Secondary Mortgage Markets and Access to Credit: 1992-2002

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Abstract

In the last few decades, U.S. financial markets have witnessed a dramatic increase in the sophistication and size of the secondary market for mortgage loans. By 2002, close to 90 percent of conforming mortgage loan originations in the U.S. were sold into the secondary market. Although there is widespread consensus that an active secondary market enhances the efficiency of mortgage credit allocation, that belief has gone largely untested. Drawing on a largely overlooked feature of the Home Mortgage Disclosure Act (HMDA) data, this paper begins to fill that gap. We combine HMDA data from 1992 to 2002 with various years of census tract socio-demographic information obtained from Decennial Censes. Controls are included for endogenous mortgage market activity along with a host of other considerations. In addition, we focus our analysis on conventional home purchase loans that conform to secondary market loan size limits.

Results indicate that U.S. mortgage markets became more efficient over the decade of the 1990s, at least as measured by the declining impact of primary market denials on secondary market purchases. In addition, increasing purchases by 50 loans in a given census tract, equivalent to the inter-quartile range for purchases in 2000, would increase the share of applications originated by primary lenders by 3.7 percent. Among non-financial institutions, an equivalent increase in secondary market purchases results in an even larger 8 percent increase in the origination share. These estimates are of similar magnitude to the 3.5 percentage point rise in the U.S. homeownership rate between 1990 and 2000. Our results confirm the long held belief that an active secondary market enhances the efficiency of mortgage credit allocation and in so doing expands the supply of credit extended to potential borrowers.

1. Introduction

A defining feature of the U.S. housing finance system has been the creation of a large, sophisticated secondary market for mortgage loans. Between 1992 and 2002, secondary market purchases of conventional home purchase (CHP) loans rose from 67 to 88 percent of CHP originations (Table 1).[1] Expansion of secondary market activity has been even more dramatic among low-income and minority neighborhoods. Among low-income communities, purchases jumped from 33 percent of originations in 1992 to 81 percent in 2002; over this same period, among predominantly African American and Hispanic neighborhoods the ratio of purchases to originations jumped by roughly 30 and 40 percentage points, respectively.[2]

The rapid growth in the secondary market has been facilitated by policies and institutions largely put into place by the federal government over the past 40 years. This includes the creation of loan insurance programs, standardization of mortgage loan instruments and underwriting, enhancements to the availability of hazard and title insurance, and especially, the establishment of government and government-sponsored secondary mortgage market enterprises (GSEs).[3] Further, investors in the mortgage-backed securities of the GSEs (Fannie Mae and Freddie Mac) attribute an "implicit" U.S. Government guarantee to those securities. In 2002, the GSEs accounted for roughly 60 percent of secondary market purchases of conventional home

[1] Here we define the secondary market purchase rate as the ratio of secondary market loan purchases to primary market loan originations.

[2] In 1992, the ratio of secondary market purchases of CHP loans to originations was roughly 50 percent for predominantly African American and Hispanic neighborhoods; by 2002, that ratio had increased to 82 percent in African American neighborhoods and 91 percent Hispanic neighborhoods.

[3] Fannie Mae was initially an agency of the U.S. Government, created in 1938 to make a secondary market in FHA mortgages. In 1968, Fannie Mae became a federally-chartered GSE owned solely by private investors, the primary role of which was to provide lenders with a ready market for their mortgage assets and to assist in promoting uniformly defined mortgage instruments. Freddie Mac was created in 1970 to make a secondary market in the non-FHA mortgages originated by the savings and loan associations.

purchase loans. Moreover, the GSE charters mandate that they enhance the supply of credit to low-income, minority, and other underserved communities.

It is widely believed that an active secondary market enhances the efficiency (if not the equity) with which mortgage credit is provided. This contention is based on scale economies: a large secondary market can arbitrage regional imbalances in the supply and demand for credit and can more effectively manage risk associated with mortgage outcomes. Section 2 presents a model that highlights the impact of secondary market activity on the availability of credit. In that section, we argue that the presence of an active secondary market should unambiguously reduce denials of mortgage applications while increasing originations. Interestingly, however, the effects of secondary market expansion on mortgage pricing are unclear, a priori. An active secondary market could cause rates to rise as lenders extend credit to a more diverse – and riskier – pool of applicants.

The idea that an active secondary market enhances the efficiency of the mortgage market is compelling. However, few previous studies have provided direct empirical evidence to support that claim. A hint, however, is evident in Table 1 based on data from the Home Mortagage Disclosure Act (HMDA). Notice that in 2000, those MSAs with the lowest CHP loan application denial rates (denials divided by applications) also had unusually high levels of secondary market purchases relative to originations, and vice-versa. These patterns clearly indicate that increased secondary market activity is strongly correlated with improved access to mortgage credit. Less clear, however, is whether these summary measures are indicative of causal effects of the secondary market. This paper will explore that issue by focusing on two distinct but related questions. First, to what extent does an active secondary market increase the willingness of primary lenders to originate mortgage loans, and second, to what extent do

primary market loan accept/reject decisions affect the willingness of secondary market institutions to purchase loans?

To examine these questions we analyze a largely overlooked feature of the HMDA data. Specifically, as suggested in Table 1, HMDA provides detailed information on secondary market purchases of mortgage loans. But with the exception of a few early studies (e.g. Canner and Gabriel (1993)), HMDA information on secondary market loan purchases has been virtually ignored. Instead, the most prominent use of HMDA data has been to analyze why individual loan applications are accepted or rejected.[4] These studies have typically paid special attention to the role of applicant race and ethnicity with corresponding implications for discrimination and fair lending practices. Although these studies have been influential, they also have been controversial. This is because of well known limitations of HMDA: the data do not provide information on loan applicant wealth and credit history, but that information is critical to lender assessments of borrower credit worthiness in the accept/reject decisions. As a result, early accept/reject studies that did not control for borrower wealth and credit history created a virtual firestorm of debate. That debate only subsided when Munnell et al (1996) supplemented HMDA records in Boston with borrower wealth and credit scores obtained directly from the primary lender originators. Results from that study confirmed that minorities in Boston were more likely to have their loan applications rejected than comparable white mortgage applicants.[5]

Our study avoids the limitations of the HMDA data while drawing on its strengths. This is because secondary market purchase decisions are not based on the attributes of the individual

[4]See, for example, Avery, Beeson and Sniderman (1994), Munnell, Tootell, Browne, and McEneaney (1996), Avery, Beeson, and Calem (1997), Huck (2001), and Dietrich (2002).

[5]Other studies using HMDA data have focused on subprime lending in low-income markets (see, for example, Harvard Joint Center for Housing Studies (2002)), or the share of primary market originations that are documented in the HMDA data (see, for example, Berkovec and Zorn (1996), FFIEC (1996)).

borrowers. Instead, secondary market institutions consider the broad features of individual loan contracts (e.g. conforming, non-conforming, etc.) when deciding whether to purchase a set of loans from primary lenders. The GSEs, for example, largely purchase pools of conventional loans that conform to their loan size and underwriting guidelines. That information is available in the HMDA data. In addition, although it is likely that secondary market purchase decisions are further influenced by neighborhood socio-economic attributes – indeed, GSE regulations *require* Fannie Mae and Freddie Mac to purchase a share of their loans in low-income and minority communities – that information is readily available from the decennial Census. Combining HMDA and Census data, we are able to largely replicate the information used by the secondary market when deciding whether to purchase loans from primary market lenders.

Nevertheless, challenges remain. Most important, the conceptual model outlined in Section 2 suggests that our key measures of mortgage market activity (originations, applications, denials, and purchases) are simultaneously determined. To address that concern, we instrument for those measures using 1980 attributes of the census tracts (coded to year-2000 tract geography).[6] The hope here is that lagged neighborhood attributes are exogenous to mortgage purchase decisions in the 1990s. Given the limited scope of the secondary market in 1980, this seems reasonable. In addition, all of the regression models include MSA fixed effects for the larger metro areas and MSA-size category fixed effects for the smaller metro areas. These fixed effects further control for the influence of MSA-wide unobserved factors such as variations in mortgage interest rates, local policy, and more. Details of our econometric procedures are outlined in Section 3.

[6]As noted later in the paper, we have also estimated all of our models using 1970 census tract attributes as instruments (coded to year-2000 tract geography). Results were little changed from when the 1980 instruments were used.

Drawing on this estimation strategy, we establish three key results pertaining to the relationship between secondary and primary mortgage market activity for each year even year from 1992 to 2002. Most important, our estimates provide compelling support for the idea that a more active secondary mortgage market increases mortgage originations, and in that sense, access to credit: in each year from 1992 to 2002, secondary market purchases significantly increase the share of applications originated by primary lenders.

The magnitude of the estimated effects is also important. In 2000, for example, the inter-quartile range (25^{th} to 75^{th} percentile) in the number of CHP loans purchased across census tracts by the secondary market was roughly 50 loans (see Table 2). Our estimates indicate that an increase in purchase activity in a given tract of that magnitude would increase the percentage of applications originated by roughly 3.5 percent. For non-financial institutions that cannot hold loans in portfolio and must, therefore, sell *all* originated loans to the secondary market, the comparable effect is larger, 8 percent. On the surface, even an 8 percent increase in the origination share may not seem like a large number. However, it is important to bear in mind that U.S. homeownership rates were 65.5 percent, 64.1 percent, and 67.5 percent in 1980, 1990, and 2000, respectively. A 3.5 percent increase in the share of applications originated is of similar magnitude to the historical variation in homeownership rates. Moreover, if even just one-half of our estimated impact of secondary market activity on origination shares translates into higher homeownership rates, this suggests that the secondary market has played an important role in the historic increase in homeownership over the last fifteen years.

