intends to use a repeat sales index based on sales (or appraisals undertaken by borrowers in conjunction with refinancing the mortgages) of the Enterprises' owned and guaranteed portfolios (see "House Price Indexes" below).

Models of mortgage default and prepayment (see "Models of Default and Prepayment" below) emphasize the importance of LTV because of its direct relationship to homeowner's equity. defined as the difference between the value of a property and the outstanding principal balance of the related mortgage. These models differ in their treatment of house price changes and with regard to how changes in equity affect default and prepayment. For example, one approach assumes that defaults occur only among loans with negative equity.<sup>17</sup> House price indexes only provide estimates of the average change in property values between two dates. Because changes in individual property values are not continuously observed, simulation models have been used to characterize the distribution of changes in house prices relative to the market average. Estimates of the percentage of loans with negative equity and estimates of default rates can be derived from these distributions.

This approach assumes that homeowner's equity includes not just the difference between property value and outstanding loan amount, but also the current value of the mortgage to the borrower. A below-market rate loan has positive value. The precise value of the mortgage depends on the loan interest rate relative to the current market rate and the borrower's expectations about future interest rates and mobility. A borrower whose loan has a fixed contract rate below current market vields has more to lose by defaulting than a borrower with a note rate above the current market rate.

*Question 4:* What is the appropriate way in which to adjust the LTVs of mortgages in the stress test?

*Question 5:* If estimates of the distribution of house price changes are used to adjust the LTVs of mortgages, what is an appropriate method, e.g., stochastic process?

*Question 6:* In what manner, if at all, should OFHEO incorporate mortgage value as a factor affecting defaults?

## Mortgage Types

## Single Family

The Act requires that the stress test consider differences in mortgage types (single family or multifamily, fixed or adjustable rate, first or second lien, owner-occupied or investor owned, positive or negative amortization, alternate term to maturity, etc.).<sup>18</sup> Risk characteristics of different types of mortgages vary considerably. Because of the fundamental differences between single family and multifamily mortgage risk, we discuss the latter in a separate section below.

Given that OFHEO plans to establish the stress benchmark based on single family, 30-year, fixed-rate mortgages, the Act calls for OFHEO to identify the worst rates of default and losses for any time period or region.<sup>19</sup> The Enterprises may not have held certain types of single family mortgages in the stress benchmark OFHEO identifies. Other types of single family mortgages held during the stress benchmark may have experienced their worst defaults and losses at other times or in other regions.

Alternative approaches could include use of multivariate models to estimate separate equations for different mortgage products or different mortgage features, default rates representing some multiple of the standard single family mortgage, or some combination of these approaches (see "Models of Default and Prepayment" below).

*Question 7:* How should OFHEO relate other types of mortgages to a single stress benchmark developed based on single family, 30-year, fixedrate mortgages?

## Multifamily

While single family properties are both a source of shelter and, for most families, their most valuable financial asset, multifamily properties are primarily income-producing businesses for their owners. Multifamily loans are less homogeneous and subject to a more diverse set of risks than single family loans. The multifamily market has more pronounced business cycles and is heavily affected by tax and regulatory policy. Patterns of losses over time for multifamily loans have not tracked those of the single family market. The Enterprises operate several different types of multifamily programs, some of which rely heavily on lender recourse or other forms of credit enhancement with differing risk characteristics.

Data needs in analyzing multifamily loans are greater than for single family loans and yet the quality of such data is poorer. Data are incomplete and cover a smaller portion of the multifamily market than the single family market. There is also a dearth of research on critical multifamily credit risk issues.

For the owner of a multifamily property, net operating income (NOI) plays a more important role than equity in the decision to default. A property's debt service coverage, rather than LTV ratio, may be the most important indicator of multifamily credit risk, yet available data can only provide a short time-series for income. Multifamily value indexes are problematic because there are fewer transactions than in the single family market and property appraisals are less reliable. Appraisals are less reliable due to the varying methodologies used to calculate multifamily property income and the application of so-called "capitalization rates" to NOI.20

Prepayments play a far less significant role in the analysis of multifamily credit risk than single family credit risk because "lockouts" and yield maintenance agreements effectively prevent most multifamily borrowers from refinancing to take advantage of declining interest rates. The Enterprises' activity in the multifamily market is expected to increase significantly in future years in order to meet the affordable housing goals established under the Act.<sup>21</sup> Thus, the treatment of multifamily risks will be increasingly important.

*Question 8:* How should existing and emerging multifamily data sources be identified?

*Question 9:* What are alternative empirical and theoretical approaches to the estimation of multifamily credit risk?

*Question 10:* How should the projection of defaults and losses on the Enterprises' multifamily portfolio be related to a single family stress benchmark?

## General Price Inflation

The Act requires that OFHEO adjust credit losses in the stress test when large increases in interest rates imply higher rates of general price inflation.<sup>22</sup> If the ten-year CMT yield is assumed to increase by more than 50 percent over the average yield during the preceding

originated earlier. OFHEO would use house price indexes for this purpose.

<sup>&</sup>lt;sup>17</sup> See Foster and Van Order, supra, (1984, 1985).

<sup>&</sup>lt;sup>18</sup> Sections 1361(b)(1) and (d)(2) (12 U.S.C. 4611(b)(1) and (d)(2)).

<sup>&</sup>lt;sup>19</sup>Section 1361(a)(1) (12 U.S.C. 4611(a)(1)).

<sup>&</sup>lt;sup>20</sup> Government Accounting Office, "Federal Home Loan Mortgage Corporation: Abuses in Multifamily Program Increase Exposure to Financial Losses" (Oct. 1991); J.M. Abraham, "On the Use of a Cash Flow Time-Series to Measure Property Performance," forthcoming in Journal of Real Estate Research; and J.M. Abraham, "Credit Risk in Commercial Real Estate Lending, "Federal Home Loan Mortgage Corporation, 1994 presented at the 1994 meetings of the American Real Estate and Urban Economics Association (available from OFHEO).

<sup>&</sup>lt;sup>21</sup> Sections 1331–1336 (12 U.S.C. 4561–4566). <sup>22</sup> Section 1361(a)(2)(E) (12 U.S.C. 4611(a)(2)(E)).