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## Local economic risk factors and the primary and secondary mortgage markets

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### Abstract

This paper presents a cross-sectional analysis of the spatial distribution of loans in the primary and secondary mortgage markets. Aggregating loan originations to the MSA level, we examine the proportion of the market served by FHA and conventional lenders. We model the geographic differences in market shares as a function of supply, demand, and economic risk factors. Results indicate that FHA market shares are higher in cities with higher economic risk characteristics. To examine the role of GSE activity, we model the spatial distribution of the disposition of conventional loans. Again, we focus on the impact of local economic risk factors on the proportion of loans purchased by the GSEs, purchased by other financial institutions, or retained by the originating lender. Our results indicate that GSEs purchase rates are fairly insensitive to local economic conditions indicating that they serve the primary market with little spatial variation. © 2000 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

The US primary mortgage market is segmented into the government (FHA) insured loan market and the non-FHA insured (conventional) loan market. Traditionally, conventional financing is less costly for most borrowers, particularly with respect to private mortgage insurance premiums and processing time. Yet, FHA insured mortgages offer attractive alternatives to conventional mortgages for income and wealth constrained borrowers.<sup>1</sup>

Underwriting guidelines that control conventional loan originations result from the interaction of the originating lender, the Government Sponsored Enterprises (GSE), and the private mortgage insurers. Although the underwriting decision may be diffuse, a natural (and not unrealistic) assumption is that profit-maximizing institutions alter originations (either by charging higher contract interest rates or by imposing tighter underwriting standards) in response to differences in economic risk. Spatial variation in conventional mortgage market shares is consistent with this behavior. In contrast, FHA has a historical mission to expand homeownership opportunities and thus charges a spatially invariant premium.<sup>2</sup> Thus, in the first part of this study, we examine whether FHA market shares increase in areas with higher economic risk to determine whether FHA serves as a steadying force in the mortgage market.<sup>3</sup>

The second part of this study focuses upon the disposition of conventional mortgages in the secondary mortgage market. In particular, we are interested in the extent to which GSE purchases vary spatially. Control over the final disposition of the mortgage loan — either retained in portfolio or sold on the secondary market (either to the GSEs or to another portfolio lender) — rests with the originating lender. Due to the size of the GSEs, however, their purchase activity has significant implications for whether the originating lender sells the mortgage and consequently on the availability of mortgage credit. The size of their respective mortgage operations together with the ‘implicit’ federal guarantee arising from their federal charter results in a significant capital costs advantage over other private institutions.<sup>4</sup> Using this capital cost advantage, the GSEs have the ability to

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<sup>1</sup>The current upfront FHA mortgage insurance premium on mortgages with terms greater than 15 years is 2.25% of the loan amount with an additional annual premium equal to 0.5% of the amount outstanding (HUD Mortgagee Letter 94-14). The annual private mortgage insurance premium for 30% coverage on a 90% LTV loan is 0.57% refundable and 0.56% non-refundable (source: GE Capital Services Mortgage Insurance).

<sup>2</sup>GAO (1997) notes that, under FHA program guidelines, FHA mortgage underwriting criteria and premium structure do not deviate across geographic locations.

<sup>3</sup>Other studies have examined the choice between conventional and government-insured mortgages using micro data on individual households (for example, Linneman and Wachter (1989), Gabriel and Rosenthal (1991), Goodman and Nichols (1997), Hendershott et al. (1997), and Pennington-Cross and Nichols (2000)).

<sup>4</sup>For example, Ambrose and Warga (1996) calculated that between 1991 and 1994 the yield on ‘AAA’ rated finance industry debt was 85 basis points higher than similar GSE issued debt, giving the GSEs a significant capital cost advantage.

purchase mortgages from originators at more favorable rates than non-GSE portfolio lenders. Since the GSEs operate at the national level and require private mortgage insurance for loans with LTVs greater than 80%, their ability to alter their purchase activity based on local variations in risk is limited. Furthermore, given that the GSEs receive a subsidy (i.e., the implicit Federal guarantee), they face significant public policy pressure to serve all markets, further limiting any incentive to alter mortgage purchase activity in risky areas.

But Fannie Mae and Freddie Mac are not identical institutions and may react differently to public policy pressures. For instance, Fannie Mae has indicated a willingness to continue purchasing loans in risky locations.<sup>5</sup> In contrast, Freddie Mac has indicated a more conservative approach indicating that prudent lending is consistent with fewer purchases in riskier locations.<sup>6</sup> Thus, we analyze Fannie Mae and Freddie Mac purchase activity separately.

In addition to the GSEs, other portfolio lenders have an impact on the ultimate disposition of mortgages in the secondary market. Portfolio lenders can either increase or decrease their mortgage purchases for a variety of factors, including changes in local economic risk or regulatory pressure to improve their CRA compliance. For example, institutions considering a future merger may actively purchase mortgages from areas with higher minority concentrations in order to bolster their CRA record in anticipation of increased scrutiny resulting from a merger application. Alternatively, portfolio lenders could seek higher returns by purchasing loans in riskier areas.

We can shed light on the question of whether the GSEs are fulfilling their public policy mandate by examining whether the disposition of conventional loans in the secondary market varies systematically with local economic risk. Unfortunately, given the complexity of the primary mortgage market and the lack of information on private mortgage insurer activities, this study cannot conclusively determine whether GSE actions created any of the observed spatial variation in conventional originations.

## 2. Data

We utilize the Home Mortgage Disclosure Act (HMDA) database to identify

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<sup>5</sup>Fannie Mae has been quoted by A CBO Study in May 1996 entitled *Assessing Public Costs and Benefits of Fannie Mae and Freddie Mac* as stating “Assessing the public costs and benefits of Fannie Mae and Freddie Mac requires them to be in all markets at all times.” For instance, Fannie Mae states that the purchase rate more than doubled in Texas when oil prices collapsed.

