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Reassessing FHA Risk

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**ABSTRACT**

Federal Housing Administration (FHA) insurance has doubled over the past two years and is projected to redouble to \$1.5 trillion over the next five. Despite clear signs of strain in the FHA's Mutual Mortgage Insurance Fund, a recent actuarial review indicates that the FHA will not need any form of government support. We identify four risk factors that make such a funding request more likely; the review underestimates how many FHA borrowers are underwater and in economic distress; it uses measures of house values that lower loss estimates; it does not incorporate early-warning signals of future losses that are available from mortgage delinquency; and it ignores potential risks associated with recent down-payment assistant programs despite higher losses on previous programs of this type. We propose measures that could be taken to improve the predictive accuracy of FHA risk assessment.

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## I. INTRODUCTION

Residential real estate, sitting as it does at the epicenter of the recent financial crisis, has recently received many sources of public support. Examples include the \$1.25 trillion dollar agency mortgage backed security (MBS) purchases by the Federal Reserve and the Federal First-Time Homebuyer tax credit program.

The Federal Housing Agency (FHA) provides an additional important source of support in the form of federally-backed insurance on low down-payment mortgages. This support has doubled over the past two years and is projected to redouble to \$1.5 trillion over the next five years. This rapid ramp-up in issuance has resulted in significant losses to the FHA's Mutual Mortgage Insurance (MMI) Fund, which has fallen from \$15.8 billion to \$2.73 billion over the past two years (Integrated Financial Engineering (IFE) [2009]).<sup>3</sup>

Recent projections of the future evolution of the MMI Fund are contained in the actuarial review that FHA is mandated to conduct on an annual basis (IFE [2009]) and the contemporaneous report to congress (HUD [2009]). The actuarial review asserts that, in the most likely case, FHA will not need any form of government support (HUD [2009], figure 1). Hence, any request for funding in the near term would raise questions as to whether early warning signals were missed in the review. We identify four such signals.

- **At Risk Borrowers in Economic Distress:** FHA risk is concentrated in borrowers who are underwater (i.e. owe more than their home is worth). When hit by unemployment, many such borrowers default (Foote *et al* [2008]). These risk factors are underestimated in the actuarial review. More FHA borrowers are severely underwater than the actuarial review identifies. Moreover, unemployment rates are particularly high in areas in which FHA borrowers are furthest underwater. This natural connection is not captured in the actuarial review. The end result is an underestimate of default costs, which directly deplete the MMI Fund.
- **Over-Valuation of Collateral:** House values which impact both default rates and default losses are an important determinant of claims to the MMI Fund. Yet the actuarial review relies on a model of house values that we find in the current period to be inaccurate and biased. In recent transactions in Los Angeles (LA) County more than one in three homes is over-valued by 20% or more based on standard valuation methods, and there are also errors in the other direction.<sup>4</sup> The large scale of these valuation errors is important in and of itself. Houses that are less valuable than estimated disproportionately end up in default, hence depleting the MMI Fund. Those that are more valuable than estimated typically produce

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<sup>3</sup> Absent new revenues from future books of business, the recent annual audit estimates that the FHAs capital ratio is down to 0.53 percent, below its required 2 percent level (HUD [2009], page 4). The audit and the MMI Fund estimates exclude any analysis of the FHA home equity conversion mortgages (HECM) for seniors. See: <http://nhl.gov/offices/hsg/sfh/hecm/hecmhome.cfm>.

<sup>4</sup> Even restricting our error analysis to a single county (Los Angeles), it required a considerable investment of data resources to provide NYU with the requisite data. LA County was chosen as the "test bed" county since there are electronic records of relevant housing market transactions stretching back for more than 25 years.

larger capital gains for their owners, yet do not further replenish the MMI Fund. On net, then, FHA losses increase with the extent of house valuation errors. While it makes allowance for valuation errors, the actuarial review underestimates their extent by more than 50%.

- **Delinquency and Modifications:** The audit analyzes only final claims to the FHA's MMI fund and does not take advantage of information about future claims that is contained in current delinquency rates. It also does not properly account for the loan-to-value ratios for streamline refinanced mortgages.
- **Down-Payment Assistance:** Most recent FHA borrowers borrow 96.5% of the house value. In principle, they are then required to bring at least 5% to the closing table: 3.5% of the house value, and the 1.5% up-front FHA insurance fee. In practice, almost all borrow the 1.5% up-front insurance fee. In addition, 75% of FHA purchasers in 2009 are first-time buyers (HUD [2009], p.22), who were likely eligible for the First-Time Homebuyer tax credit. As a result, they are required to put up little to none of their own money, and are also effectively able to save most of the insurance premium if they default. There is no analysis in the actuarial report to date of either of participation in this government down-payment assistance program, or of the potential risk to the FHA insurance fund going forward. This oversight is particularly unfortunate given that the FHA makes explicit note of the higher losses on its previous down-payment assistance programs (see IFE [2008] Exhibit IV-II, p. 55).

A change in the pattern of mortgage termination lies at the base of several measurement problems that we identify. In the early 2000's, FHA loans typically terminated when the borrower sold the house and moved, or took out a new loan from a competitor on superior terms. Both forms of prepayment entirely removed the risk from the FHA books. Yet in 2009, terminations were dominated by "streamline refinances," which involve no new underwriting and in which the risk stays with FHA.<sup>5</sup> The loss model used in the audit makes no distinction between these two very different types of prepayments, treating what are effectively loan modifications as if they removed risk of future loss from the FHA's books. Moreover, the loss model treats a streamline refinance as if a full new insurance premium was paid, whereas, in fact, a large part of the mortgage insurance fee is effectively waived.

Misclassification of streamline refinances is one factor that results in underestimation of underwater mortgages. We estimate more than 50% of these borrowers to be underwater at the time of the modification. Yet essentially all are treated in the actuarial review as having positive equity in the home. The audit analysis estimates separate models for the streamline refinances but this is an imperfect substitute for correctly treating these as modifications in the data and analysis.

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<sup>5</sup> In a streamline refinance, an existing FHA mortgage is refinanced into another FHA mortgage. No new underwriting is undertaken for these refinances. To qualify, a borrower must be current in all payments and is not allowed to take cash out. Part of the mortgage insurance fee for the former FHA mortgage is refunded to the borrower. See <http://www.fha.com/refinance.cfm>. Data from FHA indicating that January through September 2009 some 330,000 mortgages were refinanced through this program (HUD [2009], p.18).

Reliance on an insufficiently accurate model of house values is a second reason that the number of at risk mortgages is underestimated. The FHFA (formerly OFHEO) index is used to measure changes in house values over time (e.g. IFE [2009] Appendix A). During the recent period of housing market stress, we find this index to be both biased in the direction of over-valuation (the average valuation exceeds realized price by more than 15%), and highly inaccurate (the standard deviation in the valuation error is more than 25%) in data for LA County. Alternative index-based valuation methods (such as the Case-Shiller MSA-level indices and the First American CoreLogic ZIP code-level indices) reduce the bias, but do little to reduce the scale of the errors. The bottom line is that valuation error is more than 50% higher in our LA data than the actuarial review assumes. It does not have to be so: we provide proof of principle that more accurate valuation is possible working at the granular level of individual house values. We introduce a dynamic model of individual house values and confirm that it has been significantly more accurate than any house price index.<sup>6</sup>

The outline of the paper is as follows. In section 2, we precisely identify streamline refinances using a custom-designed property-level data set for LA County from First American CoreLogic (FACL). In section 3, we broaden our findings to the nation as a whole, and estimate the number of underwater borrowers at the point of refinancing. Section 4 explores the valuation errors associated with various methods of valuing houses in LA County. Section 5 highlights the concentration of underwater borrowers in areas of higher unemployment.

We open section 6 by highlighting other problems with the actuarial review, including a worst case analysis that appears overly optimistic, with home prices rising continuously from 2011 onwards (IFE [2009], Appendix D). These considerations may help to explain why the recent actuarial reviews have systematically underestimated the ensuing degradation in the FHA insurance fund. For example, the most recent report details the extent to which the 2008 review underestimated the ensuing losses on all prior FHA books of business (IFE [2009], p.27). We identify in section 6 a small number of concrete steps that would improve the risk assessment for the FHA.

## **II. FHA TERMINATIONS IN LA COUNTY**

### **A. The Deeds File for LA**

Recent reductions in interest rates have unleashed a burst of refinancing from one FHA mortgage into another, typically using the “streamline refinance” program which allows borrowers to lower interest payments without being re-underwritten. The program protects a borrower’s ability to refinance against falls in house value (Caplin, Freeman, and Tracy [1997]). There is also possible positive selection, since the borrower has to be current for the past twelve months in order to qualify. A streamline refinance is equivalent to a modification in which the monthly mortgage payment is reduced through a combination of a lower interest rate and extended term for the loan.<sup>7</sup>

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<sup>6</sup> The model hews closely to the logic of appraisals, using rich information on past sales of the given house and its spatial neighbors, while taking account of hedonic differences

<sup>7</sup> There may, in principle, be an impact on loan priority, since lenders of second mortgages have to agree to subordinate for the streamline refinance to retain first mortgage status.

While it may be good policy to allow these mortgages to refinance to a lower interest rate given that the FHA already owns the credit risk, it is important that the audit analysis properly distinguish between these loan modifications and other prepayments of FHA mortgages. The original FHA mortgages that undergo a streamline refinance are treated in the audit analysis no differently than FHA mortgages that in fact pay off and represent no further credit risk to the FHA. This is clearly incorrect since the credit risk continues for all of the streamline refinanced mortgages. Streamline refinances represent a separate category of termination with potentially very high risks as we will demonstrate.