These findings confirm that an active secondary market tends to increase the supply of mortgage credit. But is that necessarily indicative of a more efficient market? To explore this question further, we also examine the impact of mortgage denials in the primary market on

secondary market purchases. If mortgage markets are sophisticated, then any loans rejected by primary lenders should be those that primary lenders did not want to hold in portfolio *and* secondary market institutions did not want to purchase. Under those conditions, denials by primary market lenders should have no effect on secondary market purchases. Alternatively, if primary lenders reject loans that could have been profitably sold to secondary market institutions, then arbitrage opportunities are missed, and denials should reduce secondary market purchases. Our findings indicate that in 1992, denials had a sizeable and negative impact on purchases. This suggests that at that time, primary lenders were failing to take advantage of potential arbitrage opportunities with the secondary market. However, in most other years, denials had small and insignificant effects on purchases, suggestive of a greater degree of efficiency in the mortgage market over the decade of the 1990s.

To clarify these and other results, we proceed as follows. Section 2 develops a conceptual model of the role of the secondary market in the determination of primary market outcomes. Section 3 describes our empirical strategy and model. Sections 4 and 5 report on data and estimation results, while Section 6 concludes.

2. Conceptual Model

The goal of this section is to clarify two key features of the analysis. First, how does an active secondary market affect the share of loan applications that are originated in the primary market and hence access to credit? Second, to what extent do loan disposition decisions in the primary market feed back to affect secondary market loan purchases? As will become apparent, these questions are closely related. Each is considered in turn, beginning with the first.

2.1 The influence of secondary market purchases on the primary market

As suggested in the Introduction, there is broad consensus that an active secondary market for mortgage credit addresses critical limitations of the primary market with corresponding gains in the efficiency (and perhaps equity) of mortgage credit allocation. The secondary market does this in two ways. First, the secondary market re-allocates funds across regions so as to mitigate geographic imbalances in the supply and demand for mortgage credit.[7] Further, the large scale of the secondary mortgage market allows it to manage and diversify risk more effectively than primary lenders. For example, at the regional level, swings in house prices, immigration, or shocks to employment can leave local mortgage originators vulnerable.[8] At the neighborhood level, a given community could suffer from localized disasters (e.g. earthquakes, flooding).[9] Such events could prove catastrophic to local lenders if those loans were held exclusively in portfolio rather than sold to diversified investors in the secondary market.

Consider now a stylized model of the primary market for mortgage credit in which all markets are competitive and markets clear in equilibrium. The model is portrayed in the four quadrant diagram in Figure 1 and is a modification of the Stiglitz-Weiss (1981) description of credit markets. In the upper right quadrant, loan demand varies with the attributes of the local population (Z) including income and other socio-economic factors that influence preferences. Loan demand also declines with an increase in the mortgage interest rate in the usual way. Loan supply increases with the mortgage rate and is sensitive to the risk-free cost of funds (c), the

[7]It does this by purchasing mortgages from the primary market, pooling loans together, and then securitizing those loans by selling shares to investors. In the empirical work to follow, we allow for these effects by including MSA fixed effects that control for MSA-wide factors such as the local demand and supply of credit.

[8]This certainly was the case in the early 1980s in Texas when oil prices crashed causing many families that worked in the oil industry to default on their mortgages.

[9]A recent example is New Orleans following Hurricane Katrina.

credit risk inherent to a pool of loan applicants with characteristics Z, and the presence of the secondary market. The manner in which these factors affect the supply of credit is clarified in the lower quadrants.

In the lower right quadrant, assume initially that there is no unobserved credit risk associated with loan origination. In this case, in the absence of mortgage origination and servicing costs, the expected rate of return to holders of mortgage credit is the mortgage interest rate (the 45 degree line in Figure 1). However, as loan rates increase the level of risk to which lenders are exposed is also likely to increase. This occurs in part because higher mortgage rates create adverse selection and moral hazard problems. In the present context, adverse selection arises if higher mortgage rates skew the pool of loan applicants towards individuals more willing to default, make late payments, or refinance, all of which are costly to the lender. Moral hazard arises if higher mortgage rates encourage borrowers to invest in more risky "projects," increasing the likelihood of default and other ills.[10] These effects are costly to lenders and, to the extent not fully observable at the time of loan origination, serve to reduce the return on loans issued.

Consider now the rate of return on loans issued in the absence of a secondary mortgage market. Assuming that lenders are exposed to more unobserved risk as loan rates increase, the return function in the lower right quadrant lies above and increasingly diverges from the 45 degree line. When the secondary market is introduced, however, the return function rotates down towards the 45 degree line. This is because the secondary market allows lenders to diversify away some of the costly effects of risk, raising the expected rate of return to investors associated with any given mortgage rate. To complete the picture, suppose that the risk free rate observed in the marketplace is given by c. This would define the minimum mortgage rate that

[10]This could be relevant for those homebuyers who purchase their homes primarily as an investment, but is likely less of an issue for other homeowners.

lenders would offer in the absence of risk altogether. For that reason, the intercepts on the return functions are centered on c rather than at the origin.

Consider next the lower left quadrant of the diagram. As shown in that quadrant, as the expected rate of return on loans increases, the number of loans supplied increases monotonically. This simply says that – all things equal – higher expected returns call forth a greater willingness to supply credit. Drawing on that pattern and those in the lower right quadrant, it is now possible to map the supply of credit in the upper right quadrant as a function of the risk free cost of funds (c), the level of risk associated with a given pool of applicants, and the presence of the secondary market. In particular, the secondary market causes the loan supply function to rotate up, increasing the supply of loanable funds for any given mortgage rate. In equilibrium, this causes market interest rates to fall from r^* to r^{**} and the number of loans originated to rise from L* to L**. Because the secondary market enhances the efficiency with which risk is managed, loan rates fall and loan originations rise.

The simple model just outlined is instructive, but incomplete. In particular, summary measures in Table 1 indicate that in 2002 roughly 12 percent of conventional home purchase mortgage applications were denied. However, if all markets clear in equilibrium, there is no room for denials in this context. To address this issue, we draw further from Stiglitz and Weiss (1981) to allow for equilibrium credit rationing, and therefore, denials.

Consider first the case where the secondary market is not present but credit rationing may occur. This is portrayed in Figure 2a. The key difference from Figure 1 is in the lower right quadrant. Observe that the expected rate of return on the pool of loans issued initially increases with the mortgage interest rate, reaches a peak, and then declines with further increases in the mortgage rate. This hump-shaped pattern is a central feature of the Stiglitz-Weiss (1981) model.

The pattern owes its form to the assumption that as mortgage interest rates increase, adverse selection and moral hazard eventually so deteriorate the quality of the loan pool that the expected return on loans issued begins to decline. Tracing through to the upper right quadrant, it is clear that the hump-shaped return function causes the mortgage supply function in the upper right quadrant to be hump-shaped as well.

Two possibilities arise in the standard Stiglitz-Weiss (1981) diagram (Figure 2a). In the first case, demand intersects supply on the upward sloping portion of the supply curve. In this case, all loan applications are accepted and no loans are denied. In the second, demand intersects supply on the downward sloping portion of the supply curve. In this case, relative to the market clearing interest rate (r^*), lenders can do better by lowering the mortgage rate so as to increase the number of loans originated. As shown in the lower right quadrant, this would increase the expected rate of return on loans issued. Moreover, this will continue until mortgage rates are reduced to r^{**}, a level equal to the peak in the mortgage supply function. It is worth emphasizing that at r^{**}, the equilibrium interest rate, excess demand for loanable funds is present in the marketplace and lenders deny some of the loan applications received. This is consistent with the evidence noted above that a significant percentage of loan applications are denied each year.

We assume now that credit rationing is present and add in the secondary mortgage market. This is shown in Figure 2b. In Figure 2b, the presence of the secondary mortgage market increases the expected rate of return for any given mortgage rate as shown in the lower right quadrant of the figure. This causes the loan supply function in the upper right quadrant to rotate up. As a result, unambiguously, denials of loan applications are reduced while loan originations increase. Interestingly, however, equilibrium mortgage interest rates could in

principle either fall or *rise*. The latter is possible because the enhanced ability of loan markets to manage risk enables lenders to price risk more effectively. This reduces the incentive of lenders to engage in credit rationing.

The idea that an active secondary mortgage market could cause mortgage rates to rise is provocative, but may also help to clarify recent results in the literature. Lehnart, Passmore, and Sherlund (2005) have recently shown that GSE portfolio purchases and MBS issuance have had negligible effects on mortgage interest rate spreads.[11] Figure 2b suggests that such a result may not be surprising. Moreover, Figure 2b also implies that secondary market purchase activity affects loan originations and denials as well as loan prices. Specifically, Figure 2b predicts that the presence of an active secondary mortgage market should unambiguously reduce the number of denials and increase the number of loans originated. This later result provides the basis for much of the empirical work to follow.

2.2 The influence of primary market denials on secondary market purchases

The discussion above establishes that the presence of an active secondary market should increase the number of loans originated and reduce primary market denials, all else equal. This section considers a complementary issue: what is the effect of denials of loan applications on secondary market purchases? This is important for two reasons. First, from a policy perspective, concerns have been raised as to whether secondary market institutions have been reticent to purchase loans from high-risk, underserved neighborhoods typically characterized by elevated rates of loan denials. Such concerns have contributed to GSE regulations that require Fannie Mae and Freddie Mac to purchase a minimum share of their loans in low-income, minority, and

[11]Lehnart et al (2005) further find that purchases are not more effective than securitization in reducing mortgage interest rate spreads.

underserved communities. This issue is sufficiently important that it warrants a complete study in itself and is left for future research.