<sup>6</sup>Freddie Mac’s 1994 Annual report (April 1994) on page 13 states “competition for shrinking originations caused by a slackening of credit and pricing standards in the primary market. Against this backdrop, we continue to maintain our discipline. Although this may occasionally reduce our business volume, this disciplined approach is consistent with our commitment to building shareholder value . . .”.

FHA and conventional single-family home purchase mortgages<sup>7</sup> originated by MSA in 1995 and 1996 for 306 MSAs. By focusing the analysis at the MSA level, we are able to control for spatial variation in local economic risk. From HMDA, we determine the disposition of the conventional mortgages in the year of origination as either retained in portfolio, sold to the Fannie Mae, Freddie Mac, or another lender.<sup>8</sup> In order to create as homogeneous a sample as possible, we do not include refinanced mortgages, or mortgages sold out of portfolio in years subsequent to origination.<sup>9</sup> Thus, we calculate the percentage of loans insured by FHA for a given MSA as the number of FHA originations divided by the total number of loans in that MSA. Similarly, we calculate the percentage of mortgages originated as conventional loans by dividing the number of conventional originations by the total number of loans in that MSA. Reflecting the dominance of conventional lenders in terms of price and service, we find that, on average, conventional originations account for 84% of the single-family home purchase market.

Table 1 provides a list of the variables used in the analysis as well as the descriptive statistics. The data clearly indicate that substantial variation exists in the market shares. In fact, the conventional lenders control almost all (over 99%) of the market in some MSAs (e.g., San Francisco, California or Wausau, Wisconsin) while FHA controls over 50% of the market in other areas (e.g., Lima, Ohio, or Riverside, California). This variation is not systematic to any particular region or state, but rather is specific to individual MSAs. For instance, while San Francisco and Stockton California are only 80 miles apart there is more than a 30-point spread in conventional market shares.

Taking the subset of conventional originations, we calculate the GSE market share for each MSA by dividing the number of GSE purchased loans in the MSA by the total number of conventional originations in that MSA. The percentages of loans in each MSA held in portfolio or sold to other lenders are calculated similarly. While the majority of conventional loans are held in portfolio during the calendar year, in total Fannie Mae and Freddie Mac purchase 26% of the

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<sup>7</sup>Due to concerns about the market influence of sub-prime and manufactured home lenders, loans made by lenders identified as primarily sub-prime and manufactured home lenders in HMDA are excluded. See the 3rd Quarter *1997 US Housing Market Conditions* published by HUD Office of Policy Development and Research (PD&R). Randall Scheessele at HUD PD&R provided the list of lenders who report to HMDA and specialize in sub-prime and manufactured home lending. We exclude all non-FHA and non-GSE loans made by these lenders in HMDA.

<sup>8</sup>While the vast majority of FHA insured loans are sold on the secondary market as Ginnie Maes, both GSEs have the authority to purchase FHA mortgages as well. In the secondary market we focus on conventional loans on their final disposition. For conventional loans, we classify mortgages as held in portfolio if the originating institution either retained the mortgage or sold it to an affiliated institution. Thus, all loans not held in portfolio or sold to the GSEs are classified as being sold to another lender.

<sup>9</sup>Unfortunately, due to data reporting we may overestimate the number of loans recorded as retained in portfolio. For example, loans originated in December and sold into the secondary market in January would be recorded retained in portfolio.

conventional single family home purchase market with Fannie Mae purchasing slightly more loans in aggregate. In examining the geographic disposition of mortgages purchased by the GSEs, we note that Fannie Mae and Freddie Mac purchases are concentrated in different locations. For instance, Fannie Mae's top 10 markets do not overlap with Freddie Mac's top 10 markets.<sup>10</sup>

To estimate differences in economic risk across individual MSAs, we include measures of lending, housing, and labor market risks at the local level. We focus on three aspects of the lending environment. First, because lenders and mortgage insurers utilize homeowner equity as one method of quantifying risk, we include the average conventional mortgage loan-to-value (*LTV*) ratio as reported by the Federal Housing Finance Board's Monthly Interest Rate Survey (MIRS).<sup>11</sup> Since *LTV* is such an important component of underwriting, it can be argued that *LTV* and mortgage choice are jointly determined. In order to control for this endogenous relationship, we estimate *LTV* via an instrumental variables regression and utilize the predicted *LTVs* in subsequent regressions.<sup>12</sup> Second, we include the average annual effective interest rate from MIRS as an indicator of the cost of borrowing (*I*). The effective interest rate proxies for the financial strain homebuyers experience making monthly payments.

Based on simulation results from a theoretical model of mortgage default, Ambrose et al. (1997) hypothesize that borrowers living in states that allow lenders to obtain deficiency judgments will gravitate toward FHA since FHA has a policy of not seeking deficiency judgments against single-family owner-occupied borrowers.<sup>13</sup> To empirically test this hypothesis, we include dummy variables representing differences in state laws regarding mortgage default and foreclosure. These variables classify states based on judicial versus non-judicial foreclosure laws and deficiency versus non-deficiency judgment states. Thus,  $Q_1$  indicates states that have non-judicial foreclosure available and allow lenders to obtain deficiency judgments;<sup>14</sup>  $Q_2$  indicates states that have non-judicial foreclosure

<sup>10</sup>Tables showing the spatial distribution of GSE purchase activity are available upon request.

<sup>11</sup>The FHFB's MIRS covers approximately 3% of all conventional, single family, purchase money mortgages granted. In 1995 MIRS included 128 782 loans reported by 253 savings associations, 17 (mostly large) mortgage companies, 130 commercial banks, and 35 savings banks. Thirty-three MSAs are reported quarterly and for each state. We use the MSA information where available and state level information otherwise. Since FHA loans are not covered in the survey and FHA loans tend to have higher *LTVs*, the MSA *LTVs* reported by MIRS will understate the actual loan-to-value ratios.

