



**Market Estimation Model for the 2010 and 2011 Enterprise Single-Family  
Housing Goals**

September 2010

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## **PREFACE**

This Federal Housing Finance Agency (FHFA) research paper discusses the forecast models used in establishing housing goal benchmarks for 2010 and 2011. The paper is part of FHFA's ongoing effort to enhance public understanding of the nation's housing finance system. The paper was prepared by Jay Schultz of the Office of Housing and Community Investment. Theresa DiVenti, Ian Keith, Paul Manchester, Sylvia Martinez, Mario Ugoletti, and Jesse Weiher provided valuable comments.

Edward DeMarco  
Acting Director

September 2010

## Market Estimation Model for the 2010 and 2011 Enterprise Single-Family Housing Goals

### A. INTRODUCTION

In establishing benchmarks for the 2010 and 2011 single-family mortgage housing goals for Fannie Mae and Freddie Mac (the Enterprises), the Federal Housing Finance Agency (FHFA) is required to measure the size of the mortgage market. This paper documents the methodology used to establish the market size for the Low-Income Borrower Home Purchase Housing Goal (share of borrowers with incomes no greater than 80 percent of the area median income (AMI)), the Very Low-Income Borrower Home Purchase Housing Goal (share of borrowers with incomes no greater than 50 percent of AMI), the Low-Income Area Home Purchase Housing Goal (share of borrowers living in low-income areas (where census tract median income is no greater than 80 percent of AMI) and high minority areas), and the Low-Income Borrower Refinance Housing Goal (share of borrowers with incomes no greater than 80 percent of AMI).<sup>1</sup> The 2010-2011 market size estimates for the four housing goals and the one subgoal are:

- |   |      |
|---|------|
| • Low-Income Borrower Home Purchase Goal      | 27 % |
| • Very Low-Income Borrower Home Purchase Goal | 8 %  |
| • Low-Income Area Home Purchase Goal          |      |
| ▪ Low-Income and High Minority Areas Subgoal  | 13 % |
| ▪ Designated Disaster Areas Increment         | 11 % |
| ▪ Total for Goal                              | 24 % |
| • Low-Income Borrower Refinance Goal          | 19 % |

The low-income borrower refinance goal for 2010-11 is 21 percent, based on the market estimate above and a estimated increment of 2 percentage points for the effect of including

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<sup>1</sup> High minority areas are defined as census tracts where the percent minority is at least 30 percent of the population and the census tract median income is less than AMI. There is also a provision for designated disaster areas in the Low-Income Areas Home Purchase Goal (see Section E).

permanent loan modifications in this goal, *i.e.*, all such modifications in the denominator and low-income modifications in the numerator.

The housing goals are defined in terms of percentage of mortgages on owner-occupied properties, either home purchase or refinance, acquired during a calendar year. For example, the low-income borrower home purchase goal is expressed as the percentage of home purchase mortgages where the borrower's income is no greater than 80 percent of the area median income. Likewise, the low-income borrower refinance mortgage acquisitions are relative to all owner-occupied property refinance mortgages acquired, plus the increment for loan modifications.<sup>2</sup> The market is estimated in terms of percentages of mortgage originations.<sup>3</sup> The results of the market estimation model are provided in Table 1 where, for example, it expected that 27.7 percent of home purchase mortgage originations on owner occupied properties will be made to low-income borrowers in 2010.

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<sup>2</sup> To be eligible to count toward the housing goals, mortgage acquired have to meet certain counting rules. These counting rules are defined in 12 CFR 1282.

<sup>3</sup> The size of the market for each goal shall be established annually by FHFA based on data reported pursuant to the Home Mortgage Disclosure Act for a given year. Unless otherwise adjusted by FHFA, the size of the market shall be determined based on the following criteria: (1) Only owner-occupied, conventional loans shall be considered; (2) Purchase money mortgages and refinancing mortgages shall only be counted for the applicable goal or goals; (3) All mortgages flagged as HOEPA loans or subordinate lien loans shall be excluded; (4) All mortgages with original principal balances above the conforming loan limits for single unit properties for the year being evaluated (rounded to the nearest \$1,000) shall be excluded; (5) All mortgages with rate spreads of 150 basis points or more above the applicable average prime offer rate as reported in the Home Mortgage Disclosure Act data shall be excluded; and (6) All mortgages that are missing information necessary to determine appropriate counting under the housing goals shall be excluded. (12 CFR 1282.12(b))

**Table 1**

**Enterprise Single-Family Housing Goals  
Market Estimates 2009 - 2011**

| <b>Year</b> <sup>1</sup> | <b>Low-Income Borrower<br/>Home Purchase Goal</b> | <b>Very Low-Income Borrower<br/>Home Purchase Goal</b> | <b>Low-Income Area Home<br/>Purchase Subgoal</b> | <b>Low-Income Borrower<br/>Refinance Goal</b> |
|--------------------------|---|--|--|---|
| 2004                     | 27.3%   | 6.6%   | 16.7%  | 28.1%   |
| 2005                     | 24.4%   | 5.7%   | 15.3%  | 26.1%   |
| 2006                     | 24.2%   | 5.9%   | 15.8%  | 24.8%   |
| 2007                     | 26.1%   | 6.2%   | 16.2%  | 24.3%   |
| 2008                     | 25.5%   | 6.5%   | 14.3%  | 23.4%   |
| 2009 <sup>2</sup>        | 27.4% ± 1.1%                                      | 8.1% ± 0.6%  | 11.7% ± 0.7%                                     | 20.1% ± 3.7%                                  |
| 2010 <sup>2</sup>        | 27.7% ± 2.4%                                      | 8.6% ± 1.2%  | 12.7% ± 1.8%                                     | 18.1% ± 7.4%                                  |
| 2011 <sup>2</sup>        | 26.0% ± 4.8%                                      | 8.1% ± 2.3%  | 13.6% ± 3.5%                                     | 20.4% ± 10.3%                                 |

<sup>1</sup>Historical market performance is based historical HMDA data for first-lien, conventional, ARRA-equivalent conforming limit loans, excluding higher-cost and HOEPA loans (see Section B).

<sup>2</sup>Estimated (95% confidence)

Section B provides background and descriptions of the economic drivers in the mortgage market. Section C describes the data used in estimating the market size models and Section D reviews the economic and market forecast data used to project the market size of each of the single-family mortgage housing goals. Section E presents the four econometric time series models used to estimate market size. Section F, describes the methodology used to estimate the size of the Low-Income Areas Goal market in designated disaster areas. The market estimates for all four goals are adjusted to remove the impact of manufactured housing chattel loans, as discussed in Section G. Finally, the conclusion is provided in Section H.

## B. BACKGROUND

The Housing and Economic Recovery Act of 2008 (HERA) mandates that, beginning in 2010, FHFA establish a new set of housing goals. No longer are there goals based on the entire single-family and multifamily mortgage market, as was the case for the goals prior to 2010. The goals for the single-family mortgage market are based on mortgages acquired, as opposed to the previous unit-based goals. There are now separate goals for home purchase mortgages and refinance mortgages and only mortgages associated with 1-4 unit owner-occupied properties are counted.

Quantifiable factors influencing FHFA's outlook for the mortgage market include general growth in the economy, employment and inflation. Other factors that are less easily quantified include the effect of the homebuyer tax credit on the mortgage market. Also, activity in the subprime market is expected to be minimal through 2011.

In particular, the following factors have a direct or indirect impact on the affordability of home purchase mortgages or the refinancing of existing mortgages:

Interest Rates. To a large extent, FHFA's estimates of affordability in the mortgage market rely on a continuing low interest rate environment. Interest rates are expected to remain low in the near future and possibly through 2011 as the Federal Reserve expects to continue its low interest rate policy.<sup>4</sup> Mortgage interest rates reached an all-time low in September 2010, with the national average interest rate on a 30-year fixed-rate mortgage reaching 4.32 percent.<sup>5</sup> Lower interest rates directly affect the affordability of buying a home or refinancing a mortgage.

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<sup>4</sup> "The Federal Open Market Committee seeks monetary and financial conditions that will foster price stability and promote sustainable growth in output. To further its long-run objectives, the Committee seeks conditions in reserve markets consistent with federal funds trading in a range from 0 to ¼ percent." Minutes of the Federal Open Market Committee, June 22-23, 2010, p. 10.

<sup>5</sup> Freddie Mac. Primary Mortgage Market Survey. September 2, 2010.



Unemployment. In addition to being an indicator of the health of the economy in general, the employment situation impacts the housing market more directly in that buying a house is a large investment and a long-term commitment of mortgage payments. Private-sector payroll employment edged up by 71,000 and the unemployment rate remained at 9.5 percent in July.<sup>6</sup> The unemployment rate is still historically high and industry forecasts expect that it will likely remain above eight percent in the 2010 to 2011 period as shown in Table 2.

House Prices. The price of housing has a direct impact on the affordability of home mortgages. The housing and mortgage markets are also influenced by trends in house prices. In periods of house price appreciation, home sales and mortgage originations may increase as the expected return on investment rises. In periods of price depreciation or price uncertainty, home sales and mortgage originations may decrease as risk-adverse homebuyers are reluctant to enter the market. Between May 2009 and May 2010, FHFA's purchase-only House Price Index showed prices down 1.2 percent, compared to a 5.8 percent price decline between May 2008 and May 2009. While price declines appear to be moderating, and while the Standard & Poors/Case Shiller Home Price Index actually showed that prices increased 5.4 percent over the May 2009 to May 2010 period, prices are expected to decline further during the third quarter of 2010.<sup>7</sup> An analysis by Wells Fargo Securities Economics Group states that “[t]he combination of high inventories and declining home sales means prices should turn down again this summer.”<sup>8</sup>

Housing Market. A robust housing market is generally good for the affordable home market. Home sales, after increasing 7.0 percent in March and 8.0 percent in April, decreased by

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<sup>6</sup> Bureau of Labor Statistics, News Release: The Employment Situation – July 2010. August 8, 2010.

<sup>7</sup> S&P/Case Shiller. Press Release, July 27, 2010.

<sup>8</sup> Wells Fargo Securities Economics Group. Existing Home Sales Slip in June, July 22, 2010, p. 1.

4.2 percent in May, 6.2 percent in June, and an additional 26.4 percent in July.<sup>9</sup> Both the increase and the subsequent decrease in home sales are attributed to the homebuyers' tax credit program and its expiration. Many industry observers expect that home sales will remain near recent lows during the remainder of 2010.

Mortgages to first-time homebuyers who took advantage of the \$8,000 tax credit will likely have a positive impact on performance on the housing goals. Mortgages to additional repeat homebuyers who qualify for the \$6,500 tax credit (there is a five-year occupancy requirement) will likely have a negative impact on performance on the housing goals. This is because the repeat homebuyers who qualify for the tax credit include a greater proportion of older and higher income borrowers.

FHA Market Share. The composition of the affordable conventional mortgage market is also influenced by the Federal Housing Administration's (FHA) market share, which rose significantly in 2008 and 2009, and continues to be a large percentage of the market. Mortgages insured by FHA are likely to continue to represent a significant share of the mortgage market in 2010 and 2011. These loans generally are pooled into mortgage-backed securities guaranteed by the Government National Mortgage Association (GNMA). However, purchases of mortgages insured by FHA and the Department of Veterans Affairs (VA) ordinarily do not receive housing goals credit.

A key reason for FHA's market share growth is that Fannie Mae and Freddie Mac generally cannot buy loans with original loan to value (LTV) ratios greater than 80 percent without some form of credit enhancement. With the stresses on private mortgage insurers, borrowers without substantial down payments are increasingly dependent on government

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<sup>9</sup> According to data on existing home sales from the National Association of Realtors (NAR) and new home sales from the Bureau of the Census.

insurance programs. Since FHA's market share increase appears to coincide with the demise of the subprime market, it would be easy to conclude that for high-risk borrowers, FHA loans are replacing loans from subprime lenders. However, FHA's internal data indicate that the average riskiness of the loans they insure has actually decreased, *i.e.*, credit scores have increased since late 2007.<sup>10</sup>

Refinance Rate. The share of the mortgage market from the refinancing of existing mortgages has an impact on the share of affordable refinance mortgages. Specifically, when the refinancing of mortgages is motivated by low interest rates, the market is dominated by higher income borrowers. In addition, a combination of depressed housing prices and high LTV ratios could disproportionately decrease the number of low-income homeowners refinancing their mortgages.

### **C. ECONOMIC AND MORTGAGE MARKET DATA**

Historical monthly time series data used in the housing goals models were obtained from a variety of sources. Gross Domestic Product, the unemployment rate, inflation rates, median house prices for new homes, housing starts and new housing sales are from the Census Bureau, the Bureau of Economic Analysis and the Bureau of Labor Statistics.<sup>11</sup> Constant maturity interest rates on Government notes and bonds came from the U.S. Department of the Treasury, while mortgage interest rates are provided by Freddie Mac's Primary Mortgage Market Survey. Median house prices for existing homes and the Housing Affordability Index were obtained from the National Association of Realtors (NAR), and FHFA produced the House Price Index. For 2008 and previous years the refinance rate and FHA market share were calculated from Home

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<sup>10</sup> See FHA Outlook, a monthly statistical summary of application insurance endorsement, delinquency and claim information on FHA single family programs. Available at <http://www.hud.gov/offices/hsg/comp/rpts/ooe/olmenu.cfm>.