One reason that the actuarial review did not separate out terminations due to streamline refinancing from those that involve prepayment for other reasons is a weakness in the data architecture. The actuarial review is based on loan-level analysis, and the internal FHA data used in the audit analysis does not link together the two FHA mortgages involved in a streamline refinance.

We introduce a custom-designed property-level data set that enables us to track streamline refinancing.<sup>8</sup> The property records file (“deeds file”) that FACL provided to NYU comprises official County Recorder data containing all recorded property transactions in LA County from January 1984 to October 2009. Such transactions are recorded when there is a transfer of the property (arms’ length sales as well as non arms’ length purchase or non-purchase, such as a transfer due to inheritance, marriage or divorce, etc.). The deeds data not only capture assumptions of a financial interest in the property (such as a resale/purchase mortgage, a refinance mortgage, etc.), but also assignments (e.g. loan sales) and releases of such interests (e.g. when loans are fully paid-off). In addition to the transaction date, the type of transaction and associated amounts (sale price, loan amount, etc.), the deeds file contains information about transfers (parties, type of sale or transfer) and mortgages. The mortgage information specifies loan type including FHA, interest rate type, and interest rate reset and rate details for adjustable-rate mortgages.<sup>9</sup>

In addition to the deeds file, FACL also supplied NYU with the results of a quarterly retroactive open lien search of the deeds data from January 2000 to October 2009. This enabled aggregation of the full set of open liens to the property level. For each single family residence (i.e. attached or detached homes that are inhabited by one family only), the total set of outstanding liens and their priority order was identified at the end of each quarter. For each of up to four liens (in order of priority), the deeds file specifies: the type of loan secured (e.g., Conventional, FHA, VA), payment type (fixed rate, ARM, ARM adjustment parameters), loan balance at origination, and loan purpose (purchase, refinance etc.). A subprime indicator was inferred based on the originating lender and other loan characteristics. No HECM reverse mortgages were included.

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<sup>8</sup> To our knowledge, the “Warren Group” data for Massachusetts (see Gerardi, Shapiro, and Willen [2007]) is the only other property-level data set used in recent research. It does not contain information on whether or not loans are FHA insured, making it unsuitable for our purposes. In addition, the FACL property-level data includes detailed loan characteristics.

<sup>9</sup> FACL property transaction data covers more than 2,100 counties and 500 million transactions historically, or more than 97% of the recordings in the United States. Coverage is determined by how and for how long the county has made data available to FACL. One of the main reasons for focusing on LA County is that coverage is close to complete. However, certain elements of the property record, such as riders for adjustable rate mortgages, may not have been captured electronically until more recently.

## **B. Initial LTV Ratios on FHA-guaranteed mortgages in LA County**

Given that our current interest relates exclusively to FHA-guaranteed mortgages, our basic unit of observation is an unbroken string of quarters with unchanging ownership and with the indicated first mortgage having an FHA guarantee.<sup>10</sup> We call this an “FHA epoch”. To identify such epochs, we first find for each property all periods in which there is unchanged ownership and in which there is ever an FHA first mortgage. The initial period with such an FHA first mortgage identifies the opening of an FHA borrowing epoch. The first ensuing quarter with no such mortgage closes out the epoch. If there is no such quarter, then the epoch either lasts until the point of sale or remains open if there has been no such sale.

Our data on FHA borrowing is essentially complete. In the vast majority of FHA epochs in our LA data, there are at most two outstanding liens in any quarter during the entire epoch. There is only one case in recent years with more than four liens outstanding at any point in the epoch.

The data reveals one important respect in which LA is not representative of the country as a whole. In much of the country, the recent increase in FHA mortgage issuance started in 2007. Yet in LA County, the level of issuance remained minimal until March 2008. This likely reflects the very significant increases in FHA loan limits in early 2008.<sup>11</sup> These higher limits were explicitly designed to increase issuance of FHA-guarantee mortgages in higher priced areas such as LA and New York. As a result, the percentage of such guarantees issued in California rose from only 1.8% in 2007, to 7.5% in 2008, all the way to 12.4% in 2009 (IFE [2009], p.38. Exhibit IV-3).

The deeds file enables us to identify FHA mortgages that coincide with a purchase. This enables us to estimate initial loan-to-value (LTV) ratios for all purchase mortgages. We aggregate loan amounts across all liens on a property and divide by the transaction price to estimate the combined LTV at the point of purchase.<sup>12</sup> These computations show that three-quarters of FHA purchase epochs originating in 2008 and 2009 started with combined LTV ratios of around 98%, some 1.5% above the official FHA maximum loan limit of 96.5%. The reason for this may be that the “up-front” insurance fee, which indeed was 1.5% for much of the relevant period, is typically financed in the mortgage.<sup>13</sup> The fact that our data operates at the property-level rather than the loan level may also explain the slightly higher than expected initial combined LTV ratios.

Our calculations show that there is essentially no difference in terms of initial combined LTV between 2008 FHA purchasers who later did and those who did not streamline refinance. Hence,

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<sup>10</sup> We take the priority order directly from the deeds file, while noting that there are subtleties in the identification of lien order that may impact claim priority. Lien order is not directly recorded in the County registry. If multiple liens are opened simultaneously, the closing agent ideally ensures that they get recorded in the correct order. However if another lien is recorded subsequent to an active lien without this lien being closed, the newly recorded lien would get a higher order unless the other lender agrees to subordinate.

<sup>11</sup> See <http://www.fhaloanpros.com/2008/02/huge-increase-in-fha-loan-limit-passes-congress/>.

<sup>12</sup> If anything, this procedure underestimates LTV, since the minimum of the price and the appraised value is typically used in loan decisions.

<sup>13</sup> See [http://www.fhaloan.com/fha\\_mortgage\\_insurance.cfm](http://www.fhaloan.com/fha_mortgage_insurance.cfm).

more than 75% of those who streamline refinanced had initial combined LTV ratios of 98% or above. In light of the significant decline in house prices in the interim, most such borrowers were underwater when they refinanced, as our later estimates reveal. It is very important, therefore, to understand how widespread such streamline refinancing has been in LA and in the nation as a whole.

### **C. The Changing Pattern of FHA Terminations**

On the termination side, the LA deeds data enable us to separate FHA-to-FHA refinancing, refinancing out of FHA, and cases in which the FHA loan is terminated without being replaced. We plot in Figure 2.1 the absolute numbers of such terminations from 2004 to the present. We plot the same information in proportionate form in Figure 2.2.

Figures 2.1 and 2.2 illustrate the complete switch in the nature of FHA terminations. In the period from 2004-2006, exit was dominated by refinancing out of FHA, presumably to take advantage of better terms available elsewhere, as the increase in house values and availability of non-FHA (especially sub-prime) loans enticed borrowers out of FHA. During this period, FHA-to-FHA refinancing was a distant third place, well behind complete termination of FHA loans. Fast forward to 2009 and the picture is completely reversed. FHA-to-FHA refinancing dominates as the form of exit, with other forms of termination being reduced to very small proportions.

The actuarial review ignores this switch in loan terminations in estimating its competing risk model. This compromises the prediction of FHA default risk going forward, which relies essentially on the model estimates. The competing risk model allows for a three way classification of FHA-insured mortgages at any point in time: a “Bad” group that terminate with a claim on the MMI Fund; a “Good” group that terminate without such a claim; and an “Ongoing” group that may in future end up either in the Bad or Good group. In 2004-2006, many FHA loans were prepaid, and they were appropriately classified as belonging to the Good group, with no further implied risk to FHA. Loans that terminate in a streamline refinance are similarly treated in the model as belonging to the Good group, since the existing FHA mortgage concludes and there is no claim on the MMI Fund. Unfortunately, while streamline-refinancing terminates a particular mortgage, it does not terminate the underlying risk to FHA. It is neither a Bad nor a Good termination, but rather an entirely different event. Including streamline refinances in the Good group artificially inflates the size of this group, and affects the coefficient estimates that are used to predict the probabilities that mortgages in the Ongoing group will terminate in the Good group in the future.

To illustrate how this problem impacts the competing risk model, consider an extreme case, with all FHA mortgages suddenly being streamline refinanced into new FHA-mortgages at lower rates of interest. The current competing risk model would identify all of these mortgages as having Good terminations, as a result predicting low future losses. In truth, all risks would be Ongoing. The model would recover the prediction that all FHA mortgages terminate successfully, and the ongoing risks to FHA would be completely mis-specified. That is, the new FHA mortgages that are created by these streamline refinances would be predicted to have too high a probability of terminating in the Good group in the future.