This paper focuses on a different motivation for why denials of loan applications might affect secondary market purchase activity; namely, the efficiency with which credit markets operate. To clarify, the mortgage risk diversification activities of the secondary market give rise to arbitrage opportunities that benefit both primary and secondary mortgage market participants. In the absence of such arbitrage opportunities, and also government intervention, sales of loans to the secondary mortgage market would not occur.

Suppose now that loan markets are well developed and primary lenders are fully informed. Then any loan denied by a primary lender must be one that they could not sell at a profit in the secondary market. If this was not true, then both primary and secondary market lenders would have missed out on an arbitrage opportunity. Analogously, any loans originated by primary market lenders must be ones that they want to hold in portfolio or that secondary market investors would want to purchase.

These two simple arguments yield striking predictions. If primary lenders were not fully informed, then they might deny loans that secondary market investors would have been willing to purchase. In that case, loan denials reduce secondary market purchases and evidence of this would signal the presence of arbitrage opportunities. But if markets are efficient, any loans denied by primary lenders should be of no interest to the secondary market. In that case, loan denials should have little effect on the number of secondary market purchases. Considering that secondary markets were relatively limited in scope as recently as the mid-1980s, the degree to which denials might affect secondary market purchases is likely to have diminished throughout the decade of the 1990s. This too will be examined in the empirical work to follow.

3. Empirical Model

3.1 Origination regression

Our empirical work is guided by the relationships outlined in Figure 2b. In that regard, it is important to first recognize that originations in period *t* (L_t) equal applications (A_t) minus denials (D_t),

$$L_t \equiv A_t - D_t \quad . \tag{3.1}$$

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

$$A_t = A(r_t, Z_t) \quad . \tag{3.2}$$

The supply of mortgage credit is sensitive to whether a credit rationing equilibrium prevails, and also the presence of the secondary market,

$$S_t = \begin{Bmatrix} S(r_t, P_t, Z_t) & , \dfrac{\partial S_t(r_t^{clear})}{\partial r} > 0 \\ S(r_t^{max}, P_t, Z_t) & , \dfrac{\partial S_t(r_t^{clear})}{\partial r} < 0 \end{Bmatrix} . \tag{3.3}$$

Note that r^{max} is the mortgage rate associated with the peak of the loan supply function in the upper right quadrant of Figure 2b and r^{clear} is the market clearing rate.

Equilibrium in the market is as described in Figure 2b and depends on whether the loan demand function intersects the supply function at a downward or upward sloping point. Accordingly, the equilibrium number of loans originated is given by,

$$L_t^* = \begin{Bmatrix} S(r_t^{clear}, P_t, Z_t) & , \dfrac{\partial S_t(r_t^{clear})}{\partial r} > 0 \\ S(r_t^{max}, P_t, Z_t) & , \dfrac{\partial S_t(r_t^{clear})}{\partial r} < 0 \end{Bmatrix} \quad . \tag{3.4}$$

The number of loans denied in equilibrium can then be obtained by differencing (3.2) and (3.3) at the equilibrium mortgage rate,

$$D_t = \left\{ \begin{array}{r} A_t(r_t^{max}, Z_t) - L_t^*(r_t^{max}, P_t, Z_t) \ , \ \frac{\partial S_t(r_t^{clear})}{\partial r} > 0 \\ 0 \ , \ \frac{\partial S_t(r_t^{clear})}{\partial r} < 0 \end{array} \right\} . \qquad (3.5)$$

As noted earlier, in a non-credit rationing equilibrium, markets clear and denials are zero. However, when credit rationing prevails, loan denials equal the difference between A_t and L_t, as implied by (3.1).

It is also useful to formerly recognize that equilibrium mortgage rates depend on all of the arguments of the demand and supply functions,

$$r_t^* = r(c_t, P_t, Z_t) \qquad . \qquad (3.6)$$

Thus, equilibrium mortgage rates depend on the risk free cost of funds (c_t), the intensity of secondary market purchase activity, and also the observable characteristics of the loan applicants.

Using these expressions, we seek to analyze the impact of secondary market activity on access to credit. There are two channels by which this occurs. The first is through the effect of secondary market activity on mortgage interest rates as in (3.6). The second channel is through the effect of secondary market activity on loan denials conditional on the mortgage rate. The influence of secondary markets on mortgage rates has been the focus of recent work (see Lehnert, Passmore, and Sherland (2005), for example) and we do not attempt to measure that

relationship here.[12] Instead, this study focuses on the extent to which secondary market purchases reduce loan denials and in so doing enhance access to mortgage credit.

A problem that arises when considering the impact of secondary markets on denials is that some denied applications will be resubmitted to alternate lenders and ultimately approved. As a result, the impact of secondary markets on denials (D_t) likely overstates the effect of secondary markets on access to credit. For that reason, we consider the impact of secondary market activity on loan originations (L_t) as this provides a more direct measure of access to credit.[13] We proceed as follows.

In each time period, *t*, the share of loan applications that are originated is given by *s*, where *s* is bounded below by zero and above by 1:

$$L_t = s_t A_t \quad , \quad for\ 0 \le s \le 1 \tag{3.7}$$

From the expressions above, *A* depends on *r* and *Z*, while *s* also depends on secondary market purchases, *P*, since $s_t = (A_t - D_t)/A_t$. Accordingly, we specify *s* as

$$s(r_t, P_t, Z_t) = e^{r_t b_{o,t} + P_t b_{1,t} + Z_t b_{2,t}} \quad , \quad for\ s \le 1 \tag{3.8}$$

Taking logs and rearranging,

$$\log(L_t/A_t) = r_t b_{o,t} + P_t b_{1,t} + Z_t b_{2,t}, \quad for\ \log(L_t/A_t) \le 0 \tag{3.9}$$

In (3.9), note that *Z* and *P* vary within metropolitan areas, but mortgage rates, *r*, are largely invariant within individual cities, and even across broad regions of the country. Accordingly, we replace $r_t b_{o,t}$ with MSA fixed effects for larger MSAs and MSA-size category fixed effects for smaller MSAs. Our estimating equation is then given by,

[12] In the empirical model to follow, we control for inter-metropolitan variability in mortgage rates by including MSA size-related fixed effects in the estimating equations.

[13] Another challenge in working directly with denials is that there are many census tracts for which zero denials are reported in the HMDA data. Although this issue also arises when working with originations (L_t) as described below, the zeros problem is much less prevalent for that data series. That simplifies the empirical work by reducing the need to specify our models in a manner that explicitly allows for censored dependent variables.

$$\log(L_t/A_t) = \theta_{MSA,t} + P_t b_{1,t} + Z_t b_{2,t}, \quad for \ \log(L_t/A_t) \leq 0 \tag{3.10}$$

Note that $\theta_{MSA,t}$ controls for MSA-wide mortgage rates as well as any other unobserved factors common to census tracts throughout a given MSA (or group of MSAs for the smaller cities).

From the discussion above, local socio-demographic attributes, *Z*, shift both borrower demand (*A*) and the lenders' supply of credit by influencing taste for credit and credit risk, respectively. For this reason, it is important to bear in mind that the coefficients on *Z* are reduced form in nature, reflecting the influence of both demand and supply factors. In contrast, *P* does not affect demand, but does influence the supply of credit. Our estimate of b_2, therefore, measures the impact of secondary market activity on the willingness of primary lenders to supply credit; this coefficient is expected to be positive.[14]

3.2 Purchase regression

In Section 2, we pointed out that if markets are sophisticated, then primary market lenders should only deny loans that the secondary market is unwilling to purchase. Under these conditions, *D* should have no effect on *P*. On the other hand, *P* is clearly affected by *L* since *L* represents the supply of loans potentially available for purchase in the secondary market. Our second estimating equation, therefore, examines the impact of denials on the *level* of secondary

[14]Given the structure in (3.10), it is tempting to analyze the impact of Government Sponsored Enterprise (GSE) and Community Reinvestment Act (CRA) regulations on the availability or mortgage credit. CRA, for example, requires that primary market lenders extend credit to underserved neighborhoods, while GSE regulations require that Fannie Mae and Freddie Mac purchase a minimum share of their loans from low-income and minority neighborhoods. However, by specifying *Z* in a very general and reduced form manner, this makes precise interpretation of the coefficients on *Z* difficult. The payoff is that specifying *Z* in this manner helps to ensure that *Z* soaks up unobserved credit risk associated with the applicant pool, and in so doing, allows us to obtain consistent estimates of b_2, a primary goal of this paper. Partly for that reason, analysis of the influence of CRA and GSE regulations and the GSEs in general is left for a future paper in which a more structured approach is applied to the specification of *Z*.

market purchases, controlling for the level of supply as represented by L. The estimating equation is,

$$P_t = \phi_{\text{MSA,t}} + p_1 L_t + p_2 D_t + p_3 Z_t + e_{2,t} \quad . \tag{3.11}$$

If mortgage markets are not fully efficient, then primary market lenders will deny at least some loans that the secondary market would otherwise have purchased, and p_2 should be negative. If mortgage markets became increasingly sophisticated over the 1990s, the magnitude of p_2 should decline over time.

3.3 Endogenous regressors

A final important consideration concerns endogenous regressors. From (3.1) to (3.6), it is clear that the mortgage market control variables in (3.10) and (3.11) may be endogenous. Our goal, however, is to identify causal effects of the secondary market on access to credit, not simply correlations in the data. To address this issue, in all of the regressions to follow, we use 1980 attributes of the census tract population, Z_{1980}, as instruments for the contemporaneous mortgage market variables.[15] Bearing in mind that the regressions are run separately for each even year of the HMDA data from 1992 to 2002, this ensures that our instruments pre-date the endogenous regressors by twelve years for the 1992 regression, and up to twenty-two years for the 2002 regression. It is hoped that using these deeply lagged instruments will satisfy the needed exogeneity conditions, enabling us to obtain consistent estimates of the causal influence of the secondary market on access to credit. Given the limited scope of secondary market purchases prior to 1980, it seems likely that this condition is met.