<sup>11</sup> U.S. Department of Commerce and the U.S. Department of Labor.

Mortgage Disclosure Act (HMDA) data. Preliminary refinance rates for 2009 and the first two quarters of 2010 are as reported by the Mortgage Bankers Association. Preliminary FHA market shares are calculated from home sales and FHA endorsement volume as reported monthly by FHA. For the list of data sources, see the Appendix.

FHFA measures the market performance for the single-family owner-occupied property mortgage housing goals by analyzing HMDA data.<sup>12</sup> HMDA data are loan level records of mortgage applications, originations and acquisitions that occurred during a calendar year and are considered to be broadly representative of the mortgage market in the United States.<sup>13</sup> The Federal Financial Institutions Examination Council has made available a monthly nationwide time series from the loan level HMDA records with various attributes and specifications, including the performance of the four single-family housing goals and the one subgoal. For the purposes of estimating the single-family mortgage market for goal qualifying loans, FHFA defines the market as conventional conforming prime home purchase (refinance) mortgages.<sup>14</sup>

One of the issues with regard to HMDA data is the considerable delay in releasing the database. At this time the most current publicly available HMDA data are for 2008. To extend the series for the three home purchase goals and the one subgoal through 2009, FHFA supplements the HMDA series with estimated market series of goal qualifying shares provided by Freddie Mac that are based on FHFA's Monthly Interest Rate Survey (MIRS) data.

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<sup>12</sup> HMDA data are made available from the Federal Financial Institutions Examination Council, <http://www.ffiec.gov/hmda/default.htm>.

<sup>13</sup> Avery, Robert B., et al. "The 2008 HMDA Data: The Mortgage Market during a Turbulent Year." *Federal Reserve Bulletin*, (2009), p. 2. The 2008 HMDA data covered 8,400 home lenders including the nation's largest mortgage originators.

<sup>14</sup> To be consistent with the conforming loan limits established in the American Recovery and Reinvestment Act (ARRA 2009), the conforming loan limit is defined as 1.15 times the Area Median House Price (from NAR), where the maximum (ceiling) must not exceed 1.75 times the original conforming limit for the given year. A loan is considered subprime if the lender is included in [HUD's subprime lender list](#). The market estimates are based on originations of first- and second-lien mortgages.

Figures 1 through 4 show the time series for the four single-family housing goals and illustrate the seasonal characteristics of each series. The low-income (LIP) and very low-income (VLIP) borrower home purchase series are characterized by significant seasonality prior to 2000 and a dip in share during the subprime bubble from 2004 to 2006 (see Figures 1 and 2). The low-income areas home purchase subgoal (LAP) shares exhibit seasonality throughout the entire 16 year analysis period. Also, as can be seen in Figure 3, the series shifts up nearly four percent between 2002 and 2003 due to transitioning to the 2000 Census as the source for determining income and minority composition of the census tracts. While not as evident as the home purchase goals, the low-income borrower refinance goal (LIR) series is characterized by seasonality prior to 2000. The dominant feature, however is the large swings in low-income mortgage shares coinciding with refinance booms (see Figure 4).

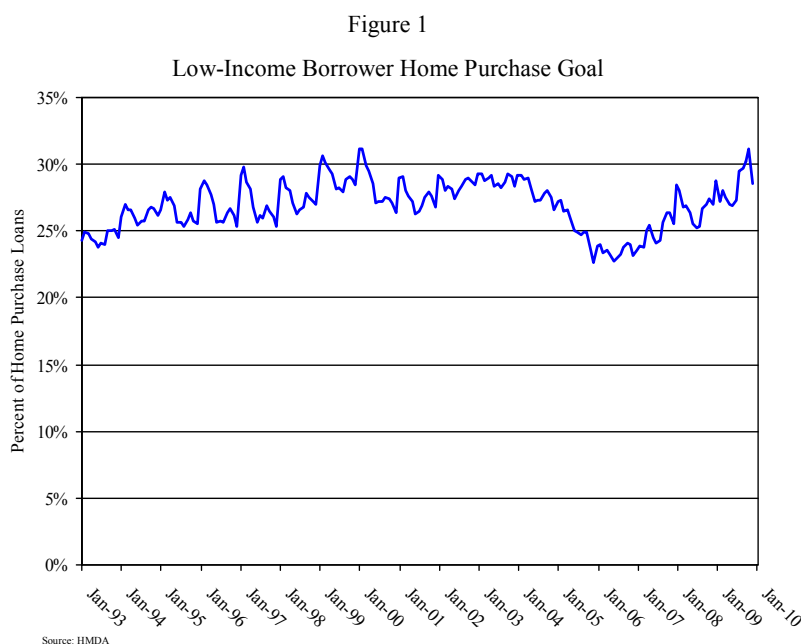


Figure 2

Very Low-Income Borrower Home Purchase Goal

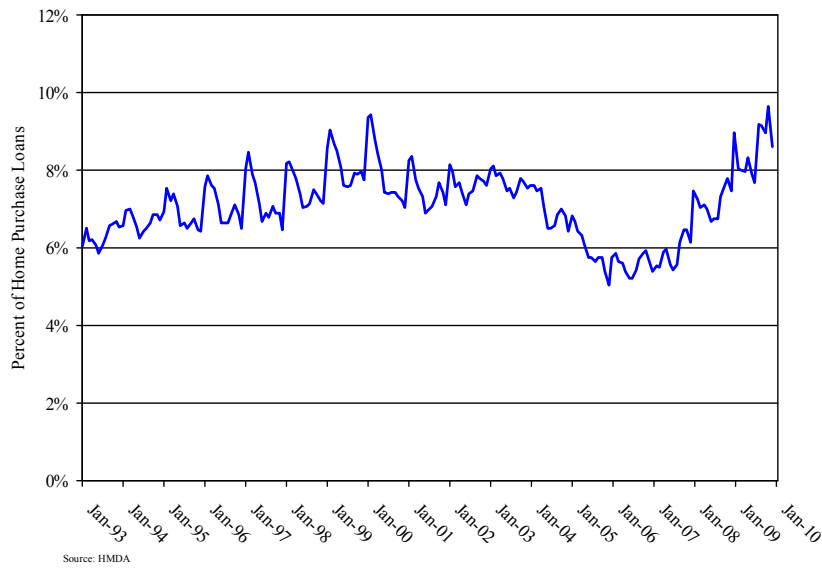


Figure 3

Low-Income Area Home Purchase Subgoal

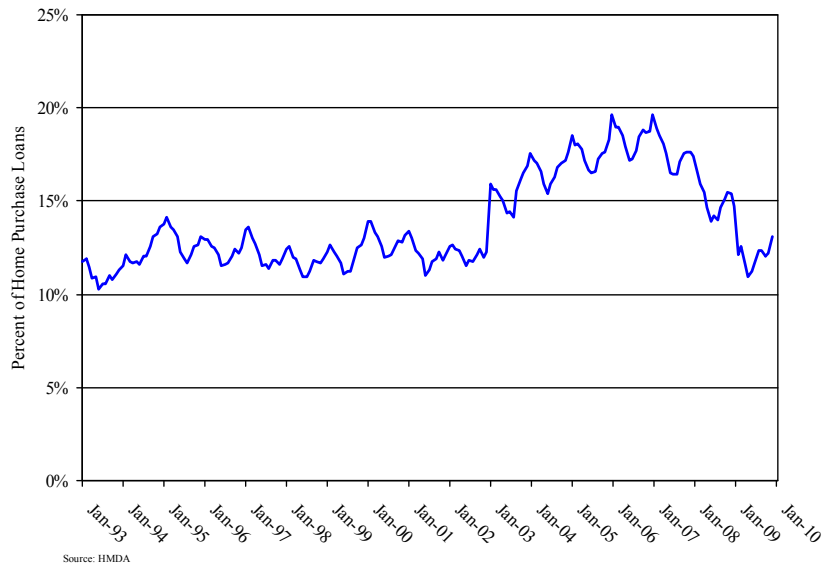
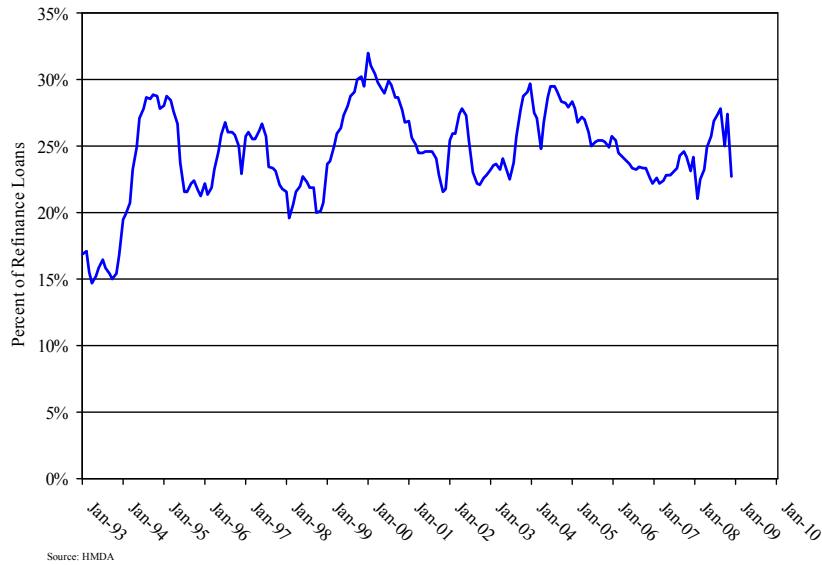


Figure 4  
Low-Income Borrower Refinance Goal



#### **D. MARKET FORECAST DATA**

FHFA compiled forecasts from eleven industry and government sources. The list of forecasters, along with the annualized projections for 2010 and 2011 of the elements each project are provided in Table 2. The forecasts for each element are averaged, by quarter.

A summary of these key market indicators is provided in Table 3, where the shaded area represents forecasts. The FHA market share projections were made by assuming FHA will be insuring nearly one million mortgages in 2010 and 2011. The FHA-insured volume is, in turn, divided by the forecasted home sales, calibrated to fit the FHA-insured market share series.

On average, industry forecasters project the economy to rebound in 2010 and 2011, with real Gross Domestic Product (GDP) growing at a rate of 3.0 and 2.7 percent, respectively. Industry assessments of housing markets generally are conservative. The unemployment rate is expected to remain above nine percent during 2010 and most of 2011. Uncertainty in the job market will continue to have a negative impact on the housing market. Mortgage interest rates are currently dependent on Federal Reserve Bank policies, and somewhat independent of the federal funds rate. The Federal Open Market Committee is committed to a low federal funds rate policy (at 0 to 0.25 percent) as it “continues to anticipate that economic conditions, including low rates of resource utilization, subdued inflation trends, and stable inflation expectations are likely to warrant exceptionally low levels of the federal funds rate for an extended period.”<sup>15</sup> For the 2010 and 2011 period, the forecasts polled by FHFA predict that interest rates will remain near recent levels.

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<sup>15</sup> Board of Governors of the Federal Reserve System. Press Release of the Federal Open Market Committee, June 23, 2010.