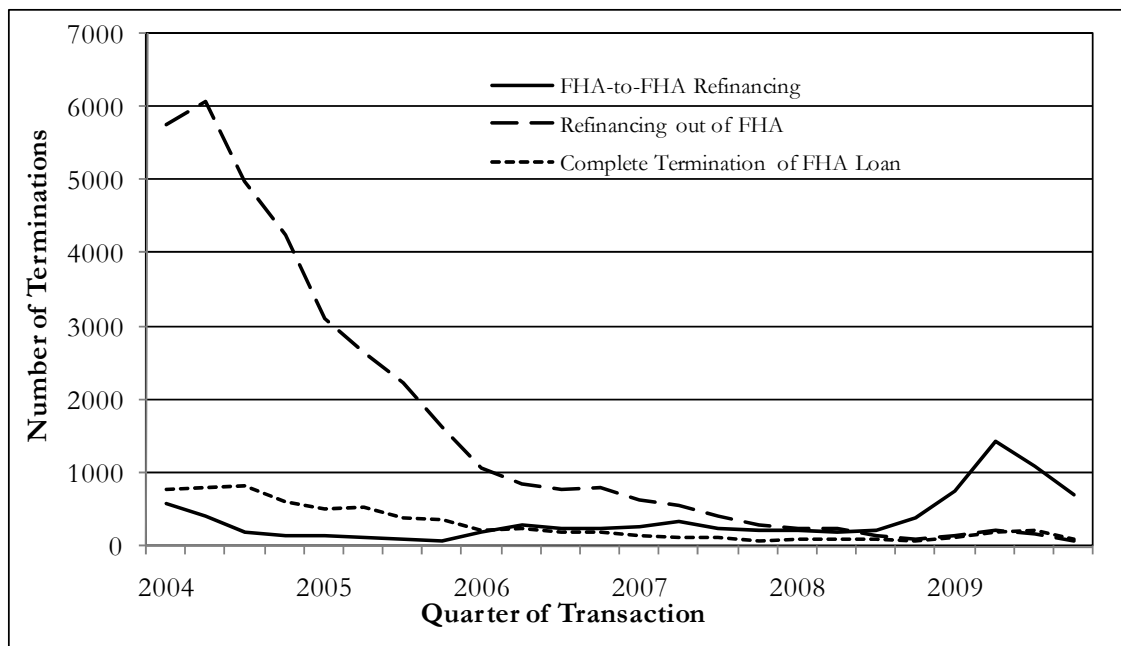
The inappropriate treatment of streamline refinancing is but one part of a larger problem with model specification. A simple model with two competing terminal risks is inadequate to the task of modeling FHA risk in a world in which there are so many intermediate events. In addition to



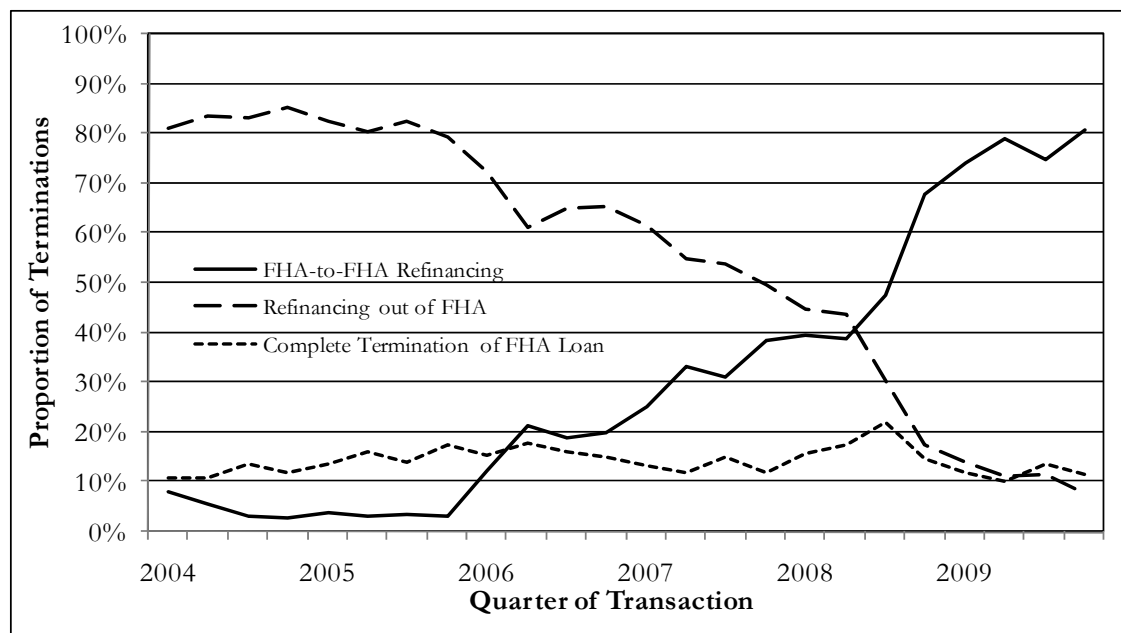
streamline refinancing, a robust model of FHA risk would take account also of the various stages of mortgage delinquency, other forms of mortgage modifications (such as “partial claims”), and other events that cannot be classified either as Good or Bad terminations, yet are profoundly informational.

The importance of the classification error for streamline refinances depends on their actual pattern over the recent period. In our LA data, it turns out that the vast majority of FHA-to-FHA refinancing in 2009 relates to FHA epochs originated in 2008. Conversely, the preponderance of FHA mortgages that terminated in 2009 without a foreclosure event was streamline refinanced. Some 30% of FHA purchase mortgages from 2008 that were active in the fourth quarter of 2008 terminated during 2009. Almost 90% of these terminations were immediately refinanced with the FHA. A significant proportion of the remaining 10% terminated with a default event of some form (we cannot identify the number precisely from our data). The fact that so many of the mortgages terminating in 2009 were streamline refinanced guides us in the next section when we estimate the extent of such refinancing nationwide.

**Figure 2.1** FHA Terminations



*Note:* Author’s calculations using FACL property-level data set for LA County.

**Figure 2.2** Proportions of FHA Terminations

*Note:* Author's calculations using FACL property-level data set for LA County.

#### **D. Dynamic Loan Balances and the Refinance Ratio**

One condition for a streamline refinance is that the new loan amount is no higher than the loan it replaces. This means that the “refinance ratio” for each FHA-to-FHA refinance, defined as the relative size of the new loan in comparison with the one it replaces, is no higher than one. To estimate this refinance ratio, we identify the terminal loan balance on the original FHA mortgage as well as the origination loan balance on the new FHA mortgage. The intricacy is that only the servicing file (detailed in the next section) has precise loan balances, while only the deeds file links the later loan with the loan it replaced.

That we are able to compute the refinance ratio for the LA data rests on the fact that the FACL deeds file includes an estimate of the outstanding principal balance on all liens as of the quarter end. The proprietary FACL loan balance algorithm uses information on the type of loan and the interest rate on each loan in the LA data set to estimate the normal patterns of payments, and uses this

simulation to infer loan balances over time.<sup>14</sup> The algorithm is particularly simple for FHA-insured mortgages, the vast majority of which are thirty year fixed rate loans, with assumptive rate tables which are very accurate.

We compare estimates based on the FACL algorithm with the true balances at the LA level, thereby confirming that it is all-but exact for recently originated FHA mortgages. Table 3.1 records both the actual balance of remaining FHA loans according to the month in which they were initiated and the amount that would be predicted based on amortization at the effective FHA interest rate. The first two rows relate to the nation as a whole, with the top row recording all mortgages from 2005 on and the second row only those from 2008 on. The third and fourth rows carry out the same calculations while restricting attention to LA ZIP codes.

**Table 3.1** FHA Loan Balances for Surviving Mortgages

Reported Loan Balances (\$M)	Algorithm Estimated Loan Balances (\$M)	Difference
40,168.4	40,121.1	0.12%
30,433.8	30,466.8	-0.11%
917.6	917.4	0.02%
859.6	860.4	-0.09%

*Note:* Authors calculations using FACL 10 percent random sample of FHA 30-year fixed-rate mortgages. Reported loan balances are as of September 2009. Estimated loan balances are based on a standard 30-year fixed-rate self amortization schedule.

<sup>a</sup> Surviving loans nationwide originated from January 2005 onwards.

<sup>b</sup> Surviving loans nationwide originated from January 2008 onwards.

<sup>c</sup> Surviving loans in LA county originated from January 2005 onwards.

<sup>d</sup> Surviving loans in LA county originated from January 2008 onwards.

The agreement between the algorithmically-estimated loan balances and those in the actual loan files is quite high. The standard amortization table estimates loan balances for surviving mortgages to within less than 0.2% in all cases. The short length of time for which these mortgages have been

<sup>14</sup> The origination amount, date, term and rate were sourced from the property record information where available, and otherwise inferred. Term is generally recorded for most loans; in the few cases where it is not recorded, a 30-year term is assumed, as this is the most common term for first-lien mortgages. For adjustable-rate loans originated since 2003, information about initial interest rate, rate resets, caps and floors is available in the electronic records. For all fixed-rate loans, as well as adjustable-rate loans prior to 2003, assumptive interest rate tables for the origination date of the lien and the defined term were used. One-year resets were assumed for all adjustable-rate loans prior to 2003, and median values were used for caps and floors. Certain loan types, such as interest-only, negative amortization and pay option mortgages required special handling. For these loans, information about utilization is not available in the public record. However, most borrowers that opt for these loans do so to take advantage of the special payment features. Thus, borrowers are assumed to pay interest only for interest-only loans and pay option loans, and minimum payments are assumed for negative amortization loans until the balance cap is reached. A balance cap was assumed at 115% unless otherwise specified. For HELOCs, the loan amount on public records sometimes reflects the line and sometimes the draw; for consistency reasons, 100% utilization was assumed at origination, although this may overstate balances and consequently overestimate some LTV ratios. FACL also used proprietary logic to determine when liens are released, as these often experience significant recording delays. This logic recognizes situations such as consolidation refinances—where multiple liens are combined into one new, larger lien—and makes reasonable assumptions to distinguish higher order lien refinances from adding new liens.

ongoing and the economic stresses on many borrowers have led outstanding balances almost exactly to mirror the standard 30 year self-amortization rate schedule. There has been very little by way of accelerated payments. Hence we have for our LA data on FHA mortgages by far the most detailed estimate of property-level loan balances that has been put together. By contrast, Gerardi, Shapiro, and Willen [2007] possess insufficient information about loan type to compute the dynamic pattern of balances.

Knowing the balance on the new mortgage exactly, and the balance on the mortgage it replaced all-but exactly, we are in position to estimate the refinance ratio. Our computations (not shown) reveal that it is within a few percentage points of 100% for more than 95% of loans. In effect, in the LA data the new FHA loan precisely replaces the prior FHA loan in the vast majority of cases. This reinforces our earlier statement that streamline refinances are equivalent to rate and term loan modifications.