<sup>12</sup>The average conventional *LTV* is regressed on (estimated signs of coefficients in parenthesis) previous year ownership rate (–), the fraction of the population 30 years old or younger (+), the fraction of the population between 30 and 50 years old (+),  $\sigma_{\Delta HP}$  (+),  $\Delta HPI$  (+),  $\Delta HPI10$  (–),  $Q2$  (+),  $Q3$  (+),  $Q4$  (+),  $LLHP$  (+), and year and region dummies. All coefficients are significant at the 95% level except for the  $\sigma_{\Delta HP}$  and the  $R^2$  using OLS is 0.57.

<sup>13</sup>FHA does pursue deficiency judgments against investors and borrowers with a history of default.

<sup>14</sup> $Q_1$  indicate AL, AR, DC, GA, HI, MO, IA, MA, MD, MI, MS, RI, NE, NH, NM, NV, NY, TN, UT, VA, WV, WY, CO.

Table 1  
Descriptive statistics for 1995 and 1996

Description	Source <sup>a</sup>	Variable	Mean	S.D.	Min	Max	Obs
<i>Dependent variable: home purchase originations</i>							
Conventional market share	HMDA	CONV	0.8355	0.0980	0.4242	0.9952	612
FHA market share	HMDA	FHA	0.1645	0.0980	0.0048	0.5758	612
<i>Dependent variable: final disposition of conventional loans</i>							
Sold to Fannie Mae	HMDA	FMAE	0.1487	0.0575	0.0123	0.5166	612
Sold to Freddie Mac	HMDA	FMAC	0.1129	0.0484	0.0188	0.3601	612
Sold to non-GSEs	HMDA	OTH	0.1692	0.0706	0.0303	0.4158	612
Held in Portfolio	HMDA	PORT	0.5692	0.1059	0.3146	0.9308	612
<i>MSA economic risk factors</i>							
Conventional mortgage average Loan to Value (LTV) ratio	FHFB	LTV	0.7958	0.0273	0.7050	0.8450	612
Conventional mortgage effective interest rate	FHFB	I	0.0783	0.0024	0.0710	0.0842	612
Non-judicial foreclosure and deficiency judgment states	Statute	Q <sub>1</sub>	0.3157	0.4532	0.0000	1.0000	612
Non-judicial foreclosure and no deficiency judgment states	Statute	Q <sub>2</sub>	0.3102	0.4558	0.0000	1.0000	612
Judicial foreclosure and deficiency judgment states	Statute	Q <sub>3</sub>	0.3050	0.4510	0.0000	1.0000	612
Judicial foreclosure and no deficiency judgment states	Statute	Q <sub>4</sub>	0.0691	0.2465	0.0000	1.0000	612
One year percent change in house prices	Freddie Mac	ΔHPI	0.0428	0.0260	-0.0641	0.1258	612
Ten year percent change in house prices	Freddie Mac	ΔHPI <sub>10</sub>	0.4887	0.2346	0.0071	1.4677	612
One year change in the unemployment rate	DRI	ΔU	-0.0020	0.0093	-0.0600	0.0840	612
Standard deviation of ΔHPI for previous 15 years	Freddie Mac	σ <sub>ΔHPI</sub>	0.0525	0.0298	0.0181	0.3021	612
The 10 year average of the unemployment rate	BLS	U	0.0596	0.0269	0.0178	0.2260	612

Demographic, regulatory, and FHA policy factors							
Percent of population residing in underserved census tracts	Census	<i>USRVD</i>	0.4010	0.1192	0.1536	0.8116	612
Percent of population non-white	Census	<i>MINOR</i>	0.2233	0.1635	0.0183	0.9532	612
GINI Coefficient for blacks in 1990	Census	<i>BGINI</i>	0.3034	0.1573	0.0290	0.7710	612
FHA loan limit/median house price	HMDA & DRI	<i>LLHP</i>	1.0317	0.1949	0.5881	1.8681	612
Percent of home purchase originations reporting to OCC	HMDA	<i>OCC</i>	0.2178	0.1083	0.0040	0.6786	612
Percent of home purchase originations reporting to FRB	HMDA	<i>FRB</i>	0.1426	0.0824	0.0028	0.4000	612
Percent of home purchase originations reporting to FDIC	HMDA	<i>FDIC</i>	0.1655	0.1180	0.0011	0.7156	612
Percent of home purchase originations reporting to OTS	HMDA	<i>OTS</i>	0.1696	0.1009	0.0005	0.4917	612
Percent of home purchase originations reporting to NCUA	HMDA	<i>NCUA</i>	0.0322	0.0325	0.0000	0.2128	612
Percent of home purchase originations reporting to HUD	HMDA	<i>HUD</i>	0.2723	0.1224	0.0284	0.6462	612
<i>HUD regional dummies</i>							
VT,ME,MA,RI,NH	HUD	<i>NE</i>	0.036	0.186	0	1	612
AK,ID,OR,WA,	HUD	<i>NW</i>	0.046	0.209	0	1	612
UT,CO,SD,WY,MT,ND	HUD	<i>RM</i>	0.055	0.228	0	1	612
IL,IN,MI,MN,OH,WI	HUD	<i>MW</i>	0.180	0.384	0	1	612
NY,NJ	HUD	<i>NYNJ</i>	0.069	0.253	0	1	612
NV,CA,AZ,HI	HUD	<i>P</i>	0.101	0.302	0	1	612
TX,OK,AR,NM,LA	HUD	<i>SW<sub>i</sub></i>	0.150	0.358	0	1	612
MO,IA,KS,NE	HUD	<i>GP<sub>i</sub></i>	0.056	0.230	0	1	612
FL,GA,KY,MS,TN,SC,AL,PR,NC	HUD	<i>SE<sub>i</sub></i>	0.212	0.409	0	1	612
DE,WV,DC,VA,MD,PA,	HUD	<i>MA<sub>i</sub></i>	0.098	0.298	0	1	612