**Table 2**  
**Forecasts of Market Indicators by Source**

| Forecast  | Real GDP    |      | Unemployment |      | Inflation Rate |      | Inflation Rate |      | 1-Year       |      | 10-Year      |      | 30-Year Mortgage |      | Housing             |      | Total                   |       | Single-Family             |         | Change in House |      | Refinance Mortgage |      | Median Sales Price -   |       | Median Sales Price -        |       |
|---|-------------|------|--------------|------|----------------|------|----------------|------|--------------|------|--------------|------|------------------|------|---------------------|------|-------------------------|-------|---------------------------|---------|-----------------|------|--------------------|------|------------------------|-------|-----------------------------|-------|
|   | Growth Rate |      | Rate         |      | (CPI)          |      | (Core CPI)     |      | Treas. Yield |      | Treas. Yield |      | Fixed Rate       |      | Starts <sup>a</sup> |      | Home Sales <sup>a</sup> |       | Originations <sup>b</sup> |         | Prices          |      | Rate               |      | New Homes <sup>c</sup> |       | Existing Homes <sup>c</sup> |       |
|   | 2010        | 2011 | 2010         | 2011 | 2010           | 2011 | 2010           | 2011 | 2010         | 2011 | 2010         | 2011 | 2010             | 2011 | 2010                | 2011 | 2010                    | 2011  | 2010                      | 2011    | 2010            | 2011 | 2010               | 2011 | 2010                   | 2011  | 2010                        | 2011  |
| <b>Mortgage Bankers Association</b> <sup>1</sup>          | 2.9%        | 2.5% | 9.6%         | 9.4% | 1.4%           | 0.8% |                |      | 0.3%         | 1.1% | 3.3%         | 3.2% | 4.9%             | 5.0% | 585                 | 689  | 5,509                   | 5,723 | \$1,475                   | \$1,175 |                 |      | 58%                | 41%  | \$217                  | \$217 | \$172                       | \$175 |
| <b>Fannie Mae</b> <sup>2</sup>                            | 2.9%        | 2.6% | 9.6%         | 9.4% | 1.3%           | 0.7% | 0.6%           | 0.6% | 0.3%         | 0.6% | 3.2%         | 3.2% | 4.7%             | 4.7% | 648                 | 932  | 5,575                   | 6,002 | \$1,450                   | \$1,173 | -1.6%           | 1.6% | 61%                | 39%  | \$213                  | \$212 | \$171                       | \$170 |
| <b>Freddie Mac</b> <sup>3</sup>                           | 3.0%        | 3.5% | 9.6%         | 8.9% | 1.6%           | 1.5% |                |      | 0.4%         | 0.6% | 3.3%         | 3.6% | 4.8%             | 5.2% | 648                 | 950  | 4,978                   | 5,850 | \$1,400                   | \$1,400 | -2.5%           | 0.0% | 72%                | 40%  |                        |       |                             |       |
| <b>National Association of Realtors</b> <sup>4</sup>      | 3.0%        | 2.5% | 9.8%         | 9.5% | 1.2%           | 2.5% |                |      |              |      | 3.4%         | 3.7% | 4.9%             | 5.5% | 689                 | 978  | 5,550                   | 6,106 |                           |         |                 |      |                    |      | \$214                  | \$220 | \$172                       | \$175 |
| <b>Wells Fargo</b> <sup>5</sup>                           | 2.8%        | 2.1% | 9.7%         | 9.6% | 0.3%           | 1.4% | 0.9%           | 1.3% |              |      | 3.2%         | 3.3% | 4.7%             | 5.2% | 590                 | 810  | 5,351                   | 6,175 |                           |         |                 |      |                    |      | \$205                  | \$211 | \$170                       | \$173 |
| <b>PNC Financial</b> <sup>6</sup>                         | 2.9%        | 2.9% | 9.7%         | 9.1% | 1.3%           | 1.7% |                |      |              |      | 3.4%         | 3.7% | 4.8%             | 5.2% | 616                 | 789  | 5,021                   | 5,317 |                           |         |                 |      |                    |      |                        |       |                             |       |
| <b>National Association of Home Builders</b> <sup>7</sup> |             |      |              |      |                |      |                |      | 0.4%         | 1.0% | 3.4%         | 3.8% | 4.9%             | 5.3% | 632                 | 906  | 5,122                   | 6,334 |                           |         |                 |      |                    |      |                        |       |                             |       |
| <b>Standard and Poor's</b> <sup>8</sup>                   | 2.8%        | 2.4% | 9.6%         | 9.2% | 1.7%           | 1.3% | 0.9%           | 1.2% |              |      | 3.3%         | 3.2% | 4.7%             | 4.6% | 610                 | 880  |                         |       |                           |         |                 |      |                    |      |                        |       |                             |       |
| <b>Wall Street Journal Survey</b> <sup>9</sup>            | 3.6%        | 3.4% | 9.6%         | 8.8% | 1.4%           | 1.9% |                |      |              |      | 3.4%         | 4.1% |                  |      | 650                 | 890  |                         |       |                           |         |                 |      |                    |      |                        |       |                             |       |
| <b>The Conference Board</b> <sup>10</sup>                 | 2.7%        | 1.7% |              |      |                |      |                |      |              |      |              |      |                  |      | 643                 | 740  |                         |       |                           |         |                 |      |                    |      |                        |       |                             |       |
| <b>Federal Open Market Committee</b> <sup>11</sup>        | 3.1%        | 3.6% | 9.4%         | 8.5% | 0.9%           | 1.3% | 0.7%           | 1.1% |              |      |              |      |                  |      |                     |      |                         |       |                           |         |                 |      |                    |      |                        |       |                             |       |
| <b>Average</b> <sup>d</sup>                               | 3.0%        | 2.7% | 9.6%         | 9.1% | 1.7%           | 1.3% | 1.0%           | 1.0% | 0.3%         | 0.8% | 3.4%         | 3.5% | 4.8%             | 5.1% | 620                 | 857  | 5,465                   | 5,934 | \$1,501                   | \$1,249 | -2.6%           | 0.4% | 62%                | 40%  | \$214                  | \$215 | \$171                       | \$173 |
| <b>Minimum</b>  | 2.7%        | 1.7% | 9.4%         | 8.5% | 0.3%           | 0.7% | 0.6%           | 0.6% | 0.3%         | 0.6% | 3.2%         | 3.2% | 4.7%             | 4.6% | 585                 | 689  | 4,978                   | 5,317 | \$1,400                   | \$1,173 | -2.5%           | 0.0% | 58%                | 39%  | \$205                  | \$211 | \$170                       | \$170 |
| <b>Maximum</b>  | 3.6%        | 3.6% | 9.8%         | 9.6% | 1.7%           | 2.5% | 0.9%           | 1.3% | 0.4%         | 1.1% | 3.4%         | 4.1% | 4.9%             | 5.5% | 689                 | 978  | 5,575                   | 6,334 | \$1,475                   | \$1,400 | -1.6%           | 1.6% | 72%                | 41%  | \$217                  | \$220 | \$172                       | \$175 |
| <b>Range</b>  | 0.8%        | 1.8% | 0.4%         | 1.1% | 1.3%           | 1.8% | 0.3%           | 0.7% | 0.1%         | 0.5% | 0.3%         | 1.0% | 0.2%             | 0.9% | 104                 | 289  | 597                     | 1,018 | \$75                      | \$227   | 0.9%            | 1.5% | 14%                | 2%   | \$11                   | \$9   | \$2                         | \$5   |

<sup>a</sup> Thousands of units<sup>b</sup> Billions of dollars<sup>c</sup> Thousands of dollars<sup>d</sup> 2010 averages include actual values for months when available. Therefore the average line may not equal the average of the above numbers.<sup>1</sup> Last Updated 8/16/2010<sup>2</sup> Last Updated 8/10/2010<sup>3</sup> Last Updated 8/9/2010<sup>4</sup> Last Updated 8/2/2010<sup>5</sup> Last Updated 8/11/2010 , U.S. Economic Forecast and 8/17/2010 , U.S. Housing Market Forecast.<sup>6</sup> Last Updated 8/10/2010<sup>7</sup> Last Updated 7/23/2010<sup>8</sup> Last Updated 8/17/2010<sup>9</sup> Last Updated 7/16/2010 , survey of 57 forecasters.<sup>10</sup> Last Updated 8/11/2010<sup>11</sup> Last Updated 6/23/2010 , midpoint of the central tendency projection.

**Table 3**  
**Economic and Mortgage Market Outlook**

|  | 2008                 |                     |                      |                      | 2009                 |                      |                     |                     | 2010                 |                      |       |       | 2011  |       |       |       | 2008    | 2009               | 2010    | 2011    |
|--|----------------------|---------------------|----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|----------------------|----------------------|-------|-------|-------|-------|-------|-------|---------|--------------------|---------|---------|
|  | Q 1                  | Q 2                 | Q 3                  | Q 4                  | Q 1                  | Q 2                  | Q 3                 | Q 4                 | Q 1                  | Q 2                  | Q 3   | Q 4   | Q 1   | Q 2   | Q 3   | Q 4   |         |                    |         |         |
| <b>Real GDP Growth (Annual Rate)</b>                   | -0.7% <sup>[a]</sup> | 0.6% <sup>[a]</sup> | -4.0% <sup>[a]</sup> | -6.8% <sup>[a]</sup> | -4.9% <sup>[a]</sup> | -0.7% <sup>[a]</sup> | 1.6% <sup>[a]</sup> | 5.0% <sup>[a]</sup> | 3.7% <sup>[a]</sup>  | 2.4% <sup>[a]</sup>  | 2.8%  | 2.5%  | 2.6%  | 2.8%  | 3.0%  | 2.8%  | 0.0%    | -2.6%              | 3.0%    | 2.7%    |
| <b>Unemployment Rate</b>                               | 4.9%                 | 5.4%                | 6.1%                 | 6.9%                 | 8.1%                 | 9.3%                 | 9.6%                | 10.1%               | 9.7%                 | 9.7%                 | 9.5%  | 9.5%  | 9.3%  | 9.2%  | 9.1%  | 9.0%  | 5.8%    | 9.3%               | 9.6%    | 9.1%    |
| <b>Inflation Rate (Y/Y)</b>                            | 4.1%                 | 4.4%                | 5.3%                 | 1.6%                 | 0.0%                 | -1.2%                | -1.6%               | 1.4%                | 2.4%                 | 1.8%                 | 1.2%  | 1.3%  | 1.2%  | 1.2%  | 1.4%  | 1.5%  | 3.8%    | -0.4%              | 1.7%    | 1.3%    |
| <b>Core Inflation Rate (Y/Y)<sup>1</sup></b>           | 2.4%                 | 2.3%                | 2.5%                 | 2.0%                 | 1.7%                 | 1.8%                 | 1.5%                | 1.7%                | 1.3%                 | 0.9%                 | 0.9%  | 0.8%  | 1.0%  | 0.9%  | 1.0%  | 1.0%  | 2.3%    | 1.7%               | 1.0%    | 1.0%    |
| <b>1-Year Treasury Yield</b>                           | 2.1%                 | 2.1%                | 2.1%                 | 1.0%                 | 0.6%                 | 0.5%                 | 0.4%                | 0.4%                | 0.4%                 | 0.4%                 | 0.2%  | 0.2%  | 0.5%  | 0.7%  | 0.9%  | 1.1%  | 1.8%    | 0.5%               | 0.3%    | 0.8%    |
| <b>10-Year Treasury Yield</b>                          | 3.7%                 | 3.9%                | 3.9%                 | 3.3%                 | 2.7%                 | 3.3%                 | 3.5%                | 3.5%                | 3.7%                 | 3.5%                 | 3.1%  | 3.2%  | 3.4%  | 3.5%  | 3.6%  | 3.7%  | 3.7%    | 3.3%               | 3.4%    | 3.5%    |
| <b>30-Year Mortgage Fixed Rate<sup>2</sup></b>         | 5.9%                 | 6.1%                | 6.3%                 | 5.9%                 | 5.1%                 | 5.0%                 | 5.2%                | 4.9%                | 5.0%                 | 4.9%                 | 4.6%  | 4.7%  | 4.9%  | 5.0%  | 5.1%  | 5.2%  | 6.0%    | 5.0%               | 4.8%    | 5.1%    |
| <b>Housing Starts<sup>3</sup></b>                      | 1,058                | 1,016               | 869                  | 658                  | 528                  | 537                  | 586                 | 564                 | 617                  | 601 <sup>[p]</sup>   | 598   | 665   | 781   | 834   | 886   | 924   | 899     | 554                | 620     | 857     |
| <b>Home Sales (New and Existing)<sup>3</sup></b>       | 5,532                | 5,426               | 5,443                | 5,102                | 4,960                | 5,148                | 5,678               | 6,338               | 5,505 <sup>[a]</sup> | 5,946 <sup>[p]</sup> | 5,081 | 5,335 | 5,784 | 5,919 | 5,975 | 6,053 | 5,375   | 5,535              | 5,465   | 5,934   |
| <b>Single-Family Originations<sup>4</sup></b>          | \$464                | \$378               | \$297                | \$369                | \$410                | \$627                | \$518               | \$548               | \$356 <sup>[a]</sup> | \$428 <sup>[p]</sup> | \$395 | \$322 | \$287 | \$330 | \$335 | \$298 | \$1,509 | \$2,102            | \$1,501 | \$1,249 |
| <b>Change in Housing Prices<sup>5</sup></b>            | -7.2%                | -6.7%               | -8.7%                | -11.1%               | -2.4%                | -2.2%                | 0.2%                | -0.4%               | -7.8% <sup>[a]</sup> | 2.0%                 | -4.6% | -0.1% | -2.7% | -1.6% | 1.0%  | 4.8%  | -8.3%   | -1.3%              | -2.6%   | 0.4%    |
| <b>Housing Affordability Index<sup>6</sup></b>         | 139                  | 131                 | 132                  | 154                  | 181                  | 174                  | 161                 | 171                 | 175                  | 165                  | 170   | 169   | 164   | 146   | 141   | 144   | 139     | 171                | 170     | 149     |
| <b>Refinance Mortgage Share<sup>7</sup></b>            | 64%                  | 52%                 | 39%                  | 48%                  | 70% <sup>[p]</sup>   | 68% <sup>[p]</sup>   | 57% <sup>[p]</sup>  | 65% <sup>[p]</sup>  | 65% <sup>[p]</sup>   | 58% <sup>[p]</sup>   | 68%   | 57%   | 45%   | 38%   | 38%   | 38%   | 51%     | 65% <sup>[p]</sup> | 62%     | 40%     |
| <b>FHA Home Purchase Market Share<sup>8</sup></b>      | 14%                  | 23%                 | 30%                  | 31%                  | 27% <sup>[p]</sup>   | 29% <sup>[p]</sup>   | 32% <sup>[p]</sup>  | 33% <sup>[p]</sup>  | 28% <sup>[p]</sup>   | 33% <sup>[p]</sup>   | 28%   | 28%   | 25%   | 25%   | 25%   | 25%   | 25%     | 30% <sup>[p]</sup> | 29%     | 25%     |
| <b>Median Sales Price - New Homes<sup>9</sup></b>      | \$235                | \$237               | \$228                | \$221                | \$208                | \$219                | \$213               | \$219               | \$222 <sup>[a]</sup> | \$212 <sup>[p]</sup> | \$209 | \$213 | \$216 | \$215 | \$212 | \$218 | \$230   | \$215              | \$214   | \$215   |
| <b>Median Sales Price - Existing Homes<sup>9</sup></b> | \$199                | \$208               | \$202                | \$181                | \$168                | \$174                | \$178               | \$171               | \$166                | \$177 <sup>[p]</sup> | \$173 | \$170 | \$168 | \$176 | \$176 | \$172 | \$197   | \$173              | \$171   | \$173   |

**Note:** Shaded area indicates forecasted values. Forecasts are an average forecast of Mortgage Bankers Association (MBA), Fannie Mae, Freddie Mac, National Association of Realtors, Wells Fargo, PNC Financial, the National Association of Home Builders, Standard and Poor's, the Wall Street Journal Survey, the Conference Board and the Federal Open Market Committee.