### **III. STREAMLINE REFINANCING NATIONWIDE**

In this section, we use loan-level mortgage servicer-sourced data to estimate FHA-to-FHA refinancing in the nation as a whole. While it is more difficult to identify streamline refinancing in this data than it is in the LA deeds file, the broader coverage allows us to develop a more complete picture of the recent burst of streamline refinancing.

#### **A. Nationwide Servicing Data**

We do not have property-level data beyond LA County available to us for this study. What we do have is loan-level data provided by FACL from a national sample of FHA mortgages from their loan servicing databases (“servicing file”).<sup>15</sup> The underlying servicing data is updated monthly with loan performance characteristics, including current balance, payments and delinquency status. The database also covers static information collected from the loan application process, such as origination amount, initial LTV, [reported intent of] owner occupancy, and credit score. This allows tracking of loans through detailed status of delinquency from the first late payment into default, bankruptcy or foreclosure. In contrast to the LA County data, however, the national servicing sample data used in this study does not link all the liens on a property or follow the outcome subsequent to foreclosure.

The overall servicing database covers more than 130 million loans in total, dating back to 1992, and includes close to 50 million active loans. Our sample consists of a 10 percent random sample of the more than 2.5 million FHA loans that FACL tracks that were originated since 2005.<sup>16</sup>

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<sup>15</sup> FACL’s loan servicing databases are estimated to represent some 92% of FHA-guaranteed mortgages issued in 2008, 77% in 2007, 50% in 2006, and 41% in 2005 based on a comparison with published figures on the size of the FHA market. Overall, FACL covers 69% of active loans as of Sept 2009. Given its long experience in this area, mortgage-level data supplied by FACL meets high standards of accuracy, completeness and timeliness.

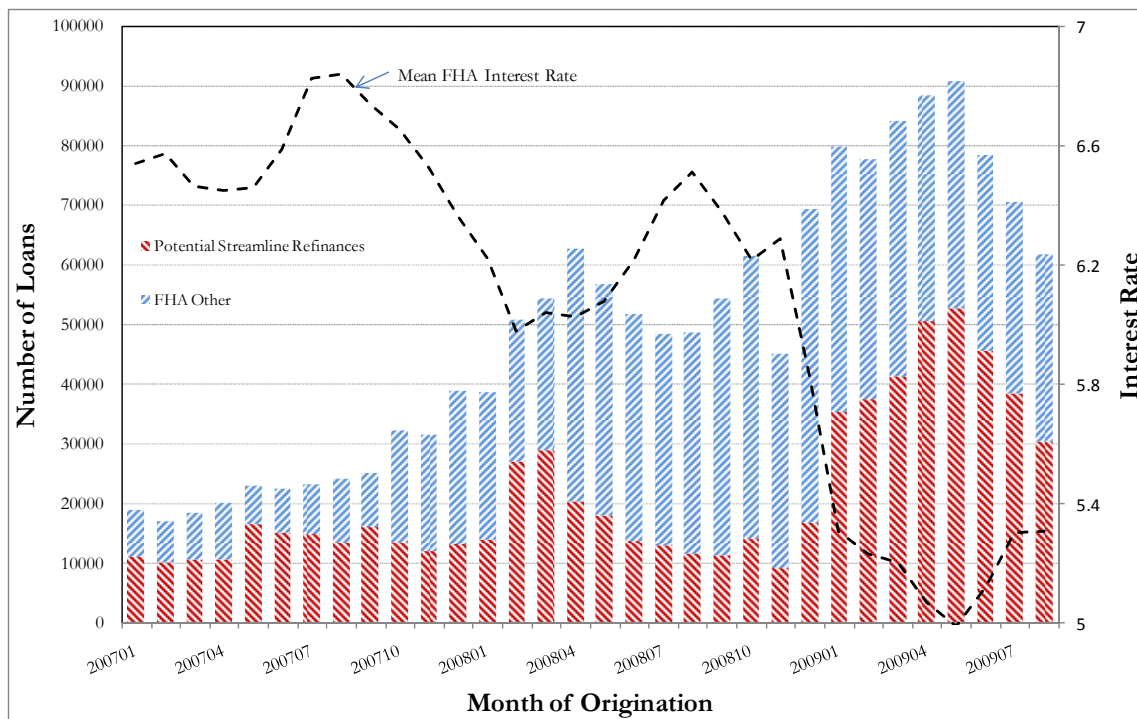
<sup>16</sup> No HECM reverse mortgages were included.

## **B. Estimating Streamline Refinancing Nationwide**

We plot in Figure 3.1 the overall volume of FHA-guaranteed mortgage refinancing in the FACL servicing data for each month from January 2007 to August 2009 (the estimates are derived by scaling up our sample and adjusting for the coverage rate). The servicing data does not enable us identify particular loans as having been refinanced from prior FHA loans. However, we have identified loans that terminated during the year without foreclosure, and which therefore may have been streamline refinanced in 2009. We have further restricted this set of loans to satisfy the stated rules for a streamline refinance in terms of not having been delinquent for the past 12 months. Also marked in Figure 3.1 is the average interest rate on FHA mortgages each month, illustrating the significant fall that motivated the boom in refinancing. There is a final category in Figure 3.1 of “FHA Other” loans that are not purchase mortgages, but cannot have been streamline refinanced from the indicated years. The vast majority of such loans will have been refinanced from outside FHA. The massive wave of FHA-to-FHA refinancing in 2009 reflects both the large volume of mortgage issuance in 2007 and 2008, and the very large decline in borrowing rates.

To estimate current LTVs on FHA-guaranteed mortgages issued in 2009, we need to estimate the actual level of streamline refinancing. Our LA data suggests that the vast majority of potential refinances that originated in 2008 will indeed have so refinanced. To be more precise, column 2 of Table 3.2 lists the number of potential streamline refinance loans that we identified by source cohort, with column 3 showing this data as shares of the total pool of potential refinances.

**Figure 3.1** FHA-Guaranteed Mortgage Refinancing



*Note:* Preliminary author’s calculations using FACL 10 percent random sample of FHA mortgages as of September 2009.

**Table 3.2** Potential Streamline Refinance Loans Insured in 2009 By Source Cohort

Source Cohort	Number of Loans	Share of Total	Proportionality Factor	Adjusted Share of Total	HUD reported Share of Total
(1)	(2)	(3)	(4)	(5)	(6)
All	324,644	100.00%		100.00%	
2009	10,294	3.17%	100%	4.54%	24.86%
2008	166,207	51.20%	95%	69.67%	50.35%
2007	57,273	17.64%	60%	15.16%	11.11%
2006	57,480	17.71%	32%	8.12%	5.81%
2005	33,390	10.29%	17%	2.50%	1.76%

*Note:* Preliminary author's calculations using FACL 10 percent random sample of FHA mortgages as of September 2009.

We use the data in Table 3.2 to estimate the actual level of refinancing in 2009 by source year. Specifically, column 4 contains proportionality factors, which represent our estimates for each source year of what proportion were in fact streamline refinanced. These proportionality factors were estimated by comparing our count to the numbers reported by FHA in the annual report to Congress, which contains a table of streamline refinances by year of origin (HUD [2009], Table 6). For source year 2007, we identify 57,273 potential streamline while the FHA reports 36,587, so we select a proportionality factor of 60%, and so on. The only adjustment to this is that for source year 2008 we identify 166,207 potential streamlines while the FHA reports 165,875. Alone, this suggests a proportionality factor of some 99%: not wishing to be excessive, we adjust this down to 95%, which fits well with our LA data.

Column 5 reports the adjusted share each cohort provided to our “pool” of 2009 streamline refinances, and the last column compares these shares to the ones reported in Table 6 of the FHA's report to Congress. There is clearly a major difference between the proportion of 2009 loans that we estimate to have been streamline refinanced and the share that HUD so reports: we are not clear on the source of this difference. By design, the match between estimated proportions from our calculations and the numbers in the annual report is close once one disregards 2009.

Our total 2009 issuance across all cohorts matches well with information in the annual report (HUD [2009, Table 1). Our estimates imply that FHA-to-FHA refinancing in 2009 has been 42% as large as purchase, while the HUD estimate is also 42%. Our estimate is that non-FHA, non-purchase issuance is 49% of purchase, while the HUD estimate is 50%.

#### **D. Initial LTV for Streamline Refinances**

The recent audit report incorrectly updates the initial LTV when mortgages are streamline refinanced. This is not because of a failure to recognize the need for an adjustment, but because of the flawed methodology described on page A-9 of the 2009 report.

“Initial loan-to-value is recorded in FHA's data warehouse. Based on discussions with FHA, any LTV values recorded for streamline refinance products may refer to values recorded at the time of the original FHA loan and were considered unreliable for use in the analysis. We imputed original

LTV values for these loans for the purpose of establishing the starting point for tracking the evolution of the probability of negative equity (see description of this variable below). The imputed values were based on the mean LTV values for non-streamlined products FRM30, FRM15, and ARM loans stratified by product, beginning amortization year and quarter, and geographic location (state and county)....”