<sup>a</sup> Source: HMDA, Home Mortgage Disclosure Act LARS & TS database; FHFBS, Federal Housing and Finance Board web site; DRI, Standard & Poor's DRI; BLS, The Bureau of Labor and Statistics; Census, The US Census Bureau, Freddie Mac; HUD, The Department of Housing and Urban Development.

available but do not allow deficiency judgments;<sup>15</sup>  $Q_3$  indicates states that require judicial foreclosure and allow deficiency judgments;<sup>16</sup> and finally  $Q_4$  indicates states that require judicial foreclosure and do not allow deficiency judgments.<sup>17</sup>

While lender underwriting standards are designed to quantify individual borrower risk, at the aggregate level, we hypothesize that the supply of credit is a function of area economic risk factors. Empirical studies of credit risk have demonstrated a negative relation between house price appreciation and default loss.<sup>18</sup> Thus, we estimate the percentage change in local house prices using the Freddie Mac MSA Repeat Sales Index where increases in house prices indicate areas that are experiencing economic growth and lower risk. Since we have no a priori indication of the appropriate length to capture a housing cycle, we include the change over the last year ( $\Delta HPI$ ) and over the last 10 years ( $\Delta HPI10$ ) to capture short term and long term effects. We also estimate the overall volatility in the local housing market as an additional measure of local economic stability. Since  $\Delta HPI$  controls for the trend of house price appreciation for the MSA, we use the standard deviation of  $\Delta HPI$  over the last 15 years,  $\sigma_{\Delta HPI}$ , to measure volatility. We interpret this variable as the volatility around the average growth rate of house prices. This variable tests whether greater volatility, regardless of price appreciation or depreciation, indicates greater risk to lenders. Economic risk is also associated with changes in local employment, as measured by the yearly change in the local unemployment rate ( $\Delta U$ ). The overall or long-term level of unemployment also provides an indication of economic distress, and thus, we include the average unemployment rate for each MSA over the last 10 years ( $U$ ).

In addition to economic risk, local demographic factors, regulatory, and public policy guidelines may also impact the demand for mortgages and their ultimate disposition in the secondary market. For example, the GSEs face affordable housing goals, which may alter their purchases of loans in various MSAs. Furthermore, regulatory pressure on conventional lenders can impact the number of loans retained in portfolio. For instance, GSE regulations require them to actively purchase mortgages from census tracts that traditionally have not been well served by the conventional market. Thus, we include a variable indicating the percentage of the population that resides in underserved census tracts ( $USRVD$ ).<sup>19</sup> If regulations requiring greater investment in these areas are successful, then market shares of conventional lenders and the GSEs should reflect these efforts.

<sup>15</sup> $Q_2$  indicate AK, AZ, CA, ID, OK, ME, MN, MT, NC, OR, SD, TX, WA.

<sup>16</sup> $Q_3$  indicate CT, DC, FL, IL, IN, KS, KY, NJ, OH, PA, SC, VT.

<sup>17</sup> $Q_4$  indicate LA, ND, WI.

<sup>18</sup>See Capozza et al. (1997), Deng and Calhoun (1997), and Ambrose and Capone (1998).

<sup>19</sup>'Underserved' is the term introduced by HUD to describe census tracts with minority populations exceeding 30% of the total and with median family income at or below 120% of the area median, or census tracts with median family income at or below 90% of the area median (HUD, 1995). On average, 27% of loans from census tracts in an MSA are classified as underserved. However, substantial variation exists across MSAs ranging from 0 to 74%.

In order to capture variation in demand resulting from differences in area demographics, we include measures of the ethnic make up of the MSA. If minorities have preferences for certain types of lenders and mortgage products then locations with higher concentrations of minority groups may affect primary and secondary market shares. Alternatively, biases in the mortgage market or special programs focusing on minority groups should also affect market shares. Thus, we include the percent of the population that is non-white (*MINOR*) to indicate the net effect of these forces. We also incorporate a measure of local segregation (*BGINI*) to determine whether market shares vary depending on the level of racial segregation.<sup>20</sup>

FHA regulatory guidelines determining the maximum loan amount that qualifies for FHA insurance have a direct impact on the primary mortgage market, particularly in areas characterized as having high-house prices. Although guidelines for setting mortgage limits are tied to area median home prices, current practice allows local HUD field offices to adjust these limits.<sup>21</sup> Increasing the FHA mortgage limit can expand the eligible market for FHA lending, creating the potential for greater competition between FHA and conventional lenders. Thus, the larger the portion of the market that is eligible for FHA mortgage insurance the larger the FHA market share should be. To capture the affect of FHA loan limits, we include the ratio of the MSA's FHA loan limit to its media house price (*LLHP*).

The organization of the mortgage lending industry can also affect the type of loan originated, whether those loans are held in portfolio, and who purchases them. To capture this affect we include the fraction of loans from HMDA that are reported to the Office of the Comptroller of Currency (OCC), the Federal Reserve Board (FRB), the Federal Deposit Insurance Corporation (FDIC), the Office of Thrift and Supervision (OTS), the National Credit Union Association (NCUA), and the Housing and Urban Development (HUD). Due to concerns regarding changing reporting rates, especially for mortgage brokers, all regulatory share variables are lagged 1 year. Finally, we include variables to control for unobserved regional and time effects.

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<sup>20</sup>*BGINI* is designed to measure the spatial distribution of different groups across the local region and is derived from the Lorenz curve with values between 0 and 100 with 100 indicating maximum segregation (see Massey and Denton, 1988). For our sample, we find the average MSA has a *BGINI* coefficient of 30, ranging from a minimum of 3 (Burlington, Vermont) to a maximum of 77 (Gary, Indiana).