[15]Results were quite similar when 1970 tract attributes were used as instruments. However, using 1970 instruments reduced the number of tracts available in the sample because of the geographic coverage of census tracts in 1970 was not as extensive as in 1980. For this reason, we report only results using the 1980 instruments.

4. Data

As noted in the Introduction, 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 1992, 1994, 1996, 1998, 2000, and 2002 and census tract socio-demographic attributes obtained from 1970, 1980, 1990, and 2000 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 and coded by FFIEC based on 1990 census tract geography. We converted these 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 in Section 2. Summary statistics for all of the key mortgage market variables are provided in Tables 1 and 2. Elements of *Z* obtained from the Census data include tract-level measures of socio-demographic and economic variables. These include 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.[16] When estimating the models for HMDA data drawn from the 1992 through 1998 files, we used year-1990 census tract attributes as control measures. When estimating for HMDA data obtained from 2000 and 2002, we used year-2000 census tract attributes for *Z*. In addition, as noted earlier, 1980 census tract attributes were used as instruments for all of the models reported in the following section. We also

[16]Recall 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 primarily on broad features of the mortgage contracts rather than on the borrowers themselves.

experimented with 1970 census tract attributes as instruments. Results were little changed when we used the 1970 tract attributes except that sample sizes were somewhat reduced because the geographic coverage of the census tracts was not as complete in 1970. For this reason, we focus on the models that use the 1980 tract attributes as instruments.

To further clean the data, we dropped certain observations. First, in calculating tract-level mortgage attributes (e.g. purchases, denials), individual loan records from the HMDA data were dropped if the type or purpose of the loan could not be determined. Second, we retained only conventional, home purchase loan records for which the size of the loan requested was less than the conforming loan limit stipulated by Fannie Mae and Freddie Mac in a given year.[17] Finally, for the origination share regressions, we estimated all of the models twice. In the first set of routines, we included all mortgages that met the criteria outlined above. In the second set of routines, we retained only loans issued by non-financial institutions, mortgage bankers and brokers. These institutions cannot hold loans in portfolio and, therefore, must sell *all* of their loans to the secondary market. As such, this group of primary market originators should be especially sensitive to the presence of an active secondary market.

5. Results

This section presents estimates of the origination share and purchase equations described in expressions (3.10) and (3.11), respectively. Separate estimates are provided for each year of the HMDA data from 1992 to 2002 (even years only). In addition, all of the models are estimated twice, first treating the mortgage market control variables (purchases, denials, and originations) as endogenous, and then again treating these variables as exogenous. In the former

[17]We are grateful to Glenn Canner at the Federal Reserve in assisting us in identifying the relevant conforming loan size limits.

case, census tract attributes from 1980 are used as instruments as noted earlier. These regressions are referred to below as IV and Non-IV regressions, respectively. Wald tests reported at the bottom of Tables 3 – 5 generally reject the null that the mortgage market variables are exogenous. For that reason, we focus primarily on the IV models. It should also be noted that for the origination share regressions, a Tobit specification is used in order to restrict the range of the dependent variable to non-positive values, consistent with the specification in (3.10). Tobit is also used when estimating the purchase equation because there are many census tracts in which zero purchases are recorded; for these regressions, the dependent variable is restricted to non-negative values.[18]

Results for the IV origination share regressions are provided in Table 3 (for 1992 through 1996) and Table 4 (for 1998 through 2002). For each year, two regressions are reported; first with all originators included in the sample, and then again using originations from just the non-financial institutions (mortgage bankers and brokers). As suggested above, non-financial institutions are not allowed to hold loans in portfolio and are likely to be especially sensitive to the presence of an active secondary market. No such distinction is made when estimating the purchase equations since it seems unlikely that secondary market institutions would distinguish between non-financial and depository institutions when purchasing loans. Results for the purchase regressions are provided in Table 5.

We consider first the coefficients on the socio-demographic attributes, both from the origination share and purchase regressions. Focusing on the origination share regressions in Tables 3 and 4 first, recall that in these regressions, *Z* has a reduced form interpretation. This is because *Z* influences both the demand and supply for mortgage credit. Although this makes interpretation of these coefficients difficult, some patterns are still worth noting.

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

In both Tables 3 and 4, notice first that the omitted education category is the percent of the census tract population with a college degree or more. Relative to that group, the presence of individuals with less education has a negative influence on the share of applications originated. This occurs in both the "All Originations" and "Non-Financial" models for each year from 1992 to 2002. On balance, this is suggestive that the willingness of lenders to supply credit rises more quickly with loan applicant education than does the size of loans requested. But given the reduced form nature of *Z*, this is at least partly speculative.

Results also indicate that a higher concentration of African Americans in the census tract reduces the share of applications originated. Although this could be suggestive of racial bias on the part of lenders, an alternate possible interpretation is that African American families tend to request large loans relative to their budget. Once again, the reduced form nature of the specification for *Z* does not allow us to identify the precise mechanism at work. Analogous patterns and interpretations could be described for several other socio-demographic variables.

Turning to Table 5, we focus next on the socio-demographic attributes in the purchase equation. The patterns here are also difficult to interpret given the reduced form character of *Z* in the model. For example, if African Americans are slow to refinance as suggested by recent work by Deng and Gabriel (2006), then primary market lenders may be more eager to hold such loans in portfolio. This would reduce sales to the secondary market. On the other hand, limited loan purchases in African American neighborhoods could also reflect reticence on the part of the secondary market to serve minority communities.[19] In some of the years (but not all), the coefficient on African American status is negative and significant, but for reasons just noted, the

[19] Note that public concerns regarding possible redlining of the part of primary and secondary market entities contributed to the enactment of HMDA and related fair lending legislation.

reduced form specification of *Z* does not allow us to identify the underlying mechanism that gives rise to that result. The same is true for the other socio-demographic variables in Table 5.

The discussion above makes clear that the reduced form specification of *Z* in Tables 3 through 5 limits our ability to identify the underlying mechanisms that contribute to the observed patterns of socio-demographic coefficients. However, that same general specification of *Z* serves to control for unobserved risk (and demand) associated with the attributes of the applicant pool. This reduces concerns about possible omitted variable bias and enables us to obtain consistent estimates of the mortgage market variables, which is the primary goal of this study. Accordingly, we turn now to those estimates.

Estimates of the coefficients on the mortgage market variables in Tables 3 to 5 are summarized in Table 6. Also provided in Table 6 are Non-IV estimates of the mortgage market coefficients. This facilitates comparisons across the origination share and purchase regressions, and also between the IV and Non-IV models. Several patterns are immediately apparent.

Focus first on Panel A which reports the IV estimates and consider the influence of denials and originations on secondary market purchases. Results indicate a monotonic decline over the 1992 – 1998 period in the coefficient on loan denials. The estimated coefficient moved down from -0.70 in 1992 to close to zero for the remaining years of the decade. In 2000 and 2002, the coefficient trended up somewhat to -.12 and -.29, respectively, but remained well below the 1992 level. Given our focus on conventional loans that adhere to conforming loan size limitations, one would expect a small coefficient magnitude in the context of an expansive and well-functioning secondary market. That is because in a well-function market, primary lenders should deny only loans that the secondary market is unwilling to purchase.

As would also be expected, originations have a positive impact on purchases. Originations, of course, expand the supply of mortgages that could be sold in the secondary market, so the qualitative nature of this result is anticipated. Also evident in Table 6 is that the magnitude of the coefficient on originations has trended up over the decade of the 1990s, from roughly 80 percent in 1992 to roughly 100 percent in 2002. This pattern is indicative of the sharp increase in secondary market activity over the 1990s; by the end of the decade, nearly 90 percent of conforming loans originated were sold in the secondary market (see Table 1).[20]

Turning to the origination share regressions in Panel A, the most important result and one that is central to this paper is that secondary market purchases increase the share of applications originated by primary market lenders. This effect is most pronounced in the first half of the 1990s, and declines somewhat in the latter years. Moreover, it is also clear that an active secondary market has a greater impact on the share of applications originated by non-financial institutions, consistent with the idea that these institutions are more dependent on the secondary market than are financial institutions that can hold loans in portfolio.

The magnitudes of the estimated impact of purchases on origination shares are also important. In 2000, for example, from Table 2, the inter-quartile range across tracts in the number of loans purchased is roughly 50. The coefficient on purchases in 2000 in the "All Institutions" origination share equation is 0.00074. Accordingly, an increase in purchase activity comparable in magnitude to a shift from the 25th to the 75th percentile in 2000 would increase the share of applications that are originated by 3.7 percent. Among non-financial institutions the estimated effect is larger, roughly 8 percent. Not all of these additional originations translate

[20] Clearly timing issues can intervene here, as pertains to the number of months over which originated loans are held by originators prior to sale. That not withstanding, results late in the decade indicate an approximate one-to-one relationship between loan originations and purchases of conventional conforming loans.

into additional homeowners, of course: some of the originated applications, for example, likely were submitted by existing homeowners who were seeking to move to another home. Nevertheless, as noted in the Introduction, homeownership rates rose roughly 3.5 percentage points from 1990 to 2000: the 3.7 percent increase in origination share is of similar magnitude.