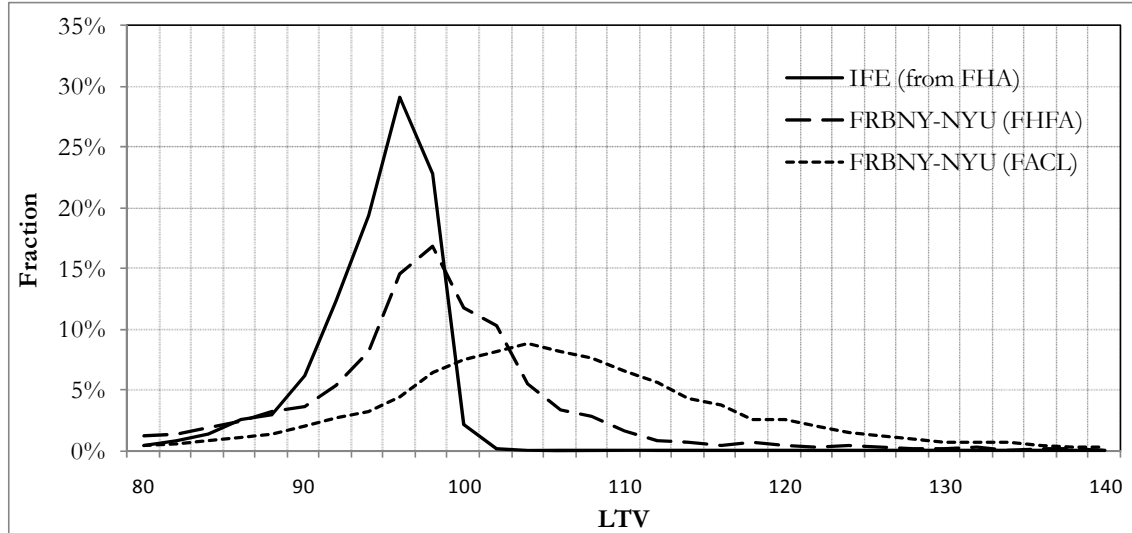
The problem with this imputation approach is that it ignores the likely declines in house values experienced by the FHA mortgages originated in 2007 and 2008 that streamline refinanced in 2009. These declines in house prices likely more than offset the debt amortization that has occurred over the year or two since these mortgages were originated. As a result, imputing the LTVs on these mortgages based on those of newly purchased or refinanced mortgages could significantly bias downward the imputed initial LTV for these loans which will lead to biased estimates of their updated LTVs used in the default analysis.

To explore the magnitude of this potential bias, we developed an alternative imputation methodology. As discussed above, we identified the set of potential streamline refinance mortgages in 2009. These were loans that prepaid with no prior delinquency over the prior 12 months. We separated these potential streamline refinance mortgages by the origination year of the earlier FHA mortgage. For each origination year, we randomly sampled using the proportionality factors listed in column 4 of Table 3.2 to generate our final sample of streamline refinanced mortgages. For each of these mortgages, we have both the initial LTV from when the mortgage was originated and the updated LTV based on when the mortgage prepaid.

Our next step involves separating the 2009 refinances into two groups: streamline refinances and refinances from non-FHA mortgages. To do this, we divide the overall refinance group into subgroups by MSA, year/quarter of origination, and initial LTV interval. We do the same for our identified streamline refinanced mortgages. For each subgroup, we randomly drop from the overall refinance mortgages an amount of mortgages equal to the number of identified streamline refinanced mortgages in that subgroup, and replace them with these identified streamline refinanced mortgages. This leaves the total number of refinanced mortgages for that subgroup unchanged, but separates them into the streamline and other refinances.

We are now in a position to compare the distribution of initial LTVs using the FHA audit methodology versus our methodology for the 2009 streamline refinanced mortgages. We present two versions of our initial LTV distribution – one based on using the FHFA home price indices to generate the current LTVs for the streamline refinances and the other using FACL’s home price indices at the ZIP code level to do this updating.

**Figure 3.2** Impact of LTV Imputation Methodology for Streamline Refinances



*Note:* Preliminary author's calculations using FACL 10 percent random sample of FHA mortgages as of September 2009.

Figure 3.2 illustrates that the bias implied by the IFE methodology appears to be quite significant for the 2009 vintage of streamline refinances. The IFE methodology applied to our data indicates that only 1.5% of streamline refinanced mortgages in 2009 started out with negative equity. Yet, when we use the FHFA price indices, some 33.4% of streamline refinances involved mortgages with negative equity.

The third distribution, which uses FACL price indices at the ZIP code level, tells an even more worrisome story. Using these indices to do the updating, 70.9% of the streamline refinances in 2009 involved mortgages with negative equity. Any bias in the initial LTV distribution carries directly over to the current LTV distribution used in the default analysis. If, as many believe, borrower default behavior is greatly exacerbated at high current LTVs of 125 and above, then the adjusted LTV distributions for the streamline refinances suggest a larger set of FHA loans that would be at risk if house prices declined by another 10 percent.

#### **IV. VALUATION ERRORS IN LA COUNTY**

Figure 3.2 raises the question of whether the FHFA indices used in the actuarial review or the FACL ZIP code-level indices are more accurate. In this section, we explore the performance of standard price indices in predicting actual transactions prices on repeat-sales in LA County. Each index can generate a predicted price of the repeat-sale as the price at initial sale multiplied by the percentage change in the index between sales. When used for this purpose, we find the FHFA index to be the least accurate method of valuation for LA County in 2009. While the Case-Shiller (CS) index and, more particularly, the FACL ZIP code-level index are less biased, the prediction errors are uniformly high, at above 25% in all three cases.



To be fair to the indices, they were not constructed for the purpose of predicting individual house prices. However, it has become common practice to use these indices to construct loan level current LTVs, and to use these LTVs to predict borrower default behavior. We provide a proof of principle that models that are explicitly designed for individual house valuation can lead to substantially lower prediction errors.

We close the section by exploring the actual technique used by FHA to take account of errors in its valuation methodology, which we find to radically understate these errors. We note also that loss prediction at FHA requires separate treatment of distress sales and non-distress sales, calling into question reliance on any single index of values.

### **A. Standard House Price Indices for LA County**

The two best known house price indices are the FHFA and Case-Shiller (CS) indices. While both are based on the repeat-sales methodology, they utilize very different underlying housing transactions. The CS index covers all repeat-sales using data from county records based on “arms length” transactions, while removing various outlying transactions. In contrast, the FHFA index uses only repeat-sales in which both the initial purchase and the ensuing sale are financed using conventional mortgages securitized by Fannie Mae or Freddie Mac. In addition to transaction prices in such trades, FHFA also uses refinance appraisals.<sup>17</sup>

For current purposes, what matters is that the indices have performed very differently in the recent period, with FHFA indices generally falling more slowly than the corresponding CS indices. This holds true in LA County, with the CS index having declined more than 40% peak to trough, as opposed to less than 30% for the FHFA index. Moreover, while the FHFA index is now at its lowest point in the current downturn, the CS index is 5% above its most recent trough. The divergence between the FHFA and CS index has been of interest to housing market analysts given its current importance (OFHEO [2008]).

To help us judge which index is less biased in its implications for repeat-sales prices in LA, FACL supplied NYU with the 2008 tax-roll file, which contains detailed information about all properties in LA County. In addition to property type (e.g. single family residence, condominium etc.), there is data on property and home characteristics. We use the file to identify single family residences, leaving 2,187,254 transactions for 971,251 distinct homes. The sales and the price information are drawn from the deeds file from 1984 to October 2009. We consider only arms length transactions that are re-sales or new constructions with either a grant deed or foreclosure document type.

We gauge the empirical accuracy of both indices by using them to estimate prices that were realized in each repeat-sale in the resulting LA transaction file. Each index can be used to generate a price-level estimate based on the last sale price and the change in index since last transaction took place. We identify repeat-sales and undertake a data cleaning process that replicates the CS methodology for repeat-sales as implemented by Standard and Poor's (S&P) for their commercial index (see Thampy [2008]). Table 4.1 shows the mean, median and standard deviation of the error [(actual less predicted) divided by predicted] in predicting repeat-sale prices of LA houses purchased since 2000

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<sup>17</sup> FHFA does produce a purchase only version of its price index.

that sold in each of 2007, 2008 and 2009. We compare the forecast error distributions using both CS and FHFA.

**Table 4.1**

Year	Mean		Median		Standard Deviation	
	FHFA	Case-Shiller	FHFA	Case-Shiller	FHFA	Case-Shiller
2007	3.78%	3.94%	0.51%	0.58%	20.61%	20.58%
2008	-10.36%	-6.66%	-11.79%	-8.15%	21.38%	22.06%
2009	-17.85%	-9.75%	-18.37%	-10.3%	26.24%	28.85%

*Note:* Author's calculations using FACL property-level data set for LA County.

The FHFA is over-predicting appreciation in repeat-sales in LA over the past two years, as is the CS index, albeit to a lesser extent. Another striking feature of Table 4.1 is the large standard error of the forecast distributions for both house price indices in each of the three years, particularly 2009. We plot the full distributions of 2009 forecast errors in Figure 4.1. These error variances would be even larger if we were estimating them in real-time. All repeat-sale price indices have the property that the estimated housing returns are revised as more housing transactions enter the data that span a particular holding period. These revisions can be quite large during periods of low transactions volume.