<sup>1</sup>Annual change in Core CPI (less food and energy)

<sup>2</sup>Freddie Mac, Primary Mortgage Market Survey

<sup>3</sup>Thousands of units (Annual Rate)

<sup>4</sup>FHFA and MBA, Billions of dollars

<sup>5</sup>FHFA House Price Index, Purchase Only (quarter over quarter change, annual rates)

<sup>6</sup>National Association of Realtors

<sup>7</sup>The refinance shares for 2008 are calculated from Home Mortgage Disclosure Act (HMDA) data. Preliminary estimates in 2009 are as reported by MBA.

<sup>8</sup>The FHA market shares for 2008 are calculated from HMDA data. Preliminary estimates for 2009 are the FHA endorsements (FHA Outlook) share of home sales (Census Bureau), scaled to match the mortgage market FHA market share.

<sup>9</sup>Thousands of dollars

<sup>[a]</sup>Advance estimate.

<sup>[p]</sup>Preliminary estimate.

<sup>[r]</sup>Revised

## E. STATISTICAL MODELS OF THE SINGLE-FAMILY HOUSING GOALS

Several specifications of the model were tested for each housing goal. While several exogenous variables had the expected sign, many were found to be insignificant at a 10 percent level of confidence. The best fitting estimation equations are described below. All of the time series were found to be nonstationary in their natural form. A stationary process has the property that the mean, variance and autocorrelation structure do not change over time and must be met when modeling time series data.<sup>16</sup> In order to use the time series in the housing goals market models, both the dependent (goal qualifying share) and independent (explanatory) variables were differenced, that is integrated, to the first order,  $I(1)$ . Table 4 shows the Augmented Dickey-Fuller (ADF) test results for both levels,  $I(0)$  and first differences,  $I(1)$ , for all the time series used in the models.<sup>17</sup> Based on the results in Table 4, we can reject the hypothesis that the first order integrated time series are non-stationary and can use these time series in our forecast models. FHFA used the MIRS augmented HMDA monthly time series for 1993-2009 to estimate statistical models of the four single-family owner-occupied property housing goals.

All of the equations were fitted with monthly binary variables to capture seasonality effects. In addition, it was found that a seasonal moving average term was required in each of the four housing goal models.

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<sup>16</sup> In simple terms, a stationary time series has no trend, has a constant variance over time, has a constant autocorrelation structure and has no periodic fluctuations (seasonality).

<sup>17</sup> Dickey D. and W. A. Fuller (1981). "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica*. 49, pp. 1057-72.

**Table 4**

**Testing for Stationarity  
The Augmented Dickey-Fuller (ADF) Test**

| <b>Variable</b> | <b>ADF-Statistic</b> |                    |
|-----------------|----------------------|--------------------|
|                 | <b><i>I</i>(0)</b>   | <b><i>I</i>(1)</b> |
| LIP             | -0.56                | -9.76 **           |
| VLIP            | -0.51                | -12.14 **          |
| LAP             | -0.31                | -11.36 **          |
| LIR             | -0.75                | -10.87 **          |
| ln(HAI)         | 0.23                 | -15.30 **          |
| ln(HPI)         | 7.93                 | -9.85 **           |
| UNEMP_RATE      | -0.28                | -13.91 **          |
| YldSpr_T1_T10   | -1.45                | -12.47 **          |
| YldSpr_T10_F30  | -0.57                | -15.17 **          |
| FHA_SHR         | -0.50                | -19.11 **          |
| ln(HOME_SALES)  | 1.45                 | -14.38 **          |
| REFI_RATE       | -0.90                | -9.77 **           |
| INVESTOR_SHR    | -0.29                | -13.34 **          |

\* Significant at the 5% level.

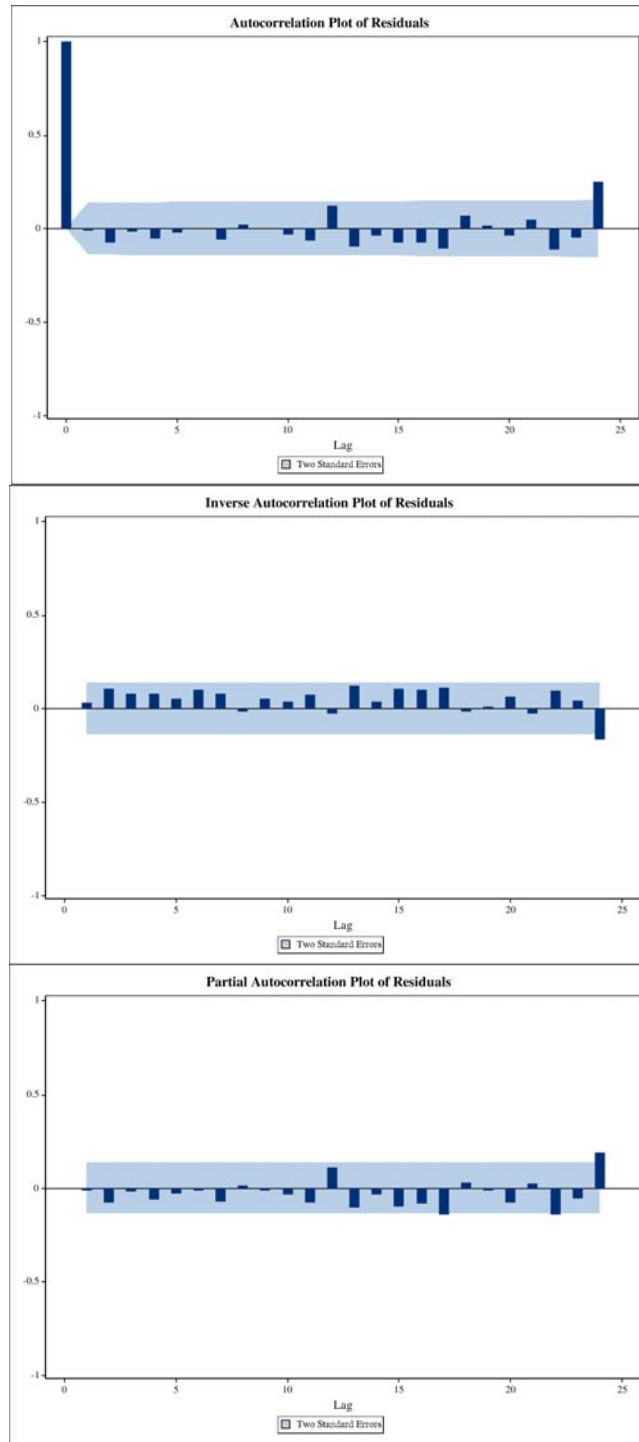
\*\* Significant at the 1% level.

The model estimation results for the Low-Income Borrower Income Home Purchase Goal (LIP) are presented in Table 5. As indicated in Figure 1 above, there is a strong seasonal effect prior to 2000. The model in Table 5 accounts for this with a set of 11 monthly binary variables, *JAN-2000* to *NOV-2000*, (the December effect is captured in the constant) for the years 1993 to 1999 and a binary variable, *DUM2000*, that is equal to 1 prior to 2000 and 0 otherwise. The best fitting equation was found to be a first differenced seasonal ARIMA(1,1,0)x(0,1,1)<sub>12</sub> model. That is, it includes one autoregressive term (*ARI, I*) and a 12 month seasonal moving average term (*MAI, I*). In addition to the time series components, drivers of this housing goal include the

Table 5

## Low-Income Borrower Home Purchase Goal

| Maximum Likelihood Estimation |          |                |         |                |     |
|-------------------------------|----------|----------------|---------|----------------|-----|
| Parameter                     | Estimate | Standard Error | t Value | Approx Pr >  t | Lag |
| MU                            | -0.00342 | 0.00295        | -1.16   | 0.2465         | 0   |
| MA1,1                         | -0.42600 | 0.08160        | -5.22   | <.0001         | 12  |
| AR1,1                         | -0.17578 | 0.07536        | -2.33   | 0.0197         | 1   |
| ln(HAI)                       | 0.10734  | 0.01689        | 6.36    | <.0001         | 0   |
| YldSpr_T1_T10                 | 0.31970  | 0.19363        | 1.65    | 0.0987         | 0   |
| YldSpr_T10_F30                | -0.87519 | 0.35281        | -2.48   | 0.0131         | 1   |
| ln(HOME_SALES)                | 0.02439  | 0.01229        | 1.98    | 0.0472         | 0   |
| JAN-2000                      | 0.02534  | 0.00465        | 5.45    | <.0001         | 0   |
| FEB-2000                      | 0.00892  | 0.00429        | 2.08    | 0.0378         | 0   |
| MAR-2000                      | -0.00032 | 0.00419        | -0.08   | 0.939          | 0   |
| APR-2000                      | 0.00086  | 0.00417        | 0.21    | 0.8366         | 0   |
| MAY-2000                      | -0.00062 | 0.00417        | -0.15   | 0.8818         | 0   |
| JUN-2000                      | -0.00275 | 0.00417        | -0.66   | 0.5096         | 0   |
| JUL-2000                      | 0.00489  | 0.00417        | 1.17    | 0.2405         | 0   |
| AUG-2000                      | 0.00218  | 0.00416        | 0.52    | 0.6001         | 0   |
| SEP-2000                      | 0.01078  | 0.00419        | 2.57    | 0.0102         | 0   |
| OCT-2000                      | 0.00295  | 0.00412        | 0.72    | 0.4734         | 0   |
| NOV-2000                      | 0.00000  | 0.00451        | 0.00    | 0.9994         | 0   |
| DUM2000                       | 0.00305  | 0.00301        | 1.01    | 0.3109         | 0   |
| Constant Estimate             | -0.00402 |                |         |                |     |
| Variance Estimate             | 0.000033 |                |         |                |     |
| Std Error Estimate            | 0.005719 |                |         |                |     |
| AIC                           | -1492.5  |                |         |                |     |
| SBC                           | -1429.64 |                |         |                |     |
| Number of Residuals           | 202      |                |         |                |     |
| Chi-Square (Lag 6)            | 1.84     |                |         |                |     |
| Pr > ChiSq                    | 0.7645   |                |         |                |     |



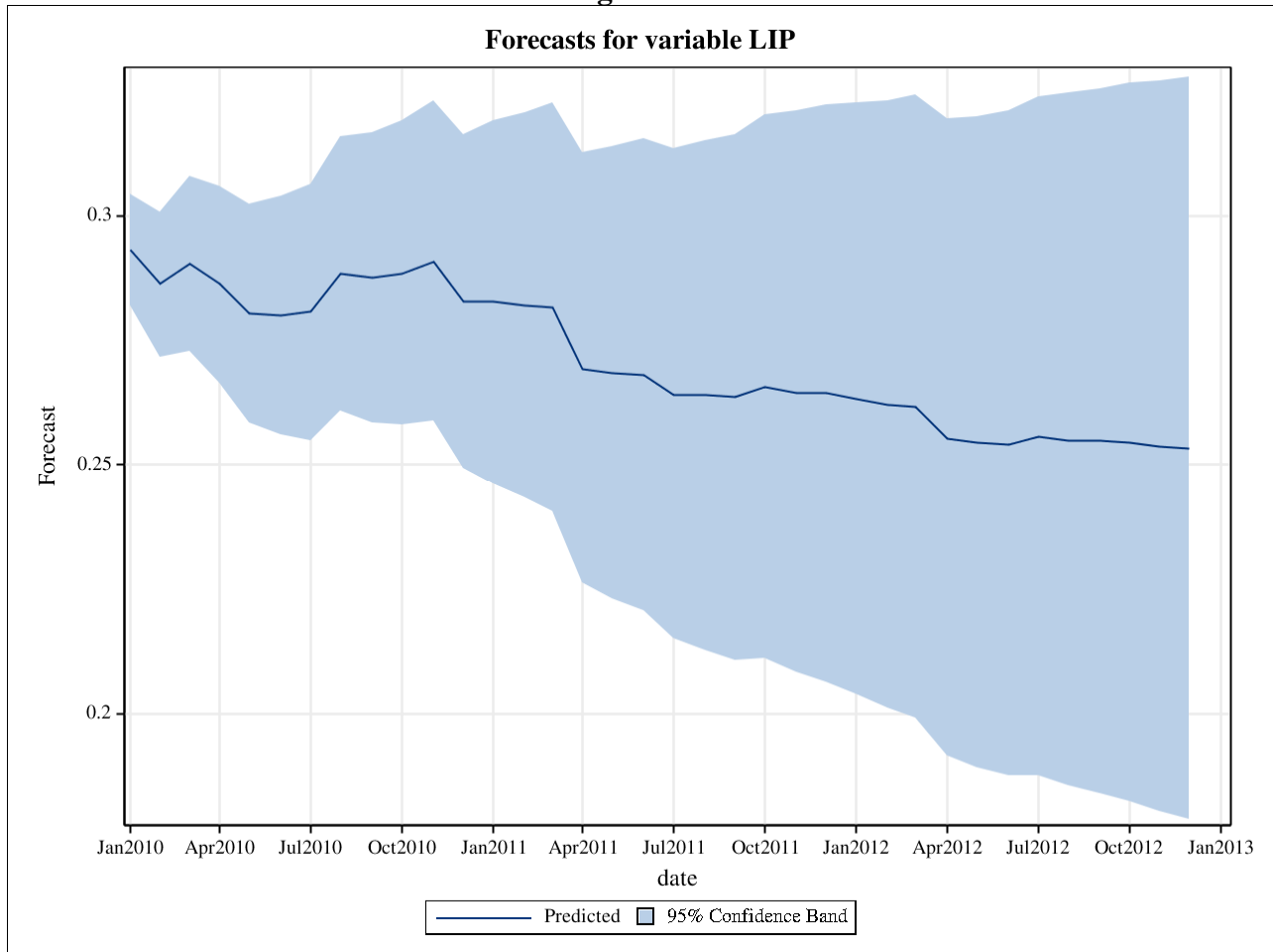
log of NAR's Housing Affordability Index,  $\ln(HAI)$ , the yield spread between the 1-year and 10-year Treasury Notes constant maturity rates,  $YldSpr_{T1\_T10}$ , the yield spread between the 10-

year Treasury Note constant maturity rate and the 30-year fixed rate mortgage (FRM) rate,  $YldSpr\_T10\_F30$ , lagged one period and log of total single-family home sales,  $\ln(HOME\_SALES)$ .