<sup>21</sup>During the period covered in this study, FHA guidelines specified that the maximum FHA loan limit was 38% of the Fannie Mae/Freddie Mac loan limit for non-high cost areas and 75% of the Fannie Mae/Freddie Mac loan limit for high cost areas. Furthermore, an area's maximum loan limit could be increased to the lesser of (a) 95% of the median one family house price for the area, or (b) 87% of the Fannie Mae/Freddie Mac loan limits. From May 1995 to present, local HUD offices have sole authority to adjust the loan limits on a county-by-county basis when interested parties submit a request showing evidence of increasing house prices.

### 3. Results

#### 3.1. FHA/Conventional Choice

To estimate the impact of differences in local risk characteristics on conventional and FHA originations, we estimate a logit model of FHA and conventional market shares. Estimation results are reported in Table 2 and include the parameter coefficients, standard errors,  $\chi^2$  statistics, and marginal probabilities. The model predicted FHA market share (evaluated at the data means) is 15.5% and the

Table 2  
Logit Model of the market shares of conventional versus FHA home purchase originations

$$P_i = \frac{e^{(\beta'x_i)}}{1 + e^{(\beta'x_i)}}$$

Variable	Parameter	S.E.	$\chi^2$ statistic	Marginal probability
<i>Intercept</i>	18.09	0.269	67.2	2.64
<i>LTV</i>	-18.05	0.349	-51.8	-2.63
<i>I</i>	-33.39	0.776	-43.0	-4.86
$\Delta HPI$	5.06	0.070	72.2	0.74
$\Delta HPI0$	0.26	0.013	20.3	0.04
$\Delta U$	-6.48	0.191	-33.9	-0.94
$\sigma_{\Delta HP}$	1.43	0.060	23.8	0.21
<i>U</i>	-3.98	0.076	-52.5	-0.58
<i>MINOR</i>	0.61	0.022	27.3	0.09
<i>BGINI</i>	-0.14	0.010	-13.6	-0.02
<i>USRVD</i>	-0.46	0.030	-15.3	-0.07
<i>LLHP</i>	-1.04	0.009	-113.7	-0.15
$Q_2$	0.36	0.008	45.4	0.05
$Q_3$	0.35	0.004	90.8	0.05
$Q_4$	0.54	0.011	49.4	0.08
<i>NW</i>	0.35	0.014	24.9	0.05
<i>MW</i>	0.86	0.016	53.7	0.12
<i>NYNJ</i>	0.98	0.010	98.2	0.14
<i>P</i>	0.70	0.011	62.5	0.10
<i>SW</i>	1.68	0.019	87.9	0.24
<i>GP</i>	1.12	0.017	66.5	0.16
<i>SE</i>	1.47	0.019	75.6	0.21
<i>NE</i>	0.85	0.015	57.3	0.12
<i>MA</i>	1.17	0.022	52.2	0.17
<i>FRB</i>	-0.31	0.027	-11.6	-0.05
<i>FDIC</i>	1.28	0.025	50.4	0.19
<i>OTS</i>	1.36	0.024	56.2	0.20
<i>NCUA</i>	2.53	0.066	38.4	0.37
<i>HUD</i>	-1.19	0.022	-54.7	-0.17
<i>1995</i>	0.14	0.004	37.1	0.02

predicted conventional market share is 84.5%. This compares with the actual mean market shares of 16.4 and 83.6% for FHA and conventional lenders, respectively. Although all the parameter coefficients are significant, the market share proportions are based on large populations of loans, which results in model estimates with potentially low standard errors and high  $\chi^2$  statistics.<sup>22</sup> Thus, we rely on sensitivity analysis to show the economic significance of the model variables.

As expected, the economic risk factors capturing the variation in MSA house prices suggest that FHA market shares are higher in areas with greater risk. We find that conventional market shares are higher in areas that experienced positive increases in house prices (both in the previous year and over the last 10 years) and lower in areas with high average unemployment rates suggesting that more borrowers meet conventional lender underwriting standards in areas experiencing positive economic growth (and hence lower economic risk). In contrast, however, the positive and highly significant coefficient on the standard deviation in local house prices ( $\sigma_{HP}$ ) indicates that conventional market shares increase in areas experiencing high volatility in house prices. In sum, the model coefficients suggest that a higher percentage of conventional originations occur in areas experiencing positive, but volatile growth while FHA market shares are higher in areas experiencing stable, but slow growth.

In examining the impact of state default and foreclosure laws, we find that FHA market shares are higher in states that have non-judicial foreclosure laws and allow lenders to obtain deficiency judgments. This is consistent with the theoretical predictions of Ambrose et al. (1997) who note that, as a matter of policy FHA does not seek deficiency judgments against borrowers in default. Thus, it appears that borrowers recognize that the FHA policy is valuable in areas where borrowers are at risk of lender deficiency judgments.

Turning to demographic and HUD policy variables, we find several interesting, yet conflicting effects. First, we find that FHA market shares increase as the number of geographically targeted loans in underserved census tracts (*USRVD*) increases, confirming prior expectations that FHA differentially serves underserved markets. In contrast, however, we find that FHA market shares actually decline as the percentage of minority applications increase. This result conflicts with previous research showing that minority borrowers tend to prefer the FHA mortgage insurance program. However, the marginal probabilities indicate that the effects of these variables are relatively modest with changes in market segregation having almost no impact on FHA or conventional market shares.

To summarize, after controlling for geographic variation in mortgage supply and demand fundamentals, geographic variation in market institutional factors, as well as differences in demographic factors, our analysis indicates that FHA market shares are higher in high-risk areas, where riskiness is indicated by house price

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<sup>22</sup>See Greene (1990) for a discussion.

appreciation, downpayments, and unemployment rates. Thus, it appears that FHA is meeting its objective of stabilizing geographic variation in the supply of mortgage credit.