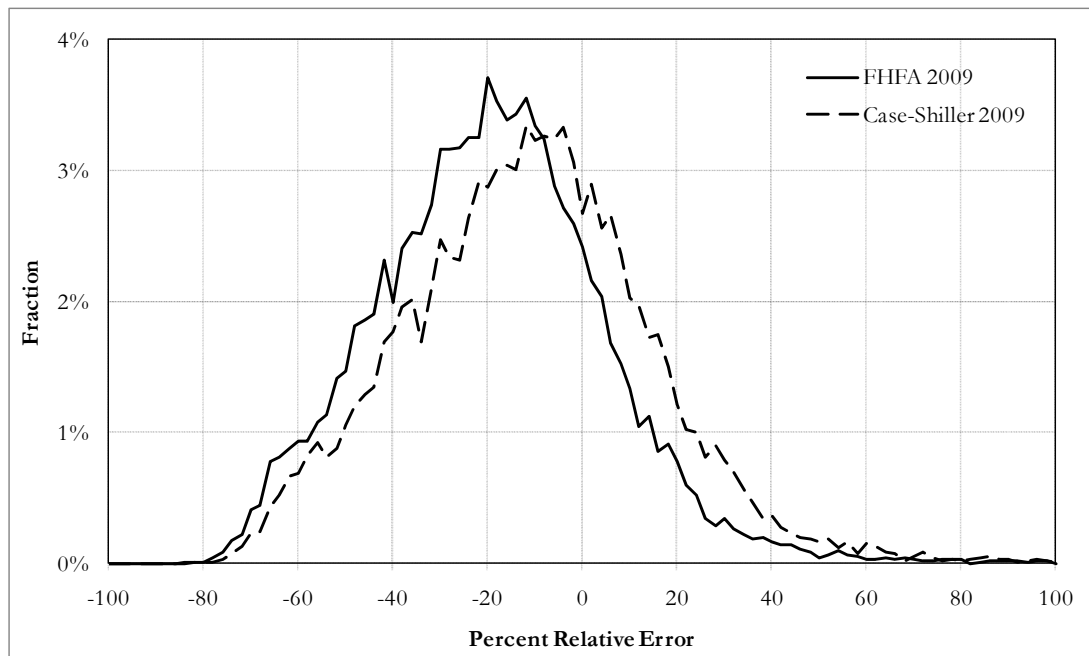
The poor performance of both indices in fitting recent LA property transactions may come as news to those of us who do not operate in the market on a day-by-day basis. An immediate consequence is that updated LTV estimates based on these house price indices should not be interpreted as having a high degree of accuracy. Not only are the errors massive in both directions in recent years, but they are also biased. The median estimate based on the FHFA index overestimates the realized value in a repeat-sale in 2009 by more than 15%.<sup>18</sup>

One natural hypothesis is that LA County is too heterogeneous an area to capture all price trends with a single index. The simplest possible fix for this is to use the FACL ZIP code-level indices rather than either FHFA or CS indices. The error distribution using these indices is presented in Figure 4.2. There are several points to note. First, the underlying sample of repeat-sales is somewhat smaller to match the LA ZIP codes for which FACL produces ZIP-level indices. Second, the mean over-prediction is significantly smaller than for FHFA, and somewhat smaller than for CS. Finally, the standard deviation of prediction errors is pretty much unchanged, remaining above 25%. Surprisingly, ZIP code indices do not noticeably narrow the distribution of the prediction errors.

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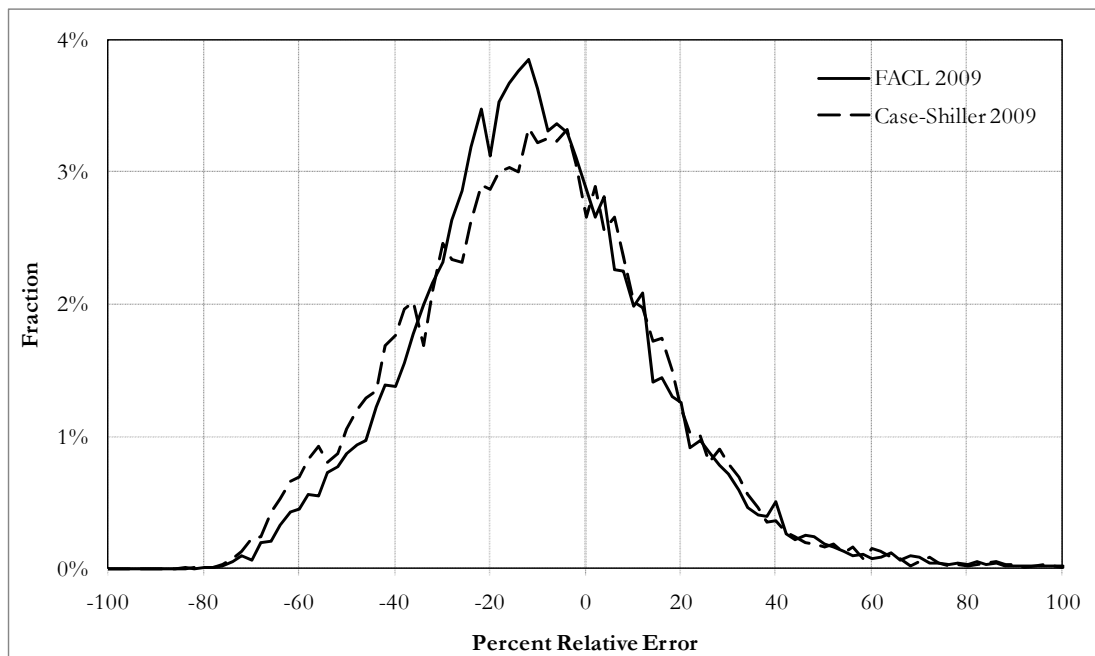
<sup>18</sup> The sign and magnitude of the biases may change over the housing cycle.

**Figure 4.1** Relative Error of Prediction Using FHFA and Case-Shiller Price Indices



*Note:* Author's calculations using FACL property-level data set for LA County.

**Figure 4.2** Relative Error of Prediction Using FACL ZIP and Case-Shiller Price Indices



*Note:* Author's calculations using FACL property-level data set for LA County.

## **B. AVAC Valuation**<sup>19</sup>

Would an even more granular method of house valuation prove more accurate? That the answer may be yes is hinted at by the performance of “automatic valuation models” (AVMs) which are strictly motivated by the desire for current accuracy. The issue in using such models is that their empirical accuracy in repeat-sales is impossible to gauge, since they are typically designed to guide current decisions (e.g. for loan origination) rather than to assess changes in value.

We introduce an approach to house valuation that estimates the change in value of each house in LA over the entire period of observation. This AVAC valuation model is designed to hew closely to the logic of appraisals, while at the same time being automatically estimated from a standardized data set. Appraisers would not value a house in Malibu only by recording the change in an LA-wide price index since the property last traded. They would use rich information on recent local transactions, with appropriate adjustments based on hedonic differences. The AVAC model adopts this approach by allowing for local attribute prices that can vary over time and space. Given its hedonic foundations, the AVAC model is fit not only on repeat-sales but also single sales, although again outliers are removed.

In estimating the model, we use both the 2008 tax-roll file and the deeds file which contains detailed information about all properties in LA County, including their addresses. This address field is used to identify precise longitude and latitude whenever possible (we match 86% of transactions) Table 4.2 compares AVAC valuation errors with those deriving from the FACL ZIP code index and the CS LA County index. Figure 4.3 then plots the distribution of errors in 2009. Note that the sample is somewhat smaller than that for figure 4.2 given that the AVAC valuation model requires property identifiers to be mapped into GPS coordinates.

**Table 4.2**

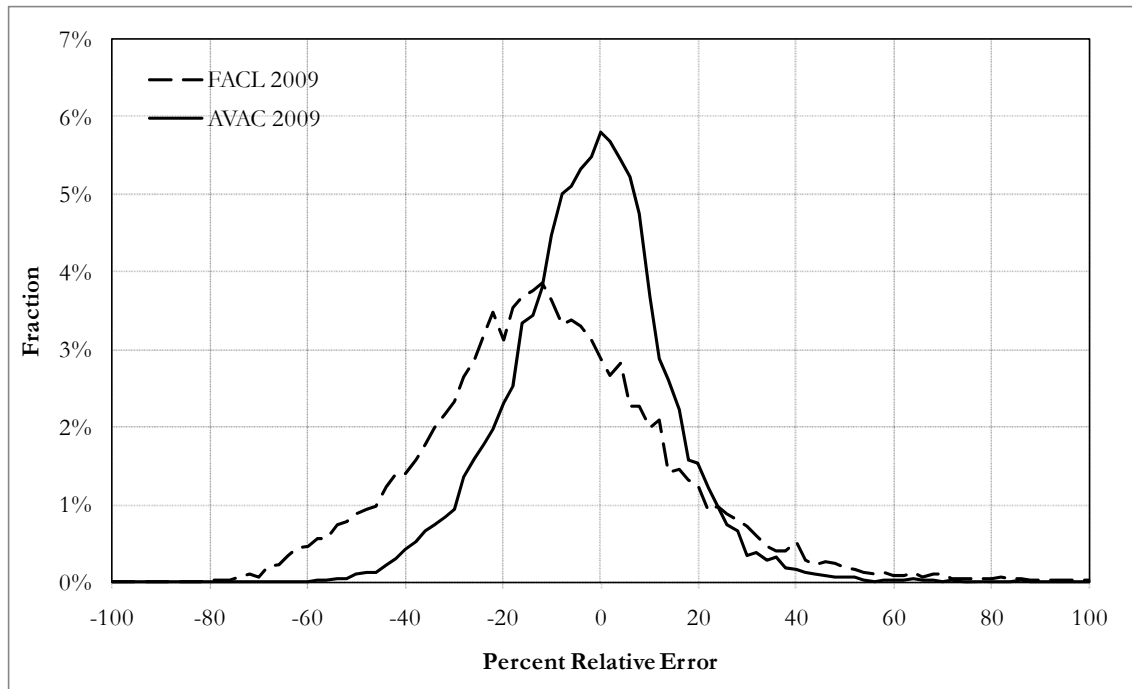
Year	Mean		Median		Standard Deviation	
	FACL	AVAC	FACL	AVAC	FACL	AVAC
2007	-1.54%	1.70%	-4.64%	0.58%	20.56%	10.38%
2008	-9.93%	-1.52%	-11.99%	-1.99%	20.26%	11.45%
2009	-8.88%	-1.46%	-10.64%	-0.98%	27.29%	16.28%

*Note:* Author’s calculations using FACL property-level data set for LA County.