Panel B of Table 6 presents Non-IV estimates of the Tobit models. Results are qualitatively similar to those in Panel A where we allow the mortgage market variables to be endogenous. Also, the estimated coefficients are similar in magnitude in most instances. The most prominent difference between the two panels pertains to the 1992 estimate of the coefficient on Denials in the purchase regressions. In the Non-IV model, that coefficient is -0.15, much smaller in magnitude than the -0.69 estimate in the IV specification. Nevertheless, the key patterns persist: the influence of denials on purchases is small in most years, and trends down through the 1990s, before moving up in 2002. That increase, evident both in the IV and Non-IV models, is mirrored by a sharp drop in the coefficient on purchases in the origination share equations for 2002, also for the IV and Non-IV models. The year 2002 was a recession year and followed immediately upon the stock market crash of 2001. This was also a period in which the Federal Reserve moved aggressively to lower short-term loan rates, contributing to a sharp steepening of the yield curve. It seems likely that these dramatic events contributed to the shift in our estimated coefficients from 2000 to 2002. However, a more precise assessment of what caused those shifts is left for future work.[21]

[21]For example, it is possible that the heightened risk associated with the market crash and recession of 2001 caused primary market lenders to become more cautious about originating loans. To the extent that this occurred, the patterns in Table 6 suggest that primary market lenders overreacted and denied loans that the secondary market would otherwise have been willing to purchase. This would account for the increased coefficient on Denials in the purchase equation and the corresponding decreased coefficient on Purchases in the origination share equation. But this is speculative, and we can only be note that the observed patterns fit this scenario.

6. Conclusion

Recent decades have witnessed dramatic growth in the sophistication and size of the secondary market for mortgage loans. By 2002, close to 90 percent of conforming loan originations in the U.S. were sold to the secondary market, up from 67 percent just ten years earlier. This expansion has been actively encouraged by the federal government, most explicitly, through the creation and oversight of Fannie Mae and Freddie Mac. In 2002, those institutions accounted for roughly 60 percent of secondary market purchases of conventional home purchase loans; further, the GSE charters mandate that they enhance the supply of credit in low-income, minority, and other underserved communities.

Although it is widely believed that the presence of a secondary market enhances the efficiency with which mortgage credit is supplied, few studies to date have provided direct evidence on this point. Indeed, a recent study by Lehnert et al (2005) found that the Government Sponsored Enterprises (GSEs) have had little effect on market mortgage interest rates. We revisit this issue and develop a conceptual framework to guide the analysis. That framework suggests that the effect of an active secondary market on mortgage pricing is indeterminant. Specifically, it is possible that an activie secondary market could cause mortgage rates to *rise* because of the enhanced ability of lenders to price risk in conjunction with the extension of credit to more marginal borrowers. This could account for the limited interest rate effects discerned by Lehnert et al (2005).

In contrast, our conceptual model predicts that an active secondary market unambiguously reduces denials of mortgage applications while increasing originations. Accordingly, it is this dimension upon which we focus our empirical work. Specifically, we

examine two closely related but distinct questions. First, to what extent do loan purchases by the secondary market cause the origination share of loan applications to increase? Second, to what extent do denials of mortgage applications in the primary market feed back to affect purchase activity? In the latter case, if markets are well-developed, primary lenders should deny only those loans that the secondary market is unwilling to purchase. In this case, denials should have little impact on purchases. If instead, primary lenders deny loans that are attractive to the secondary market, then arbitrage opportunities remain unexploited and denials should reduce purchase by the secondary market.

To examine these questions we draw upon a largely overlooked feature of the Home Mortgage Disclosure Act (HMDA) data. Specifically, HMDA data report detailed information about purchases of loans by secondary market institutions. We merge those data from various years between 1992 and 2002 with census tract data from the 1970, 1980, 1990, and 2000 Decennial Censes. Results confirm that in most years through the 1990s, denials of mortgages had little impact on secondary market purchases, although interestingly, this is less true in 1992. This suggests that mortgage markets have increased in sophistication through the 1990s as would be expected.

Results also confirm that an active secondary market increases the share of applications for conventional home purchase loans that are originated. In 2000, if purchase activity in a given census tract increased by 50, an amount equal to the inter-quartile range in loan purchases across tracts in that year, our regression models predict that the origination share of mortgage applications would increase by 3.7 percent. Moreover, among non-financial institutions that must sell their loans in the secondary market, the effect would be 8 percent. These estimates are of similar order of magnitude to the historical variation in homeownership rates in the United

States, especially in light of the 3.5 percentage point increase in homeownership rates between 1990 and 2000. Our estimates, therefore, are strongly suggestive that an active secondary market does indeed enhance the efficiency with which mortgage credit is provided, and in so doing, expands the supply of credit.

We should also emphasize that our results here are largely robust when we allow the mortgage market variables to be endogenous as opposed to exogenous. These findings are also robust to the inclusion of a large number of MSA- and MSA-size fixed effects that strip away the influence of a host of MSA-specific factors, including interest rate levels. A host of tract-specific socio-demographic attributes further control for demand and loan applicant credit risk associated with the local population.

As a final point, we should emphasize that although much has been learned from this study, many questions remained unanswered. Unresolved are questions concerning the efficacy of banking and GSE regulation in the enhancement of mortgage credit flows and homeownership among underserved, low-income, and minority neighborhoods. As is well-appreciated, loan origination and loan purchase goals are articulated in the 1977 Community Reinvestment Act and the 1992 GSE Act for lenders and the GSEs, respectively, in the form of specified proportions of loan originations and purchases that must derive from targeted low-income and underserved neighborhoods. Estimates are required of the magnitude, significance and geographic dispersion of loan originations, purchases and homeownership outcomes directly attributable to the CRA and GSE goals. These questions are all the more relevant, given the substantial influence of the GSEs and ongoing debate regarding the focus of their future activities. While these issues are pressing, they are beyond the scope of this paper and are left for future study.

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Figure 1: Primary Mortgage Market With No Credit Rationing With and Without a Secondary Market