The signs on the respective explanatory variable are what is expected. The low-income borrower mortgage share is positively related to housing affordability, the Treasury Note yield spread and home sales. Both an increasing yield spread and increasing home sales are indications of a growing economy, therefore one would expect a relative increase in affordable lending (an increasing yield spread may also indicate an expansionist monetary policy, which is intended to keep all interest rates low and is conducive to affordable lending). The low-income borrower mortgage share is negatively related to the spread between the 10-year Treasury Note and the 30-year FRM. If the cost of borrowing for mortgages is relatively high, as indicated by the spread between the 30-year FRM and the 10-year Treasury Note rate, affordability of buying a home is decreased. The Chi-Square statistic indicates that we cannot reject the hypothesis that the residuals are white noise, implying that the residuals have a random distribution.

The forecast for the LIP goal is shown in Figure 5. Given the current average forecasts, FHFA projects that the LIP goal will average 27 percent of home purchase mortgage originations over the 2010 to 2011 period.

Figure 5

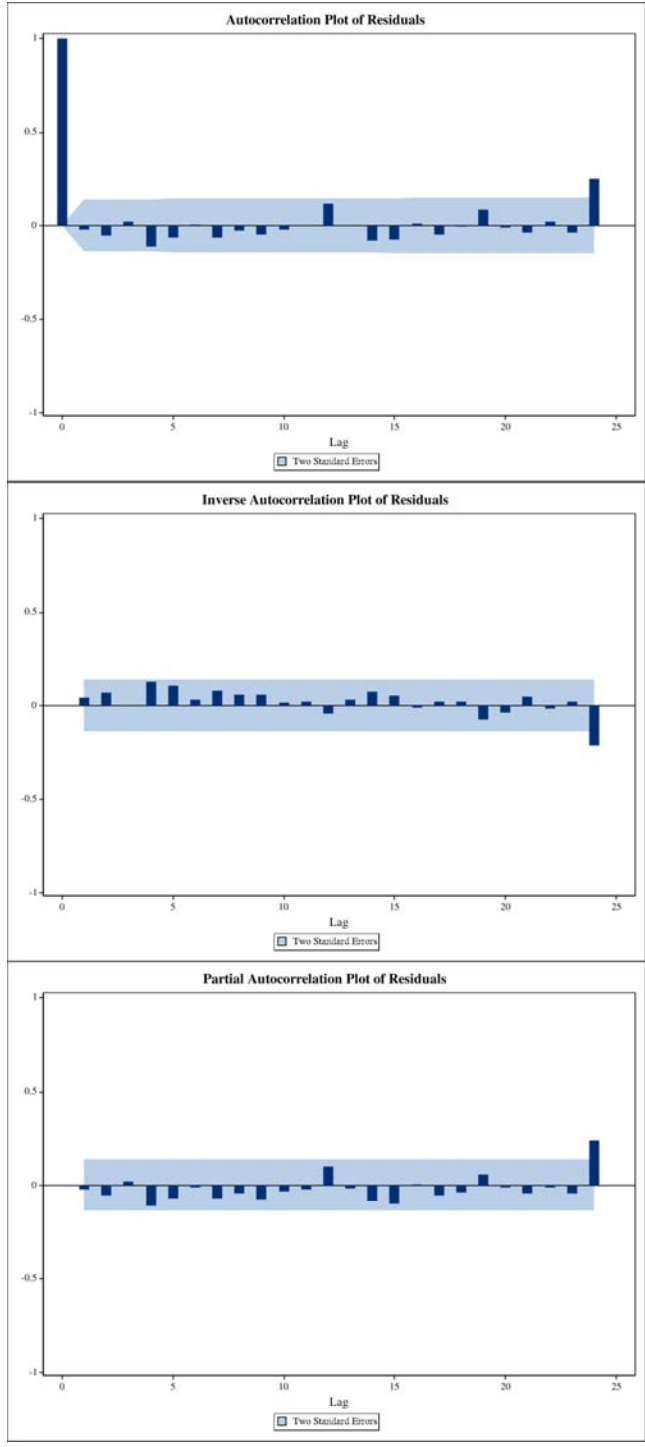


The model estimation results for the Very Low-Income Borrower Income Home Purchase Goal (VLIP) are presented in Table 6. As with the Low-Income Borrower Goal there is a strong seasonal effect prior to 2000 (see Figure 2). The model in Table 6 also accounts for this with a set of 11 monthly binary variables, *JAN-2000* to *NOV-2000*, (the December effect is captured in the constant) for the years 1993 to 1999 and a binary variable, *DUM2000*, that is equal to 1 prior to 2000 and 0 otherwise. The best fitting equation for the VLIP models was found to be a first differenced seasonal ARIMA(1,1,0)x(0,1,1)<sub>12</sub> model. That is, it includes one



**Table 6****Very Low-Income Borrower Home Purchase Goal**

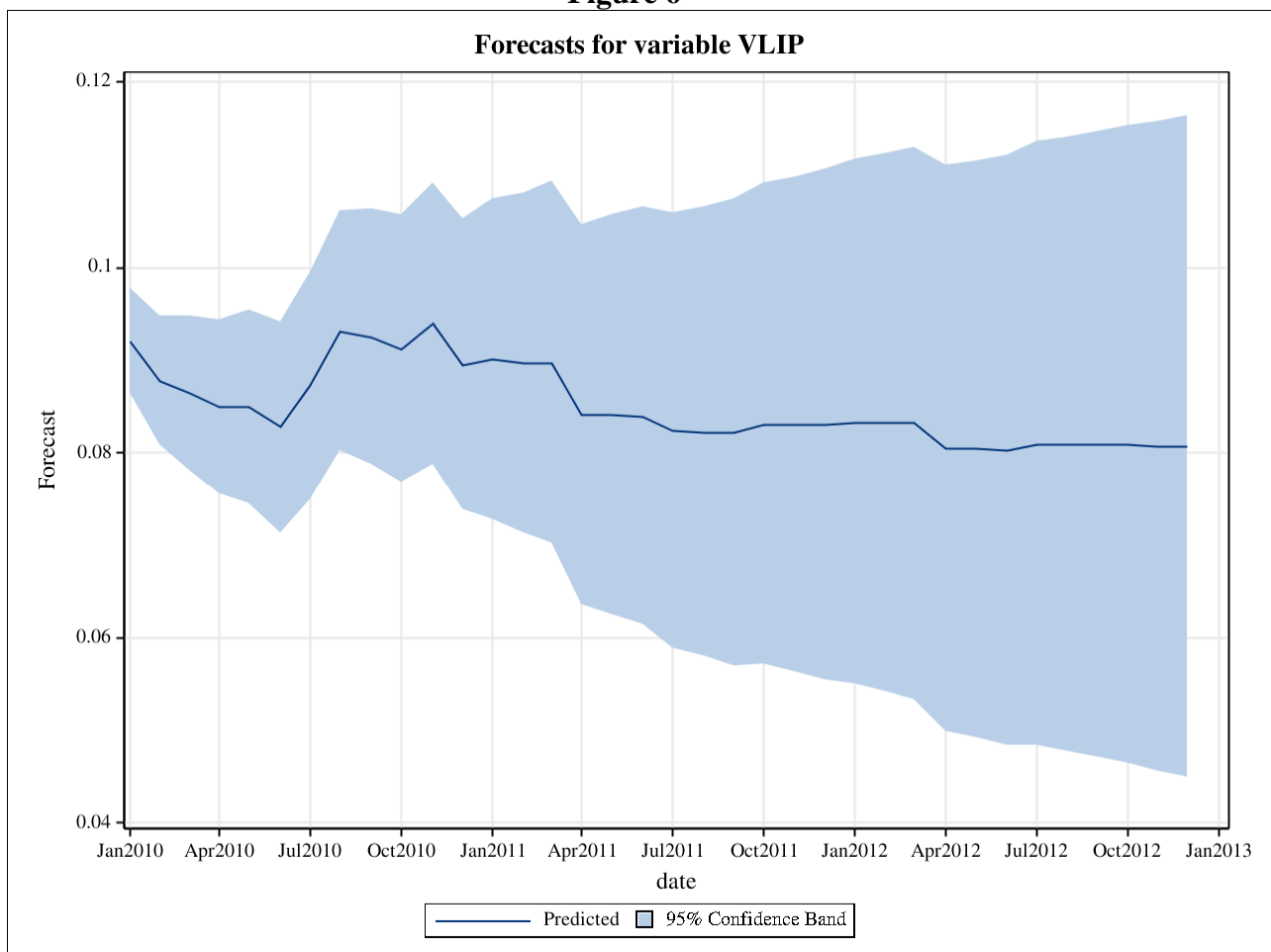
| <b>Maximum Likelihood Estimation</b> |                 |                       |                |                           |            |
|--------------------------------------|-----------------|-----------------------|----------------|---------------------------|------------|
| <b>Parameter</b>                     | <b>Estimate</b> | <b>Standard Error</b> | <b>t Value</b> | <b>Approx Pr &gt;  t </b> | <b>Lag</b> |
| <b>MU</b>                            | -0.00057        | 0.00151               | -0.38          | 0.7057                    | 0          |
| <b>MA1,1</b>                         | -0.45327        | 0.07957               | -5.70          | <.0001                    | 12         |
| <b>AR1,1</b>                         | -0.25624        | 0.07284               | -3.52          | 0.0004                    | 1          |
| <b>ln(HAI)</b>                       | 0.04695         | 0.00771               | 6.09           | <.0001                    | 0          |
| <b>FHA_SHR</b>                       | -0.02927        | 0.01671               | -1.75          | 0.0799                    | 0          |
| <b>JAN-2000</b>                      | 0.00777         | 0.00244               | 3.19           | 0.0014                    | 0          |
| <b>FEB-2000</b>                      | 0.00415         | 0.00210               | 1.97           | 0.0484                    | 0          |
| <b>MAR-2000</b>                      | -0.00116        | 0.00216               | -0.54          | 0.592                     | 0          |
| <b>APR-2000</b>                      | 0.00046         | 0.00214               | 0.22           | 0.8294                    | 0          |
| <b>MAY-2000</b>                      | -0.00169        | 0.00215               | -0.79          | 0.4312                    | 0          |
| <b>JUN-2000</b>                      | -0.00189        | 0.00215               | -0.88          | 0.3792                    | 0          |
| <b>JUL-2000</b>                      | 0.00119         | 0.00215               | 0.55           | 0.5802                    | 0          |
| <b>AUG-2000</b>                      | 0.00056         | 0.00214               | 0.26           | 0.7925                    | 0          |
| <b>SEP-2000</b>                      | 0.00270         | 0.00217               | 1.24           | 0.2134                    | 0          |
| <b>OCT-2000</b>                      | 0.00016         | 0.00209               | 0.08           | 0.9396                    | 0          |
| <b>NOV-2000</b>                      | -0.00028        | 0.00240               | -0.12          | 0.9069                    | 0          |
| <b>DUM2000</b>                       | 0.00050         | 0.00154               | 0.33           | 0.7449                    | 0          |
| <b>Constant Estimate</b>             | -0.00072        |                       |                |                           |            |
| <b>Variance Estimate</b>             | 8.22E-06        |                       |                |                           |            |
| <b>Std Error Estimate</b>            | 0.002866        |                       |                |                           |            |
| <b>AIC</b>                           | -1781.85        |                       |                |                           |            |
| <b>SBC</b>                           | -1725.52        |                       |                |                           |            |
| <b>Number of Residuals</b>           | 203             |                       |                |                           |            |
| <b>Chi-Square (Lag 6)</b>            | 4.16            |                       |                |                           |            |
| <b>Pr &gt; ChiSq</b>                 | 0.3848          |                       |                |                           |            |



autoregressive term ( $ARI, I$ ) and a 12 month seasonal moving average term ( $MAI, I$ ). The additional drivers of this housing goal include the log of NAR’s Housing Affordability Index,  $\ln(HAI)$ , and the market share of FHA endorsed mortgages,  $FHA\_SHR$ .