### *3.2. Conventional mortgage disposition*

In this section, we focus on the disposition of conventional mortgages in the secondary market and highlight two policy considerations. First, we examine the sensitivity of market shares to local economic risk. Our second interest is on GSE market shares with respect to differences in the percentage of applicants from geographically targeted ‘underserved’ census tracts. Given the affordable housing targets recently established by HUD for the GSEs, we expect to find evidence that the GSEs purchase more loans from areas with a high concentration of targeted census tracts.

Once a loan is originated, the lender has the option to retain the loan in portfolio, sell the loan to the GSEs (either Fannie Mae or Freddie Mac), or sell it to another non-GSE institution/lender, and thus, we estimate a multinomial logit model of conventional mortgage disposition. Table 3 reports the estimation results while Table 4 reports the marginal probabilities for the four options. The model predicts that 57.2% of all conventional mortgage originations remain with the originating lender while 15.4% are sold to Fannie Mae, 11.3% are sold to Freddie Mac, and the remaining 16.1% are sold to other institutions. The high percentage of loans going to the GSEs (27%) is not surprising given their capital cost advantage. These predicted market shares compare to the actual mean market shares of 57.0, 14.9, 11.3 and 16.9%, for loans retained in portfolio, sold to Fannie Mae, Freddie Mac, and to non-GSE institutions, respectively (see Table 1).

Looking at the local economic risk factors (1 and 10 year change in house prices, house price volatility, change in unemployment rates, and long-term unemployment levels), we find evidence to indicate that the GSEs purchase more loans in areas experiencing less economic risk, however, differences do exist in their purchase activity. For example, Fannie Mae market shares increases in areas with low house price growth while Freddie Mac purchase activity increases in areas with high house price growth. In contrast, mortgage originators tend to retain mortgages in portfolio from areas with high unemployment levels, high house price volatility, and high house price growth rates. Again, given that we are observing aggregate geographic variation in market shares, caution should be observed when drawing conclusions from these results as it is unclear to what degree private mortgage insurers may impact the geographic variation in market shares. Thus, if private mortgage insurers underwrite fewer mortgages in high risk areas, then GSE purchase activity would be correspondingly lower. Marschoun (2000) finds that the proportion of loans sold to the GSEs with high LTVs is lower in areas with high house price volatility. Thus, his results appear to confirm the importance of mortgage insurers in determining GSE market activity.

Table 3  
Multinomial Logit Model of conventional loan disposition

$$M_{ij} = \frac{e^{(\beta_j' x_i)}}{\sum_{k=1}^3 e^{(\beta_k' x_i)}}$$

Variable	Sold to Fannie Mae			Sold to Freddie Mac			Sold to Non-GSEs		
	Parameter	S.E.	$\chi^2$ statistic	Parameter	S.E.	$\chi^2$ statistic	Parameter	S.E.	$\chi^2$ statistic
Constant	-5.92	0.287	-20.6	-5.66	0.331	-17.1	-5.86	0.282	-20.8
LTV	3.29	0.370	8.9	2.77	0.426	6.5	4.39	0.365	12.0
I	26.51	0.906	29.3	16.74	1.067	15.7	21.09	0.880	24.0
$\Delta HPI$	-0.97	0.080	-12.1	-0.20	0.092	-2.2	-0.79	0.080	-9.9
$\Delta HPI0$	-0.06	0.015	-4.2	0.33	0.017	19.1	0.08	0.015	5.1
$\Delta U$	0.35	0.235	1.5	0.28	0.272	1.0	4.21	0.227	18.5
$\sigma_{\Delta HPI}$	-0.95	0.070	-13.7	-2.02	0.081	-25.0	-2.76	0.073	-37.7
U	-3.26	0.096	-33.9	-2.72	0.116	-23.5	-3.01	0.091	-33.1
MINOR	0.93	0.025	37.0	0.08	0.029	2.8	0.50	0.025	20.1
BGINI	0.17	0.011	14.5	-0.06	0.013	-4.9	-0.29	0.011	-25.7
USRVD	-1.14	0.034	-33.7	-0.90	0.038	-23.5	-0.16	0.034	-4.8
Q <sub>2</sub>	-0.15	0.009	-17.0	0.03	0.010	3.4	-0.35	0.008	-42.2
Q <sub>3</sub>	-0.02	0.005	-3.8	-0.11	0.005	-20.2	-0.43	0.005	-95.1
Q <sub>4</sub>	0.01	0.011	1.0	0.01	0.013	0.4	-0.32	0.012	-27.4
FRB	1.28	0.031	41.7	2.00	0.035	57.6	0.59	0.030	19.5
FDIC	-0.60	0.029	-20.4	0.55	0.033	16.9	-0.09	0.029	-3.1
OTS	-0.26	0.028	-9.3	0.47	0.032	14.8	0.26	0.028	9.2
NCUA	1.77	0.073	24.4	2.46	0.081	30.4	-0.55	0.076	-7.3
HUD	2.37	0.025	93.1	3.23	0.030	109.0	1.82	0.025	73.4
NW	0.30	0.017	18.0	-0.32	0.019	-16.7	-0.13	0.016	-8.0
MW	-0.10	0.018	-5.3	-0.01	0.021	-0.5	-0.50	0.018	-28.1
NYNJ	-0.25	0.012	-20.8	-0.02	0.013	-1.6	-0.56	0.012	-48.1
P	-0.07	0.013	-5.2	-0.39	0.015	-25.8	-0.18	0.013	-14.2
SW	-0.20	0.021	-9.3	-0.24	0.025	-9.8	-0.39	0.021	-18.7
GP	-0.15	0.019	-7.7	0.11	0.022	5.0	-0.53	0.019	-28.1
SE	-0.48	0.021	-22.5	-0.39	0.024	-15.9	-0.56	0.021	-26.8
NE	0.13	0.017	7.5	0.21	0.019	11.0	-0.19	0.017	-11.4
MA	-0.26	0.025	-10.3	-0.10	0.029	-3.5	-0.54	0.025	-21.6
1995	-0.15	0.004	-35.1	-0.43	0.005	-89.0	-0.18	0.004	-44.0