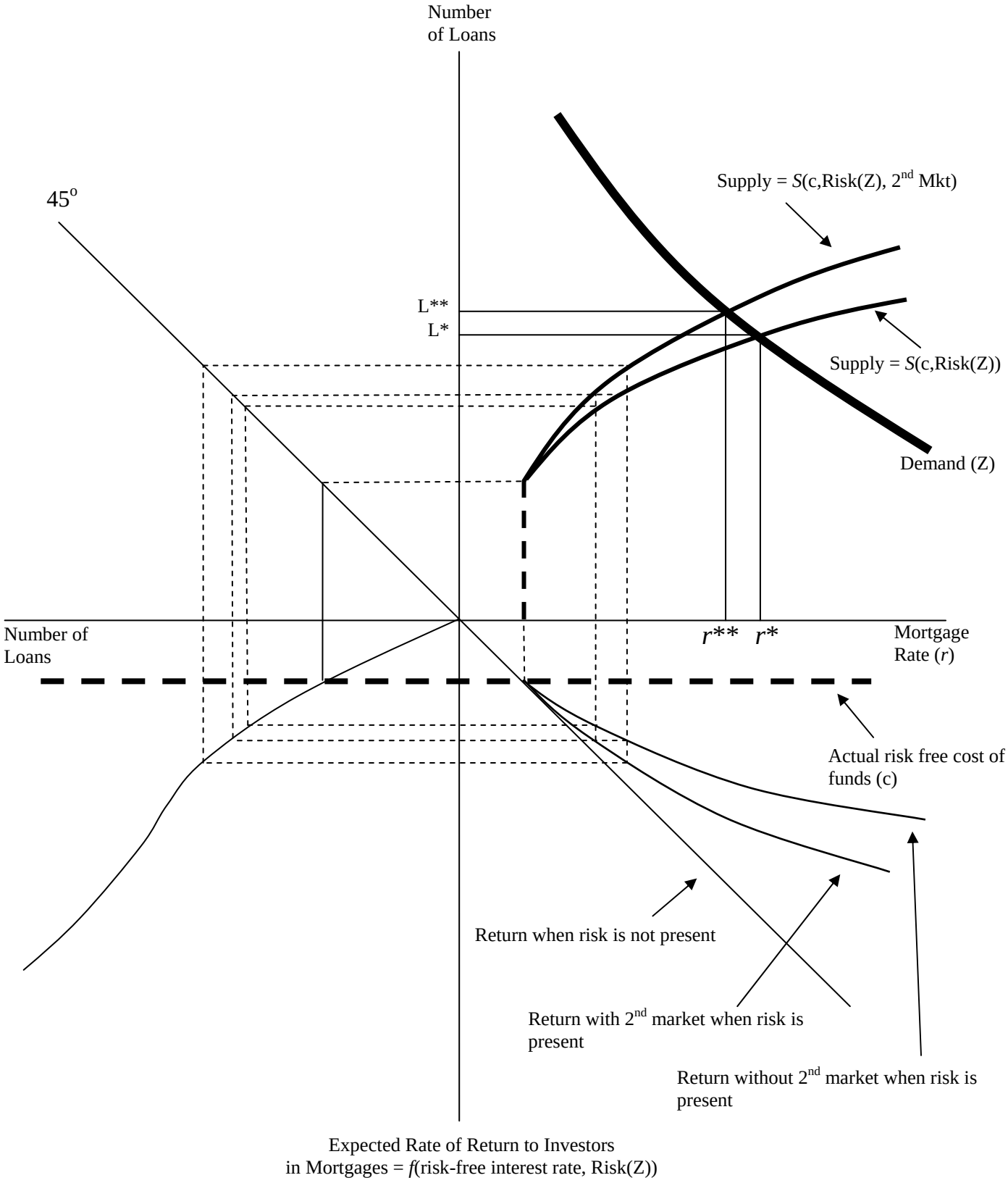

Figure 2a: Primary Mortgage Market With Credit Rationing and No Secondary Market

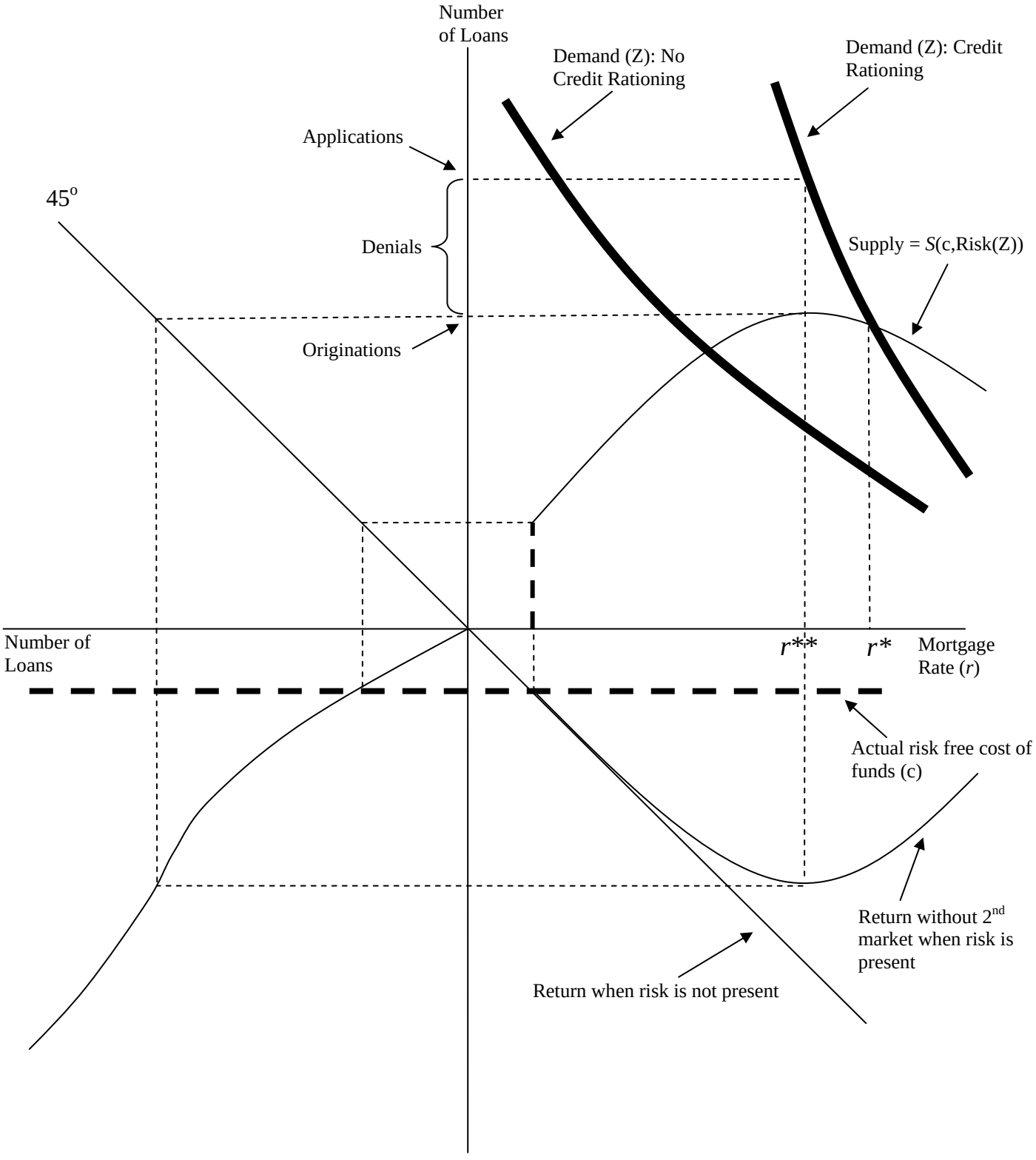

Figure 2b: Primary Mortgage Market With Credit Rationing With and Without a Secondary Market

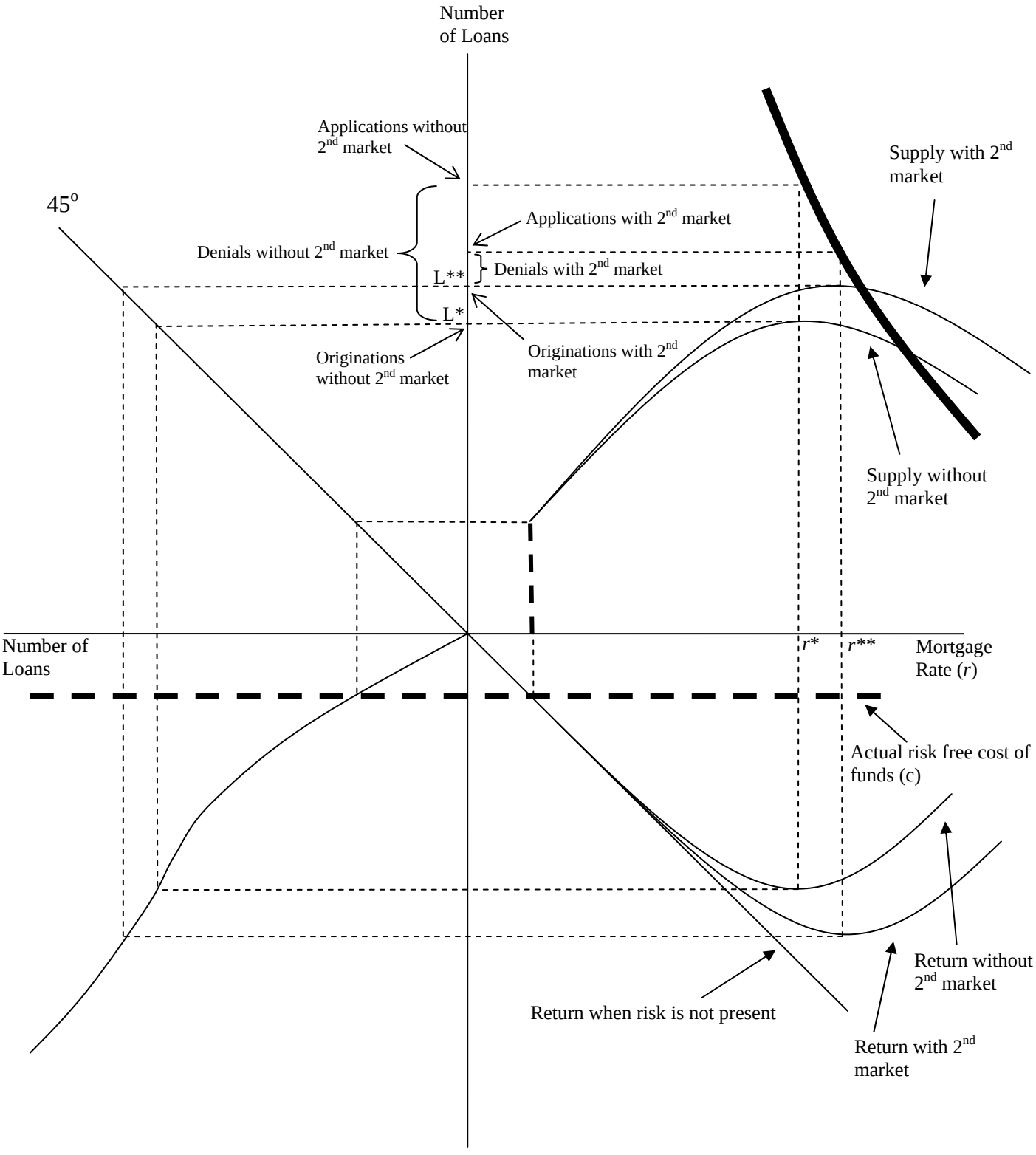

Table 1: Primary and Secondary Mortgage Market Activity in the 1990s
All Mortgage Values are MEDIANS Across Tracts
Based on Conventional Home Purchase (CHP) Loans

	Year	Denial Rate[2]	Origination Rate[2]	2nd Market Purchase to Origination Ratio[1]
Entire US	2002	0.121	0.581	0.876
	1992	0.116	0.653	0.672
Tract Income				
Less Than 25,000	2002	0.195	0.471	0.813
Less Than 25,000	1992	0.188	0.595	0.333
Tract Race and Ethnicity				
Percent Black > 50	2002	0.203	0.444	0.818
Percent Black > 50	1992	0.200	0.545	0.500
Percent Hispanic > 50	2002	0.163	0.493	0.910
Percent Hispanic > 50	1992	0.216	0.551	0.500
Low Secondary Market Purchase to Origination Ratio for CHP Loans[1]				
Huntington-Ashland WV-KY-OH	2002	0.352	0.448	0.476
Rocky Mount NC	2002	0.376	0.382	0.659
Dothan AL	2002	0.283	0.484	0.488
Florence SC	2002	0.316	0.413	0.679
High Secondary Market Purchase to Origination Ratio for CHP Loans[1]				
Visalia-Tulare-Porterville CA	2002	0.119	0.561	1.168
Tucson AZ	2002	0.087	0.599	1.095
Chico-Paradise CA	2002	0.083	0.648	1.058
Anchorage AK	2002	0.062	0.619	1.214

[1]Secondary market includes FNMA, GNMA, FHLMC, FAMC, commercial banks, savings banks and associations, life insurance companies, affiliates, and other purchasers.

[2]Denial and origination rates are relative to the sum of primary market originations, denials, withdrawals, approved but not accepted, and files closed because of incomplete information.