The signs on the respective explanatory variable are as expected. The very low-income borrower mortgage share is positively related to housing affordability and negatively related to FHA’s market share. As the general affordability of owning a home increases, loans made to lower income borrowers are also likely to increase. FHA-insured loan products compete directly with the conventional loan products when it comes to very low-income borrowers. Therefore, as

**Figure 6**



FHA increases market share, the very low-income borrower conventional loan share is reduced. The Chi-Square statistic indicates that we cannot reject the hypothesis that the residuals are white noise.

The forecast for the VLIP goal is shown in Figure 6. Given the current average forecasts, FHFA projects that the VLIP goal will average eight percent of home purchase mortgage originations over the 2010 to 2011 period.

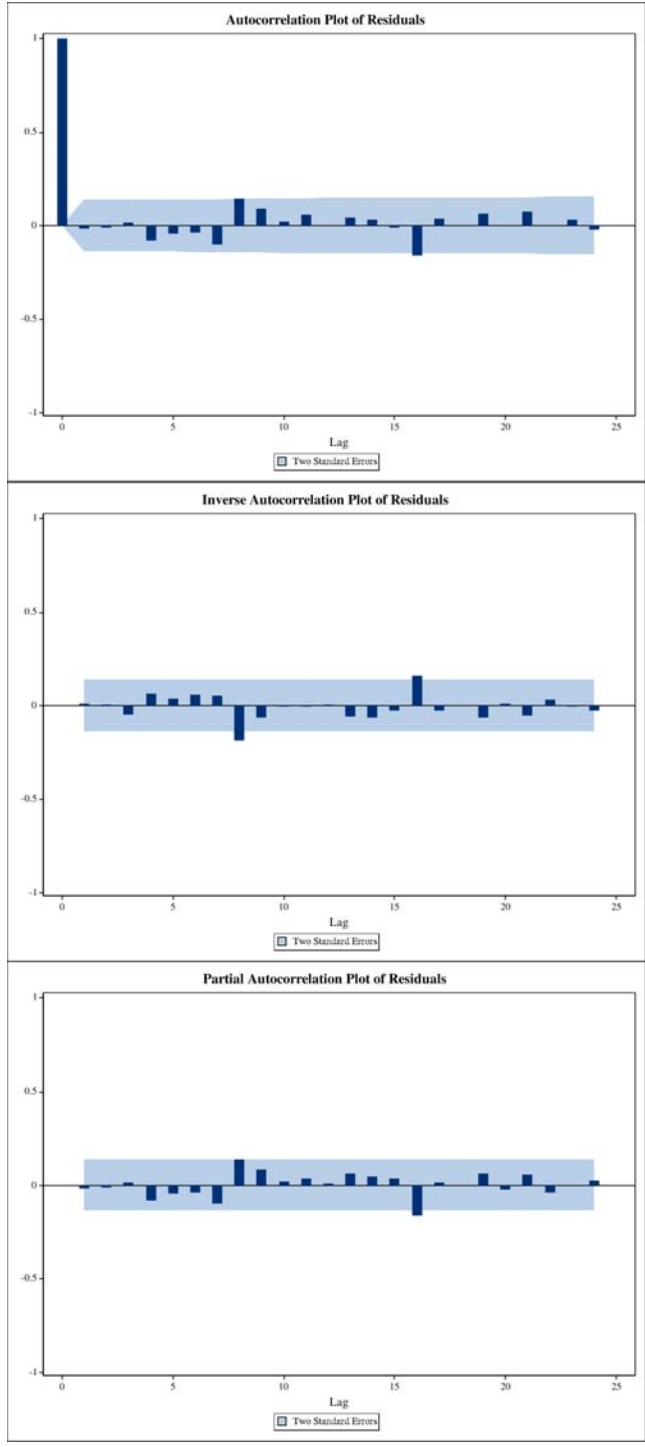
The model estimation results for the Low-Income Area Home Purchase Subgoal (LAP) are presented in Table 7. As indicated in Figure 3, for the LAP goal, there is a strong seasonal effect throughout the estimation period. The model in Table 7 accounts for this with a set of 11 monthly binary variables, *JAN* to *NOV*, (the December effect is captured in the constant). A binary variable, *DUM2003*, is also included to account for the switch in 2003 from the 1990 Census to the 2000 Census as the basis for defining low-income area census tracts. The best fitting equation for the LAP goal was found to be a first differenced seasonal ARIMA(0,1,0)x(0,1,1)<sub>12</sub> model. That is, it includes one 12 month seasonal moving average term (*MAI,1*). Additionally, the drivers of this housing goal include the unemployment rate, *UNEMP\_RATE*, the log of total single-family home sales,  $\ln(HOME\_SALES)$ , and the share of the mortgages by investors, *INVESTOR\_SHR*.

As one would expect, the low-income area mortgage share is negatively related to the unemployment rate as a better economy, and thus favorable labor conditions, means more lower-income families are likely to become homeowners. It is also negatively related to home sales, unlike the low-income borrower share, which is positively related to home sales. As home sales increase, it is expected that they increase disproportionately in higher income areas. The low-income area subgoal share is positively related to the investor share. While the unemployment

Table 7

## Low-Income Area Home Purchase Subgoal

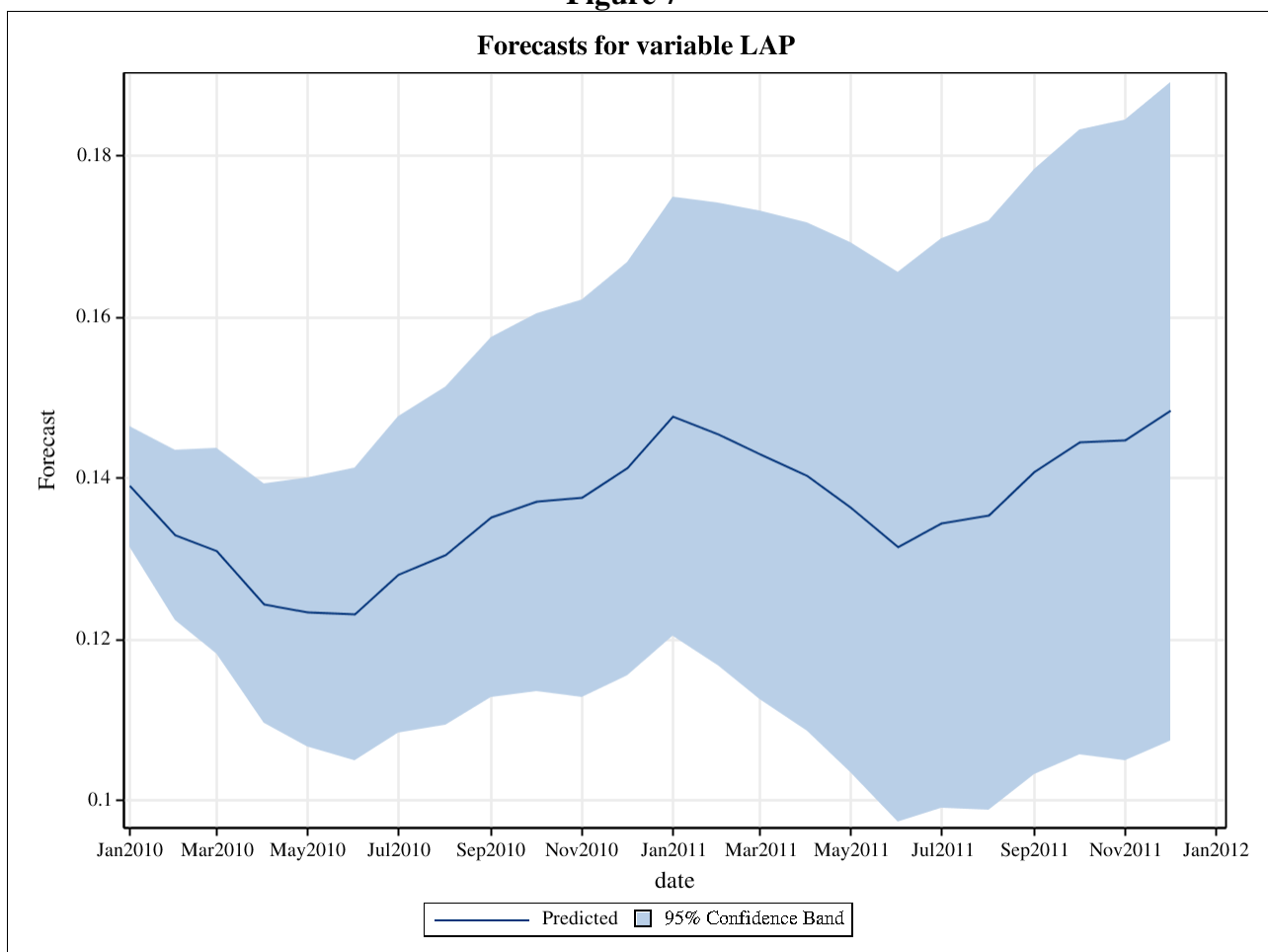
| Maximum Likelihood Estimation |          |                |         |                |     |
|-------------------------------|----------|----------------|---------|----------------|-----|
| Parameter                     | Estimate | Standard Error | t Value | Approx Pr >  t | Lag |
| MU                            | 0.00304  | 0.00115        | 2.64    | 0.0083         | 0   |
| MA1,1                         | -0.23110 | 0.08291        | -2.79   | 0.0053         | 12  |
| UNEMP_RATE                    | -0.74516 | 0.17233        | -4.32   | <.0001         | 0   |
| ln(HOME_SALES)                | -0.02290 | 0.00892        | -2.57   | 0.0102         | 0   |
| INVESTOR_SHR                  | 0.12074  | 0.05283        | 2.29    | 0.0223         | 0   |
| JAN                           | 0.00267  | 0.00161        | 1.66    | 0.0967         | 0   |
| FEB                           | -0.00559 | 0.00162        | -3.45   | 0.0006         | 0   |
| MAR                           | -0.00598 | 0.00160        | -3.74   | 0.0002         | 0   |
| APR                           | -0.00615 | 0.00159        | -3.88   | 0.0001         | 0   |
| MAY                           | -0.00736 | 0.00158        | -4.65   | <.0001         | 0   |
| JUN                           | -0.00827 | 0.00159        | -5.20   | <.0001         | 0   |
| JUL                           | -0.00145 | 0.00159        | -0.91   | 0.3624         | 0   |
| AUG                           | -0.00255 | 0.00158        | -1.61   | 0.1073         | 0   |
| SEP                           | 0.00197  | 0.00158        | 1.24    | 0.2136         | 0   |
| OCT                           | -0.00025 | 0.00159        | -0.16   | 0.8768         | 0   |
| NOV                           | -0.00312 | 0.00159        | -1.97   | 0.0487         | 0   |
| DUM2003                       | 0.00042  | 0.00065        | 0.65    | 0.5152         | 0   |
| Constant Estimate             | 0.003042 |                |         |                |     |
| Variance Estimate             | 0.000014 |                |         |                |     |
| Std Error Estimate            | 0.003789 |                |         |                |     |
| AIC                           | -1670.75 |                |         |                |     |
| SBC                           | -1614.43 |                |         |                |     |
| Number of Residuals           | 203      |                |         |                |     |
| Chi-Square (Lag 6)            | 2.07     |                |         |                |     |
| Pr > ChiSq                    | 0.8391   |                |         |                |     |



rate is considered a measure of the viability of the economy in general, the investor share (*i.e.*, more investors) is a measure of the viability of the mortgage market. The Chi-Square statistic indicates that we cannot reject the hypothesis that the residuals are white noise.

The forecast for the LAP subgoal is shown in Figure 7. Given the current average forecasts, FHFA projects that the LAP subgoal will average 13 percent of home purchase mortgage originations over the 2010 to 2011 period.

**Figure 7**



The model estimation results for the Low-Income Borrower Income Refinance Goal (LIR) are presented in Table 8. As with the Very Low-Income and Low-Income Borrower Home

Purchase Goals there is a strong seasonal effect prior to 2000 (see Figure 4). The model in Table 8 also accounts for this with a set of 11 monthly binary variables, *JAN-2000* to *NOV-2000*, (the December effect is captured in the constant) for the years 1993 to 1999 and a binary variable, *DUM2000*, that is equal to 1 prior to 2000 and 0 otherwise. The best fitting equation for the LIR goal was found to be a first differenced seasonal ARIMA(0,1,0)x(0,1,1)<sub>12</sub> model. That is, it includes one 12 month seasonal moving average term (*MAI, I*). Other drivers of this housing goal include log of FHFA's House Price Index lagged one period, *ln(HPI)*, the yield spread between the 1-year and 10-year Treasury Notes constant maturity rates, *YldSpr\_T1\_T10*, and the refinance rate, *REFI\_RATE*.