Table 4  
 Conventional loan disposition — Multinomial Logit Model Marginal Probabilities

Variable	Retain in Portfolio	Sell to Fannie Mae	Sell to Freddie Mac	Sell to Non-GSEs
Constant	1.45	-0.56	-0.36	-0.53
<i>LTV</i>	-0.88	0.29	0.14	0.46
<i>I</i>	-5.46	2.83	0.79	1.84
$\Delta HPI$	0.18	-0.11	0.01	-0.08
$\Delta HPI0$	-0.02	-0.02	0.03	0.01
$\Delta U$	-0.43	-0.08	-0.06	0.57
$\sigma_{\Delta HPI}$	0.47	-0.01	-0.14	-0.32
<i>U</i>	0.75	-0.32	-0.16	-0.27
<i>MINOR</i>	-0.14	0.12	-0.02	0.04
<i>BGINI</i>	0.02	0.03	0.00	-0.04
<i>USRVD</i>	0.18	-0.14	-0.07	0.03
$Q_2$	0.04	-0.01	0.01	-0.05
$Q_3$	0.05	0.01	0.00	-0.06
$Q_4$	0.03	0.01	0.01	-0.04
<i>FRB</i>	-0.30	0.12	0.17	0.01
<i>FDIC</i>	0.03	-0.09	0.07	-0.01
<i>OTS</i>	-0.03	-0.05	0.05	0.03
<i>NCUA</i>	-0.27	0.22	0.23	-0.18
<i>HUD</i>	-0.59	0.22	0.25	0.12
<i>NW</i>	0.00	0.05	-0.04	-0.02
<i>MW</i>	0.06	0.00	0.01	-0.07
<i>NYNJ</i>	0.08	-0.02	0.01	-0.07
<i>P</i>	0.05	0.00	-0.04	-0.02
<i>SW</i>	0.07	-0.01	-0.01	-0.04
<i>GP</i>	0.05	-0.01	0.03	-0.07
<i>SE</i>	0.12	-0.04	-0.02	-0.06
<i>NE</i>	-0.01	0.02	0.02	-0.03
<i>MA</i>	0.08	-0.02	0.01	-0.07
<i>1995</i>	0.06	-0.01	-0.04	-0.01
<i>Baseline probability</i>	0.57	0.15	0.11	0.17

Turning to the local demographic and policy factors, we find that both Fannie Mae and Freddie Mac market shares are lower in MSAs with higher percentages of underserved census tracts, with Fannie Mae's purchase activity being twice as sensitive as Freddie Mac (see Fig. 1). Interestingly, the share of mortgages retained by the originating lender increases substantially as the percent of applicants from underserved census tracts increases. Given the GSE affordable housing goals, this result is surprising and should be interpreted with caution. The purchase mortgages in this analysis are only mortgages sold in the year of origination for single-family home purchases and do not include mortgage refinance activity. Furthermore, HUD provides the GSEs with significant flexibility in meeting their affordable

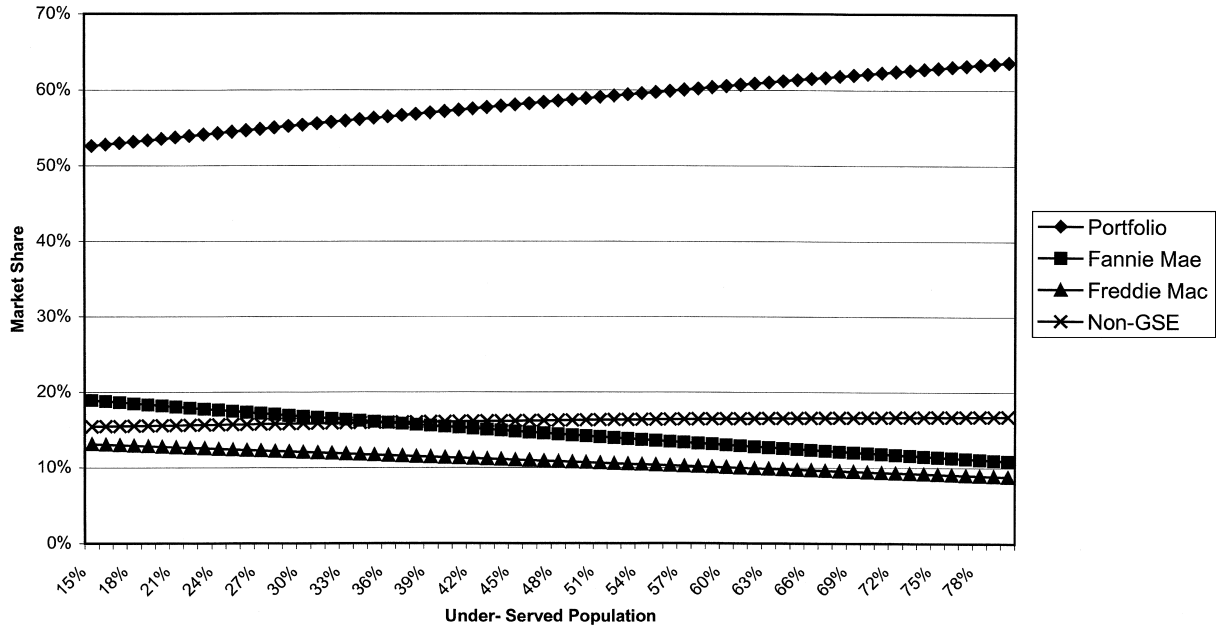


Fig. 1. Market share sensitivity to variation in MSA undeserved population percentage.

housing goals.<sup>23</sup> Thus, these results should not be interpreted as indicating that the GSEs are not meeting their HUD mandated affordable housing goals.