Table 2
Summary Statistics for Mortgage Market Variables from the HMDA Data

PANEL A: All Lending Institutions

Stats	Year	App	Orig	2nd Pur	Denials	Orig/App	Stats	Year	App	Orig	2nd Pur	Denials	Orig/App
mean	1992	42.35	31.67	23.23	5.90	0.72	mean	1994	58.90	43.46	26.61	7.95	0.72
p25	1992	13	9	5	2	0.63	p25	1994	19	13	6	2	0.63
p50	1992	29	21	14	4	0.75	p50	1994	41	29	16	5	0.75
p75	1992	55	41	30	8	0.84	p75	1994	73	54	33	10	0.83
mean	1996	72.91	47.47	33.62	14.83	0.65	mean	1998	95.98	59.02	51.10	21.06	0.61
p25	1996	23	14	8	3	0.54	p25	1998	32	17	13	4	0.47
p50	1996	47	31	20	7	0.68	p50	1998	63	38	30	10	0.64
p75	1996	88	59	41	16	0.79	p75	1998	116	72	62	22	0.75
mean	2000	100.85	62.44	53.14	20.95	0.60	mean	2002	114.73	80.06	76.71	14.29	0.66
p25	2000	36	20	14	5	0.49	p25	2002	36	22	18	4	0.57
p50	2000	67	40	31	11	0.63	p50	2002	68	45	40	8	0.69
p75	2000	119	74	62	23	0.74	p75	2002	119	83	78	16	0.77

PANEL B: Non-Financial Lending Institutions

Stats	Year	App	Orig	2nd Pur	Denials	Orig/App	Stats	Year	App	Orig	2nd Pur	Denials	Orig/App
mean	1992	13.83	9.84	10.65	2.07	0.73	mean	1994	21.23	14.18	13.05	3.65	0.68
p25	1992	3	2	2	0	0.57	p25	1994	6	3	3	0	0.52
p50	1992	7	5	6	1	0.75	p50	1994	12	8	7	2	0.71
p75	1992	16	11	13	2	0.92	p75	1994	25	17	15	4	0.84
mean	1996	28.34	14.27	14.65	8.62	0.57	mean	1998	43.54	20.24	21.48	13.70	0.50
p25	1996	7	3	3	1	0.39	p25	1998	12	5	6	2	0.33
p50	1996	15	8	8	3	0.57	p50	1998	25	12	12	5	0.50
p75	1996	31	16	17	8	0.75	p75	1998	50	24	25	14	0.67
mean	2000	33.97	17.88	20.76	8.42	0.54	mean	2002	39.63	24.06	26.21	6.41	0.57
p25	2000	10	5	5	1	0.38	p25	2002	10	5	6	1	0.43
p50	2000	20	10	12	3	0.55	p50	2002	20	11	12	3	0.59
p75	2000	38	20	24	8	0.70	p75	2002	39	22	25	7	0.72

Table 3a
Primary Market Originations of Conventional Home Purchase (CHP) Loans
Tobit Two-Step IV Estimates Using 1980 Tract Attributes as Instruments

Dependent Variable: Log(Originations/Applications)
(Absolute value of t-ratios in Parentheses)

	1992		1994		1996	
	All Orig	Non-Fin Inst	All Orig	Non-Fin Inst	All Orig	Non-Fin Inst
CHP 2nd Market Purchases	0.001987	-0.0046	0.00114	0.004461	0.000524	0.003078
	(5.10)	(3.34)	(4.49)	(4.65)	(2.57)	(3.67)
% Population Hispanic	-0.225931	-0.09312	-0.17099	0.089004	-0.15054	0.099243
	(15.61)	(2.88)	(13.23)	(3.48)	(10.12)	(3.66)
% Population African American	-0.179542	-0.11238	-0.24391	-0.18891	-0.32743	-0.24227
	(16.07)	(4.34)	(25.03)	(9.61)	(30.12)	(12.09)
Avg Age of population	0.001009	-0.00119	0.001057	0.003971	-7.1E-05	0.001258
	(2.26)	(1.29)	(2.86)	(5.21)	(0.18)	(1.71)
% Male	-0.209483	-0.59982	-0.27461	-0.16573	-0.40727	0.080632
	(4.72)	(5.46)	(6.59)	(1.93)	(8.74)	(0.90)
Avg Family Income ($1,000)	0.00057	0.001068	0.002213	0.003715	0.003706	0.007176
	(2.61)	(2.17)	(11.47)	(9.51)	(16.57)	(17.50)
Avg Family income squared ($1,000)	-0.000003	-7E-06	-9E-06	-1.2E-05	-1.4E-05	-2.3E-05
	(4.63)	(4.38)	(14.97)	(9.07)	(18.88)	(17.92)
% People 25+ with no high school	-0.196939	-0.74938	-0.25577	-0.65886	-0.42691	-0.59607
	(5.68)	(9.33)	(7.96)	(10.19)	(12.02)	(8.92)
% People 25+ with some high school	-0.487423	-0.81913	-0.48528	-0.66767	-0.67851	-0.7887
	(14.12)	(10.44)	(15.81)	(10.81)	(19.48)	(11.75)
% People 25+ with high school degree	-0.016252	-0.292	-0.08798	-0.04591	-0.10615	-0.11463
	(0.57)	(5.04)	(3.76)	(0.99)	(4.10)	(2.49)
% People over 25 with some college	-0.440227	-0.48639	-0.45385	-0.317	-0.56059	-0.57209
	(11.82)	(6.44)	(14.06)	(5.06)	(15.29)	(8.51)
% Of Age 16+ unemployed	-0.060021	0.799445	0.184902	0.634586	0.329742	1.087582
	(1.22)	(5.96)	(4.06)	(6.42)	(6.41)	(10.84)

Continued on next page

Table 3a cont.
Primary Market Originations of Conventional Home Purchase (CHP) Loans
Tobit Two-Step IV Estimates Using 1980 Tract Attributes as Instruments

Dependent Variable: Log(Originations/Applications)
(Absolute value of t-ratios in Parentheses)

	1992		1994		1996	
	All Orig	Non-Fin Inst	All Orig	Non-Fin Inst	All Orig	Non-Fin Inst
% Population in poverty last year	-0.132189	-0.194	-0.23801	-0.2785	-0.55137	-0.87973
	(4.82)	(2.83)	(9.31)	(5.31)	(19.52)	(16.54)
% Female-headed families with children	0.060194	0.209691	0.135048	0.18461	0.218681	0.252357
	(3.30)	(4.64)	(7.80)	(5.16)	(10.97)	(6.58)
Average age of housing stock	0.002818	0.004323	0.00384	0.007366	0.003758	0.005216
	(7.58)	(6.34)	(11.89)	(11.34)	(10.53)	(8.03)
% Single family detached housing	-0.008154	0.070833	0.0352	-0.02648	0.026204	-0.05943
	(1.02)	(4.44)	(5.01)	(1.97)	(3.41)	(4.30)
Population density (pop/land area)	4.59E-07	10.5E-07	7.55E-07	21.9E-07	20.9E-07	36.3E-07
	(2.77)	(2.64)	(4.89)	(6.64)	(11.72)	(10.21)
Observations	37685	30448	39092	35767	39867	37196
Uncensored observations	35864	23668	37752	31275	39259	34682
Right-censored observations	1821	6780	1340	4492	608	2514
Number of MSA and MSA-Size fixed effects	20	20	20	20	20	20
Wald test of exogeneity						
Chi-square(1)	6.68	19.78	1.68	5.38	1.03	0.87
Prob > Chi-square(1)	0.0098	0.0000	0.1947	0.0204	0.3107	0.3518

Table 4b
Primary Market Originations of Conventional Home Purchase (CHP) Loans
Tobit Two-Step IV Estimates Using 1980 Tract Attributes as Instruments

Dependent Variable: Log(Originations/Applications)
(Absolute value of t-ratios in Parentheses)

	1998		2000		2002	
	All Orig	**Non-Fin Inst**	**All Orig**	**Non-Fin Inst**	**All Orig**	**Non-Fin Inst**
CHP 2nd Market Purchases/Originations	0.000967	0.002956	0.000736	0.001642	0.000324	0.001623
	(7.35)	(5.82)	(7.99)	(4.09)	(9.42)	(9.44)
% Population Hispanic	-0.1416	0.098224	-0.08896	0.074422	-0.11831	0.132679
	(9.25)	(4.14)	(6.38)	(3.20)	(10.02)	(5.69)
% Population African American	-0.45878	-0.39301	-0.39015	-0.449	-0.36514	-0.39974
	(41.04)	(22.52)	(39.45)	(27.47)	(45.79)	(25.73)
Avg Age of population	0.001664	0.002734	0.002257	0.002895	0.000951	0.002977
	(4.28)	(4.32)	(6.01)	(4.63)	(3.21)	(5.16)
% Male	-0.15978	0.066111	-0.54649	-0.45066	-0.3351	-0.19742
	(3.38)	(0.86)	(13.13)	(6.27)	(9.58)	(2.84)
Avg Family Income ($1,000)	0.004859	0.00834	0.000471	0.003714	-0.00019	0.003993
	(20.67)	(22.35)	(2.98)	(10.80)	(1.47)	(11.90)
Avg Family income squared ($1,000)	-1.6E-05	-2.6E-05	-4E-06	-1.4E-05	-2E-06	-1.4E-05
	(21.38)	(21.74)	(11.17)	(13.88)	(5.11)	(13.72)
% People 25+ with no high school	-0.37928	-0.6565	-0.35704	-0.72377	-0.36335	-0.68175
	(10.60)	(11.51)	(9.42)	(11.30)	(11.73)	(11.15)
% People 25+ with some high school	-0.8109	-0.74563	-0.93625	-0.79958	-0.69253	-0.75039
	(22.64)	(12.40)	(27.21)	(13.49)	(24.10)	(13.03)
% People 25+ with high school degree	-0.14943	-0.30982	-0.38016	-0.4358	-0.28093	-0.34558
	(5.71)	(7.67)	(16.65)	(11.57)	(15.67)	(9.88)
% People over 25 with some college	-0.56119	-0.47808	-0.41879	-0.27923	-0.32325	-0.22104
	(15.12)	(7.78)	(13.32)	(5.25)	(12.01)	(4.15)
% Of Age 16+ unemployed	0.130748	0.72094	-0.03378	0.365754	-0.13859	0.358505
	(2.52)	(8.46)	(0.89)	(5.53)	(4.43)	(5.63)