The results highlight the reduction in valuation errors that may be attainable by using more granular methods to identify changes in house value (the reduction in the mean error results to some extent from the ex post nature of the valuation exercise). The reduction in the standard deviation of the error distribution is proportionately larger in 2007, when the AVAC standard deviation is approximately one half as high as the 20% level associated with all three house price indices.

<sup>19</sup> By way of disclosure, Advanced Valuations Analytic Corporation (AVAC) was formed to commercialize advanced real estate analytics. Several of the co-authors of this report (Andrew Caplin, Sumit Chopra, John Leahy, Yann LeCun) as well as NYU are equity holders, and Andrew Caplin also serves on the board.

**Figure 4.3** Relative Error of Prediction Using FACL ZIP and AVAC Price Indices



*Note:* Author's calculations using FACL property-level data set for LA County.

There is one simple refinement that will permit prediction errors to be further reduced, at least in 2008 and 2009. There is no attempt in the above calculations to identify and separate out distress sales. Given their increased prevalence, methods are being developed to measure the discount between these and non-distress sales and how it changes over time. Calculating both a distress and a non-distress valuation model would in all likelihood reduce valuation errors, although the extent of this reduction remains unknown.

Focusing on the distinction between house values in normal (non-distress) and in distress sales makes clear the many channels through which house valuation impacts FHA risk. On the one hand, the relevant value in terms of the default decision may be that in a normal sale, since this is the value relevant to an owner who decides not to default. On the other hand, if the default does occur, the price that matters for determining the loss to the FHA is the distress sale price. Hence accurate evaluation of FHA risk requires understanding house valuation in both distress and non-distress sales.

### **C. Valuation Risk in the Actuarial Review and in Practice**

Claims on the FHA MMI Fund are modeled in the actuarial review as depending on the probability that a borrower is in negative equity rather than the expected updated LTV.<sup>20</sup> This probability is calculated from an estimate of the mean and the variance of the holding period house price return

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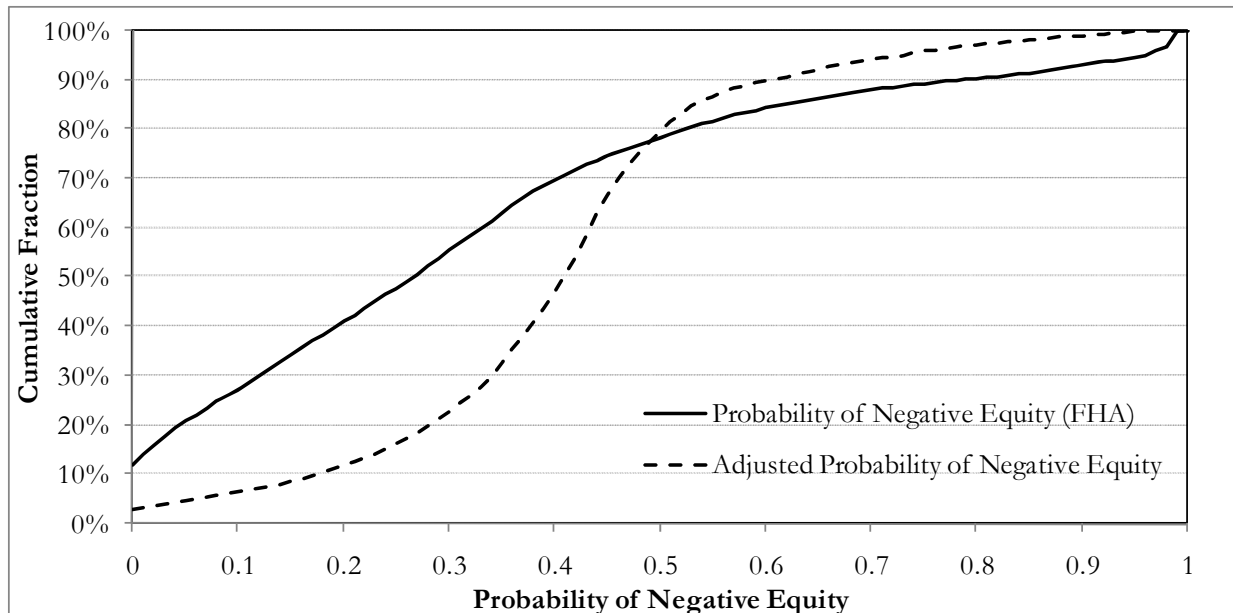
<sup>20</sup> This approach is used in Deng et al (2000) and Calhoun and Deng (2002).

for that property. Biases in the mean and/or the variance will translate into biases in the estimated probability of negative equity.

We have pointed out already the bias in the mean for the LA data. In the current analysis, we abstract entirely from this effect and explore the impact of any bias in the estimate of the variance of returns, again using our LA data to conduct the test. The purpose of this exercise is simply to illustrate how difficulties in correctly estimating the variance of house price returns can impact this probability of negative equity calculation. We use the feature of our LA data that we observe both the purchase and the sale price for properties which allow us to carry out this illustration.

We use the FHFA LA price index as well as the FHFA variance of housing returns for LA to calculate the 90 percent confidence interval for each property that sells in the period from 2007 to 2009. A test of the accuracy of the procedure is whether this 90 percent confidence interval in fact captures close to 90 percent of the actual sales prices. The variance estimate is too low if the confidence interval captures less than 90 percent of the sale prices, and is too high if it captures more than 90 percent of the sale prices. Specifically, we checked the “coverage” of the LA confidence interval for houses that were purchased from 2000 onwards and that sold between 2007 and 2009. We restricted our attention to houses that sold for less than the conforming loan limit since the FHFA variance estimates are based on transactions using conforming mortgages. The sample consisted of 20,314 matched purchases/sales. The data indicate that the 90 percent confidence intervals captured only 58 percent of the sales prices. To attain the proper coverage, we would have to scale up the estimated standard deviation of the holding period returns by a factor of 2.9. This indicates that for these three years in LA the FHFA estimated house price returns variances are significantly downward biased.

Any downward bias in the estimate of the house price returns variances will lead to downward bias in the estimate of the probability that a borrower is in negative equity. To illustrate, we calculate the probability of negative equity for active LA FHA mortgages in December 2008. We focus on this time period since it precedes the rise in streamline refinances. For each of these FHA mortgages, we calculate the probability of negative equity first using the unadjusted variance and then recalculate the probability using the adjusted variance. The median estimated probability of negative equity for this sample of FHA mortgages is 28 percent based on the unadjusted variances. When we use the adjusted variances the median increases to 42 percent. We show in Figure 4.4 the two cumulative distributions of these estimated negative equity probabilities.

**Figure 4.4:** Impact of House Price Variances on Probability of Negative Equity

*Note:* Author’s calculations using FACL property-level data set for LA County.

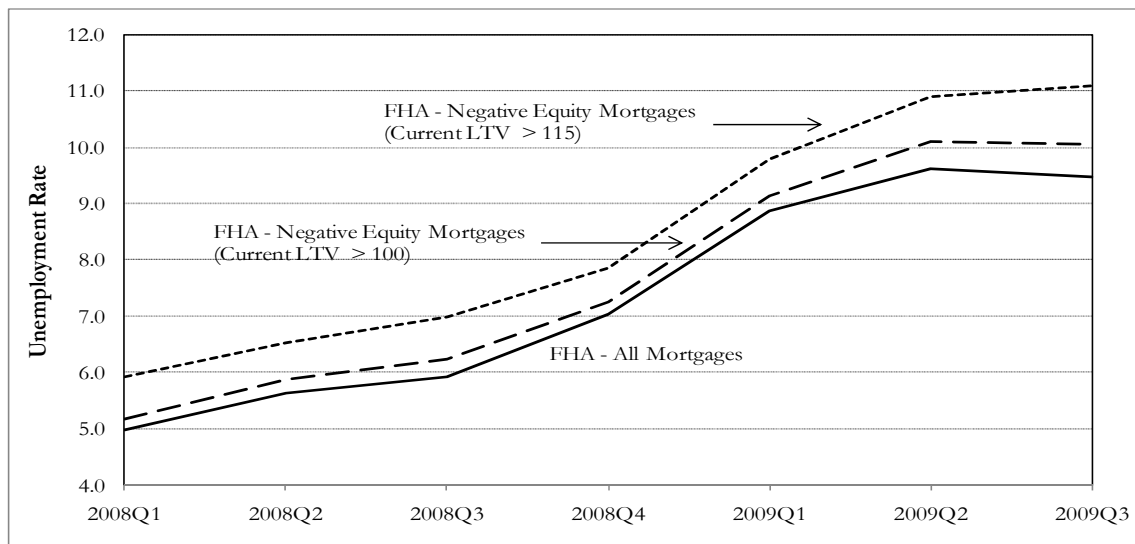
## **V. THE DOUBLE-TRIGGER HYPOTHESIS**

Gerardi, Shapiro, and Willen [2007] stress the “double trigger” hypothesis that the combination of a borrower being in negative equity and then suffering an income shock leads to a higher likelihood of default and foreclosure. Given this, the critical questions determining the extent of vulnerability of FHA mortgages are: how many of its borrowers are underwater; how far underwater they are; and how many are vulnerable to negative income shocks. Unfortunately, the analysis of the last section indicates that house valuation methods at the national level are not sufficiently robust to provide definitive answers concerning the distribution of updated LTV ratios: the estimates differ from index-to-index; all of the indices make large valuation errors; and they may also be systematically biased. However, there is one important robust finding, which is that weak local housing markets tend to be associated with weak labor markets. We show that many FHA borrowers who are significantly underwater are also dangerously exposed to unemployment risk.