The impact of an increase in the percentage of minority applications in an MSA has an interesting impact on the disposition of mortgages from that area. Fig. 2 shows the sensitivity of conventional mortgage disposition market shares for various percentages of minority applications. We note that the share of mortgages retained by the originating lender declines significantly as the percentage of minority applications increases. We also see a dramatic difference in GSE purchase activity with Fannie Mae market shares increasing from 13 to 26% as the minority application percentage increases while Freddie Mac market shares shows almost no change (declining from 12 to 10%). As with the results from the primary market, the marginal probabilities suggest that minority segregation in an MSA has almost no impact on loan disposition.

#### 4. Conclusions

This paper presents a cross-sectional analysis of the spatial distribution of single-family purchase loans in the primary and secondary mortgage markets. Our empirical results clearly indicate that FHA market shares are higher in cities having higher economic risk characteristics. Since we control for differences in demand resulting from variation in loan to value ratios and effective interest rates, the results suggest that FHA does provide stability to the primary mortgage market. Given the well-known adverse selection problem inherent in the FHA program, however, the higher market shares in higher risk cities will continue to reinforce the higher risk position of the FHA portfolio. It should be pointed out, however, that since this analysis does not examine the role of private mortgage insurers, we are unable to determine the institutions responsible for this outcome.

In examining the disposition of conventional mortgages, we find some evidence that the GSEs purchase more loans from areas experiencing less economic risk with differences existing in the purchase activity of Fannie Mae and Freddie Mac. Overall, the marginal probabilities indicate that Fannie Mae and Freddie Mac purchase activity is relatively insensitive to short-run changes in local economic conditions. Sensitivity analysis, however, indicates that Fannie Mae and Freddie Mac purchase activity does vary with long-run economic indicators. Given the small variation in Fannie Mae and Freddie Mac market shares across the economic risk factors, the results suggests that the GSEs are meeting their public policy objectives by serving the primary market with little spatial variation.

Our analysis also sheds light on the response of the GSEs and conventional lenders to regulatory pressures to increase lending in geographically targeted

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<sup>23</sup>For example, the GSEs can meet their regulatory goals through the purchase of seasoned mortgages, which are not included in this analysis.

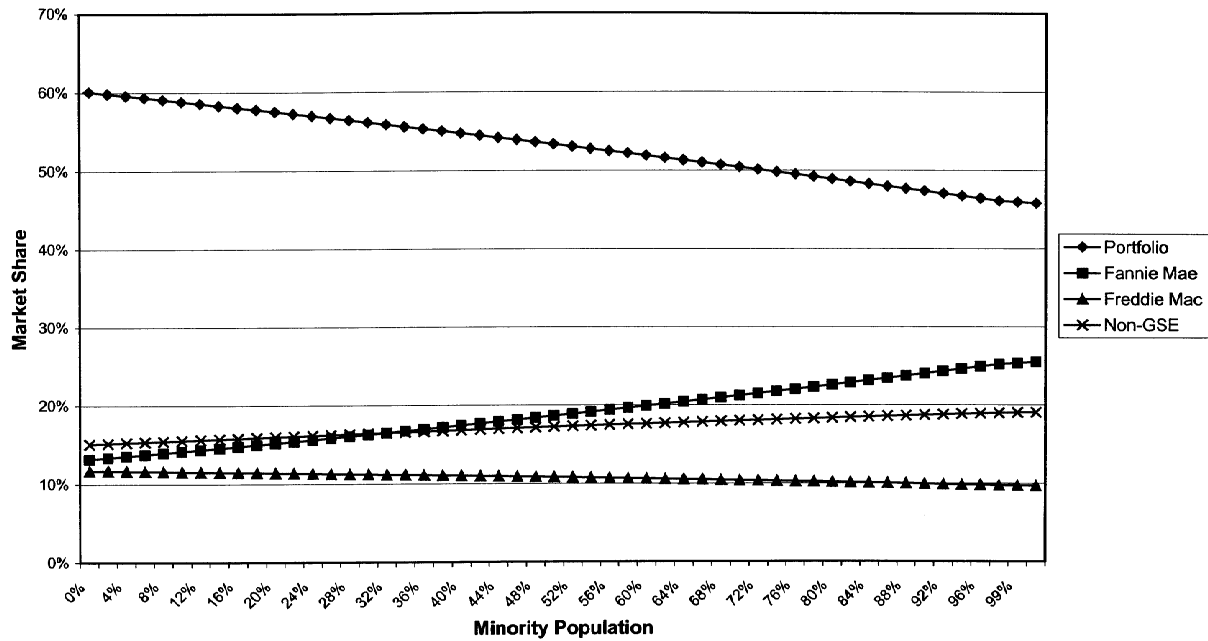


Fig. 2. Market share sensitivity to variation in MSA minority population percentage.

underserved areas. As expected, we find higher FHA market shares in MSAs with greater proportion of underserved households. This confirms previous research showing that FHA does differentially serve underserved markets. In examining the disposition of conventional mortgages in the secondary market, our results indicate lower GSE purchase activity in MSAs with higher percentages of loans originated in underserved census tracts. Again, this finding does not indicate that the GSEs are not meeting their affordable housing goals since the sample of mortgages in this study only includes purchase activity for recent mortgage originations and not seasoned loans. As a result, the relationship between GSE activity and loans actually purchased from targeted census tracts requires further study.

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