Continued on next page

Table 4b cont.
Primary Market Originations of Conventional Home Purchase (CHP) Loans
Tobit Two-Step IV Estimates Using 1980 Tract Attributes as Instruments

Dependent Variable: Log(Originations/Applications)
(Absolute value of t-ratios in Parentheses)

	1998		2000		2002	
	All Orig	Non-Fin Inst	All Orig	Non-Fin Inst	All Orig	Non-Fin Inst
% Population in poverty last year	-0.45778	-0.68954	-0.35095	-0.44442	-0.2753	-0.27532
	(16.03)	(14.86)	(12.70)	(9.42)	(12.22)	(6.06)
% Female-headed families with children	0.244338	0.30315	0.03818	0.029659	0.090049	0.100093
	(12.16)	(9.28)	(2.16)	(0.98)	(6.12)	(3.38)
Average age of housing stock	0.004735	0.004216	0.00347	0.002396	0.002248	0.003965
	(13.31)	(7.56)	(12.41)	(5.12)	(11.64)	(11.23)
% Single family detached housing	0.010212	-0.03631	0.061127	-0.01228	0.039656	-0.02121
	(1.32)	(3.00)	(8.35)	(0.98)	(6.58)	(1.80)
Population density (pop/land area)	19.6E-07	34.6E-07	13.6E-07	20.1E-07	5.42E-07	14.5E-07
	(11.03)	(11.72)	(8.39)	(6.98)	(4.05)	(5.18)
Observations	40102	38855	39905	38245	40081	38455
Uncensored observations	39796	37958	39659	37060	39762	37147
Right-censored observations	306	897	246	1185	319	1308
Number of MSA and MSA-Size fixed effects	20	20	20	20	20	20
Wald test of exogeneity						
Chi-square(1)	5.86	3.67	19.02	0.59	56.33	59.43
Prob > Chi-square(1)	0.0155	0.0554	0.0000	0.4436	0.0000	0.0000

Table 5
Secondary Market Purchases of Conventional Home Purchase (CHP) Loans
Tobit Two-Step IV Estimates Using 1980 Tract Attributes as Instruments

Dependent Variable: Secondary Market Purchases
(Absolute value of t-ratios in Parentheses)

	1992	1994	1996	1998	2000	2002
CHP Loans Denied	-0.69584	0.004534	0.053561	-0.04711	-0.11738	-0.29614
	(7.68)	(7.68)	(3.04)	(3.04)	(5.81)	(4.92)
CHP Loans Originated	0.796246	0.671614	0.762105	0.939584	0.942336	1.065808
	(45.23)	(45.23)	(95.94)	(95.94)	(153.90)	(145.26)
% Population Hispanic	2.762644	1.654258	7.500863	7.438734	6.629981	7.010829
	(4.04)	(4.04)	(11.65)	(11.65)	(8.33)	(6.16)
% Population African American	-2.8758	-1.42932	-0.00397	1.364282	-2.09685	-0.04006
	(6.10)	(6.10)	(0.01)	(0.01)	(3.72)	(0.05)
Avg Age of population	-0.37187	-0.32659	-0.17846	-0.12447	-0.27014	-0.28501
	(23.46)	(23.46)	(11.04)	(11.04)	(12.15)	(9.50)
% Male	-11.0134	-7.98685	-6.69503	-5.39839	0.865716	-3.99458
	(6.07)	(6.07)	(3.53)	(3.53)	(0.38)	(1.25)
Avg Family Income ($1,000)	0.034164	-0.03734	0.007572	0.049941	0.015005	0.038902
	(3.63)	(3.63)	(0.75)	(0.75)	(1.68)	(2.98)
Avg Family income squared ($1,000)	-0.00017	0.000028	-9.3E-05	-0.00018	-4.1E-05	-4.5E-05
	(5.28)	(5.28)	(2.84)	(2.84)	(1.78)	(1.28)
% People 25+ with no high school	-9.37122	-8.62068	-8.06346	-4.91597	-5.21103	5.901989
	(6.35)	(6.35)	(5.32)	(5.32)	(2.37)	(1.98)
% People 25+ with some high school	0.320821	-4.91887	0.760691	3.965189	7.024796	23.81108
	(0.14)	(0.14)	(0.44)	(0.44)	(2.79)	(6.79)
% People 25+ with high school degree	-18.8856	-19.1816	-21.138	-18.5887	-18.7628	-11.027
	(15.44)	(15.44)	(19.71)	(19.71)	(12.62)	(5.41)
% People over 25 with some college	10.45419	9.556448	20.85772	27.58679	32.92366	53.80818
	(4.99)	(4.99)	(13.06)	(13.06)	(17.74)	(19.58)
% Of Age 16+ unemployed	-1.40015	2.58961	0.047778	3.935447	4.428066	3.469357
	(0.69)	(0.69)	(0.02)	(0.02)	(2.00)	(1.17)

Continued on next page

Table 5 cont.
Secondary Market Purchases of Conventional Home Purchase (CHP) Loans
Tobit Two-Step IV Estimates Using 1980 Tract Attributes as Instruments

Dependent Variable: Secondary Market Purchases
(Absolute value of t-ratios in Parentheses)

	1992	1994	1996	1998	2000	2002
% Population in poverty last year	-10.2137	-8.69345	-7.81236	-2.76736	-0.18231	3.56903
	(9.15)	(9.15)	(6.53)	(6.53)	(0.12)	(1.67)
% Female-headed families with children	2.653968	2.518301	4.50432	4.683399	2.702464	0.702538
	(3.42)	(3.42)	(5.15)	(5.15)	(2.69)	(0.49)
Average age of housing stock	-0.12239	-0.00621	0.013291	-0.00194	0.002987	0.080459
	(7.84)	(7.84)	(0.82)	(0.82)	(0.17)	(3.75)
% Single family detached housing	1.806349	2.619015	2.607643	2.217734	3.254674	3.637154
	(4.86)	(4.86)	(7.75)	(7.75)	(7.30)	(6.04)
Population density (pop/land area)	-3.2E-05	-3.2E-05	-6E-06	0.000022	-0.00001	-1.7E-05
	(4.62)	(4.62)	(0.83)	(0.83)	(1.14)	(1.36)
Observations	39603	40406	40653	40662	40387	40572
Uncensored observations	36157	37809	39172	39847	39608	39865
Left-censored observations	3446	2597	1481	815	779	707
Number of MSA and MSA-Size fixed effects	20	20	20	20	20	20
Wald test of exogeneity						
Chi-square(2)	13.39	2.85	10.47	6.90	8.98	7.05
Prob > Chi-square(2)	0.0012	0.2405	0.0053	0.0318	0.0112	0.0294

Table 6
rigination Shares and Purchases of Conventional Home Purchase (CHP) Loans
Two-Step Tobit IV and Non-IV Tobit Models
(t-ratios in parentheses)

PANEL A: Two-Step Tobit IV Models

	1992	1994	1996	1998	2000	2002
Secondary Market Purchases						
CHP Loans Denied	-0.6958	0.0045	0.0536	-0.0471	-0.1174	-0.2961
	(7.68)	(7.68)	(3.04)	(3.04)	(5.81)	(4.92)
CHP Loans Originated	0.7962	0.6716	0.7621	0.9396	0.9423	1.0658
	(45.23)	(45.23)	(95.94)	(95.94)	(153.90)	(145.26)
Origination Share of Applications						
All Institutions						
CHP 2nd Market Purchases	0.00199	0.00114	0.00052	0.00097	0.00074	0.00032
	(5.10)	(3.34)	(4.49)	(4.65)	(2.57)	(3.67)
Non-Financial Institutions						
CHP 2nd Market Purchases	-0.00460	0.00446	0.00308	0.00296	0.00164	0.00162
	(3.34)	(4.49)	(4.65)	(2.57)	(3.67)	(7.35)

PANEL B: Tobit Non-IV Models

	1992	1994	1996	1998	2000	2002
Secondary Market Purchases						
CHP Loans Denied	-0.1548	-0.1371	-0.0516	-0.0462	-0.0942	-0.3081
	(17.64)	(-20.68)	(-21.34)	(-35.55)	(-35.15)	(-38.01)
CHP Loans Originated	0.7778	0.7040	0.7928	0.9508	0.9674	1.0948
	(376.1)	(492.20)	(653.90)	(980.96)	(944.56)	(1070.28)
Origination Share of Applications						
All Institutions	0.00088	0.00074	0.00088	0.00074	0.00038	0.00006
CHP 2nd Market Purchases	(16.27)	(15.97)	(22.65)	(29.54)	(21.13)	(11.81)
Non-Financial Institutions						
CHP 2nd Market Purchases	0.00132	0.00156	0.00246	0.00213	0.00125	0.00028
	(6.70)	(11.36)	(19.42)	(26.59)	(18.32)	(12.42)

*Coefficients for the IV models are drawn from Tables 3, 4, and 5. Coefficients for the Non-IV models are taken from analogous tables that are not shown to conserve space.