A broad, inclusive definition of ''central city'' that includes all areas of all central cities would include the ''remaining'' portions of central cities. Figure B.1 shows that these areas, which account for approximately half of the central city population, appear to be well served by the mortgage market. They are not experiencing problems obtaining access to mortgage credit.[26]

HUD's definition also targets in the suburbs as well as in central cities—for example, the average denial rate in underserved suburban areas is almost twice that in the remaining areas of the suburbs. Low-income and high-minority suburban tracts appear to have credit problems similar to their central city counterparts. These suburban tracts, which account for 23 percent of the suburban population, should also be included in the definition of underserved areas. Thus, the advantage of HUD's targeted definition of underserved areas is illustrated by sharp differences in measures of mortgage access between served and underserved areas within both central cities and suburbs.

William Shear, James Berkovec, Ann Dougherty, and Frank Nothaft, economists at Freddie Mac, recently completed an analysis of mortgage flows and application acceptance rates in 32 metropolitan areas that also supported a targeted definition of underserved areas.[27] These researchers regressed the number of mortgage originations per 100 properties in the census tract on several independent variables that are intended to account for some, but admittedly not all, of the demand and supply (i.e., credit risk) influences at the census tract level. Examples of the demand and supply variables at the census tract level include: Tract income relative to the area median income, the increase in house values between 1980 and 1990, the percentage of units boarded up, and the age distributions of households and housing units. The tract's minority composition and central city location were included to test if these characteristics are associated with underserved neighborhoods after controlling for the demand and supply variables. Several of their findings relate to the issue of defining underserved areas:

- Black and Hispanic census tracts have lower rates of applications, originations, and acceptance rates. For instance, the regression estimates suggest that all-White census tracts would have an average 10.5 originations per 100 properties, while all-Black and all-Hispanic census tracts would have about 7 originations per 100 properties.
- Tract income influences mortgage flows—tracts at 80 percent of median income are estimated to have 8.6 originations per 100 owners as compared with 10.8 originations for tracts over 120 percent of median income.
- Once census tract influences are accounted for, central city location has only a minimal effect on credit flows.

Shear, Berkovec, Dougherty, and Nothaft recognized that it is difficult to interpret their estimated minority effects—the effects may indicate lender discrimination, supply and demand effects not included in their model but correlated with minority status, or some combination of these factors. They explain the implications of their results for measuring underserved areas as follows:

* * * While it is not at all clear how we might rigorously define, let alone measure, what it means to be underserved, it is clear that there are important housing-related problems associated with certain location characteristics, and it is possible that, in the second or third best world in which we live, mortgage markets might be useful in helping to solve some of these problems. We then might use these data to help single out important areas or at least eliminate some bad choices. * * * The regression results indicate that income and minority status are better indicators of areas with special needs than central city location.[28]

Robert Avery, Patricia Beeson, and Mark Sniderman of the Federal Reserve Bank of Cleveland recently presented a paper specifically addressing the issue of underserved areas in the context of the GSE legislation.[29] Their study examines variations in application rates and denial rates for all individuals and census tracts included in the 1990 and 1991 HMDA data base. They seek to isolate the differences that stem from the characteristics of the neighborhood itself rather than the characteristics of the individuals that apply for loans in the neighborhood or lenders that happen to serve them. Similar to the two studies of redlining reviewed in the previous section, Avery, Beeson and Sniderman hypothesize that variations in mortgage application and denial rates will be a function of several risk variables such as the income of the applicant and changes in neighborhood house values; they test for independent racial effects by adding to their model the applicant's race and the racial composition of the census tract. Econometrics are used to separate individual applicant effects from neighborhood effects.

Based on their empirical work, Avery, Beeson and Sniderman reach the following conclusions:

- The individual applicant's race exerts a strong influence on mortgage application and denial rates. Black applicants, in particular, have unexplainably high denial rates.
- Once individual applicant and other neighborhood characteristics are controlled for, overall denial rates for purchase and refinance loans were only slightly higher in minority census tracts than non-minority census tracts.[30] For white applicants, on the other hand, denial rates were significantly higher in minority tracts.[31] That is, minorities have higher denial rates wherever they attempt to borrow but whites face higher denials when they attempt to borrow in minority neighborhoods. In addition, Avery *et al.* found that home improvement loans had significantly higher denial rates in minority neighborhoods. Given the very strong effect of the individual applicant's race on denial rates, Avery *et al.* note that since minorities tend to live in segregated communities, a policy of targeting minority neighborhoods may be warranted.
- The median income of the census tract had strong effects on both application and denial rates of purchase and refinance loans, even after other variables were accounted for.
- There is little difference in overall denial rates between central cities and suburbs, once individual applicant and census tract characteristics are controlled for.

Avery, Beeson and Sniderman conclude that a tract-level definition would be a more effective way to define underserved areas in the GSE regulation than using central city as a proxy.

Insights Gained About Underserved Areas. HUD's analysis of 1993 HMDA data has led it to propose a targeted definition of central cities, rural areas, and other underserved areas based on the income and minority characteristics of the census tract. The studies by Shear, *et al.* and Avery, Beeson, and Sniderman support a targeted approach to defining underserved areas. HUD recognizes that the mortgage origination and denial rates that served as the basis for determining the tract income and minority thresholds in its definition of underserved areas are the result of a multitude of risk, demand and supply factors operating at the individual applicant and neighborhood levels that analysts have yet to completely disentangle and interpret. Like the above researchers, HUD believes that this technical concern, although important, does not negate the fact that there are widespread and pervasive differences in mortgage credit flows between neighborhoods and that these differences suggest a targeted rather than a broad approach for defining underserved areas. The next section will also document that there are equally widespread and pervasive differences in socioeconomic conditions across neighborhoods, which also supports a targeted definition of central

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[26] Section D below will provide additional reasons why central city location should not be used as a proxy for underserved areas.

[27] William Shear, James Berkovec, Ann Dougherty, and Frank Nothaft, ''Unmet Housing Needs: The Role of Mortgage Markets,'' presented at mid-year meeting of the American Real Estate and Urban Economics Association, June 1, 1994. See also Susan Wharton Gates, ''Defining the Underserved,'' *Secondary Mortgage Markets*, 1994 Mortgage Market Review Issue, pp. 34–48.

[28] Shear *et al.*, p. 18.

[29] See Avery, *et al.*

[30] Avery *et al.* find very large unadjusted differences in denial rates between white and minority neighborhoods, and although the gap is greatly reduced by controlling for applicant characteristics (such as race and income) and other census tract characteristics (such as house price and income level), a significant difference between white and minority tracts remains (for purchase loans, the denial rate difference falls from an unadjusted level of 16.7 percent to 4.4 percent after controlling for applicant and other census tract characteristics, and for refinance loans, the denial rate difference falls from 21.3 percent to 6.4 percent). However, when between-MSA differences are removed, the gap drops to 1.5 percent and 1.6 percent for purchase and refinance loans, respectively. See Avery, *et al.*, p. 16.

[31] Avery, *et al.*, page 19, note that, other things equal, a black applicant for a home purchase loan is 3.7 percent more likely to have his/her application denied in an all-minority tract than in an all-white tract, while a white applicant from an all-minority tract would be 11.5 percent more likely to be denied.