With regard to index-based updated LTV computations, we have computed the entire county-wide distribution using various house price indices. We find a similar fraction of the active FHA mortgages are in negative equity using the FHFA or the FACL price indices (38.7% for FHFA versus 40.5% for FACL). Yet the estimated degree to which the FHA loans are underwater differ across the two sets of house price indices. For example, using the FHFA prices indices to update the initial LTV, we estimate that only 6.2% of active FHA mortgages have a current LTV that exceeds 115. However, using the FACL prices indices we estimate that 13.8% have a current LTV that exceeds 115 – more than double the estimate implied from FHFA.

Rather than take the current LTV estimates at face value, we use them to explore the correlation between average LTV and unemployment at the MSA level. Figure 5.1 shows three constructed time profiles for unemployment relevant for the FHA insurance fund. The baseline unemployment profile is created by taking a weighted average of MSA unemployment rates where the weights are each MSA's share in total FHA loan balances in that quarter. We contrast this to two other unemployment profiles. The first uses as the weights each MSA's share in FHA loan balances for those FHA loans estimated to be in negative equity using the FACL ZIP code-level house price indices. The second modifies the first by requiring the loans to have a current LTV exceeding 115. While LTV estimates will inherit any bias there is in the underlying index, the relative ranking of different areas may be relatively stable: house values have certainly fallen further in Las Vegas than they have in Houston, even though the actual change in price may be hard to identify in either city.

**Figure 5.1** Effective FHA Unemployment Rates



*Note:* The FHA-all mortgages rate is the MSA weighted average unemployment rate where the weights are each MSA's share in FHA outstanding mortgage balances. The FHA-negative equity mortgages rate is the MSA weighted average unemployment rate where the weights are each MSA's share in FHA outstanding mortgage balances for mortgages in negative equity (based on FACL ZIP code level house price indices).

Two features of Figure 5.1 stand out. First, the FHA portfolio of mortgages is being exposed to a rapidly rising risk of income shocks from job loss. This is not surprising given the rise in the overall unemployment rate nationally. Second, the FHA mortgages that are estimated to be in negative equity and most at risk to these income shocks are disproportionately located in MSAs that are experiencing relatively more unemployment stress than the national average. This feature is magnified as we focus in on those FHA loans that are significantly underwater (current LTV > 115). This is a particularly worrisome geographic configuration of at-risk FHA mortgages in MSAs with high unemployment rates. Unfortunately, the actuarial review does not take account of this correlation in risk factors.

## **VI. IMPROVING THE PREDICTIVE ACCURACY OF FHA RISK ASSESSMENT**



In addition to the problems identified above, there are also important omissions from the risk analysis. For example, borrowers who are using FHA mortgages to purchase homes can participate in national and state programs that may reduce their initial investment below 3.5%. Such participation has not been integrated into the risk analysis, despite the significant amounts of money involved. The current national program is a tax credit of up to \$8,000 for first-time home buyers until April 30, 2010, or up to \$6,500 to current home owners purchasing a new or existing home between November, 2009 and April 30, 2010.<sup>21</sup> Home buyers who qualify for down-payment assistance and take out the maximum LTV mortgage allowed by the FHA may have to put essentially none of their own money down. The ability of a borrower to save up for a downpayment may be an important screening device in terms of reducing default rates. This effect can operate in addition to the incentive effects from having downpayment money (from any source) that is at risk in a default.

This raises analogies with the FHA “down-payment assistance programs” of the past. These programs allowed the borrower to receive down-payment assistance from a variety of sources including relatives, non-profits and government. Loss rates on these loans ended up higher than for loans without this down-payment assistance. For example, the 2008 audit indicates a loss rate for loans guaranteed in 2003 with no down-payment assistance of 2.86%. In contrast, the loss rate for loans with down-payment assistance from government sources was 9.39%, and was 11.59% if the assistance was from a non-profit.<sup>22</sup> Understanding the reasons for these high loss rates is important. Carefully tracking whether FHA mortgages that used federal and/or state tax credits also experience relatively high loss rates would shed light on these reasons as well as inform future policy decisions on such tax credits.

A second omission is that, while mortgage modifications and partial claims are increasingly prevalent, they are not incorporated in the risk analysis. Even the streamline refinances that have been undertaken are best viewed as interest rate and term modifications. The FHA annual report to Congress stresses the reduction in the monthly payment for the mortgages that undergo a streamline refinance.<sup>23</sup> Yet the question of the effectiveness of interest rate and term modifications is not addressed. Is this the best modification strategy for FHA given that it owns the credit risk for these mortgages - particularly for those mortgages that are underwater?<sup>24</sup> For subprime mortgages that are underwater, Haughwout *et al* [2009] demonstrate that reducing the monthly payment by cutting

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<sup>21</sup> As the name indicates, this is a credit that is received after filing tax returns. The FHA has instructed its lenders to not apply these tax credits towards the minimum downpayment (see HUD, Mortgage Letter 2009-15). Yet various bridge loans are available (NAR [2009]). Such bridge loans, being in general unsecured, are not recorded along with the first lien. The maximum bridge loan is determined based on the value of the property being purchased and the income of the applicant. If the property is sold within a three year window, the full amount of the tax credit will be recouped on the sale.

<sup>22</sup> See IFE [2008] Exhibit IV-II, page 55. Down-payment assistance from non-profits was often financed by the seller.

<sup>23</sup> See U.S. Department of Housing and Urban Development [2009], page 1.

<sup>24</sup> This same modification strategy of reducing monthly payments through interest rate reductions and term extensions is the template of the Home Affordable Modification Program modification program as well as the Home Affordable Refinance Program for GSE guaranteed mortgages.

principal is much more effective at lowering the post modification default rate than an equivalent reduction in the monthly payment achieved by cutting the interest rate and extending the term.

Time will tell how successful the streamline refinance modification program is as a modification strategy. It is important, however, that the data is collected in such a manner as to enable a careful analysis of the program. This requires that the original FHA mortgage and the streamline refinanced FHA mortgage are recombined into a single data record so that a more accurate current LTV ratio can be calculated at each month since origination. A single data record would also allow auditors and analysts to control for the true age of the modified mortgages as well as their full payment history.

The actuarial review also does not take advantage of information on delinquency, a clear leading indicator of later foreclosure. As noted in the introduction, this significantly reduces the potential of the review to shed light on evolving default risk. It is no surprise that recent actuarial reviews have systematically underestimated the ensuing degradation in the FHA insurance fund.

We offer six suggestions that we believe could be implemented quickly to improve the ability to monitor FHA risk.

- 1) **Incorporate Servicing Data on Delinquencies into FHA Audits:** Servicing data with information on delinquencies could be merged into the FHA data warehouse. The default analysis contained in the annual audit reports could be expanded to examine the trends in various levels of delinquency of FHA mortgages and the implications that this has for future claims to the FHA mutual insurance fund.
- 2) **Improve Measurement of Current LTVs:** At the center of all models of default behavior sits the updated LTV, measuring whether or not the homeowner is underwater, and if so how far. This is particularly critical to likely future default behavior in a period such as the present in which many are hit not only by falling house values, but also declining income and unemployment. Valuation methods that are more up-to-date and more granular than the FHFA index could be utilized. In addition, developing dynamic measures of loan balances is also critical for generating more accurate measurement of current LTVs.
- 3) **Track all Loan Modifications:** All FHA loan modifications such as streamline refinances could be tracked so that their post modification performance can be calculated. The streamline modification data could link the prior and subsequent FHA mortgages into a single record. This will permit the audit analysis to properly calculate the updated LTV at the modification date, as well as to properly control for the age of the loan and the payment history in the risk analysis.
- 4) **Track Participation in Taxpayer-Funded Programs:** It is important to record which borrowers use each homebuyer tax credit at the state and national levels so that the performance of the resulting loans can be tracked.
- 5) **Update Default Modeling:** As indicated, default modeling could be modified to address the following three points at a minimum.
  1. As noted above, it is important to model the various stages of delinquency and any modifications that are undertaken. Mortgages that ultimately default may spend time in various stages of delinquency. There may also be additional lags due to backlogs in legal and

regulatory aspects of the foreclosure process, with an additional lag before the claim is paid by FHA.

2. The current default model does not allow for interactions between current LTV, DTI, and FICO in their impact on default. The joint behavior of risk factors must be taken into account, especially in light of the double-trigger hypothesis whereby underwater homeowners default at a far faster rate when income falls.<sup>25</sup>
  3. Currently a single model is estimated for a long period despite massive changes in market structure, refinancing options, etc. It is important to check the robustness of the estimation results to how far back in history the estimation sample is constructed - that is, allow for the possibility that changes in the mortgage market and borrowers limits the usefulness of early history for predicting future claims.
- 6) **Use Monte Carlo Methods to Simulate Future House Values:** The mandate of the actuarial review is to predict out many years the risk of loss associated with current FHA insurance guarantees. Such loss projection requires consideration of future house price trajectories. In the current audit, even the worst case analysis has home prices rising continuously from 2011 onwards (IFE [2009], Appendix D). It is crucial to develop a Monte Carlo based approach to stress testing that incorporates more stressful environments.

We make two additional suggestions that could support the long run integrity of risk assessment at FHA.

- 7) **Focus the Actuarial Review only on Existing Business:** The actuarial review indicates optimism that any losses on the current FHA guarantees will be more than made up by profits on future guarantees (IFE [2009], p. 14). Given the difficulty in accurately predicting future business flows, the audit analysis could be limited to the profitability only of the current books of business.
- 8) **Expand Data Access:** The best way to keep FHA risk analysis at the frontier is to open up access to the data to outside researchers. An “open source” approach would increase the degree of research done on the FHA portfolio and identify areas for improvement in the risk analysis. This is also a way to leverage the existing budget that the FHA has to conduct its risk analysis.

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<sup>25</sup>This point was also stressed by Schnare [2009].

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