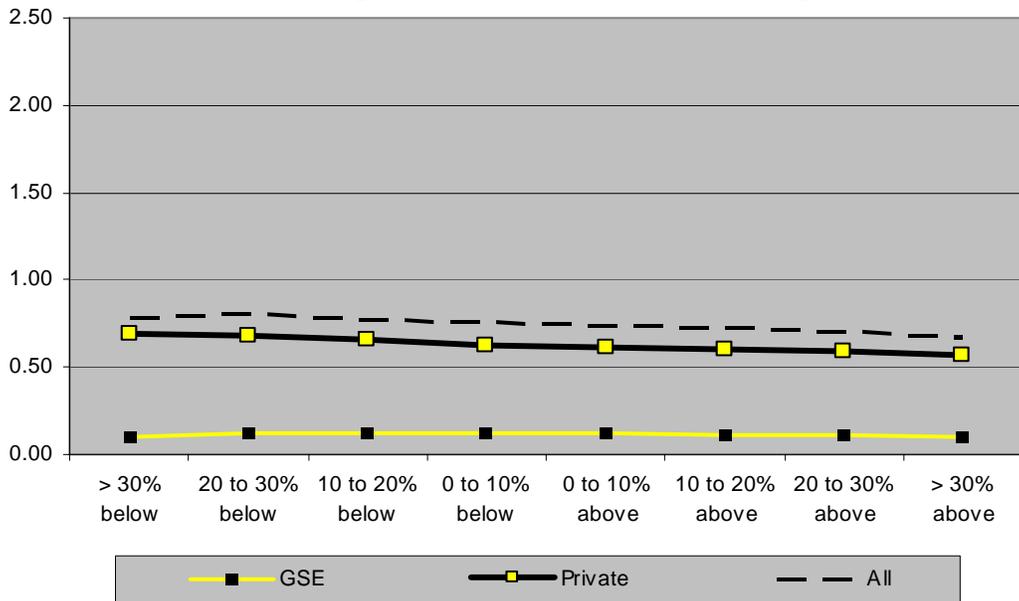


Figure 3: Crowd Out in the Secondary Market