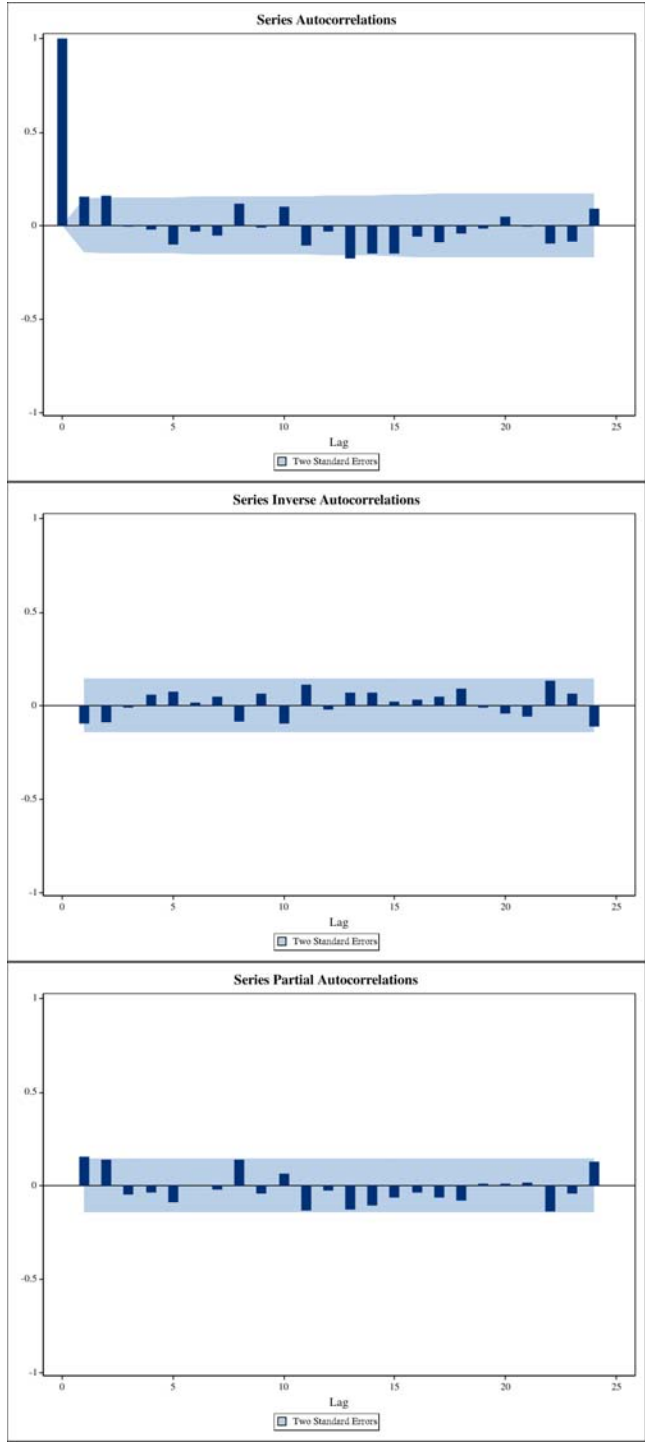
The signs on the respective explanatory variable are what is expected. The very low-income borrower refinance mortgage share is positively related to fluctuations in house prices and the Treasury Note yield spread. It is negatively related to the share of the market that includes refinance mortgages. Periods of increasing house prices increases the likelihood of cashout refinances as well as a sign of a good mortgage market in general. However, as the number of refinanced mortgages increase, and thus the refinance rate, a disproportionate share of the refinances is made by higher income homeowners. So while the number of low-income borrower refinanced mortgages increase, an even larger number of higher income mortgages are refinanced. The Chi-Square statistic indicates that we cannot reject the hypothesis that the residuals are white noise.



Table 8

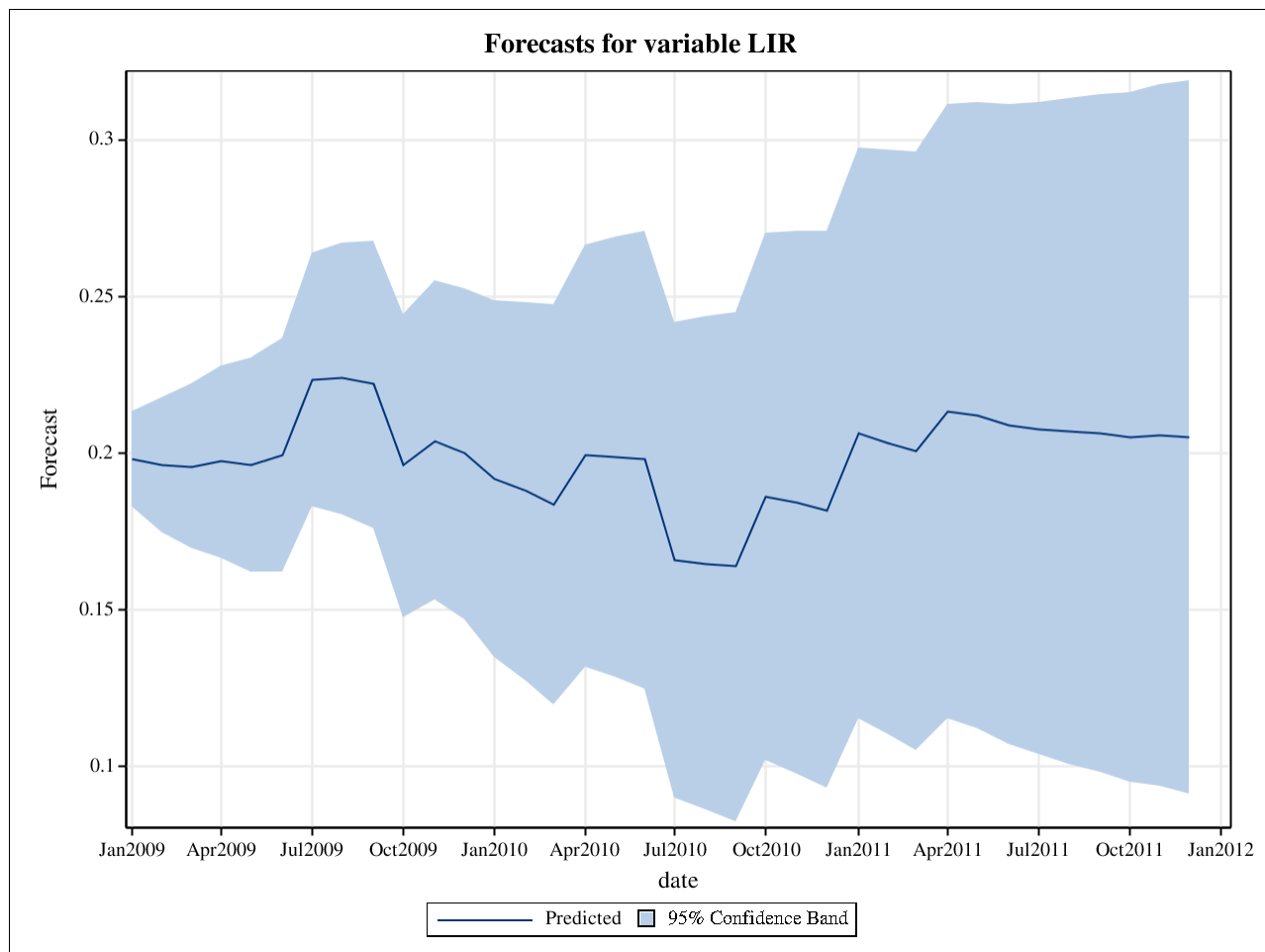
## Low-Income Borrower Refinance Goal

| Maximum Likelihood Estimation |          |                |         |                |     |
|-------------------------------|----------|----------------|---------|----------------|-----|
| Parameter                     | Estimate | Standard Error | t Value | Approx Pr >  t | Lag |
| MU                            | -0.00154 | 0.00382        | -0.40   | 0.6874         | 0   |
| MA1,1                         | -0.34526 | 0.08256        | -4.18   | <.0001         | 12  |
| ln(HPI)                       | 0.37989  | 0.15483        | 2.45    | 0.0141         | 1   |
| YldSpr_T1_T10                 | 0.55187  | 0.29280        | 1.88    | 0.0595         | 0   |
| REFI_RATE                     | -0.22477 | 0.01436        | -15.65  | <.0001         | 0   |
| JAN-2000                      | 0.02286  | 0.00560        | 4.08    | <.0001         | 0   |
| FEB-2000                      | 0.00041  | 0.00557        | 0.07    | 0.9413         | 0   |
| MAR-2000                      | -0.00106 | 0.00537        | -0.20   | 0.8441         | 0   |
| APR-2000                      | -0.00165 | 0.00540        | -0.31   | 0.7594         | 0   |
| MAY-2000                      | -0.00386 | 0.00541        | -0.71   | 0.4757         | 0   |
| JUN-2000                      | -0.00308 | 0.00539        | -0.57   | 0.5671         | 0   |
| JUL-2000                      | -0.00280 | 0.00536        | -0.52   | 0.6013         | 0   |
| AUG-2000                      | -0.00020 | 0.00536        | -0.04   | 0.9707         | 0   |
| SEP-2000                      | 0.00518  | 0.00535        | 0.97    | 0.3327         | 0   |
| OCT-2000                      | 0.00532  | 0.00537        | 0.99    | 0.3215         | 0   |
| NOV-2000                      | 0.00312  | 0.00535        | 0.58    | 0.5600         | 0   |
| DUM2000                       | -0.00018 | 0.00391        | -0.05   | 0.9634         | 0   |
| Constant Estimate             | -0.00154 |                |         |                |     |
| Variance Estimate             | 0.000061 |                |         |                |     |
| Std Error Estimate            | 0.007804 |                |         |                |     |
| AIC                           | -1287.27 |                |         |                |     |
| SBC                           | -1232.07 |                |         |                |     |
| Number of Residuals           | 190      |                |         |                |     |
| Chi-Square (Lag 6)            | 7.06     |                |         |                |     |
| Pr > ChiSq                    | 0.2165   |                |         |                |     |



The forecast for the LIR goal is shown in Figure 8. Given the current average forecasts, FHFA projects that the LIR goal will average 19 percent of refinance mortgage originations over the 2010 to 2011 period.

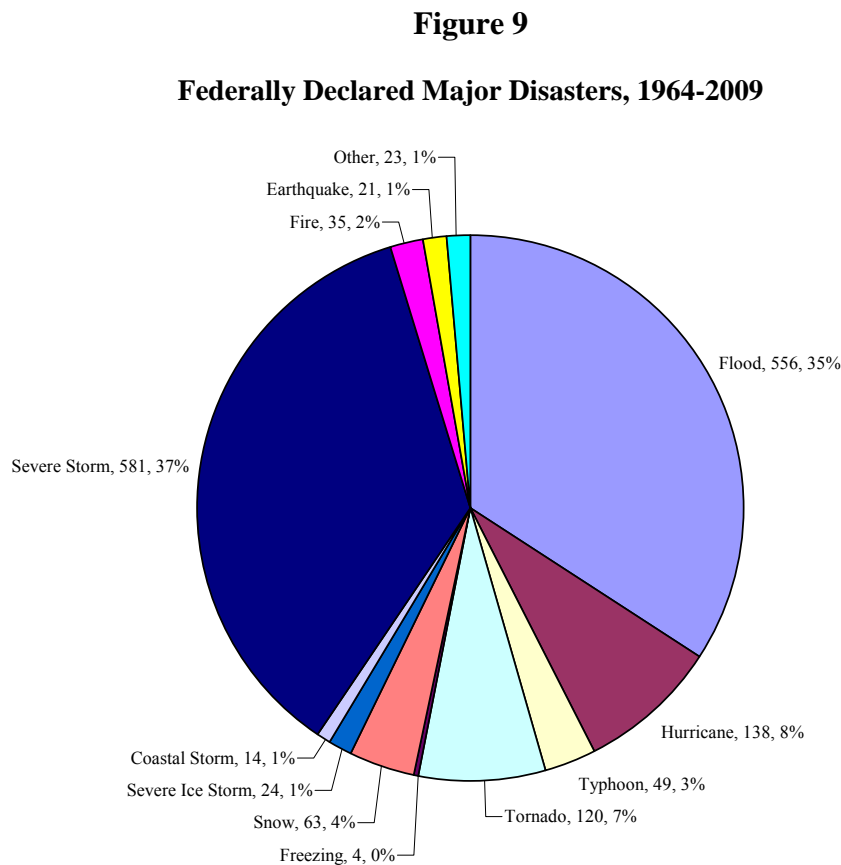
**Figure 8**



**F. DESIGNATED DISASTER AREAS**

The Low-Income Areas Home Purchase Goal includes mortgages for families whose income is no greater than AMI living in a designated disaster area. Through the Federal Emergency Management Agency (FEMA), the federal government declares major disaster areas.

Among other categories major disasters include earthquakes, floods, hurricanes, severe storms and tornados. Figure 9 shows the relative frequency of disaster categories between 1964 and 2009.



Source: FEMA

For the purpose of establishing market size for the 2010 and 2011 low-income area home purchase goal, FHFA is defining a designated disaster as (1) any county designated by the federal government as adversely affected by a declared major disaster under FEMA's administration, (2) where individual assistance payments (*i.e.*, payments that can be made to homeowners for the purposes of repairing or replacing a home damaged during the disaster event) were authorized by FEMA, and (3) effective beginning no later than January 1 of the year

following the FEMA designation and continuing through December 31 of the third full calendar year following the FEMA designation. The disasters that are applicable to the 2010 housing goals are disasters that occurred during 2007, 2008 and 2009. Likewise, disasters that are applicable to the 2011 housing goals are disasters that occurred during 2008, 2009 and 2010. Nearly half of census tracts that are in declared disaster counties already qualify for the Low-Income Areas Goal, as they are low-income or high minority tracts.

Table 9 illustrates the process used to estimate the impact of designated disaster areas on the goal. The process begins with the average loan distribution, column 1, for 2007 to 2009, given the applicable disaster designations. Based on declared disasters in the 2007 to 2009 period, an additional 15,731 census tracts are added to the 24,325 low-income and high minority tracts (see column 4). Given the net number of census tracts that changed from designated disaster area to non-designated disaster area, column 5, from the average distribution, column 3, to the 2009 distribution, column 4, and the percent borrower that qualify for the goal, column 2, an adjusted average loan distribution is calculated (see column 6). However, this distribution still reflects market conditions during the 2007 to 2009 period. Adjusting column 6 for 2010 market conditions results in the estimated 2010 distribution (see column 7). The estimate for 2010 is that an additional 11.4 percent of the single-family owner-occupied home purchase mortgage market will qualify for the Low-Income Areas Home Purchase Goal.<sup>18</sup>

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<sup>18</sup> A similar analysis will be conducted in January 2011 to establish the impact for that year.

Table 9

## Estimated Impact on the Low-Income Areas Housing Goal from Designated Disaster Areas for 2010

| Low-Income Area Home Purchase Goal Categories <sup>1</sup> |   |                          |  | (1)                                 | (2)                        | (3)   | (4)                                  | (5)                      | (6)  | (7)  |
|--|---|--------------------------|--|-------------------------------------|----------------------------|---|--------------------------------------|--------------------------|--|--|
| Percent of Area Median Income                              | Minority Population in the Census Tract | Designated Disaster Area | Borrower Income as a Percentage of the Area Median | Average 2007-2009 Loan Distribution | Percent by Borrower Income | 2006-08 Average Tract Distribution <sup>2</sup> | 2009 Tract Distribution <sup>3</sup> | Percent Change in Tracts | Adjusted Average 2007-2009 Loan Distribution | Distribution Based on 2010 Market Size Estimates |
| <b>&lt;= 80%</b>   | n/a                                     | n/a                      | <b>&lt;= 100%</b>                                  | 6.6%                                | 55.5%                      | 18,615  | 18,615                               | 0.0%                     | 6.6%   | <b>5.9%</b>                                      |
|  |   |                          | <b>&gt; 100%</b>                                   | 5.3%                                | 44.5%                      |   |                                      |                          | 5.3%   | <b>4.7%</b>                                      |
| <b>&gt; 80%, but &lt; 100%</b>                             | <b>&gt;= 30%</b>                        | n/a                      | <b>&lt;= 100%</b>                                  | 2.7%                                | 43.7%                      | 5,710   | 5,710                                | 0.0%                     | 2.7%   | <b>2.4%</b>                                      |
|  |   |                          | <b>&gt; 100%</b>                                   | 3.5%                                | 56.3%                      |   |                                      |                          | 3.5%   | 3.1%   |
|  | < 30%                                   | No                       | <b>&lt;= 100%</b>                                  | 4.4%                                | 52.5%                      | 7,600   | 8,584                                | 7.7%                     | 4.7%   | 4.2%   |
|  |   |                          | <b>&gt; 100%</b>                                   | 4.0%                                | 47.5%                      |   |                                      |                          | 4.3%   | 3.8%   |
|  |   | Yes                      | <b>&lt;= 100%</b>                                  | 3.8%                                | 53.9%                      | 5,201   | 4,217                                | -7.7%                    | 3.5%   | <b>3.2%</b>                                      |
|  |   |                          | <b>&gt; 100%</b>                                   | 3.3%                                | 46.1%                      |   |                                      |                          | 3.0%   | 2.7%   |
| <b>&gt;= 100%</b>  | n/a                                     | No                       | <b>&lt;= 100%</b>                                  | 11.3%                               | 32.7%                      | 15,296  | 17,247                               | 6.8%                     | 12.0%  | 14.2%  |
|  |   |                          | <b>&gt; 100%</b>                                   | 23.3%                               | 67.3%                      |   |                                      |                          | 24.8%  | 29.3%  |
|  |   | Yes                      | <b>&lt;= 100%</b>                                  | 9.9%                                | 31.3%                      | 13,283  | 11,332                               | -6.8%                    | 9.2%   | <b>8.3%</b>                                      |
|  |   |                          | <b>&gt; 100%</b>                                   | 21.8%                               | 68.7%                      |   |                                      |                          | 20.3%  | 18.2%  |
| Unknown  | n/a                                     | No                       | <b>&lt;= 100%</b>                                  | 0.0%                                | 22.4%                      | 255   | 258                                  | 0.6%                     | 0.0%   | 0.0%   |
|  |   |                          | <b>&gt; 100%</b>                                   | 0.0%                                | 77.6%                      |   |                                      |                          | 0.0%   | 0.0%   |
|  |   | Yes                      | <b>&lt;= 100%</b>                                  | 0.0%                                | 15.8%                      | 185   | 182                                  | -0.6%                    | 0.0%   | <b>0.0%</b>                                      |
|  |   |                          | <b>&gt; 100%</b>                                   | 0.0%                                | 84.2%                      |   |                                      |                          | 0.0%   | 0.0%   |
| <b>Totals</b>  |   |                          |  | 100.0%                              |                            | 66,145  | 66,145                               |                          | 100.0%                                       | 100.0%   |
| <b>Low-Income and High Minority Areas</b>                  |   |                          |  | 14.5%                               |                            | 24,325  | 24,325                               |                          | 14.5%  | <b>13.0%</b>                                     |
| <b>Additional from Designated Disaster Areas</b>           |   |                          |  | 13.8%                               |                            | 18,669  | 15,731                               |                          | 12.8%  | <b>11.4%</b>                                     |

<sup>1</sup> Bold indicates operable categories that qualifies mortgages in the numerator of the goal.<sup>2</sup> A combined three year census tract distribution is calculated for each of the three years (e.g. the 2006 distribution includes disasters declared in 2004, 2005 and 2006). The 2006, 2007 and 2008 distributions are averaged together.<sup>3</sup> A combined three year census tract distribution is calculated for 2009 (i.e. includes disasters declared in 2007, 2008 and 2009). This is the applicable designation for 2010.

## G. ADJUSTMENT FOR MANUFACTURED HOME LOANS

The market estimates produced from the time series analysis in Section E exclude loans from subprime lenders, but no adjustment was made for manufactured housing. During 2004 to 2008, 57 percent of manufactured housing loans were higher-cost, according to the HMDA data. Only 8.5 percent of manufactured housing loans, with most being refinance loans, were from subprime lenders. Table 10 shows manufactured housing's contribution to the housing goals for the years 2004 to 2008. The table also shows the share of manufactured housing that was reported in the HMDA data as higher cost. This is used as a proxy for chattel loans in order to remove them from the market estimates. To adjust the market estimates of the housing goals to account for the effect from chattel loans on manufactured housing, FHFA weighted the average 2004 to 2008 manufactured housing contribution to the goals market estimates by 60 percent for

**Table 10**

### Manufactured Housing Loans

|                   | Home Purchase Loans    |                      |       | Refinance Loans |                        |                        |
|-------------------|------------------------|----------------------|-------|-----------------|------------------------|------------------------|
|                   | Percent<br>Higher Cost | Contribution to Goal |       |                 | Percent<br>Higher Cost | Contribution to<br>LIR |
|                   |                        | VLIP                 | LIP   | LAP             |                        |                        |
| <b>2004</b>       | 55.0%                  | 0.6%                 | 1.6%  | 0.7%            | 44.7%                  | 0.6%                   |
| <b>2005</b>       | 58.3%                  | 0.5%                 | 1.4%  | 0.6%            | 54.0%                  | 0.6%                   |
| <b>2006</b>       | 50.5%                  | 0.5%                 | 1.3%  | 0.6%            | 52.6%                  | 0.7%                   |
| <b>2007</b>       | 61.5%                  | 0.6%                 | 1.6%  | 0.7%            | 55.1%                  | 0.7%                   |
| <b>2008</b>       | 75.4%                  | 0.7%                 | 1.7%  | 0.8%            | 62.2%                  | 0.7%                   |
| <b>Average</b>    | 59.0%                  | 0.6%                 | 1.5%  | 0.7%            | 52.7%                  | 0.6%                   |
| <b>Adjustment</b> | <b>60%</b>             | -0.3%                | -0.9% | -0.4%           | <b>50%</b>             | -0.3%                  |

Source: HMDA data.

the home purchase mortgage goals and 50 percent for the refinance mortgage goal (see Table 10). The market estimates were adjusted downward by that amount. This results in the market estimate for the Low-Income Borrower Home Purchase Housing Goal being adjusted by -0.9 percent, the Very Low-Income Borrower Home Purchase Housing Goal by -0.3 percent, the Low-Income Area Home Purchase Housing Subgoal by -0.4 percent, and the Low-Income Borrower Refinance Housing Goal by -0.3 percent. By subtracting the weighted contribution to the goals (weighted by the chattel share) an adjustment is derived which was subtracted from Section E's results. The projected market estimates in Table 1 reflect these adjustments.



## H. CONCLUSION

FHFA is required to consider market size when establishing housing goals. This paper describes the methodologies used to estimate market size of the four single-family housing goals for 2010 and 2011. The 2010-2011 market size estimates for the four housing goals are:

- Low-Income Borrower Home Purchase Goal 27 %
- Very Low-Income Borrower Home Purchase Goal 8 %
- Low-Income Area Home Purchase Goal
  - Low-Income and High Minority Areas Subgoal 13 %
  - Designated Disaster Areas Increment 11 %
  - Total for Goal 24 %
- Low-Income Borrower Refinance Goal 19 %

The market projections are based on econometric time series models, incorporating industry and government economic, housing and mortgage market forecasts. The market estimates in this paper exclude mortgage modifications, which can have a sizable impact on the share of affordable mortgages in the Enterprises' current business volume. Since loan modifications, by their nature, are an in-house transaction, there is no market to measure, thus no market estimates. However, as discussed above, FHFA is adjusting the low-income borrower refinance goal upward, to 21 percent, to account for the estimated effect of permanent loan modifications, based on Enterprise data on the likely volume and low-income share of such modifications.

## APPENDIX

### Data Sources

#### **Federal Financial Institutions Examination Council, Home Mortgage Disclosure Act Data**

Low-Income Borrower Home Purchase Mortgage Share  
Very Low-Income Borrower Home Purchase Mortgage Share  
Low-Income Area Home Purchase Mortgage Share  
Low-Income Borrower Refinance Mortgage Share  
Refinance Mortgage Share, 1993 - 2008  
FHA Home Purchase Mortgage Market Share, 1993 - 2008  
Investor Share  
<http://www.ffiec.gov/hmda/default.htm>

#### **Federal Housing Finance Agency**

House Price Index  
<http://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx>

#### **U.S Department of Commerce, Bureau of Economic Analysis**

Gross Domestic Product  
<http://www.bea.gov/national/index.htm#gdp>

#### **U.S Department of Commerce, Census Bureau**

Housing Starts  
<http://www.census.gov/const/www/newresconstindex.html>

New Home Sales  
Median and Sales Price of New One-Family Houses Sold  
<http://www.census.gov/const/www/newressalesindex.html>

#### **U.S Department of Labor, Bureau of Labor Statistics**

Consumer Price Index  
<http://www.bls.gov/cpi/data.htm>

Unemployment Rate  
<http://www.bls.gov/cps/>

#### **Federal Reserve Bank of St. Louis**

Monthly average of the 10-Year Treasury Constant Maturity Rate  
Monthly average of the 1-Year Treasury Constant Maturity Rate  
<http://research.stlouisfed.org/fred2/categories/115>

**Federal Housing Administration**

FHA Endorsements

<http://www.hud.gov/offices/hsg/comp/rpts/ooe/olmenu.cfm>

**Mortgage Bankers Association**

Single-Family Originations

Refinance Mortgage Share, 2009

Forecast

<http://www.mbaa.org/ResearchandForecasts/EconomicOutlookandForecasts>

**Freddie Mac**

Monthly average of the 30-Year Fixed Rate Mortgage Rate

<http://www.freddiemac.com/pmms/pmms30.htm>

Forecast

<http://www.freddiemac.com/news/finance/>

**Fannie Mae**

Forecast

<http://www.fanniemae.com/media/economics/index.jhtml?p=Media&s=Economics+&+Mortgage+Market+Analysis>

**National Association of Realtors**

Monthly Housing Affordability Index

Existing-Home Sales

Median Sales Price - Existing-Homes

<http://www.realtor.org/research/research/ehspage>

Forecast

<http://www.realtor.org/research/research/reportsstatistics>

**Wells Fargo**

Forecast

<https://www.wachovia.com/foundation/v/index.jsp?vnextoid=957e10a2090aa110VgnVCM1000004b0d1872RCRD&vnextfmt=default>

**PNC Financial**

Forecast

<https://www.pnc.com/webapp/unsec/NCAboutMicrositeNav.do?siteArea=/pnccorp/PNC/Home/About+PNC/Media+Room/Economic+Reports>

**National Association of Home Builders**

Forecast

[http://www.nahb.org/reference\\_list.aspx?sectionID=138](http://www.nahb.org/reference_list.aspx?sectionID=138)

**Standard and Poor's**

Forecast

<http://www.standardandpoors.com/home/en/us/>

**Wall Street Journal Survey**

Forecast

<http://online.wsj.com/public/resources/documents/info-flash08.html?project=EFORECAST07>

**The Conference Board**

Forecast

<http://www.conference-board.org/data/chiefeconomist.cfm>

**Federal Reserve Board of Governors, Federal Open Market Committee**

Forecast

<http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm>