Staff Studies in Housing and Community Development
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Office of Policy Development and Research

Cityscape: A Journal of Policy Development and Research strives to share HUD-funded and other research on housing and urban policy issues with scholars, government officials, and others involved in setting policy and determining the direction of future research.

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PD&R

Cityscape

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Paul K. Gatons
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As with the articles in this issue, this introduction reflects the views of the authors and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

This issue of *Cityscape* diverges from the journal's usual format of organizing a set of articles around a single subject; instead, the set of articles in this issue presents a unique direction. It highlights inhouse research from the U.S. Department of Housing and Urban Development's (HUD's) Office of Policy Development and Research (PD&R).

PD&R provides expert analysis and research on housing markets, program evaluation, and policy analysis to HUD. PD&R is a compact, multidisciplinary organization composed of experts from a variety of housing and economic development research disciplines, including anthropology, architecture, business, economics, engineering, law, planning, political science, public policy, sociology, urban affairs, computer science, and geography. These experts provide objective data and independent analyses that enable policymakers to develop informed government policy.

PD&R produces publicly available information on housing needs and market conditions, evaluates HUD programs, develops analyses of current policy issues, and conducts research on a wide range of housing and community development issues as well as advances in housing technology. This information is accessible at www.huduser.org.

In this issue of *Cityscape*, the first article, "Home Equity Conversion Mortgage Terminations: Information To Enhance the Developing Secondary Market," is written by Edward J. Szymanoski and Theresa R. DiVenti from PD&R and James C. Enriquez from the Office of Housing. The article examines loan level data in the Federal Housing Administration's (FHA's) reverse mortgage program, also known as the Home Equity Conversion Mortgage (HECM) program. Szymanoski, DiVenti, and Enriquez analyze historical HUD data on HECM loan terminations to determine annual hazard and survival rate tables for HECM loans by the age and type of borrower. They also examine termination experiences among the different groups. The results of this analysis are critical not only for program operations and private market product development but also for developing an effective secondary market for HECM loans.

Todd Richardson, in "Analyzing a Community Development Needs Index," examines the most recent index developed by HUD to determine how well the Community Development Block

Grant (CDBG) program targets funds to its grantees based on their relative needs. He also shows how factor analysis can be used in different ways to reduce many variables into a few variables measuring different patterns of distress. He compares two approaches with the 2000 census data and reaches the same basic conclusions about what key variables are important for demonstrating community development need. Richardson's discourse then turns to examining the wide range of policy choices regarding how to weight those variables in determining what types of need are considered a higher priority for funding than others. He concludes that it is in the weighting of the variables used in the White House Administration's proposal for changing the formula, rather than the formula variables themselves, that the debate on improving the formula should focus.

"The Value of the Sunshine Cure: The Efficacy of the Real Estate Settlement Procedures Act Disclosure Strategy," by Mark D. Shroder, explores the potential impact of the Real Estate Settlement Procedures Act (RESPA), which regulates the provision of services involved in the sale of most single-family homes in the United States. The intent of RESPA is to protect consumers by regulating the completeness and timing of disclosure to homebuyers. In the article, Shroder poses four essential empirical questions on the effects of RESPA on social welfare. Given the small sample of mortgages issued by the FHA in this study, however, the author provides only tentative conclusions in response to these questions. First, are lending and title fees large enough to be worth regulating? Second, is the Good Faith Estimate, mandated by RESPA, an unbiased and consistent estimate of lending and title fees? Third, does state law significantly affect closing costs? Finally, does RESPA achieve fairness in the negotiating position of buyers and sellers relative to service providers? At the end of his analysis, Shroder determines that RESPA does not achieve fairness.

Meena Bavan, in "Does Housing Discrimination Exist Based on the 'Color' of an Individual's Voice?" uses extensive data from the Housing Discrimination Study (HDS) 2000, sponsored by HUD and conducted by the Urban Institute, to address the issue of whether housing discrimination exists based on the "color" of an individual's voice; that is, does linguistic profiling enter into an individual's ability to make an appointment to view a rental or sales housing unit. The HDS 2000 study was conducted from a nationally representative sample of 20 metropolitan areas with a population greater than 100,000 and with significant African American and/or Hispanic minority populations. Linguistic profiling occurs when a person makes judgments over the telephone about the character of the individual they are talking to; in this case, judgments that are based on race. This study finds little association between race and the ability to make an appointment over the phone to view a rental or sales unit. It finds that the predicted probability of making an appointment to inquire about a rental or sales unit is similar across social and ethnic groups, varying slightly at around 97 percent. Using data from the HDS 2000 study, Bavan uses a logit model regression to determine if a pattern exists between a minority caller and his or her ability to make appointments with housing rental or sales agents. Because the purpose of the HDS study was not to examine racial linguistic profiling, Bavan's conclusions are limited and may require further study.

"Ten Years of Smart Growth: A Nod to Policies Past and a Prospective Glimpse Into the Future," by Regina C. Gray, provides an overview of progress and challenges of the smart growth movement in the 10 years since the first smart growth programs were enacted. Smart growth initiatives seek to remove barriers to homeownership, provide adequate public facilities, and increase employment opportunities by providing access to valuable land resources, limiting urban sprawl, and regulating

land use. The article traces the history of the smart growth movement, addresses how smart growth influenced growth management policies at local and state levels, and describes how it is now guiding policies at state and federal levels. Gray concludes the article by assessing how the smart growth movement is currently shaping local and federal government policies regarding city planning and urban growth and by describing best practices and innovative approaches that governments at all levels are implementing.

Although most research in the field of urban and regional economics focuses on intraregional variations, the article by Robyn K. Welch, John I. Carruthers, and Brigitte S. Waldorf, "Public Service Expenditures as Compensating Differentials in U.S. Metropolitan Areas: Housing Values and Rents," examines how public service expenditures contribute to *interregional* variations in housing values and rents. The research uses an econometric analysis of housing values and rents in a national data set of metropolitan counties to address four questions. Do public service expenditures help explain interregional variation in the cost of housing? What types of spending make the most difference? How does their effect on housing values compare to their effect on rents? Do these effects change through time? The findings suggest that police protection makes the most difference for owners and renters alike, with education and fire protection, respectively, being close seconds. In addition, certain services have a more enduring effect than others. The article adds to the existing body of knowledge by linking a broad spectrum of public goods and services to the place-to-place cost of housing comparisons.

The next two articles discuss the subject of housing affordability for low-income renters. Both of these articles build on PD&R's development of "worst case needs" for housing assistance, chiefly carried out by Kathryn P. Nelson during her tenure with PD&R. During the 1980s, PD&R developed the "worst case needs" approach to estimate the need for affordable housing, with input from congressional committees, particularly the Senate Committee on Appropriations. PD&R continues to issue regular reports on this subject.

The first article on this subject, "Duration of Rent Burden as a Measure of Need," is written by Scott Susin, an economist with the U.S. Census Bureau, who regularly works with PD&R through a cooperative contract. The article builds on an analysis included in a 2005 PD&R worst case needs report, "Affordable Housing Needs: A Report to Congress on the Significant Need for Housing," and analyzes the length of time low-income families experience periods of high housing costs, defined as paying more than half their income for rent. The analysis uses data from the Census Bureau's Survey of Income and Program Participation, a nationwide survey of household incomes, labor force information, program participation and eligibility data, and general demographic characteristics. The analysis shows that very low-income families often swing in and out of high-rent-burden status, especially if they have a nonelderly or nondisabled head of household.

The second article on housing affordability, "Is There Enough Housing To Go Around?" by David A. Vandenbroucke examines whether the supply of affordable rental housing stock is available to meet the number of low-income renters. Vandenbroucke uses American Housing Survey data to examine the distribution of housing supply relative to demand. He begins with the assumption that housing can be assigned to householders based on affordability and that rental unit shortages and surpluses can be identified by income ranges. Not all affordable units are available, however, because some

of these units may be occupied by higher income renters. Vandenbroucke restricts the analysis to units that are affordable, available, and adequate. Using this framework, he examines specific issues, such as rental supply by income class, variation of rental units by location, the sufficiency of the Fair Market Rent (FMR) standard, changes in housing supply over the period 1985 to 2003, and the relationship between supply and crowding. He concludes that affordable, available, and adequate stock is sufficient to house only 89 percent of all rental households; units renting for less than the FMR are available for only 70 percent of all rental households; nonmetropolitan areas and the Midwest have more available rental stock; and about 5 percent of all renter households live in crowded households.

"Geographic Information Systems Supporting Disaster Response and Recovery," by Todd Richardson and Robert Renner, describes the extensive use of Geographic Information Systems (GIS) by HUD in response to national disasters, specifically those created by Hurricanes Katrina, Rita, and Wilma. GIS data were used to provide information and analyses on the disasters' impacts on the housing stock and the people who lived in those homes. The data were also used to inform policymakers on decisions they needed to make in response to the aftermath of the disasters and to support data analysis used in making funds allocation decisions, such as deciding how supplemental appropriations of CDBG funds should be given—to assist individual jurisdictions or to facilitate long-term disaster recovery. In general, GIS data enabled policymakers and planners to decide how to estimate the impact of the disaster areas and to judge how federal and local resources could facilitate long-term recovery.

Dianne T. Thompson's study, "Evaluating Length of Stay in Assisted Housing Programs: A Methodological Note," introduces new methods and approaches that augment findings from previous research on tenants' length of stay in assisted housing programs. First, most previous research used mean and median calculations for a single program year, but the present study evaluates data from an 8-year period, from 1995 to 2002. Second, largely due to data limitations, prior research has generally focused on current assisted households who continue to receive housing assistance. This new research includes data for households that have exited the programs (former households). By including former households, this study gains a broader perspective on housing tenure. Third, this study identifies multiple program participants, or mixed households, identified as those who move between public housing and housing voucher programs across the 8-year study period. Fourth, this study includes participants who stay in assisted housing for very short durations (less than 6 months). By including this subgroup, the analysis may reflect an administrative data collection problem or may suggest some other phenomenon among assisted housing recipients needing further investigation. Fifth, this study systematically identifies data gaps, logical inconsistencies, and out-of-range data in the file by using a data quality process that goes beyond what has been done in past studies. Finally, and perhaps most importantly, this study presents tenure estimates for assisted households based on median survival time, which may be more realistic than calculations that rely solely on mean and median summary statistics. Furthermore, measurements of housing tenure based on mean and median survival time may underestimate tenure because current recipients have not yet left the program. Using a life-table method, including the median survival time, however, will produce statistics that more accurately and realistically measure tenure in assisted housing programs.

Home Equity Conversion Mortgage Terminations: Information To Enhance the Developing Secondary Market

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This article reflects the views of the authors and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

This article examines loan terminations under the U.S. Department of Housing and Urban Development's (HUD's) reverse mortgage *insurance program formally known as the Home Equity Conversion Mortgage (HECM). Demand for HECM loans is increasing and may continue to rise in the future as the baby boom generation enters its retirement years. An efficient secondary market would help the HECM program realize its full market potential to meet this growing demand. Information for investors to gauge the future performance of HECM loans has not been widely available but is critical to help the secondary market mature. This article addresses the need for information by analyzing HUD historical data on HECM loan terminations—a major risk factor in assessing loan performance. Reverse mortgage terminations are primarily driven by the timing of borrower deaths and voluntary loan payoffs associated with moving out of the mortgaged property. Thus, borrower age and type (specifically single female or male or couples) affect reverse mortgage termination rates. One unique feature of the HECM program (compared to other reverse mortgage products available in the market) is that it gives lenders the option to assign an active HECM loan to HUD in the event the loan balance reaches the maximum claim covered by FHA insurance. From an investor's perspective, the assignment of an active loan to HUD is the equivalent of a loan termination. The research described in this article generates annual hazard and survival rate tables for HECM loans grouped by age and borrower type and examines the impact assignments have on expected termination experiences for these groups. It finds that assignments begin to impact hazard and survival rates after policy year*

Abstract (continued)

six for all borrowers and as early as policy year four for older borrowers. Additional findings related to borrower age and borrower type are discussed.

Introduction

This article examines loan terminations for the U.S. Department of Housing and Urban Development's (HUD's) *reverse mortgage* insurance product formally known as the Home Equity Conversion Mortgage (HECM). Reverse mortgages enable homeowners to convert home equity into liquid assets. Older Americans who own their own homes and who have most of their wealth in their houses use HUD-insured HECMs and conventional (not government insured) reverse mortgages. Market interest in reverse mortgages is expanding both in the United States and internationally where rapidly aging populations are looking for alternative ways to access financial assets to raise or maintain the standard of living for the elderly.

The purpose of this article is to enhance the development of an efficient secondary market for HECM loans by providing the general public and mortgage market participants (particularly potential reverse mortgage investors) with analysis of 16 years of actual program experience on the timing of HECM loan terminations. Such detailed HECM termination experience has not been made public elsewhere. Specifically, this article provides information on discrete-time (annual) HECM loan termination and survival rates, focusing on the impacts on these rates of differing borrower ages and borrower types. The article also provides information on the impact on termination and survival rates associated with the unique assignment option feature of the HECM product that is not found in conventional reverse mortgages.

A reverse mortgage derives its name from the pattern of payments that is typically the reverse of a traditional mortgage loan used to buy a home. Specifically, with a home purchase mortgage, the lender advances funds to the borrower in a lump sum at the outset, while the borrower makes periodic repayments to the lender that eventually retire the debt. With a reverse mortgage, the pattern is the opposite: the lender advances funds periodically to the borrower, while the borrower makes no repayment to the lender until the end of the loan, when a lump sum repayment is due. HECM reverse mortgages do not require repayment as long as the borrower is alive and resides in the home. Because periodic advances to borrowers, interest on the debt, and other fees accrue, reverse mortgages such as HECMs are generally rising debt loans. Equity declines because the debt usually rises at a faster rate than property appreciation.

The HECM product, launched in 1989, has become the dominant reverse mortgage product in the U.S. market. HUD's Federal Housing Administration (FHA) provides mortgage insurance to private HECM lenders, protecting them against losses resulting from nonrepayment in full of the loans and making lenders more willing to make these loans. Nonrepayment losses would typically occur if the amount of the debt exceeds the net proceeds from the sale of the property when the loan becomes due. If a loss due to nonrepayment occurs, the lender files a claim to HUD for insurance benefits.

One feature that distinguishes the HECM product from conventional reverse mortgage products is an option that HUD gives its lenders to assign the loan to HUD when the total loan balance grows to equal 98 percent or more of the loan's *maximum claim amount*.[1] HUD offers this option (1) to increase the liquidity of these loans that have no stated term to maturity and (2) to provide lenders with full insurance coverage from losses due to nonrepayment.[2] When the balance of a HECM loan reaches 98 percent of the maximum claim, the lender may assign the loan to HUD, and HUD assumes all responsibilities for servicing the loan going forward. At the time of the assignment, HUD pays an insurance claim to the lender equal to the loan balance (up to the maximum claim). The timing of these assignments varies depending on the rates at which borrowers draw down their cash advances from the HECM loan and on the path that interest rates have followed, given that nearly all HECM loans accrue interest at adjustable rates. Loans made to older borrowers tend to get assigned sooner because older borrowers may receive larger loan advances (as a fraction of the property value) than younger borrowers.

When the initial 1989 pricing model for HUD's HECM insurance product was created, no actual program experience data existed for estimating the cashflows of reverse mortgages. The key risk factors affecting the cashflows and, consequently, the pricing of HECM insurance, are (1) borrower mortality rates and voluntary loan terminations, which together determine the timing of loan terminations and lump sum repayments; (2) interest rate changes, which affect the rate at which the debt rises; and (3) the uncertainty of future property values, which affects the net proceeds from a sale. Similar risk factors would also affect the pricing of securities backed by reverse mortgage assets. Szymanoski (1994) notes that absent actual program experience, HECM insurance was priced based on reasonable, but untested, assumptions relating to the previously mentioned factors. Regarding mortality and voluntary terminations, the original pricing assumption was that HECM loans made to borrowers of any given age would terminate in the future at a rate equal to 1.3 times the age-specific mortality rate for female borrowers.[3]

Since HUD's HECM product was launched, additional research on the risk factors affecting HECM cashflows has occurred. Some of this research on borrower mortality rates, loan termination rates, and house price appreciation for older homeowners suggests that the original HECM assumptions may need updating. DiVenti and Herzog (1992) simulated HECM pricing and cashflows using an alternative mortality model that forecasted improvements in survival rates over a 25-year period. Their findings suggest that the HECM program assumptions might have underestimated borrower survival rates. Nevertheless, Szymanoski, DiVenti, and Chow (2000) note that HUD does not collect complete data on borrowers' deaths; hence, actual HECM termination experience cannot distinguish between mortality and move-out. These authors found that for some HECM borrowers—especially for younger borrowers in their 60s at the time of loan origination—HUD's assumptions appeared to be underestimating total terminations and, therefore, overestimating loan (as opposed to borrower) survival rates. Szymanoski, DiVenti, and Chow (2000), McConaghy (2004), and Rodda, Lam, and Youn (2004) construct multivariate statistical models of HECM termination probabilities. These studies show that factors such as borrower type, house price appreciation at the metropolitan area level, and interest rates affect termination probabilities. More research into model specification may be necessary for multivariate statistical analysis to be useful in understanding HECM termination probabilities.[4]

The investment community has begun to issue securities backed by reverse mortgage assets, including the first-ever HECM-backed securities issued during August 2006. Potential exists for rapid growth in the volume of HECM securitizations in the future. On October 17, 2006, Ginnie Mae announced that it is in the process of creating a HECM mortgage-backed security (MBS) product. The first Ginnie Mae-guaranteed HECM securities are planned before the end of 2007.

According to Lehman Brothers, the investment banking firm that pioneered the first reverse mortgage security in the United States, reverse mortgages have two unique features that complicate the securitization process. First, reverse mortgages involve two-way flows of cash, unlike traditional home purchase mortgages from which cash flows only to investors. Specifically, purchase mortgage cash inflows to investors include scheduled monthly principal and interest payments plus prepayments from borrowers. Reverse mortgage cash outflows to borrowers include regular annuity payments or unscheduled line of credit draws, and cash inflows to investors include repayments of principal and accrued interest when the loan is repaid in a lump sum. Second, investors often prefer to hold current-pay securities, but reverse mortgages, unlike home purchase mortgages, provide cash inflows only when they terminate. A securitization of reverse mortgages must be structured to satisfy obligations to advance cash to borrowers as well as to investors "despite the unusual nature of reverse mortgage payments."[5]

The secondary market is still developing ways to meet the challenges of securitizing reverse mortgages. Some securitizations to date have structured the securitization trust with prefunded cash accounts to make necessary obligations to borrowers and investors if cash inflows from terminations do not provide sufficient cash to meet these obligations. An alternative reverse mortgage securitization structure under development is to allow for dividing each whole reverse mortgage loan used as collateral into participations (shares of the loan) and for placing only fully funded loan participations into a security so investors would have no obligation to advance funds to the borrower. In this alternative securitization model, a prefunded cash account to meet the borrower's obligations would not be needed because the issuer of the security would retain these obligations to make required cash advances to the borrower. Future cash advances, when met, could become additional fully funded loan participations that the issuer could place in a subsequent security.

Until the secondary market for reverse mortgages develops and becomes more efficient (reducing the costs of securitization), the HECM product may not be realizing its full market potential. As a result, the HECM has not fully benefited from the increased liquidity that the home purchase mortgage market has achieved. Increased liquidity could broaden the lender distribution channels for HECM loans and expand the investor base. These benefits could also lead to lower costs for borrowers and product innovations that are permitted under current product rules but not supplied by lenders (for example, zero-closing-cost and fixed-rate HECM loans).

An efficient secondary market for asset-backed securities requires information about the timing of terminations, or payoffs, for the underlying assets for investors to estimate the duration and price of these securities. To support the development of such a market for HECM loans, this article provides termination information in the form of discrete-time hazard and survival rate tables using historical HUD HECM data and standard life-table techniques. The tables show annual hazard and survival rates for selected initial borrower age categories and borrower types (single female, single

male, couples, and all borrowers). The hazard and survival tables are presented in two ways. In the first set of tables, the hazard is defined in the traditional manner as the event of the loan being repaid upon the death or move-out of the borrower (including borrower payoffs for other reasons, such as refinancing). A second set of tables is presented in which the hazard definition is extended to include the assignment of an active loan to HUD by the lender as an additional termination event. The actual loan termination due to the borrower's death, move-out, or refinancing may occur many years after the assignment to HUD, but the assignment event is likely to be treated as a loan termination by investors in HECM securities. From an investor's perspective, the assignment of a HECM loan to HUD would result in the loan's purchase out of the mortgage pool.

The next section of this article provides background information on the HECM product and the recent developments in the secondary market for these loans. The section following background information describes the database used in the analysis, provides a theoretical overview of the discrete-time hazard model, and applies this theory to estimate annual HECM hazard and survival rates directly from the data. The final section discusses main findings from the estimated hazard and survival rates as presented.

Background on HECM

HUD-insured HECM loans, which have been available for more than 16 years, have come to dominate the primary reverse mortgage market; yet, for most of this time no secondary market has been available for these loans. The investment community and Ginnie Mae have recently shown increasing interest in developing a secondary market for reverse mortgages in general and for the HECM product specifically. This section provides a useful comparison of cashflow patterns of traditional "forward" mortgages and reverse mortgages, a brief history of the HUD HECM reverse mortgage program, and the investment community's increased interest in the securitization of these loans.

Forward and Reverse Mortgage Cashflow Patterns

A major difference between the cashflows of a traditional home purchase, or forward, mortgage and a reverse mortgage is in the pattern of equity and debt over time. For the forward mortgage, debt is largest at the beginning of the loan term than at any other time. As a borrower makes monthly principal and interest payments on the mortgage and the property appreciates in value, the borrower's debt declines and equity increases. In contrast, for a reverse mortgage, the borrower's debt is smallest at the beginning of the loan term than at any other time. As the lender makes periodic principal advances to borrowers and accrues interest and loan fees into the outstanding balance, the borrower's debt increases faster than the property value appreciates and equity decreases.

Exhibits 1 and 2 illustrate the different equity and debt patterns associated with forward and reverse mortgages, respectively. Exhibit 1 shows a typical pattern of changes in the equity and debt for a 30-year fixed-rate mortgage over the full loan term. Exhibit 2 shows the changes in the equity and debt for a reverse mortgage for which the borrower draws down cash advances in the typical pattern observed in the HECM program. This typical pattern of cash paid out for a HECM (expressed as average percentages of the initial principal limit by policy year) is provided in exhibit 3.[6]

Exhibit 1

Debt and Equity for a Traditional 30-Year Fixed-Rate Mortgage by Age of Loan in Years

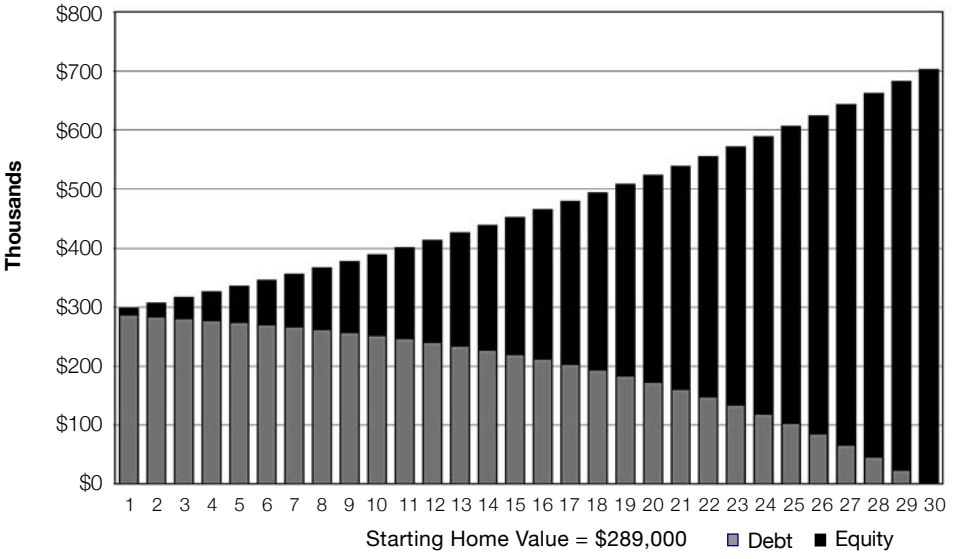
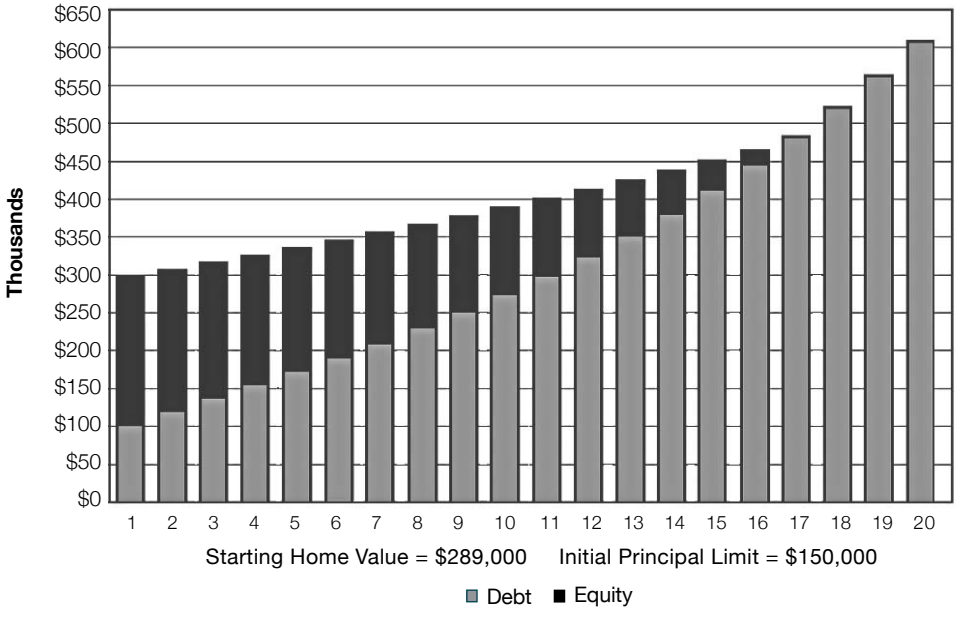


Exhibit 2

Debt and Equity for a HECM Reverse Mortgage by Age of Loan in Years



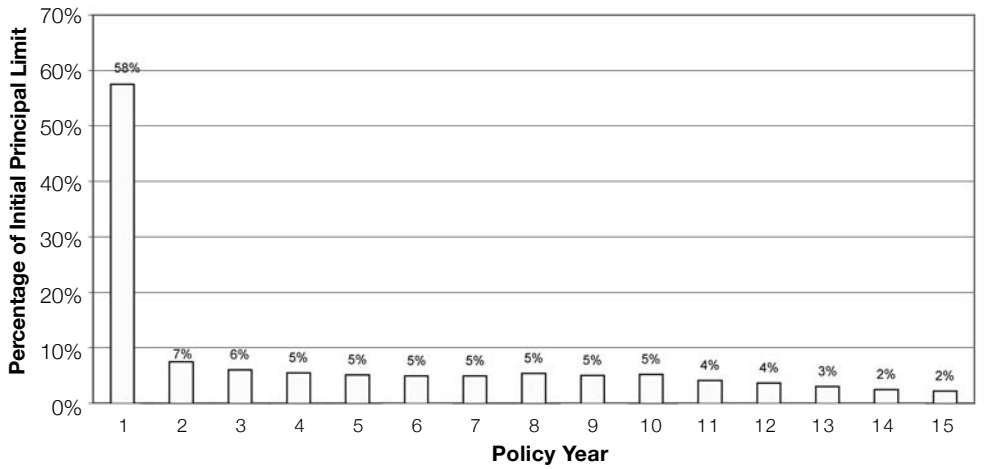
HECM = Home Equity Conversion Mortgage.

For a single reverse mortgage loan, cash flows from the lender to the borrower in periodic payments, which typically decline over time. Cash flows in the other direction, from the borrower to the lender (or investor), only one time—as a lump sum repayment when the loan terminates.

Nevertheless, for a large pool of reverse mortgages, the pattern of cashflows is very different. If the pool is large enough, some loans are expected to terminate in each discrete-time period. Hence, the expected net cashflows for the pool quickly switch from a net outflow to a net inflow as lump sum repayments exceed aggregate cash advances paid to the remaining borrowers. The expected cashflows on a pool of HECM loans are illustrated in exhibit 4 using average termination rates for a 75-year-old borrower and the typical cash payouts shown in exhibit 3. These net cashflows from a pool of reverse mortgages represent the cash passthroughs on a reverse mortgage security. If the security is formed with loans that have been seasoned past the first year, then the net cash inflows in most cases will be adequate to create current pay securities for investors and meet additional borrower cash drawdown obligations. In case the net cash inflows fall short, however, the trust created for a reverse mortgage security often includes a cash funding account to ensure that all obligations will be met. The appendix at the end of this article illustrates the structure of a stylized reverse mortgage security.

Exhibit 3

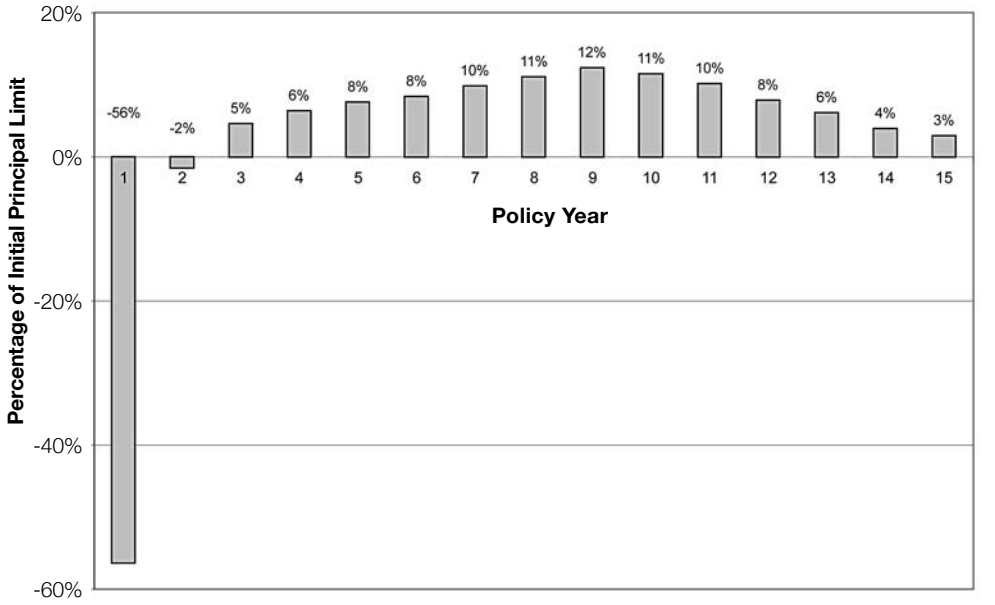
Cash Paid Out to Borrowers on a Typical HECM Loan by Policy Year as Percentage of Initial Principal Limit



HECM = Home Equity Conversion Mortgage.
Source: Preliminary analysis of HUD's Single Family Data Warehouse and Single Family Mortgage Asset Recovery Technology databases

Exhibit 4

Net Cash Flows to Investors on a Pool of HECM Loans by Policy Year as Percentage of Initial Principal Limit



History of the HUD HECM Program

A demonstration program for home equity conversion was authorized by the Housing and Community Development Act of 1987 (Public Law 100-242) and was initially limited to 2,500 total mortgages, although that limit was soon raised. The first HECM loan was made in September 1989. HUD designed the HECM product in response to the statute, and it has become the dominant reverse mortgage product in the U.S. market. The HUD Appropriation Act of 1998 made HECM a permanent program of HUD and the FHA.

The history of the HECM program is documented in five reports to Congress prepared by HUD. The first, submitted in 1990, described the HECM product's features and explained why various design decisions were made, including the actuarial assumptions of the HUD pricing model. The second HUD report, submitted to Congress in 1992, provided initial findings on borrower, loan, property, and lender characteristics and on outstanding legal and programmatic issues. The third report to Congress, submitted in 1995, updated the findings of the 1992 report and conducted an initial actuarial review of the program's insurance fund. The fourth report, submitted to Congress in May 2000, updated the 1995 actuarial review and presented the latest available borrower, loan, and property characteristics. The 2000 report also included borrower feedback on satisfaction with the program. The fifth and most recent report to Congress, submitted in 2003, was mandated by Congress to update the actuarial analysis presented in the 2000 HECM report and to examine the potential impact of three legislative proposals affecting the HECM program: (1) replacing FHA's

local loan limits with a single, national loan limit for HECM; (2) reducing the premium for HECM refinancing; and (3) waiving the upfront premium for HECMs used exclusively for the payment of long-term care insurance policies.[7]

The HUD reports show that HECM borrowers tend to be older than the general population of homeowners age 62 and older and are more likely to be single females. According to the 2000 report, which was the last report to contain detailed borrower and loan characteristics, the median age of a HECM borrower was 75 compared with a median age of 72 among all elderly homeowners. Of the HECM borrowers, 56 percent were single females, compared with 28 percent of elderly homeowners in the general population. Single males accounted for 14 percent of HECM loans and couples accounted for 30 percent, compared with 8 and 65 percent, respectively, among the general population. The properties of HECM borrowers tended to be more valuable than those of the general population of homeowners age 62 and older: the median value was $107,000 for HECM borrowers compared with $87,000 for elderly homeowners in the general population. The typical HECM loan, as of the 2000 study, had an initial principal limit of $54,890, the maximum amount that can be borrowed under the terms of the HECM loan (either taken as a lump sum at closing or as the present value of an annuity or credit line).

Current HUD data on HECMs show that the previously mentioned borrower and loan characteristics have changed since the 2000 report to Congress. Specifically, among HECM loans insured in fiscal year (FY) 2006, the median borrower's age is now 74; single females still represent the largest share of borrower types, although their share has fallen to 44 percent compared with 17 percent for single males; 39 percent of borrowers are couples; average property values have grown to $289,000; and the average principal limit is now about $159,000.

The HUD reports to Congress also show that HECM loans have been primarily purchased by a single investor, Fannie Mae, and held as whole loans in Fannie Mae's portfolio. Originating lenders rarely hold HECM loans in portfolio, even though the loans nearly always carry adjustable interest rates, choosing instead to sell these loans to an investor as quickly as possible.

As noted previously, HUD's HECM product does not require any repayment as long as the borrower remains in the home. This feature increases the demand for HECM loans among elderly homeowners (the minimum qualifying age is 62) because they can borrow without the fear of involuntary displacement or foreclosure due to failure to make monthly payments or a lump sum repayment by a specified date. Nonrepayment on a HECM loan can occur only after the borrower's death or a voluntary move-out, at which time the loan becomes due and payable.[8] In the case of death or move-out, the property is sold to pay off the debt. If the sales proceeds are sufficient to pay the debt, including interest, the remaining cash usually belongs to the borrower or his or her estate. If the sales proceeds are insufficient, the lender (or investor) must absorb the loss, releasing the mortgage upon receipt of the net sales proceeds, and then must file a claim with HUD for insurance benefits that fully reimburse the lender for the deficiency.

Even with the risk of loss due to nonrepayment borne by the government, private lenders may have additional reasons for not holding reverse mortgage loans in their portfolios. Specifically, regulated depository institutions may find it difficult to manage portfolio capital requirements if they hold illiquid whole loan assets such as HECMs. In addition, some lenders may not want to

accrue taxable interest income on reverse mortgage assets because this income will not actually be received until the loan is paid off—potentially many years in the future.

Although Fannie Mae's participation as the principal investor for HECM loans has been a major factor in the early success of HECM as a niche product, the long-term success of HECM as a more mainstream loan product may require the eventual development of a more efficient secondary market for these loans. If an efficient secondary market in HECM loans does develop, then the liquidity and taxation problems could be shifted to investors who may value these assets more highly than portfolio lenders do. Furthermore, increased liquidity from an efficient secondary market could broaden the lenders' distribution channels for HECM loans and expand the investor base. Broader distribution channels and increased investor demand could also lead to lower costs for borrowers and product innovations, including some that are permitted under current product rules but not currently supplied by lenders (for example, zero-closing-cost and fixed-rate HECM loans).[9]

The Secondary Market for HECMs

The investment community's interest in developing a secondary market for reverse mortgages dates back to the late 1990s. In 1999, for example, Lehman Brothers led the first U.S. securitization of reverse MBSs with a $317 million structured financing by the Structured Asset Securities Corporation (SASCO) using conventional reverse mortgages as assets. At that time, Standard & Poor's (S&P), a public ratings agency, published its ratings criteria for reverse mortgage backed securities.[10] The S&P criteria state that, from a cashflow perspective, "the repayment rate [due to move-out and mortality] is the most important [cashflow] variable of the security." For reverse mortgage securities backed by HECM assets, the underlying termination rate of the loans is by far the most critical cashflow risk factor because the HECM mortgage insurance mitigates cashflow risks arising from interest rate and property value uncertainties.

More recently, the investment community's interest in the reverse mortgage market (both for FHA-insured HECM loans and conventional reverse mortgages) has accelerated. Whether fueled by the low interest rates and robust house price growth of the past 5 years, the rapid growth of HECM and conventional reverse mortgage volumes over this same period, growth in the number of lenders with experience in lending and servicing these loans, or a combination of all these factors, the market for reverse mortgage securities, including those backed by both conventional and HECM reverse mortgages, is poised for considerable growth.

In August 2006, the Mortgage Equity Conversion Asset Corporation issued $221 million in Class A notes backed by a pool of HECM loans. This issuance, which received a rating of "AAA" by Fitch Ratings, represented the first ever asset-backed security using HECM loans as assets. The trust in this securitization consisted of a mortgage pool of HECM loans with a cutoff aggregate balance of $135.5 million, plus an $85.45 million funding account comprising cash and securities to provide assurance that borrowers would be advanced funds even if pool cash inflows from terminated cases fell short.[11]

The following month, Fitch rated another $598.3 million reverse mortgage pool trust, which was a structured financing backed by conventional reverse mortgages with a cutoff date balance of $522.3 million. Because the assets in the pool, unlike HECM loans, have no federal insurance

to cover nonrepayment risk, the securities were structured (as was the 1999 SASCO deal) with multiple risk classes, in which the lower rated classes absorbed some of the nonrepayment risks of the highest rated classes. Thus, the security's Class A-IO and Class A-1 notes, with a combined balance of $490 million, received Fitch's highest rating of "AAA" because they were structured with sufficient protection from nonrepayment risk. The security's $83.3 million Class M-1 notes, structured with less protection from nonrepayment risk, received a lower rating of "AA," and the security's $25.0 million Class M-1 notes, which assumed the most nonrepayment risk, received the lowest rating of "A."

The potential exists for continued HECM securitizations in the future. On October 17, 2006, Ginnie Mae announced that it is in the process of creating a new product to securitize HECMs. Ginnie Mae, an arm of HUD, has a mission to promote an efficient government-guaranteed secondary mortgage market linking the global capital markets with federally insured housing markets.[12] The first of these Ginnie Mae-guaranteed HECM securities will likely be issued before the end of 2007.

Clearly, a growing supply of HECM loans available for securitization exists. FHA has insured about 236,000 HECM loans since the program's inception in 1989.[13] Of these loans, FHA insured more than 74,000 cases during FY 2006 (October 1, 2005, through September 30, 2006), which represents nearly 32 percent of the cases ever insured and a 73-percent increase over the 43,000 cases FHA insured in FY 2005. As of September 30, 2006, more than 175,000 of the ever-insured HECM loans were still actively insured—that is, the loans were active and had not been assigned to HUD—with an average outstanding loan balance of $103,000 and an aggregate outstanding loan balance of $18.1 billion. Both FHA and Ginnie Mae believe that HECM volume will continue to rise in the future as the baby boom generation enters its retirement years and the demand for reverse mortgages, in general, is expected to increase.

The previously mentioned reverse mortgage ratings criteria from Wall Street public ratings agencies reflect the market's desire to gain a better understanding of HECM cashflows. For a secondary market for HECM loans to thrive, it will need specific information on HECM cashflow factors—especially information about the timing of loan terminations due to mortality, move-out, and refinancing.

Constructing Discrete-Time Hazard and Survival Rates Using HUD's HECM Data

This section provides a discussion of HUD HECM data. It emphasizes the impact of assignments, unique to HUD's program, on expected terminations. Discrete-time hazard and survival models are constructed for borrowers of different types and ages. Hazard and survival rates are recomputed taking into consideration the impact of loan assignment on termination experience.

HUD's HECM Data

The analyses are based primarily on a database containing 235,993 loan-level records representing all loans that HUD had endorsed for HECM insurance as of September 30, 2006.[14] The data come

from two sources: the HUD Single Family Data Warehouse and FHA's Single Family Mortgage Asset Recovery Technology (SMART) database. HUD's Single Family Data Warehouse compiles its HECM data from the primary program source systems: the Computerized Housing Underwriting Management System and the Insurance Accounting Collection System. The SMART database contains information about HECM cases which have been assigned to HUD. The post-assignment case data in SMART are not currently captured in the Single Family Data Warehouse.

Each loan-level record obtained for analysis contains fields for the loan origination or funding date and borrower and co-borrower (if applicable) characteristics, including date of birth and gender, date of termination (if applicable), date of assignment (if applicable), and loan status codes, all as of the cutoff date of September 30, 2006. The borrower's age at loan origination was calculated using the loan origination date and the borrower's date-of-birth information. Also, where a co-borrower is present on the loan, the date-of-birth information for the younger of the couples was used to represent the borrower's age.[15]

Lack of data in some fields resulted in a small number of termination dates being estimated and a small number of loans being dropped from the analysis. For 385 cases with termination status codes indicating claims were paid but the cases were missing termination dates, the claim payment dates were obtained from the Single Family Data Warehouse to approximate the loan termination dates. A total of 531 records with bad data for the borrower's date-of-birth could not be proxied using other data; these records were discarded, leaving 235,993 valid cases for analysis.

Exhibits 5A and 5B summarize the numbers of loans among the 235,993 valid records originated by calendar year and by termination status; that is, terminated or censored.[16] In exhibit 5A, these data are presented using the loan termination status as it appeared through September 30, 2006, in the Single Family Data Warehouse for cases not assigned to HUD. Exhibit 5A uses similar data on termination status from the SMART database for assigned cases. In exhibit 5A, loans that are assigned to HUD are not shown as terminations until the borrower dies or pays off the loan.

Exhibit 5A

HECM-Insured Cases by Termination Status as of September 30, 2006
Terminations Exclude Assignment to HUD

Origination Year	Terminated		Censored		Total Originations	
	Count	Percentage of Row	Count	Percentage of Row	Count	Percentage of Row
1989	11	100.0	0	0.0	11	100.0
1990	362	91.0	36	9.0	398	100.0
1991	579	88.1	78	11.9	657	100.0
1992	1,597	84.5	293	15.5	1,890	100.0
1993	2,277	80.1	567	19.9	2,844	100.0
1994	3,333	81.5	757	18.5	4,090	100.0
1995	3,025	77.7	870	22.3	3,895	100.0
1996	3,626	72.7	1,364	27.3	4,990	100.0
1997	4,197	72.2	1,617	27.8	5,814	100.0
1998	4,299	64.1	2,411	35.9	6,710	100.0

HECM = Home Equity Conversion Mortgage.
Note: Excludes 531 cases with missing data.

Exhibit 5A

HECM-Insured Cases by Termination Status as of September 30, 2006
Terminations Exclude Assignment to HUD (continued)

Origination Year	Terminated		Censored		Total Originations	
	Count	Percentage of Row	Count	Percentage of Row	Count	Percentage of Row
1999	4,682	61.5	2,934	38.5	7,616	100.0
2000	3,665	58.3	2,617	41.7	6,282	100.0
2001	4,507	46.0	5,287	54.0	9,794	100.0
2002	5,161	38.0	8,406	62.0	13,567	100.0
2003	7,214	25.3	21,249	74.7	28,463	100.0
2004	5,971	16.0	31,389	84.0	37,360	100.0
2005	2,415	4.2	54,886	95.8	57,301	100.0
2006	166	0.4	44,145	99.6	44,311	100.0
Total	**57,087**	**24.2**	**178,906**	**75.8**	**235,993**	**100.0**

HECM = Home Equity Conversion Mortgage.
Note: Excludes 531 cases with missing data.

Exhibit 5B

HECM-Insured Cases by Termination Status as of September 30, 2006
Terminations Include Assignment to HUD

Origination Year	Terminated		Censored		Total Originations	
	Count	Percentage of Row	Count	Percentage of Row	Count	Percentage of Row
1989	11	100.0	0	0.0	11	100.0
1990	389	97.7	9	2.3	398	100.0
1991	649	98.8	8	1.2	657	100.0
1992	1,833	97.0	57	3.0	1,890	100.0
1993	2,733	96.1	111	3.9	2,844	100.0
1994	3,761	92.0	329	8.0	4,090	100.0
1995	3,493	89.7	402	10.3	3,895	100.0
1996	4,134	82.8	856	17.2	4,990	100.0
1997	4,456	76.6	1,358	23.4	5,814	100.0
1998	4,642	69.2	2,068	30.8	6,710	100.0
1999	4,833	63.5	2,783	36.5	7,616	100.0
2000	3,693	58.8	2,589	41.2	6,282	100.0
2001	4,543	46.4	5,251	53.6	9,794	100.0
2002	5,183	38.2	8,384	61.8	13,567	100.0
2003	7,277	25.6	21,186	74.4	28,463	100.0
2004	5,983	16.0	31,377	84.0	37,360	100.0
2005	2,416	4.2	54,885	95.8	57,301	100.0
2006	166	0.4	44,145	99.6	44,311	100.0
Total	**60,195**	**25.5**	**175,798**	**74.5**	**235,993**	**100.0**

HECM = Home Equity Conversion Mortgage.
Note: Excludes 531 cases with missing data.

In exhibit 5B, the data are presented using termination status as it appears in the Single Family Data Warehouse, including the date that a case was assigned to HUD as a termination event. That is, in exhibit 5B, those cases that are assigned to HUD are considered to be terminated even if the borrower continues to live in the mortgaged property. From an investor's perspective, an assignment to HUD is equivalent to a loan termination because the assigned loan is bought out of the securitization pool by HUD's payment of the claim.

Discrete-Time Hazard Model

Discrete-time hazard models use regularly defined time periods (such as years, months, or other units of time) to describe the likelihood of events occurring at various points in time among a group of individuals. These events can include loan terminations among a group of mortgages such as HECMs.

A central concept in the discrete-time hazard model is that of the *hazard rate*. The discrete-time hazard rate is the probability that an event will occur during a particular time period to a particular individual, given that the individual is at risk at the beginning of the period. In this article, the event of interest is the act of terminating a HECM loan. Based on this definition, the discrete-time hazard rate is sometimes referred to as the *conditional probability* of the event occurring during a given time period, with the condition being that the individual was at risk at the start of the time period.[17] A second key concept is that of the *risk set*, which is the set of individuals (in our case, HECM loans) who are at risk of some event occurring at the start of each discrete point in time. The risk set is also called the risk *exposure*.

By grouping together individuals with similar characteristics (such as those having the same initial borrower age), we find that the hazard rate varies over discrete-time periods but can be considered the same for all individuals in the group at each period. We estimate the hazard rate for the group at each time period by dividing the number of events observed during the period by the number of individuals at risk during the period.

Another concept in the discrete-time hazard model is that of the *survival rate*. Survivors are those individuals from the original group that have not experienced the event through a given time period. The number of survivors expected at the end of a time period equals the expected number of survivors from the start of the period minus the expected number of events that occur during the period. The expected number of events in a period is the estimated hazard rate for that period multiplied by the number of individuals at risk at the start of the period. Absent censoring, the number of individuals at risk is equal to the number of survivors at the start of the period. The survival rates for the group are the proportions of the initial group that have not experienced the event of interest as of the start of each time period. Note that the introduction of censoring in the data will require some adjustments to these calculations. See Allison (1984, 1995).

Constructing Discrete-Time HECM Hazard and Survival Rates

We construct discrete-time HECM hazard and survival rates from the data using the *life-table* method to account for censoring of some of the data.[18] The hazard being considered is HECM loan termination defined either with or without loan assignments to HUD as termination events. The data are right-censored because actual termination dates for loans that did not terminate as of the

cutoff date of the study (September 30, 2006) are censored from further observation. The timing of the termination and censoring events is based on each loan's policy year. *Policy year* is the age of the loan in years beginning with the date the loan was originated and insured by HUD. All loans, regardless of calendar year of origination, begin in the first policy year. The number of policy years observed varies for each loan record.[19] The files contain a loan origination date for each loan and a termination date if the loan is terminated. If there is no termination date, the loan is considered to have survived at least through September 30, 2006.

The hazard rate in policy year *i* is estimated by dividing the number of loans that terminated in the i-th policy, d(i), by the number of loans at risk, or exposed to the hazard of interest, E(i), at the start of that policy year

$$h(i) = d(i) / E(i).^{20} \quad (1)$$

The survival rates in policy year i are computed as follows:

$$S(0) = 1.0000 \quad (2)$$

$$S(1) = S(0) \times (1 - h(1)), \text{ and in general} \quad (3)$$

$$S(i) = S(i\text{-}1) \times (1 - h(i)) \quad (4)$$

$$= \prod_{j=1}^{i} (1 - h(j)) . \quad (5)$$

The discrete-time survival rates constructed from the discrete-time hazard rates as noted previously are analogous to continuous-time hazard and survival probabilities in a continuous-time hazard model.[21] See Allison (1984).

Exhibits 6 through 9 present HECM hazard and survival rates that have been constructed from the HUD database of 235,993 loan-level records. The tables are split into parts A and B. In exhibits 6A through 9A, the hazard is defined as mortality, move-out, or other voluntary payoff of the loan (including refinancing) but excluding assignment of the loan to HUD. In exhibits 6B through 9B, the hazard definition is expanded to include assignment of the loan to HUD along with mortality, move-out, and voluntary payoff. Three selected age groupings are presented in exhibits 6A through 8A and repeated for exhibits 6B through 8B: younger borrowers (defined as those ages 64 to 66 at closing), typical borrowers (defined as those ages 74 to 76 at closing), and older borrowers (defined as those ages 84 to 86 at closing).[22] Exhibits 9A and 9B pool all the HECM data to show aggregate hazard and survival rates for all ages. Within each exhibit, hazard and survivor information is broken out for selected borrower types (all borrowers, couples, single females, and single males). The exhibits also show the effective sample size for each policy year along with standard errors for the estimated hazard rates. Finally, the exhibits show the 2006 general population mortality rates for females as determined by the National Center for Health Statistics (based on the age corresponding to the midpoint of the age interval illustrated in the exhibit at origination) and the ratios of the observed hazard rates to the corresponding U.S. Department of Health and Human Services female mortality rates. This ratio is given for illustrative purposes only because the underlying mortality rates for each group of borrowers are unknown and will vary by group composition. The mortality rate comparison is not presented for exhibits 9A and 9B because these exhibits aggregate all ages.

Exhibit 6A

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	14288.0	0.0000	—	0.0000	1.0000	5569.0	0.0000	—
1	0.0122	0.0142	0.9858	11830.0	0.0011	1.2	0.0092	0.9908	4584.0	0.0014	0.7
2	0.0134	0.0658	0.9209	7841.0	0.0028	4.9	0.0483	0.9430	3002.0	0.0039	3.6
3	0.0147	0.1143	0.8157	4944.5	0.0045	7.8	0.0936	0.8547	1902.0	0.0067	6.4
4	0.0160	0.1297	0.7099	2929.0	0.0062	8.1	0.1133	0.7579	1156.5	0.0093	7.1
5	0.0174	0.1361	0.6133	1925.0	0.0078	7.8	0.1076	0.6763	771.5	0.0112	6.2
6	0.0190	0.1295	0.5338	1375.0	0.0091	6.8	0.1064	0.6044	564.0	0.0130	5.6
7	0.0208	0.1326	0.4631	1041.0	0.0105	6.4	0.1047	0.5411	439.5	0.0146	5.0
8	0.0227	0.1328	0.4016	753.0	0.0124	5.9	0.1325	0.4694	332.0	0.0186	5.8
9	0.0246	0.1816	0.3286	490.0	0.0174	7.4	0.1618	0.3934	222.5	0.0247	6.6
10	0.0266	0.1742	0.2714	298.5	0.0220	6.5	0.1773	0.3237	141.0	0.0322	6.7
11	0.0290	0.1224	0.2382	196.0	0.0234	4.2	0.0782	0.2984	89.5	0.0284	2.7
12	0.0318	0.1255	0.2083	135.5	0.0285	3.9	0.0945	0.2702	63.5	0.0367	3.0
13	0.0349	0.2222	0.1620	76.5	0.0475	6.4	0.2162	0.2118	37.0	0.0677	6.2
14	0.0381	0.1250	0.1418	24.0	0.0675	3.3	0.1739	0.1749	11.5	0.1118	4.6
15	0.0417	0.1538	0.1200	6.5	0.1415	3.7	0.3333	0.1166	3.0	0.2722	8.0

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 6A

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	6150.0	0.0000	—	0.0000	1.0000	2512.0	0.0000	—
1	0.0122	0.0166	0.9834	5169.5	0.0018	1.4	0.0192	0.9808	2035.0	0.0030	1.6
2	0.0134	0.0718	0.9128	3536.0	0.0043	5.4	0.0897	0.8928	1282.5	0.0080	6.7
3	0.0147	0.1288	0.7952	2275.5	0.0070	8.8	0.1233	0.7827	754.0	0.0120	8.4
4	0.0160	0.1334	0.6891	1349.5	0.0093	8.4	0.1602	0.6573	412.0	0.0181	10.0
5	0.0174	0.1507	0.5853	896.0	0.0120	8.7	0.1723	0.5441	249.5	0.0239	9.9
6	0.0190	0.1352	0.5062	636.0	0.0136	7.1	0.1845	0.4437	168.0	0.0299	9.7
7	0.0208	0.1637	0.4233	476.5	0.0169	7.9	0.1176	0.3915	119.0	0.0295	5.7
8	0.0227	0.1225	0.3714	326.5	0.0181	5.4	0.1582	0.3296	88.5	0.0388	7.0
9	0.0246	0.2019	0.2965	213.0	0.0275	8.2	0.1980	0.2643	50.5	0.0561	8.1
10	0.0266	0.1569	0.2499	127.5	0.0322	5.9	0.1923	0.2135	26.0	0.0773	7.2
11	0.0290	0.1600	0.2099	87.5	0.0392	5.5	0.1176	0.1884	17.0	0.0781	4.1
12	0.0318	0.1368	0.1812	58.5	0.0449	4.3	0.2400	0.1432	12.5	0.1208	7.5
13	0.0349	0.2462	0.1366	32.5	0.0756	7.1	0.1538	0.1212	6.5	0.1415	4.4
14	0.0381	0.0000	0.1366	10.0	0.0000	0.0					
15	0.0417	0.0000	0.1366	3.5	0.0000	0.0					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 6B

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	14288.0	0.0000	—	0.0000	1.0000	5569.0	0.0000	—
1	0.0122	0.0142	0.9858	11830.0	0.0011	1.2	0.0092	0.9908	4584.0	0.0014	0.7
2	0.0134	0.0659	0.9208	7841.5	0.0028	4.9	0.0483	0.9430	3002.0	0.0039	3.6
3	0.0147	0.1143	0.8156	4944.5	0.0045	7.8	0.0936	0.8547	1902.0	0.0067	6.4
4	0.0160	0.1297	0.7098	2929.0	0.0062	8.1	0.1133	0.7579	1156.5	0.0093	7.1
5	0.0174	0.1361	0.6132	1925.0	0.0078	7.8	0.1076	0.6763	771.5	0.0112	6.2
6	0.0190	0.1302	0.5334	1375.0	0.0091	6.9	0.1064	0.6044	564.0	0.0130	5.6
7	0.0208	0.1327	0.4626	1040.0	0.0105	6.4	0.1047	0.5411	439.5	0.0146	5.0
8	0.0227	0.1329	0.4011	752.5	0.0124	5.9	0.1325	0.4694	332.0	0.0186	5.8
9	0.0246	0.1837	0.3274	490.0	0.0175	7.5	0.1663	0.3913	222.5	0.0250	6.8
10	0.0266	0.1946	0.2637	298.0	0.0229	7.3	0.2071	0.3103	140.0	0.0343	7.8
11	0.0290	0.2474	0.1985	194.0	0.0310	8.5	0.2171	0.2429	87.5	0.0441	7.5
12	0.0318	0.2773	0.1434	119.0	0.0410	8.7	0.2456	0.1833	57.0	0.0570	7.7
13	0.0349	0.4553	0.0781	61.5	0.0635	13.1	0.4776	0.0957	33.5	0.0863	13.7
14	0.0381	0.2000	0.0625	15.0	0.1033	5.2	0.1333	0.0830	7.5	0.1241	3.5
15	0.0417	0.5455	0.0284	5.5	0.2123	13.1	0.8000	0.0166	2.5	0.2530	19.2

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 6B

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	6150.0	0.0000	—	0.0000	1.0000	2512.0	0.0000	—
1	0.0122	0.0166	0.9834	5169.5	0.0018	1.4	0.0192	0.9808	2035.0	0.0030	1.6
2	0.0134	0.0721	0.9125	3536.5	0.0044	5.4	0.0897	0.8928	1282.5	0.0080	6.7
3	0.0147	0.1288	0.7950	2275.5	0.0070	8.8	0.1233	0.7827	754.0	0.0120	8.4
4	0.0160	0.1334	0.6889	1349.5	0.0093	8.4	0.1602	0.6573	412.0	0.0181	10.0
5	0.0174	0.1507	0.5851	896.0	0.0120	8.7	0.1723	0.5441	249.5	0.0239	9.9
6	0.0190	0.1368	0.5051	636.0	0.0136	7.2	0.1845	0.4437	168.0	0.0299	9.7
7	0.0208	0.1640	0.4222	475.5	0.0170	7.9	0.1176	0.3915	119.0	0.0295	5.7
8	0.0227	0.1227	0.3704	326.0	0.0182	5.4	0.1582	0.3296	88.5	0.0388	7.0
9	0.0246	0.2019	0.2956	213.0	0.0275	8.2	0.1980	0.2643	50.5	0.0561	8.1
10	0.0266	0.1719	0.2448	128.0	0.0333	6.5	0.1923	0.2135	26.0	0.0773	7.2
11	0.0290	0.2400	0.1861	87.5	0.0457	8.3	0.3529	0.1382	17.0	0.1159	12.2
12	0.0318	0.2991	0.1304	53.5	0.0626	9.4	0.3529	0.0894	8.5	0.1639	11.1
13	0.0349	0.4082	0.0772	24.5	0.0993	11.7	0.5714	0.0383	3.5	0.2645	16.4
14	0.0381	0.1538	0.0653	6.5	0.1415	4.0					
15	0.0417	0.3333	0.0435	3.0	0.2722	8.0					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 7A

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	24295.0	0.0000	—	0.0000	1.0000	9614.0	0.0000	—
1	0.0306	0.0144	0.9856	20621.0	0.0008	0.5	0.0070	0.9931	8059.5	0.0009	0.2
2	0.0337	0.0659	0.9206	14707.0	0.0021	2.0	0.0464	0.9470	5642.0	0.0028	1.4
3	0.0371	0.1151	0.8147	10253.5	0.0032	3.1	0.1031	0.8493	3938.0	0.0049	2.8
4	0.0408	0.1204	0.7166	6838.0	0.0039	2.9	0.1170	0.7500	2607.0	0.0063	2.9
5	0.0450	0.1266	0.6259	4889.5	0.0048	2.8	0.1206	0.6595	1832.0	0.0076	2.7
6	0.0498	0.1407	0.5378	3611.5	0.0058	2.8	0.1438	0.5647	1342.0	0.0096	2.9
7	0.0552	0.1452	0.4597	2707.5	0.0068	2.6	0.1426	0.4842	989.0	0.0111	2.6
8	0.0613	0.1622	0.3852	1960.0	0.0083	2.6	0.1520	0.4106	710.5	0.0135	2.5
9	0.0680	0.1846	0.3141	1295.0	0.0108	2.7	0.1822	0.3358	477.5	0.0177	2.7
10	0.0756	0.1794	0.2577	791.5	0.0136	2.4	0.1465	0.2866	293.5	0.0206	1.9
11	0.0842	0.1770	0.2121	491.5	0.0172	2.1	0.1762	0.2361	193.0	0.0274	2.1
12	0.0940	0.1681	0.1764	297.5	0.0217	1.8	0.1494	0.2008	120.5	0.0325	1.6
13	0.1048	0.1776	0.1451	152.0	0.0310	1.7	0.1760	0.1655	62.5	0.0482	1.7
14	0.1168	0.0847	0.1328	59.0	0.0363	0.7	0.1739	0.1367	23.0	0.0790	1.5
15	0.1299	0.1364	0.1147	22.0	0.0732	1.1	0.1333	0.1185	7.5	0.1241	1.0

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 7A

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	11279.0	0.0000	—	0.0000	1.0000	3329.0	0.0000	—
1	0.0306	0.0184	0.9816	9729.5	0.0014	0.6	0.0216	0.9784	2782.5	0.0028	0.7
2	0.0337	0.0709	0.9120	7137.0	0.0030	2.1	0.1049	0.8758	1906.5	0.0070	3.1
3	0.0371	0.1142	0.8079	5062.5	0.0045	3.1	0.1574	0.7379	1238.5	0.0103	4.2
4	0.0408	0.1179	0.7126	3451.0	0.0055	2.9	0.1443	0.6314	769.0	0.0127	3.5
5	0.0450	0.1240	0.6242	2509.0	0.0066	2.8	0.1581	0.5316	537.5	0.0157	3.5
6	0.0498	0.1358	0.5395	1877.5	0.0079	2.7	0.1567	0.4483	383.0	0.0186	3.1
7	0.0552	0.1448	0.4614	1429.5	0.0093	2.6	0.1607	0.3763	280.0	0.0219	2.9
8	0.0613	0.1650	0.3852	1042.5	0.0115	2.7	0.1818	0.3079	198.0	0.0274	3.0
9	0.0680	0.1797	0.3160	679.0	0.0147	2.6	0.2281	0.2376	131.5	0.0366	3.4
10	0.0756	0.1825	0.2583	411.0	0.0191	2.4	0.2875	0.1693	80.0	0.0506	3.8
11	0.0842	0.1694	0.2146	248.0	0.0238	2.0	0.2022	0.1351	44.5	0.0602	2.4
12	0.0940	0.1608	0.1801	143.0	0.0307	1.7	0.2000	0.1081	30.0	0.0730	2.1
13	0.1048	0.2113	0.1420	71.0	0.0484	2.0	0.0571	0.1019	17.5	0.0555	0.5
14	0.1168	0.0000	0.1420	26.5	0.0000	0.0	0.1111	0.0906	9.0	0.1048	1.0
15	0.1299	0.0909	0.1291	11.0	0.0867	0.7	0.2857	0.0647	3.5	0.2415	2.2

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 7B

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	24295.0	0.0000	—	0.0000	1.0000	9614.0	0.0000	—
1	0.0306	0.0144	0.9856	20621.0	0.0008	0.5	0.0071	0.9929	8059.5	0.0009	0.2
2	0.0337	0.0659	0.9206	14706.0	0.0021	2.0	0.0464	0.9469	5641.0	0.0028	1.4
3	0.0371	0.1151	0.8147	10252.5	0.0032	3.1	0.1031	0.8492	3937.0	0.0049	2.8
4	0.0408	0.1205	0.7165	6837.0	0.0039	3.0	0.1170	0.7499	2606.0	0.0063	2.9
5	0.0450	0.1271	0.6254	4887.5	0.0048	2.8	0.1212	0.6590	1831.0	0.0076	2.7
6	0.0498	0.1430	0.5360	3607.5	0.0058	2.9	0.1448	0.5636	1340.0	0.0096	2.9
7	0.0552	0.1620	0.4492	2697.5	0.0071	2.9	0.1550	0.4762	987.0	0.0115	2.8
8	0.0613	0.2286	0.3465	1924.5	0.0096	3.7	0.2121	0.3752	702.5	0.0154	3.5
9	0.0680	0.3238	0.2343	1167.5	0.0137	4.8	0.3193	0.2554	438.5	0.0223	4.7
10	0.0756	0.3516	0.1519	583.0	0.0198	4.6	0.3304	0.1710	227.0	0.0312	4.4
11	0.0842	0.3904	0.0926	292.0	0.0285	4.6	0.3775	0.1065	124.5	0.0434	4.5
12	0.0940	0.4138	0.0543	130.5	0.0431	4.4	0.4167	0.0621	60.0	0.0636	4.4
13	0.1048	0.4894	0.0277	47.0	0.0729	4.7	0.5116	0.0303	21.5	0.1078	4.9
14	0.1168	0.2222	0.0216	13.5	0.1132	1.9	0.2222	0.0236	4.5	0.1960	1.9
15	0.1299	0.5333	0.0101	7.5	0.1822	4.1	0.6667	0.0079	3.0	0.2722	5.1

HECM = Home Equity Conversion Mortgage.

Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.

Source: National Center for Health Statistics, 2006

Exhibit 7B

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	11279.0	0.0000	—	0.0000	1.0000	3329.0	0.0000	—
1	0.0306	0.0184	0.9816	9729.5	0.0014	0.6	0.0216	0.9784	2782.5	0.0028	0.7
2	0.0337	0.0709	0.9120	7137.0	0.0030	2.1	0.1049	0.8758	1906.5	0.0070	3.1
3	0.0371	0.1142	0.8079	5062.5	0.0045	3.1	0.1574	0.7379	1238.5	0.0103	4.2
4	0.0408	0.1182	0.7124	3451.0	0.0055	2.9	0.1443	0.6314	769.0	0.0127	3.5
5	0.0450	0.1240	0.6240	2508.0	0.0066	2.8	0.1600	0.5304	537.5	0.0158	3.6
6	0.0498	0.1386	0.5375	1876.5	0.0079	2.8	0.1623	0.4443	382.0	0.0189	3.3
7	0.0552	0.1629	0.4500	1424.0	0.0098	3.0	0.1874	0.3611	277.5	0.0234	3.4
8	0.0613	0.2320	0.3456	1021.5	0.0132	3.8	0.2715	0.2630	191.5	0.0321	4.4
9	0.0680	0.3164	0.2362	610.0	0.0188	4.7	0.3661	0.1667	112.0	0.0455	5.4
10	0.0756	0.3494	0.1537	300.5	0.0275	4.6	0.4571	0.0905	52.5	0.0688	6.0
11	0.0842	0.3918	0.0935	145.5	0.0405	4.7	0.4500	0.0498	20.0	0.1112	5.3
12	0.0940	0.3934	0.0567	61.0	0.0625	4.2	0.4706	0.0264	8.5	0.1712	5.0
13	0.1048	0.4889	0.0290	22.5	0.1054	4.7	0.3333	0.0176	3.0	0.2722	3.2
14	0.1168	0.1429	0.0248	7.0	0.1323	1.2	0.5000	0.0088	2.0	0.3536	4.3
15	0.1299	0.2857	0.0177	3.5	0.2415	2.2					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 8A

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	9217.0	0.0000	—	0.0000	1.0000	2339.0	0.0000	—
1	0.0874	0.0326	0.9674	7728.5	0.0020	0.4	0.0217	0.9783	1890.5	0.0034	0.2
2	0.0976	0.1321	0.8396	5270.0	0.0047	1.4	0.1083	0.8724	1200.0	0.0090	1.1
3	0.1091	0.1904	0.6797	3345.5	0.0068	1.7	0.1785	0.7166	734.0	0.0141	1.6
4	0.1218	0.2079	0.5384	2005.5	0.0091	1.7	0.1758	0.5907	421.0	0.0186	1.4
5	0.1358	0.2018	0.4298	1283.5	0.0112	1.5	0.2243	0.4582	272.0	0.0253	1.7
6	0.1509	0.2390	0.3271	866.0	0.0145	1.6	0.2126	0.3608	174.0	0.0310	1.4
7	0.1672	0.2444	0.2471	577.0	0.0179	1.5	0.2131	0.2839	122.0	0.0371	1.3
8	0.1847	0.2654	0.1815	365.5	0.0231	1.4	0.2317	0.2181	82.0	0.0466	1.3
9	0.2031	0.2333	0.1392	210.0	0.0292	1.1	0.1957	0.1754	46.0	0.0585	1.0
10	0.2226	0.3033	0.0970	122.0	0.0416	1.4	0.2083	0.1389	24.0	0.0829	0.9
11	0.2420	0.2581	0.0719	62.0	0.0556	1.1	0.1538	0.1175	13.0	0.1001	0.6
12	0.2612	0.3125	0.0495	32.0	0.0819	1.2	0.2667	0.0862	7.5	0.1615	1.0
13	0.2797	0.1739	0.0409	11.5	0.1118	0.6					
14	0.2968	0.4444	0.0227	4.5	0.2342	1.5					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 8A

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	5277.0	0.0000	—	0.0000	1.0000	1564.0	0.0000	—
1	0.0874	0.0364	0.9636	4510.0	0.0028	0.4	0.0353	0.9647	1302.5	0.0051	0.4
2	0.0976	0.1341	0.8344	3192.0	0.0060	1.4	0.1525	0.8176	865.5	0.0122	1.6
3	0.1091	0.1848	0.6802	2088.5	0.0085	1.7	0.2263	0.6326	517.0	0.0184	2.1
4	0.1218	0.2030	0.5421	1295.5	0.0112	1.7	0.2762	0.4578	286.0	0.0264	2.3
5	0.1358	0.1903	0.4389	846.0	0.0135	1.4	0.2202	0.3570	163.5	0.0324	1.6
6	0.1509	0.2479	0.3301	585.0	0.0179	1.6	0.2358	0.2728	106.0	0.0412	1.6
7	0.1672	0.2474	0.2485	380.0	0.0221	1.5	0.2838	0.1954	74.0	0.0524	1.7
8	0.1847	0.2900	0.1764	234.5	0.0296	1.6	0.2083	0.1547	48.0	0.0586	1.1
9	0.2031	0.2471	0.1328	129.5	0.0379	1.2	0.2388	0.1178	33.5	0.0737	1.2
10	0.2226	0.3624	0.0847	74.5	0.0557	1.6	0.1778	0.0968	22.5	0.0806	0.8
11	0.2420	0.3333	0.0565	33.0	0.0821	1.4	0.1875	0.0787	16.0	0.0976	0.8
12	0.2612	0.3448	0.0370	14.5	0.1248	1.3	0.3000	0.0551	10.0	0.1449	1.1
13	0.2797	0.2000	0.0296	5.0	0.1789	0.7	0.0000	0.0551	4.0	0.0000	0.0
14	0.2968	0.0000	0.0296	2.0	0.0000	0.0					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 8B

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	9217.0	0.0000	—	0.0000	1.0000	2339.0	0.0000	—
1	0.0874	0.0326	0.9674	7728.5	0.0020	0.4	0.0217	0.9783	1890.5	0.0034	0.2
2	0.0976	0.1322	0.8395	5270.5	0.0047	1.4	0.1083	0.8724	1200.0	0.0090	1.1
3	0.1091	0.1910	0.6792	3345.5	0.0068	1.8	0.1798	0.7155	734.0	0.0142	1.6
4	0.1218	0.2141	0.5338	2004.0	0.0092	1.8	0.1786	0.5877	420.0	0.0187	1.5
5	0.1358	0.2283	0.4119	1270.5	0.0118	1.7	0.2370	0.4484	270.0	0.0259	1.7
6	0.1509	0.3183	0.2808	823.0	0.0162	2.1	0.2604	0.3317	169.0	0.0338	1.7
7	0.1672	0.3395	0.1855	483.0	0.0215	2.0	0.2715	0.2416	110.5	0.0423	1.6
8	0.1847	0.4000	0.1113	262.5	0.0302	2.2	0.4286	0.1381	70.0	0.0591	2.3
9	0.2031	0.4180	0.0648	122.0	0.0447	2.1	0.3333	0.0920	30.0	0.0861	1.6
10	0.2226	0.5818	0.0271	55.0	0.0665	2.6	0.4286	0.0526	14.0	0.1323	1.9
11	0.2420	0.4706	0.0143	17.0	0.1211	1.9	0.1818	0.0430	5.5	0.1645	0.8
12	0.2612	0.4615	0.0077	6.5	0.1955	1.8	0.6667	0.0143	3.0	0.2722	2.6
13	0.2797	0.4000	0.0046	2.5	0.3098	1.4					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 8B

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	5277.0	0.0000	—	0.0000	1.0000	1564.0	0.0000	—
1	0.0874	0.0364	0.9636	4510.0	0.0028	0.4	0.0353	0.9647	1302.5	0.0051	0.4
2	0.0976	0.1344	0.8341	3192.5	0.0060	1.4	0.1525	0.8176	865.5	0.0122	1.6
3	0.1091	0.1853	0.6795	2088.5	0.0085	1.7	0.2263	0.6326	517.0	0.0184	2.1
4	0.1218	0.2108	0.5363	1295.0	0.0113	1.7	0.2797	0.4556	286.0	0.0265	2.3
5	0.1358	0.2177	0.4195	836.0	0.0143	1.6	0.2646	0.3351	162.5	0.0346	1.9
6	0.1509	0.3351	0.2790	555.0	0.0200	2.2	0.3265	0.2257	98.0	0.0474	2.2
7	0.1672	0.3392	0.1843	312.5	0.0268	2.0	0.4576	0.1224	59.0	0.0649	2.7
8	0.1847	0.3951	0.1115	164.5	0.0381	2.1	0.3571	0.0787	28.0	0.0906	1.9
9	0.2031	0.4706	0.0590	76.5	0.0571	2.3	0.3226	0.0533	15.5	0.1187	1.6
10	0.2226	0.7302	0.0159	31.5	0.0791	3.3	0.3158	0.0365	9.5	0.1508	1.4
11	0.2420	0.6667	0.0053	6.0	0.1925	2.8	0.5455	0.0166	5.5	0.2123	2.3
12	0.2612	0.0000	0.0053	1.5	0.0000	0.0	0.5000	0.0083	2.0	0.3536	1.9

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 9A

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

Policy Year	1. All Borrowers				2. Couples With Younger Borrower in Age Group			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	235993.0	0.0000	0.0000	1.0000	85067.0	0.0000
1	0.0203	0.9797	199200.5	0.0003	0.0105	0.9895	70786.0	0.0004
2	0.0860	0.8954	138690.0	0.0008	0.0567	0.9334	48081.5	0.0011
3	0.1351	0.7745	92192.5	0.0011	0.1047	0.8357	32011.0	0.0017
4	0.1426	0.6640	58398.5	0.0015	0.1184	0.7367	20390.0	0.0023
5	0.1504	0.5642	39822.5	0.0018	0.1316	0.6398	13912.0	0.0029
6	0.1514	0.4787	28237.0	0.0021	0.1309	0.5560	9936.0	0.0034
7	0.1634	0.4005	20814.0	0.0026	0.1468	0.4744	7481.5	0.0041
8	0.1735	0.3310	14601.0	0.0031	0.1572	0.3998	5370.5	0.0050
9	0.1863	0.2694	9399.0	0.0040	0.1722	0.3310	3537.0	0.0064
10	0.1804	0.2208	5766.5	0.0051	0.1599	0.2781	2201.0	0.0078
11	0.1830	0.1804	3649.5	0.0064	0.1490	0.2366	1416.0	0.0095
12	0.1681	0.1500	2225.5	0.0079	0.1452	0.2023	888.5	0.0118
13	0.1666	0.1250	1128.5	0.0111	0.1478	0.1724	446.5	0.0168
14	0.1321	0.1085	439.0	0.0162	0.1493	0.1466	167.5	0.0275
15	0.1220	0.0953	147.5	0.0270	0.1176	0.1294	51.0	0.0451

HECM = Home Equity Conversion Mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibit 9A

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

Policy Year	3. Single Female Borrowers				4. Single Male Borrowers			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	113985.0	0.0000	0.0000	1.0000	36083.0	0.0000
1	0.0243	0.9757	97769.0	0.0005	0.0302	0.9698	30057.5	0.0010
2	0.0948	0.8832	70221.0	0.0011	0.1258	0.8478	20104.0	0.0023
3	0.1439	0.7561	47511.0	0.0016	0.1800	0.6952	12492.0	0.0034
4	0.1512	0.6418	30518.0	0.0021	0.1740	0.5742	7363.5	0.0044
5	0.1554	0.5421	20977.0	0.0025	0.1840	0.4686	4825.5	0.0056
6	0.1582	0.4563	14904.0	0.0030	0.1827	0.3830	3301.0	0.0067
7	0.1710	0.3783	10882.5	0.0036	0.1821	0.3132	2367.0	0.0079
8	0.1793	0.3104	7527.5	0.0044	0.1999	0.2506	1631.0	0.0099
9	0.1901	0.2514	4798.0	0.0057	0.2189	0.1958	1005.0	0.0130
10	0.1869	0.2044	2921.0	0.0072	0.2183	0.1530	595.5	0.0169
11	0.1998	0.1636	1821.5	0.0094	0.2187	0.1196	375.0	0.0213
12	0.1847	0.1334	1083.0	0.0118	0.1798	0.0981	228.0	0.0254
13	0.1788	0.1095	542.5	0.0165	0.1841	0.0800	119.5	0.0355
14	0.1106	0.0974	217.0	0.0213	0.1720	0.0662	46.5	0.0553
15	0.1205	0.0857	83.0	0.0357	0.1481	0.0564	13.5	0.0967

HECM = Home Equity Conversion Mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibit 9B

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

Policy Year	1. All Borrowers				2. Couples With Younger Borrower in Age Group			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	235993.0	0.0000	0.0000	1.0000	85067.0	0.0000
1	0.0203	0.9797	199200.5	0.0003	0.0106	0.9894	70786.0	0.0004
2	0.0862	0.8952	138683.5	0.0008	0.0567	0.9333	48077.5	0.0011
3	0.1365	0.7730	92191.0	0.0011	0.1050	0.8353	32007.5	0.0017
4	0.1458	0.6603	58311.5	0.0015	0.1192	0.7357	20378.5	0.0023
5	0.1548	0.5581	39605.5	0.0018	0.1331	0.6378	13887.5	0.0029
6	0.1640	0.4666	27909.0	0.0022	0.1375	0.5501	9896.5	0.0035
7	0.1907	0.3776	20233.5	0.0028	0.1636	0.4601	7390.0	0.0043
8	0.2272	0.2918	13780.0	0.0036	0.2024	0.3670	5222.5	0.0056
9	0.2779	0.2107	8328.0	0.0049	0.2538	0.2738	3274.5	0.0076
10	0.3147	0.1444	4541.5	0.0069	0.2877	0.1951	1852.5	0.0105
11	0.3537	0.0933	2460.0	0.0096	0.3093	0.1347	1041.0	0.0143
12	0.3810	0.0578	1233.5	0.0138	0.3607	0.0861	554.5	0.0204
13	0.4286	0.0330	504.0	0.0220	0.3850	0.0530	226.0	0.0324
14	0.4000	0.0198	160.0	0.0387	0.3803	0.0328	71.0	0.0576
15	0.4694	0.0105	49.0	0.0713	0.5263	0.0155	19.0	0.1145

HECM = home equity conversion mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibit 9B

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

Policy Year	3. Single Female Borrowers				4. Single Male Borrowers			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	113985.0	0.0000	0.0000	1.0000	36083.0	0.0000
1	0.0243	0.9757	97769.0	0.0005	0.0302	0.9698	30057.5	0.0010
2	0.0949	0.8831	70219.0	0.0011	0.1260	0.8476	20103.5	0.0023
3	0.1459	0.7543	47512.5	0.0016	0.1819	0.6934	12492.5	0.0035
4	0.1558	0.6367	30458.0	0.0021	0.1776	0.5703	7348.0	0.0045
5	0.1613	0.5340	20817.0	0.0026	0.1901	0.4619	4793.0	0.0057
6	0.1749	0.4406	14667.5	0.0031	0.1954	0.3716	3249.0	0.0070
7	0.2033	0.3511	10472.5	0.0039	0.2206	0.2896	2289.0	0.0087
8	0.2370	0.2679	6980.0	0.0051	0.2635	0.2133	1510.5	0.0113
9	0.2887	0.1905	4150.0	0.0070	0.3098	0.1472	858.5	0.0158
10	0.3284	0.1280	2216.5	0.0100	0.3539	0.0951	446.5	0.0226
11	0.3791	0.0794	1166.0	0.0142	0.4051	0.0566	237.0	0.0319
12	0.4025	0.0475	559.0	0.0207	0.3772	0.0352	114.0	0.0454
13	0.4602	0.0256	226.0	0.0332	0.4792	0.0184	48.0	0.0721
14	0.3946	0.0155	73.5	0.0570	0.5000	0.0092	14.0	0.1336
15	0.4231	0.0089	26.0	0.0969	0.5000	0.0046	4.0	0.2500

HECM = home equity conversion mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibits 10 through 12 illustrate the impact of assignments to HUD on loan survival rates for all borrowers within the three age groups (younger, typical, and older). The policy year for which the assignments begin to affect the hazard and survival rates varies with the initial age of the borrowers. Exhibit 13 extends this illustration to borrowers of all ages by pooling all the HECM data. Assignments begin to impact hazard and survival rates after policy year six for all borrowers and as early as policy year four for older borrowers.

Exhibit 10

HECM Survival Rates—Ages 64 to 66

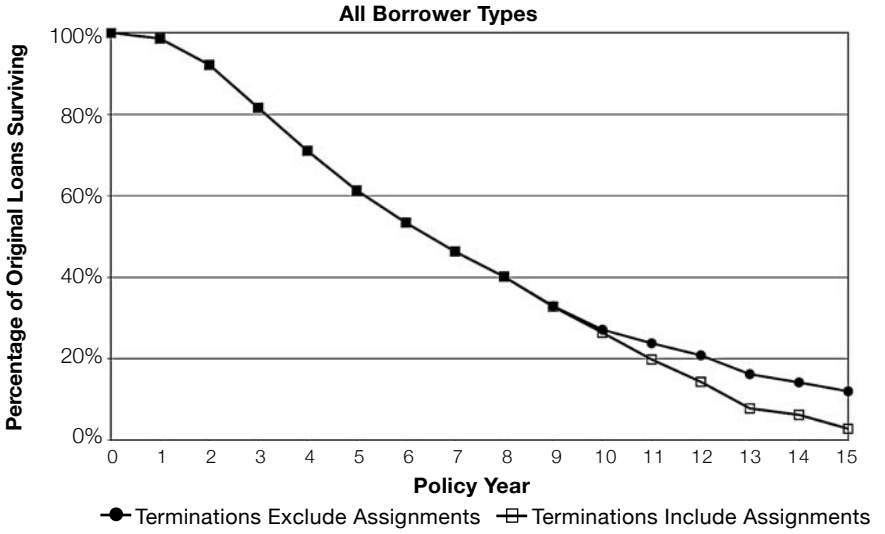


Exhibit 11

HECM Survival Rates—Ages 74 to 76

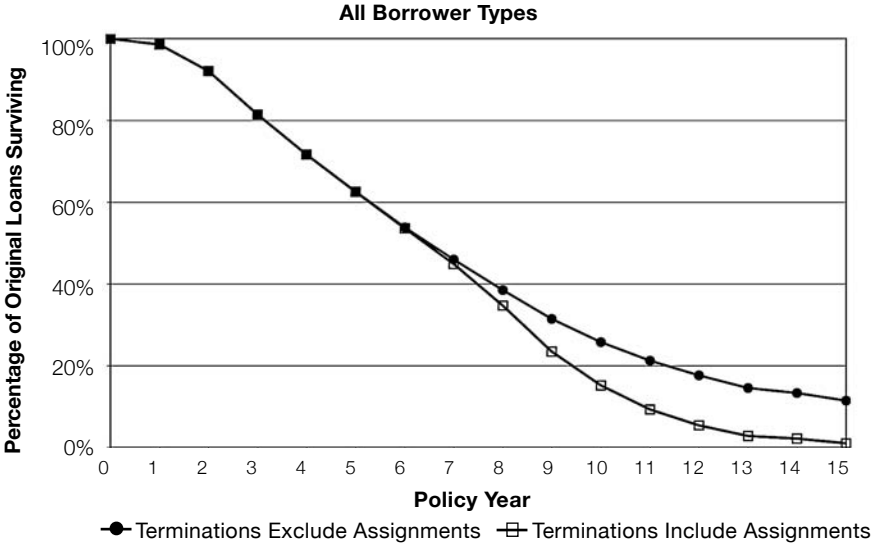


Exhibit 12

HECM Survival Rates—Ages 84 to 86

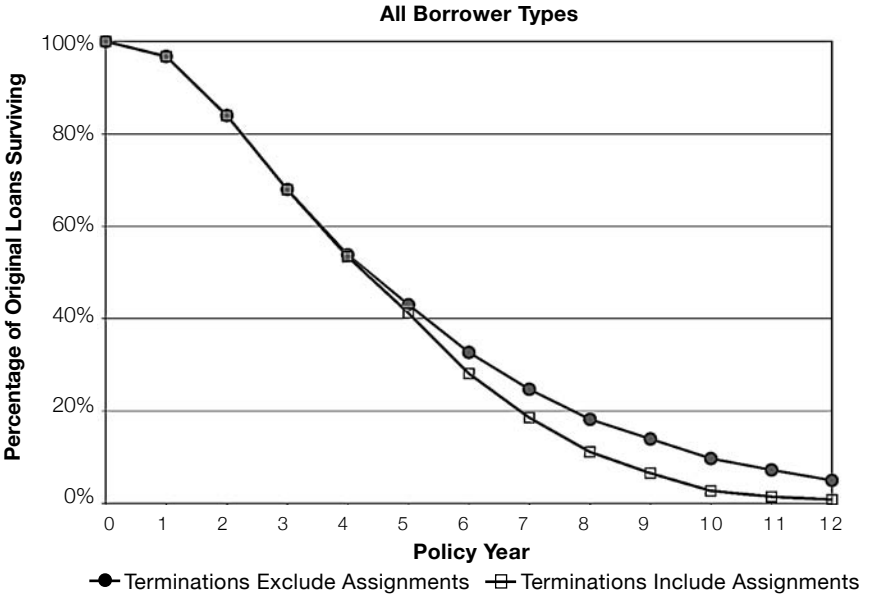
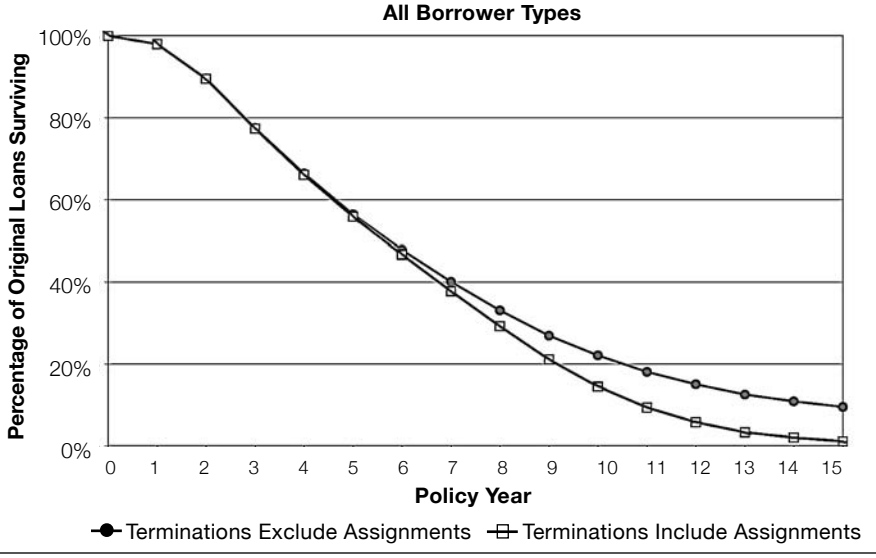


Exhibit 13

HECM Survival Rates—All Ages



Findings

The main findings from the data presented in exhibits 6 through 9 are as follows. First, the exhibits make clear that borrower age and type, as well as the timing of loan assignments to HUD, all affect the hazard and survival rates for HECM loans. Investors in particular need to be aware of the impact of loan assignments, because conventional reverse mortgage products do not have a similar feature.

Borrower Age

If the termination event of a HECM loan is defined in the traditional manner as a loan payoff due to borrower death, move-out, or other voluntary payoff such as refinancing, then—

- Exhibit 6A presents discrete-time hazard and survival rates that show younger borrowers (those in their mid-60s at loan origination) are paying off their HECM loans much faster than the underlying general population mortality rates for females. Specifically, for all borrower types in this age group, payoffs are occurring at approximately 6 to 8 times the female mortality rate.
- Exhibit 7A shows that typical HECM borrowers (those in their mid-70s at loan origination) are paying off their loans faster than the underlying general population mortality rates for females but at much smaller multiples (about 2 to 3 times the female mortality rates) than those observed for the younger borrowers.
- Despite the wide observed difference in the payoff rates for younger borrowers compared with typical borrowers when expressed as multiples of the underlying female mortality rates, the actual observed hazard rates for these two groups of borrowers are relatively similar. This similarity results, for example, in the 10-year survival rate of a HECM loan to younger borrowers being 27 percent and the 10-year loan survival rate for typical borrowers being nearly the same, at 26 percent.
- Exhibit 8A shows that older borrowers (those in their mid-80s at loan origination) are paying off their loans at much smaller multiples of the underlying general population mortality rates for females (about 1.5 times the female mortality rates).
- Despite observed payoff rates at much lower multiples of the underlying female mortality rates, older borrowers are paying off their loans faster than younger or typical borrowers are due to the higher mortality rates. This faster payoff results in the 10-year loan survival rate for older borrowers being observed at only 10 percent.
- Exhibit 9A, which includes all borrower ages, shows a 10-year loan survival rate of 22 percent.

Borrower Type

The hazard and survival rates in exhibits 6A through 8A also show, as one might expect due to differences in gender-specific mortality rates, that single females generally terminate their HECM loans more slowly than do single males of comparable age, but not as fast as couples (where the younger of the two is of comparable age). For example, the 10-year loan survival rates for typical

borrowers (those in their mid-70s at loan origination) are 26 percent for single females, 17 percent for single males, and 29 percent for couples.

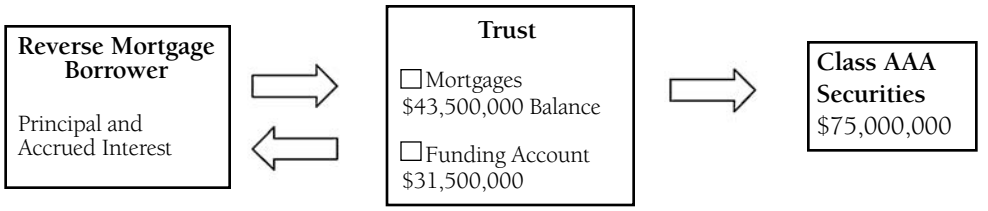
HECM Assignments

Because HUD pays the lender an insurance claim equal to the unpaid loan balance when an active HECM loan is assigned to HUD, investors in mortgage securities backed by HECM loans should consider assignments as termination events. Therefore, investors should define HECM terminations as loan payoffs due to death, move-out, other voluntary payoff, or by lender assignment of the loan to HUD. HECM termination experience changes in the following ways.

- First, hazard rates rise and loan survivor probabilities fall due to the loan assignments observed by policy year.
- Second, the first policy year for which assignments begin to affect the hazard and survival rates varies with the initial age of the borrowers. As shown in exhibits 6B through 8B, hazard and survival rates begin to change in policy year nine for younger borrowers, in policy year six for typical borrowers, and in policy year four for older borrowers. Before these policy years, very few loan assignments are observed.

Appendix

Stylized Reverse Mortgage Trust



A Stylized Trust

This stylized trust is based on 1,500 identical reverse mortgages. The borrowers are 75 years old with homes valued at $100,000. We assume the loans accrue interest at a variable rate that is indexed to the 1-year constant maturity Treasury rate if they are Home Equity Conversion Mortgage (HECM) loans, or to alternative interest rate indices, such as the London Interbank Offered Rate, if they are conventional reverse mortgages. The funding account consists of cash and/or liquid assets that accrue interest at a lower adjustable rate than the mortgages do. The securities, which are collateralized by both the mortgages and the funding account, are current-pay with coupon rates that are also lower than the mortgage interest rates.

The loans all have a 50-percent loan-to-value ratio (principal limit) and are structured as line-of-credit reverse mortgages. The borrowers take out 58 percent of the available balance on the first day. Subsequent withdrawals follow the pattern in exhibit 3 where an additional 7 percent is withdrawn in the second year of the loan, an additional 5 percent is withdrawn in the third year, and so on.

In this example, the aggregated collateral is $150 million of which $75 million is the initial principal limit. The aggregate initial loan balance is $43.5 million (based on the 58-percent draw on the principal limit) with a remaining $31.5 million of additional credit that the borrowers can draw. This additional credit makes up the funding account.

The securities are rated by a public ratings agency based on a specified stress scenario determined by the agency. Because reverse mortgages may not generate enough cashflow under stressful house price and interest rate scenarios to support timely interest and ultimate principal payments on the securities, the ratings agency will apply ratings criteria corresponding to the severity of the stress that the security can withstand.

If the reverse mortgages are HECM loans that are insured against losses from house price declines or rising mortgage accrual rates, then the securities will have considerable protection from stressful economics. The flowchart in this appendix corresponds to a HECM security in which there is a single class of AAA-rated securities. Conventional reverse mortgages, on the other hand, will have much less protection from stressful economics, and the trust may be structured with multiple classes of securities, with subordinated classes absorbing sufficient losses to enable senior classes to withstand higher stress levels and thereby achieve higher ratings from the ratings agency.

We note that a reverse mortgage security and a traditional forward mortgage-backed security (MBS) have similar structures. Nevertheless, MBSs do not have funding accounts because there is not a two-way flow of cash between the trust and the borrowers. We also note that alternative reverse mortgage securitization structures are under development that would divide each whole reverse mortgage loan used as collateral into participations (shares of the loan) and place only fully funded participations into the trust so that the trust would have no obligation to advance funds to borrowers. In this alternative securitization model, there would be no need for a funding account to meet borrower obligations because the issuer of the security would retain these obligations to make required cash advances to borrowers.

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Notes

1. The maximum claim amount is defined as the lesser of the original appraised value of the property securing the Home Equity Conversion Mortgage (HECM) loan or the maximum insurable mortgage under the Federal Housing Administration's (FHA's) Section 203(b) Program. The latter varies by locality and is set to equal 95 percent of the local median sales price for a single-family home, subject to a minimum of 48 percent of the Fannie Mae and Freddie Mac conforming loan limit in low-cost areas, to a maximum of 87 percent of the conforming loan limit in the highest cost markets. Thus, HECM maximum claim amounts are currently capped by Section 203(b) limits that range from $200,160 to $362,790.

2. When loan balances grow above the maximum claim that the U.S. Department of Housing and Urban Development will pay, lenders would become exposed to nonrepayment risk.

3. The HECM pricing assumptions use the age of the youngest of multiple borrowers and the 1979-through-1981 U.S. general population life tables published by the U.S. Department of Health and Human Services.

4. The literature also includes work on other reverse mortgage risk factors. For example, Rodda and Patrabansh (2005) estimate that the house values of elderly owners (age 75 and older) appreciate at real rates that are 1.0 to 1.2 percent less per year than the houses of middle-aged owners (ages 50 to 74). Similarly, Davidoff (2004) found evidence of real house price growth about 3.6 percent lower for homeowners age 75 and older compared with real house price growth for younger homeowners.

5. Lehman Brothers (2000: 19).

6. The average payout that HECM borrowers take in the first year is about 58 percent of the maximum payment (principal limit) followed by considerably smaller declining payments in all subsequent years.

7. U.S. Department of Housing and Urban Development (HUD) (2003, 2000, 1995, 1992, and 1990). These reports may be obtained from HUD's research dissemination service at www.huduser.org.

8. Refinancing a HECM loan is also a voluntary termination. In this case, the debt is paid in full from the proceeds of the new loan. In practice, borrowers have had little incentive to refinance a HECM, and the data confirm that few HECM refinances occurred during the 1990s. In 2004 HUD implemented a policy that reduced the upfront mortgage insurance premium on HECM cases that were refinanced after the effective date. This policy appears to have increased the incidence of refinance cases, particularly because, in addition to the reduced premium, robust house price appreciation in many parts of the country has increased HECM borrower incentives to refinance. Specifically, for the period from fiscal year (FY) 1990 through FY 2004, we identified only 2,256 refinanced cases in the data, which represented 2.0 percent of the total 115,472 cases insured through FY 2004. In FY 2005 and FY 2006, during which the reduced premium refinance policy was fully in effect, the number of refinanced cases was 6,338, bringing the total number of refinanced cases to 8,554, or 3.7 percent of the 236,500 cases ever insured.

9. A detailed discussion of the potential secondary market impacts on the overall HECM market can be heard in the audio transcript of an educational session of the National Reverse Mortgage Lenders' Association 2006 Annual Meeting and Expo in San Francisco, September 28 through 30, 2006. To access this audio file, "Developing a Secondary Market for Reverse Mortgages," use the link http://media.nrmlaonline.org/2006AM/SecondaryMarket.mp3.

10. "Structured Finance: Reverse Mortgage Criteria" by Standard & Poors' Ratings Services, New York, 1999. Similar reverse mortgage securities ratings criteria have subsequently been published by other public rating agencies: "Reverse Mortgage Securitizations: Understanding and Gauging the Risks" by Moody's Investors Service in 2000 and "Repay My Mortgage? Over My Dead Body! – Fitch's Reverse Mortgage Criteria" by Fitch Ratings in 2005.

11. On November 2, 2006, Fitch announced a AAA rating for another HECM security issued by the Mortgage Equity Conversion Asset Corporation consisting of $456 million in Class A notes.

12. Ginnie Mae does not buy or sell loans or issue mortgage-backed securities (MBSs). Rather, Ginnie Mae guarantees investors the timely payment of principal and interest on MBSs that are issued by private intermediaries and that are backed by federally insured or guaranteed loans—mainly loans insured by the Federal Housing Administration or guaranteed by the U.S. Department of Veterans Affairs. Ginnie Mae securities carry the full faith and credit guaranty of the U.S. government.

13. As of September 30, 2006.

14. The study did not capture any cases originated before September 30, 2006, but not endorsed for insurance by that date because reasons for the nonendorsement are unknown.

15. "Couples" does not necessarily refer to married couples; the term applies to all HECM loans with two co-borrowers, irrespective of gender.

16. "Censored" means the loan did not terminate as of the cutoff date of the analysis (September 30, 2006). The timing of the termination event for a censored loan is thereby not observed.

17. To illustrate the difference between a conditional probability and an unconditional one, consider the probability of someone dying exactly at age 95. The unconditional probability of dying at age 95 is very low (the vast majority of people die at other, mostly younger, ages). Nevertheless, if a person is already 94 years old, the probability of dying in the next year is quite large. The latter is a conditional probability of dying at age 95, given one has survived to age 94.

18. For example, the life-table method reduces the number of individuals at risk at the start of the period by one-half of the observations that were censored during the period to correct for individuals who were exposed to the hazard for less than the full period. A brief summary of the life-table method can be found in *SAS/STAT® User's Guide, Vol. 2, Version 6, Fourth Edition*, Chapter 26, "The LIFETEST Procedure," p. 1044, SAS Institute, Cary, NC.

19. For example, a loan that was originated on September 30, 2003, and that had not terminated as of the September 30, 2006, censoring or cutoff date would receive a policy year of

3.0, meaning that the loan was observed for exactly 3 policy years before it was censored from further observation. If a loan originated on September 30, 2003, had terminated on September 30, 2005, it would be given a policy year of 2.0, meaning it had been observed for exactly 2 policy years before it terminated. Most loans have fractional values for policy years, which means they have been observed for some whole number of policy years plus a fraction of another.

20. The following equations illustrate the life-table method's handling of censored observations. Let

A = the total number of loan records in the database (or a defined subset of the database, such as all loans made to borrowers of a given age),

d(i) = the number of loans that terminate in the i-th policy year,

C(i) = the number of loans censored in the i-th policy year (that is, the cutoff date occurred during policy year i for these loans), and

E(i) = the number of loans at risk at the *start* of the i-th policy year.

The life-table method treats all loans that are censored during the i-th policy year as if they all occurred at the midpoint of the year. This treatment assumes that censoring is randomly distributed throughout the year, and, as such, the average censored loan is exposed to risk for half of the policy year in which the censoring occurs. Thus, the *risk exposure*, E(i), also called the *effective sample size*, at the start of any year should be reduced by half of the censored cases during the year. Specifically:

$$E(1) = A - \tfrac{1}{2} C(1).$$

Similarly,

$$E(2) = E(1) - d(1) - \tfrac{1}{2} C(1) - \tfrac{1}{2} C(2)$$

$$= A - d(1) - C(1) - \tfrac{1}{2} C(2).$$

In general,

$$E(i+1) = E(i) - d(i) - \tfrac{1}{2} C(i) - \tfrac{1}{2} C(i+1)$$

$$= A - \Sigma\, d(j) - \Sigma\, C(j) - \tfrac{1}{2} C(i+1),$$

where the summations are taken over j = (1, ... , i).

21. In continuous time, the probability that an event occurs at *exactly* time t is infinitesimal. Instead, the hazard rate in the continuous model is the limit as s approaches 0 of the conditional probability of an event occurring during the interval from t to t + s:

$$h(t) = \lim_{s \to 0} P(t \le T < t+s \mid T \ge t) / s ,$$

where T represents the time at which the event occurs, and the condition $T \geq t$ implies that the individual is at risk at time t. If the hazard function h(t) thus defined is continuous, then the survival probability S(t) can be expressed by

$$S(t) = \exp\left(-\int_0^t h(y)\, dy \right).$$

22. To keep effective sample sizes higher, each age group presented in exhibits 6 through 8 includes borrowers who were 1 year older and 1 year younger at origination. For example, the exhibit for age 65 includes borrowers who were ages 64 through 66 at origination.

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Analyzing a Community Development Needs Index

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This article reflects the views of the author and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

The Community Development Block Grant formula has not changed since 1982. As a program that allocates billions of dollars each year, it is important that those funds be targeted as efficiently as possible to the places with the greatest community development needs. To first understand how well the current formula targets funds to these needs and then to identify better ways of targeting the funds, each community must have a score to represent its relative level of community development need. Because community development need is a function of many different things, it requires using a dozen variables or more to construct the score.

Since 1976, HUD has developed, and published in a series of reports, a community development needs index using the statistical procedure factor analysis. The first index was developed with 1970 data and subsequent indexes have used 1980, 1990, and 2000 census data. Factor analysis can be used in different ways to reduce many variables into a few variables that measure different patterns of distress. This article compares two approaches using 2000 census data and reaches the same basic conclusions about which key variables are important for demonstrating community development need. A wide range of policy choices on how to weight those variables exists, however, regarding what types of need are higher priorities for funding than others. It is in the weighting of the variables used in the Bush administration's proposal in 2006 for changing the formula, rather than the formula variables themselves, that the debate on improving the formula should focus.

Introduction

Established in 1974, the Community Development Block Grant (CDBG) formula program at the U.S. Department of Housing and Urban Development (HUD) has allocated roughly $116 billion[1] through fiscal year (FY) 2006 to cities, counties, and states to make improvements to distressed communities and improve the living conditions for low- and moderate-income households. The funds are allocated through a dual formula that was first fully implemented in 1981. The formula has remained substantially unchanged for 25 years. In 1976, 1979, 1983, 1995, and 2005, HUD developed indexes of community development need to rank cities, counties, and states by their relative level of community need and compare these levels against their CDBG formula allocation.

This article takes a second look at the needs index developed for the 2005 report and shows how the needs index might be improved and also shows a method for better informing policymakers about the policy choices imbedded within the needs index.

History of the CDBG Program

Title I of the Housing and Community Development (HCD) Act of 1974 terminated several categorical grant programs and replaced them with the new CDBG program. The Urban Renewal and Model Cities programs, open space land and beautification grants, neighborhood facilities grants, basic water and sewer facilities grants, and public facility loans were terminated and consolidated into the CDBG program.

Between 1949 and 1974, the federal government reviewed, approved, and financed proposals submitted by local governments for these categorical programs designed to improve downtown areas and revitalize distressed urban neighborhoods (HUD, 1995). With this funding system, specific projects were funded under categories that limited their scope to activities specified at the federal level. Grants were awarded on a competitive basis and required detailed applications for requesting funding. Matching funds were often required under the categorical grant system for participating cities.

Large-scale dissatisfaction with many components of categorical grant programs led to discussions about how federal community development funds should be allocated. As part of the Nixon administration's New Federalism, enactment of the HCD Act of 1974 marked the beginning of a new era in relations between the federal government and units of general local government (HUD, 1975). Title I of this legislation created the CDBG program, which replaced existing grant-in-aid programs. Under the CDBG program, funds go directly to general local governments. Observers believed that giving more decisionmaking power to local governments was an important aspect that was missing from previous community development programs. The belief was that local level officials could better assess community development needs.

The underlying purpose of Title I of the HCD Act is to increase the viability of urban communities by addressing housing needs and creating healthy living environments by expanding economic opportunity primarily for low- and moderate-income people. Furthermore, Title I objectives are met in many different ways, including stabilizing neighborhoods, increasing available public

services, vastly improving housing options and conditions, eliminating slums and blight, and meeting urgent community needs.

To increase localities' flexibility in carrying out community development activities, CDBG funds may be used anywhere within a local government's jurisdiction to serve the needs of low- and moderate-income people, address urgent needs, or eliminate slum and blight (HUD, 1975). For the first time, block grants offered an unprecedented degree of local control over allocating funds to programs and activities, which provided city and county officials broad discretion for funding housing, economic development activities, social services, and infrastructure (HUD, 1975).

Initially, the HCD Act specified the following seven national objectives:
1. Eliminating slums and blight.
2. Eliminating detrimental conditions.
3. Conserving or expanding the housing stock.
4. Expanding and improving services.
5. Facilitating more rational use of land and better arrangement of activity centers.
6. Reducing the isolation of income groups within communities.
7. Facilitating restoration and historic preservation.

In 1978, two additional purposes for the program were added (42 U.S.C. 5301(c)):
1. Stimulating private investment.
2. Conserving energy resources.

The formula-based design of the CDBG program gives local governments advanced knowledge of approximate annual funding amounts. This knowledge provides local governments with maximum planning opportunity.

CDBG Formula Creation

The primary purpose of Title I, to create a suitable living environment for people of low and moderate income, served as the driving force in designing the needs formula (Bunce, 1976). The belief behind the original formula was that a city's need for community development funds could be measured by three variables: population, poverty (weighted twice), and overcrowded housing, which were chosen as indicators with reliable data that would give an equitable measure of community development need and serve as the original formula factors.

Previously, under categorical grant programs, funds were distributed by competitive application procedures. This process may have meant that communities with similar needs would get very different grant amounts. To decrease the impact of a sharp drop in funding for communities that were receiving funds because of their greater success at obtaining funds under the competitive grant programs, compared with other similarly needy places, a "hold-harmless" provision was included in the 1974 CDBG legislation. The hold-harmless amount was the sum of the average of each amount received under the displaced categorical programs, not including the Model Cities and Urban Renewal programs, during FYs 1968–72 and the average annual grants received before July 1, 1972, under the Model Cities and Urban Renewal programs (Bunce, 1976).

In FYs 1975–77, entitlement communities having received higher levels of funding under displaced categorical grant programs than under the new formula grant would be held harmless and continue to receive the higher amounts (Bunce, 1976). For the next 3 years of the hold-harmless provision, 1978–80, these cities would see their excess funding dollars decreased by one-third in each program year. After the 3 years, all entitlement communities would receive a grant amount based on the CDBG formula, and communities in nonentitlement areas would compete for the funds allocated to their state nonentitlement areas (Bunce, 1976).

As the CDBG program began, many questions were raised about how well the program would function and whether the program should be continued. To provide for congressional reconsideration of methods for distributing funding assistance, Congress required that the Secretary of HUD submit a report by March 31, 1977, containing the Secretary's recommendations for modifying, expanding, and applying provisions related to the funding method, fund allocation, and basic grant entitlement determination (Bunce, 1976). The study of the formula required that methodology and results determine how funds could be distributed with the maximum extent feasible by objective standards.

Before the study was conducted, a series of objectives, including the following, were put into place to ensure meaningful results (Bunce, 1976):

- Developing criteria to measure the multidimensional variation in community development needs among entitlement cities.
- Evaluating and comparing the distribution of funds under the hold-harmless continuation of the displaced categorical programs and the existing CDBG formula.
- Designing alternative formulas that increase the emphasis on those dimensions of community development need ignored by the existing CDBG formula.
- Evaluating CDBG allocations under alternative formulas and comparing them with the hold-harmless continuation of the displaced categorical distribution with the current formula and with each other.

The HUD study had both significant and meaningful findings. First, the study reported that the hold-harmless distribution had a weak relationship with community development need. Second, study results suggested that the existing formula was highly responsive to the poverty dimensions but unresponsive to the nonpoverty dimensions of community development need. The study identified two variables related to community development need that were responsive to nonpoverty dimensions of community development need:

- The number of housing units constructed before 1939 was identified as having a significant correlation with housing abandonment and substandard housing and was a proxy for both government repair costs of sanitation facilities and sewage lines and housing maintenance costs (Bunce, 1976).
- Cities losing population exhibited far higher levels of community development need and fiscal strain than did fast-growing cities.

A separate study conducted by The Brookings Institution concluded that, compared with the categorical programs, full funding under the 1974 formula would have reduced funding most in the larger cities, especially those located in the Northeast and Midwest regions characterized by older housing stocks (Bunce and Goldberg, 1979). Both studies revealed that the major flaw of the 1974 formula was its unresponsiveness to the severe physical, social, and fiscal problems of older, deteriorating metropolitan cities (Bunce, 1976).

Questions concerning the allocation of block grant funds were critical community development legislative issues in 1977. At the time, HUD argued that an age variable, supplemented by a growth-lag variable, was needed to guarantee funding to cities experiencing the most severe physical and economic problems (Bunce and Goldberg, 1979). After much debate, a dual-formula system, with the second formula including growth lag and pre-1940 housing to target declining cities with older infrastructure, was adopted to replace the single-formula system. The 1977 amendments adopted a dual formula, which was first used in FY 1978 and greatly increased the formula allocation of funds to many jurisdictions, particularly the declining central cities of the Northeast and Midwest (Dommel et al., 1980).

The original 1974 CDBG single formula called for 20 percent of the CDBG funds to be set aside for nonmetropolitan area nonentitlement areas. The remaining 80 percent of funds were distributed to entitlement communities in metropolitan areas (MAs) and the nonentitled balance of MAs. The funds allocated based on the nonentitled balance of MAs were then to be administered by HUD through a categorical competition for nonentitled MA communities. Similarly, the nonentitlement set-aside was to be administered by HUD for the non-MA nonentitlement areas (Bunce, 1976). This system continued through FY 1981, even after switching to a dual formula in FY 1978.

Beginning in FY 1982, HUD offered states the opportunity to administer the CDBG Small Cities program. In doing so, the formula was modified so that the total state nonentitlement areas, including both non-MA and MA areas, would receive a 30-percent share of the CDBG allocation, with the remaining 70 percent being allocated exclusively to entitlement communities (Bunce, Neal, and Gardner, 1983).

Although several minor adjustments have been made to definitions over the years that have affected allocations for a few grantees, the major elements of the formula have remained unchanged since 1982.

Current Formula Mechanics

At the core of the current formula is the "dual formula." As noted above, this "dual formula" was created in reaction to the analysis of 1970 data that indicated problems associated with poverty to be very different than the problems associated with aging infrastructure and general population and economic decline.

The mechanics of the current "dual" formula are really two sets of dual formulas—one that allocates 70 percent of the funds among eligible metropolitan cities and counties (referred to as entitlement communities) and the other that allocates 30 percent of the funds among the states to serve nonentitled communities. It is worth noting that although the research that led to the dual

formula allocation was based on the different needs among cities, no similar research argued that the same approach would be applicable for the nonentitled areas served by states. Nonetheless, the states also have a dual formula.

The dual formulas are known as Formula A and Formula B. Exhibit 1 shows that for entitlements, Formula A allocates funds to a community based on its metropolitan shares of (1) population, weighted at 25 percent; (2) poverty, weighted at 50 percent; and (3) overcrowding, weighted at 25 percent, multiplied by appropriations. Formula B allocates funds to a community based on (1) its metropolitan shares of growth lag,[2] weighted at 20 percent; (2) its metropolitan shares of poverty, weighted at 30 percent, and (3) pre-1940 housing, weighted at 50 percent, multiplied by appropriations.

HUD calculates the amounts for each entitlement jurisdiction under each formula. Jurisdictions are then assigned the larger of the two grants. That is, if a jurisdiction gets more funds under Formula A than Formula B, its grant is based on Formula A. With this dual formula system, the total amount assigned to CDBG grantees has always exceeded the total amount available through appropriation. To bring the total grant amount allocated to entitlement communities within the appropriated amount, HUD uses a pro rata reduction. In FY 2006, for example, the pro rata reduction was 11.66 percent.

Exhibit 1

The Community Development Block Grant Formula Factors and Weights

Entitlement Communities

Formula A:

$$\left[0.25\ \frac{\text{Pop (a)}}{\text{Pop (MA)}} + 0.5\ \frac{\text{Pov (a)}}{\text{Pov (MA)}} + 0.25\ \frac{\text{Ocrowd (a)}]}{\text{Ocrowd (MA)}}\right] \times 70\%\ \text{of approp}$$

Formula B for cities:

$$\left[0.2\ \frac{\text{GLag (a)}}{\text{GLag (MC)}} + 0.3\ \frac{\text{Pov (a)}}{\text{Pov (MA)}} + 0.5\ \frac{\text{Age (a)}]}{\text{Age (MA)}}\right] \times 70\%\ \text{of approp}$$

Formula B for urban counties:

$$\left[0.2\ \frac{\text{GLag (a)}}{\text{GLag (ENT)}} + 0.3\ \frac{\text{Pov (a)}}{\text{Pov (MA)}} + 0.5\ \frac{\text{Age (a)}]}{\text{Age (MA)}}\right] \times 70\%\ \text{of approp}$$

States (Nonentitlements)

Formula A:

$$\left[0.25\ \frac{\text{Pop (a)}}{\text{Pop (NEnt)}} + 0.5\ \frac{\text{Pov (a)}}{\text{Pov (NEnt)}} + 0.25\ \frac{\text{Ocrowd (a)}]}{\text{Ocrowd (NEnt)}}\right] \times 30\%\ \text{of approp}$$

Formula B:

$$\left[0.2\ \frac{\text{Pop (a)}}{\text{Pop (NEnt)}} + 0.3\ \frac{\text{Pov (a)}}{\text{Pov (NEnt)}} + 0.5\ \frac{\text{Age (a)}]}{\text{Age (NEnt)}}\right] \times 30\%\ \text{of approp}$$

where:

- *(a)* is the value for the jurisdiction.
- *(MA)* is the value for all metropolitan areas.
- *(MC)* is the value for all entitlement cities.
- *(ENT)* is the value for all entitlement jurisdictions (cities and urban counties).
- *(NEnt)* is the value for all nonentitled areas nationwide.
- *Pop* is the total resident population.
- *Pov* is the number of people below the poverty level.
- *Ocrowd* is the number of overcrowded housing units.
- *Age* is the number of housing units built before 1940.
- *GLag* is the population growth lag.

As an example of this process, exhibit 2 shows the FY 2006 calculation for the Providence, Rhode Island CDBG grant.

The formula for the nonentitled areas of states generally operates like the entitlement formula. Two key differences exist, however: (1) Formula B uses population instead of growth lag, and (2) jurisdiction share is based on the state nonentitlement total rather than the metropolitan or nonmetropolitan total. As with entitlement communities, HUD calculates the amounts for each state under each formula and then assigns the larger of the two grants. To bring the total grant amount to states within the appropriated amount, HUD uses a pro rata reduction. In FY 2006, the pro rata reduction for states was 17.74 percent.

Exhibit 2

Example of the Current Community Development Block Grant Formula Mechanics

Step 1. Formula A and Formula B proportional allocation:

	Providence	Metropolitan or National Denominator	Providence's Share	National Appropriation	Providence's Base Grant ($000)
Formula A					
Population	178,126	247,680,575	0.0007192	0.25 * $3.704 billion	$466
Poverty	46,688	28,652,008	0.0016295	0.50 * $3.704 billion	$2,112
Overcrowding	5,225	5,668,390	0.0009218	0.25 * $3.704 billion	$597
Formula A "Base" Grant					$3,176
Formula B					
Growth lag	119,193	29,184,122	0.0040842	0.20 * $3.704 billion	$2,118
Poverty	46,688	28,652,008	0.0016295	0.30 * $3.704 billion	$1,267
Pre-1940 housing	31,950	13,350,260	0.0023932	0.50 * $3.704 billion	$3,103
Formula B "Base" Grant					$6,488

Step 2. Select the larger grant of the two and then use the pro rata adjustment:

The grant for Providence is larger under Formula B than Formula A and thus its base funding would be based on the $6.488 million Formula B grant. When all entitlement grants are summed together, however, the total amount of $2.935 billion exceeds the $2.593 billion appropriated by 11.66 percent. This leads to an across-the-board reduction of 11.66 percent:

Providence's final allocation is $6,488,000 * (1 – 0.1166) = $5,731,000.

CDBG Formula Studies, 1976–2005

In addition to undergoing the 1976 study noted above that led to the dual formula, the CDBG formula has undergone four other major assessments:

1. Bunce and Goldberg (1979). A followup report in 1979 discussed the targeting of the newly created formula.

2. Bunce, Neal, and Gardner (1983). With the introduction of new census data into the formula in 1980, HUD performed followup studies to determine whether the CDBG formula continued to target well to community development need. The studies showed that targeting to need had declined as new census data were introduced into the formula, but, in general, the formula still provided considerably more dollars per capita to needier communities than it did to less needy communities.

3. Neary and Richardson (1995). This study examined the impact that introducing 1990 census data would have on CDBG formulas' targeting to community development need. It documented the trends first identified by Bunce, Neal, and Gardner that the formulas' targeting had declined. It noted in particular the dramatic amount of demolition of pre-1940 housing that occurred in the 1980s, resulting in a shift in funds from needy communities demolishing those homes to wealthier communities rehabilitating their older homes.

4. Richardson (2005). This report continued in the tradition of the earlier reports, assessing how well the formula allocated toward community development need following the full introduction of 2000 census data into the formula. This report also provided several alternative formulas for improving targeting to community development need.

Developing a Community Development Needs Index

All of the studies from 1976 to 2005 developed community development needs indexes using the most current available data. Those indexes have been measuring sticks for assessing how well the CDBG formula allocates to need. In a broader sense, the indexes are also helpful for determining which communities are the most distressed in the country.

To assess how well the CDBG formula targets to the community development need of 2000, the Richardson (2005) report created two indexes: one capturing a range of community development needs among entitlement grantees and another capturing the community development needs of nonentitled areas served by states. This study made some advances on the earlier work of Bunce (1976), Bunce and Goldberg (1979), Bunce, Neal, and Gardner (1983), and Neary and Richardson (1995) by including urban counties[3] in the needs index for entitlements (prior studies had looked only at cities) and creating a separate needs index for nonentitlement areas of states.

As with the previous needs indexes, Richardson (2005) developed a needs index based on the statutory objectives of the CDBG program. The objectives are broad and, as such, the variables used for creating the index encompass many different elements—housing quality, infrastructure, economic development, poverty, tax base, and others. To account for these dimensions of need, the needs index is intended to serve as a "best estimate" of the actual level of community development need. For entitlements, the needs index developed for the Richardson (2005) study comprises 17 variables identified as indicators of one or more dimensions of community development need.[4] Exhibit 3 shows the variables used for the entitlement needs index along with a brief explanation about why each variable was selected. The variables are separated within the broad category of CDBG purpose, specifically targeting toward (1) low- and moderate-income people, (2) places in need of decent housing, (3) places without a suitable living environment, and (4) places with a lack of economic opportunities.

Factor analysis condenses the 17 variables listed in exhibit 3 into only a few variables. Factor analysis groups variables that appear to relate to each other and create a factor score for the patterns of variance common among variables. In past studies of the CDBG formula, three distinct patterns of variance have emerged, resulting in factors relating to problems associated with (1) poverty, (2) aging communities, and (3) communities in decline (Bunce, 1976; Bunce, Neal, and Gardner, 1983; Neary and Richardson, 1995). These different patterns of need between high-poverty communities and communities whose housing is aging and economy is declining drove the creation of the dual formula.

Exhibit 3

Variables for Measuring Community Development Need Among Entitlement Communities

Variable	Justification
1. Low- and Moderate-Income People	
People in poverty living in families or elderly households	The first CDBG formula study identified the importance of poverty as a measure of community development need because poor people have a high reliance on city government for basic necessities. This study uses people in poverty living in families or elderly households instead of simply people in poverty because the people in poverty variable from the census includes off-campus college students, who often receive support from their families that is not recorded by the census.
Percentage point change in poverty rate between 1990 and 2000	Jurisdictions with growing numbers of people in poverty have special community development needs associated with the jurisdictions' capacity to address a growing impoverished population. Research has demonstrated, for example, that every 1-percent increase in a city's poverty rate reflects a 5.5-percent increase in per capita expenditure on police services. Similar effects exist for fire protection costs (Ladd and Yinger 1989).
Jurisdiction per capita income relative to metropolitan per capita income	This is a new variable for this study. Rather than use per capita income alone, this measure takes into account the metropolitan context of that per capita income. It extends research conducted by Rusk (1993) showing that "the city-suburb per capita income ratio is the single most important indicator of an urban area's social health." Conceptually, it takes into account the relationship between the cost of providing services, which is driven by metropolitan area incomes (the employment and services market), and the tax base to pay for those services, which is driven by local incomes. The lower this ratio, the more difficult it is for a community to provide a level of service that can compete with the level of service provided in other communities in the metropolitan area.
Net change in per capita income from 1989 to 1999	This variable measures the economic growth of a community. Rising per capita income reflects a growing economy and a stronger tax base. Declining or relatively slow per capita income growth suggests a struggling economy and a waning tax base relative to rising costs for a jurisdiction.
Concentrated poverty	The sixth objective of the CDBG statute calls for the "reduction of the isolation of income groups within communities." A number of recent studies have documented the extent of poverty concentrations in the United States (Jargowsky, 1996; Rusk, 1999) and the consequences of ghetto poverty (Blank, 1997; Brooks-Gunn, Duncan, and Aber, 1997; Wilson, 1987). Recent research on the impact of moving poor families from high-poverty to lower poverty neighborhoods demonstrates significant effects for women and girls in terms of increased safety, reduced incidence of psychological disorders, and less obesity (Orr et al., 2003). Generally, the social cost of poor people living in high-poverty neighborhoods appears to be higher than the cost of just having poor people, in terms of public safety and healthcare costs.

CDBG = Community Development Block Grant.

Exhibit 3

Variables for Measuring Community Development Need Among Entitlement Communities (continued)

Variable	Justification
Female-headed households with children	This is a group seen to have daycare needs and consume more in public services than it returns in taxes. In addition, communities with large segments of single-parent households are often correlated with neighborhood instability and substandard housing (Bunce, 1976). This variable is also a good supplement to the poverty measure because it captures a high number of households that are just above the poverty threshold. According to census 2000 data, 49 percent of female-headed households with children in the United States have incomes of less than $20,000 compared with just 8 percent of married families with children. Very few female-headed households with children have higher incomes; only 4 percent nationwide have incomes greater than $60,000.
People with lower education levels	Lack of high school education is correlated with high crime rates, unemployment, and social problems. Individuals without a high school education also often live in declining neighborhoods. Not having a high school education increases the likelihood a person is dependent on public support (Bunce, 1976).
2. Decent Housing	
Occupied housing units that are pre-1950 and occupied by a poverty household Occupied housing units that are pre-1970 and occupied by a poverty renter	Earlier studies found that housing built before 1940 was an indicator of substandard housing and a good proxy for "government repair and maintenance costs of older sanitation facilities and sewage lines." Older housing was also associated with housing abandonment (Bunce, 1976). As needier jurisdictions have demolished their pre-1940 housing stock over time and less needy jurisdictions have renovated their pre-1940 housing stock, pre-1940 housing has steadily lost this targeting ability (Bunce, Neal, and Gardner, 1983; Neary and Richardson, 1995). Age of housing remains a good proxy for an older infrastructure, the costs of maintaining that infrastructure, and a need for historic preservation. Ladd and Yinger (1991) found that cities with older housing had higher operating costs than cities with newer housing did. It is highly desirable to capture the concept of age without overly rewarding communities that have aged gracefully. The 2000 census data do not have a perfect proxy for inadequate housing. Analysis of 2001 American Housing Survey data shows that, nationally, 6.3 percent of the nation's housing stock is inadequate. Older housing is indeed more likely to be substandard, with housing built before 1940 nearly twice as likely (11.1 percent) to be substandard than on average nationally. Poor people are also more likely to live in inadequate housing (12.1 percent). Combining poverty with old housing substantially improves targeting toward inadequate housing. Approximately 18 percent of pre-1950 housing units occupied by people in poverty have housing quality problems. Tenure is also a good measure of housing inadequacy and even more so when combined with income and age of housing. Nineteen percent of poverty renters of pre-1970 housing live in inadequate housing.
Housing units with more than 1.01 people per room	Overcrowding has increased between 1990 and 2000 and is closely associated with a growing immigrant population, which puts a unique strain on local government resources. Studies of the states of California and New Jersey commissioned by the National Academy of Sciences found that immigrants, particularly the low-skilled immigrants with larger families that reflect overcrowding, contribute less to local and state revenues than they consume (Smith and Edmonston, 1997).

Exhibit 3

Variables for Measuring Community Development Need Among Entitlement Communities (continued)

Variable	Justification
3. Suitable Living Environment	
Number of murders, assaults with weapons, incidents of nonnegligent manslaughter, and robberies per 1,000 people in 2001	Communities with higher crime rates are confronted not only by the need for greater police enforcement but also the social cost associated with higher crime, including substantial health costs (Orr et al., 2003). Crime also is a "push" factor that provides a strong incentive for people with a choice, generally the people contributing most to a jurisdiction's tax base, to leave the community (Skogan, 1990).
Number of people per square mile in 2000	Research by Ladd and Yinger (1991) demonstrated that higher general service costs are associated with both high- and low-density communities. According to Ladd and Yinger, "Cities with low densities face high transportation and coordination costs, whereas cities with high densities face severe congestion."
Level of minority segregation in metropolitan area multiplied by the percentage of the minority population	This study uses a metropolitan level dissimilarity index. This index measures the proportion of the population in the metropolitan area that would need to move for the minority population to be evenly represented in all census tracts. Zero represents complete integration and 1 is complete segregation. The index is then multiplied by the percentage of the minority population in a particular jurisdiction. In previous studies, the percentage of the population that is minority has been used as a separate indicator because urban blight and abandonment were found to be concentrated in minority neighborhoods. Areas with high minority concentrations were associated with overcrowded housing, a higher infant mortality rate, greater welfare dependency, substandard housing, and high rates of unemployment (Bunce, 1976). Minorities are also more likely to have extended stays in poverty (Blank, 1997). More recent research indicates that these problems are much more concentrated in metropolitan areas with high degrees of segregation (Rusk, 1999). Racial segregation has also been found to have a high correlation with fiscal inequality and urban sprawl, defined as decreases in population density in the urbanized area (Orfield, 2002). This observation could be driven partly by the substantial wealth gap between minorities and Whites (Oliver and Shapiro, 1995). From this evidence, this study concludes that jurisdictions with the highest percentages of minority populations in a racially segregated metropolitan area are likely to have relatively high levels of distress in terms of fiscal revenue capacity and loss of population density in favor of urban sprawl.
4. Economic Opportunities	
Population loss between 1960 and 2000	The 1960 census marked the population height for many older, industrial central cities. The growth of interstate highway systems and housing finance systems that favored suburban development over central city housing, along with the decline in the number of manufacturing jobs located in central cities, contributed a great deal to this population loss (Oliver and Shapiro, 1995). Cities with significant population loss are often confronted by the costs associated with managing abandoned housing, an aging infrastructure that is larger than needed or that it can support, and usually an older and larger poverty population than growing cities confront. As a result, these cities have higher than average numbers of municipal employees per 10,000 residents and tend to levy a higher combined state and local tax burden (Moore and Stansel, 1993). Even those jurisdictions that stabilized their population between 1990 and 2000 still retain the higher costs noted above.

Exhibit 3

Variables for Measuring Community Development Need Among Entitlement Communities (continued)

Variable	Justification
Population loss between 1990 and 2000	Some jurisdictions with populations that continued to grow between 1960 and 1990 have begun to experience population loss. These "newer" declining cities and urban counties, many of them inner-ring suburbs, are beginning to experience population decline and some of the stresses noted in the previous section for the older cities with population loss.
Population age 16 to 64 that was employed in 2000	The smaller the segment of a working-age population that is employed, the greater the social distress for a community. This variable is a measure of the extent that the primary generators of income for a community are idle, unemployed, or dependent on services. High rates of idleness are often related to higher crime and dependence on community services without contributing to the tax base.
People age 16 or older in the labor force who were unemployed in 2000	This variable is a direct measure of economic distress for a community. High numbers of unemployed people who are looking for work is reflective of a troubled regional economy or a mismatch between the skills of the people and the jobs available in the region.

Richardson's factor analysis likewise creates three factors, but the factors are different than those in previous studies (Richardson 2005). His 2005 study notes that a single factor now captures most of the variance associated with the variables of poverty, age of housing, and population decline, suggesting that a single formula could now capture those three elements, reducing the justification for the current dual formula. Richardson (2005) also highlights two new patterns of variance that arise in 2000—patterns that were not evident in 1970, 1980, or 1990: (1) a factor representing fiscal stress associated with immigrant growth (as shown by a factor that correlates highly with overcrowding and population growth) and (2) a factor reflecting low-density places with high-poverty concentrations but declining poverty rates.

Richardson (2005), using a different approach to the factor analysis than used in previous studies, employed an approach that seeks to have the first factor account for as much of the variance as possible; that is, choosing not to do any "rotations."[5] Previous studies had used Varimax rotation of the data, which is intended to "simplify" the factor solution. Both methods provide the same degree of fit between the data and the factor structure (Kim and Mueller, 1978).

This approach raises the question about whether the needs index developed in Richardson (2005) would be much different than a needs index developed using a Varimax rotation with Kaiser normalization.[6] To test this question, exhibit 4 compares the factor score correlations against the 17 variables in the needs index for both the unrotated factor scores and the rotated factor scores.

Exhibit 4

Comparing Factor Scores

	Factors Without Rotation				Factors With Varimax Rotation			
	U1	U2	U3	U4	R1	R2	R3	R4
Percent of variance explained	**45.5**	**15.6**	**8.8**	**5.9**	**25.1**	**24.6**	**16.1**	**10.0**
Correlation of variables to factors								
Percent of people living in families or elderly households in poverty	**0.913**	0.049	0.284	– 0.042	**0.607**	0.399	0.490	0.389
Percentage point change in poverty rate between 1990 and 2000	0.018	0.315	**– 0.644**	– 0.075	0.111	– 0.056	0.156	**– 0.693**
Jurisdiction per capita income relative to metropolitan per capita income	**– 0.668**	– 0.142	0.223	0.479	– 0.251	– 0.251	**– 0.774**	0.147
Net change in per capita income from 1989 to 1999	**– 0.676**	– 0.238	0.108	**0.578**	– 0.271	– 0.133	**– 0.875**	0.059
Percent of people in poverty living in census tracts of more than 40 percent poverty	0.489	– 0.058	**0.602**	0.146	0.393	0.181	0.087	**0.657**
Percent of households female-headed with children	**0.740**	– 0.454	0.032	– 0.139	0.136	**0.727**	0.401	0.255
Percent of the population age 25-64 with less than a high school education	**0.781**	0.464	0.077	– 0.041	**0.752**	0.073	0.508	0.065
Occupied housing units that are pre-1950 and occupied by a poverty household	**0.734**	– 0.491	– 0.250	0.028	0.173	**0.863**	0.261	– 0.008
Occupied housing units that are pre-1970 and occupied by a poverty renter	**0.855**	– 0.305	– 0.173	0.046	0.373	**0.776**	0.338	0.035
Percent of housing units with more than 1.01 people per room	0.479	**0.780**	– 0.026	0.179	**0.848**	– 0.265	0.234	– 0.161
Homicides, assaults, and robberies per 1,000 people (2001 UCR)	**0.711**	– 0.110	0.170	0.133	0.465	0.467	0.215	0.290
People per square mile	0.430	0.326	**– 0.557**	0.420	**0.633**	0.241	– 0.058	**– 0.562**
MA dissimilarity index multiplied by the percent of the population that is minority in the jurisdiction	**0.715**	0.401	0.004	0.337	**0.857**	0.174	0.146	– 0.003
Population lost between 1960 and 2000 (negative or 0)	**– 0.516**	**0.643**	0.242	– 0.151	– 0.008	**– 0.872**	– 0.019	– 0.006
Population lost between 1990 and 2000 (negative or 0)	– 0.429	**0.616**	0.178	– 0.139	0.032	**– 0.782**	0.011	– 0.048
Percent of population age 16 to 64 that is employed	**– 0.835**	– 0.206	– 0.172	– 0.052	**– 0.688**	– 0.287	– 0.404	– 0.229
Percent of population older than age 16 in the labor force that is unemployed	**0.864**	0.022	0.130	– 0.035	**0.552**	0.436	0.460	0.242

MA = metropolitan area.
UCR = Uniform Crime Reports.

As noted in Richardson (2005), the *unrotated factor* score creates the following:

- UFactor 1—Correlates most strongly with poverty and has very high correlations with 12 of the 17 variables in the needs index, including pre-1950 housing occupied by a poverty household, female-headed households with children, unemployment, and, to a lesser extent, population loss. This factor was defined as places with problems associated with poverty, age, and population decline.[7]
- UFactor 2—Correlates very strongly with overcrowding and places not losing population. This factor was categorized as representing places with growing immigrant populations.
- UFactor 3—Correlates with areas with high poverty concentration, declining poverty rates, and low poverty. This factor was defined as places with problems associated with poverty concentration and improvement.
- UFactor 4—Correlates with income growth during the 1990s.[8] This factor was defined as places with income improvement.

To create a single "needs score" for each grantee, Richardson (2005) weighted the Ufactors as follows: UFactor 1 at 80 percent, UFactor 2 at 15 percent, UFactor 3 at 5 percent, and UFactor 4 at 0 percent. The rationale for these weightings were that UFactor 1 captured most of the previously accepted priorities for the CDBG program; UFactor 2 represented immigrant growth, a growing source of fiscal stress on select communities; and UFactor 3 represented concentrated poverty but also, perhaps, an anomaly of declining poverty rates in the 1990s. UFactor 4 was not seen as representing any need at all.

By rotating the factors using the Varimax rotation approach, instead of creating a single factor strongly associated with poverty, four factors are created that each have a modest correlation to poverty and unemployment and strong correlations as follows:

- RFactor 1—Correlates most strongly with overcrowding, segregation, and low education levels.
- RFactor 2—Correlates most strongly with places with population loss, older housing occupied by poor people and renters, and female-headed households with minor children.
- RFactor 3—Correlates very strongly with places that have declining or slow-growing incomes and very low per capita incomes relative to their metropolitan areas.
- RFactor 4—Similar to UFactor 3 in the unrotated factor analysis, this factor correlates with areas with high poverty concentration, declining poverty rates, and low poverty. This factor was defined as places with problems associated with poverty concentration and improvement.

The advantage of this second approach is that it essentially ignores poverty as a factor to distinguish among the variations of other types of needs; that is, most of the communities that score high on the four RFactors also tend to have high poverty rates. It is evident, however, that, in addition to making policy decisions about poverty, we can make policy decisions regarding whether these four other factors—segregated communities with overcrowding and low education levels (RFactor 1), older urban areas with population decline (RFactor 2), places with income

decline in the 1990s (RFactor 3), or communities with concentrated poverty but decreasing poverty rates (RFactor 4)—are a higher priority.

With the unrotated approach, it is easy to conclude that the poverty/age/decline variable (UFactor 1) should be the most important. With the rotated approach, it is more difficult to decide how to weight the factors. RFactor 1 and RFactor 2 both represent about 25 percent of the variance, followed by RFactor 3 (16 percent) and RFactor 4 (10 percent). Of course, because any rotated factor solution explains exactly as much covariation in the data as the initial solution (Kim and Mueller, 1978), by regressing the needs score created on the unrotated factors against the factors created by using the Varimax rotation, it is possible to determine what weights could be applied to the rotated approach to create a needs index that has a perfect (1.000) correlation with the needs score using the unrotated approach. Doing this analysis finds that the rotated factors would be weighted as follows to match the needs index in Richardson (2005):

- RFactor 1—41-percent weight.
- RFactor 2—22-percent weight.
- RFactor 3—29-percent weight.
- RFactor 4—8-percent weight.

In other words, this analysis is another way to understand the *policy priorities* associated with the needs index used in Richardson (2005). Segregated communities with high rates of overcrowding and low rates of high school education attainment receive a 41-percent weight, communities with aging or dilapidated housing and population loss receive a 22-percent weight, communities with declining incomes and highly disadvantaged relative to their neighbors receive a 29-percent weight, and communities with concentrated poverty but declining poverty rates receive an 8-percent weight.

Clearly, how the factors are weighted matters enormously in terms of how a grantee might be ranked. Exhibit 5 shows the 20 most needy cities with populations of more than 100,000 according to the needs index and how the cities rank on each of the individual factors, both from the unrotated factor score and the rotated factor score. If, for example, the needs index had a greater weight on UFactor 1 of the unrotated factor score or on RFactor 2 of the rotated factor score while reducing the weights on the other factors, Buffalo and St. Louis would move up to being near the top of this list and El Monte, California, and Brownsville, Texas, would move toward the middle of the list.

Comparing Targeting of the Current Formula and the Administration's Proposed Formula

The analysis of the unrotated and rotated factors provides us with some tools to understand how well the current formula targets to different dimensions of community development need. In Richardson (2005), a fairly simple approach was used to show how the formula targeted against the needs index as a whole. It demonstrated this formula targeting both through a simple regression of the needs score against per capita grants and through graphic representation, as shown in exhibit 6.

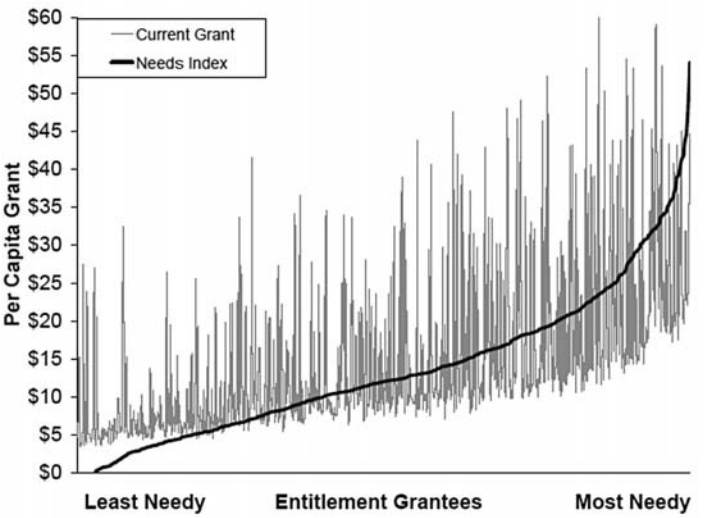
Exhibit 5

Twenty Most Needy Cities With Populations of More Than 100,000, by Needs Score and Ranks on Individual Factors

City and State	Need	Unrotated Factor Score			Rotated Factor Score			
		1	2	3	1	2	3	4
Newark, NJ	1	2	120	214	13	18	35	163
Hartford, CT	2	1	230	199	33	6	13	86
El Monte, CA	3	11	2	230	1	228	15	239
Brownsville, TX	4	15	20	1	6	243	77	1
Detroit, MI	5	3	236	72	25	3	201	24
Miami, FL	6	10	27	26	4	60	164	36
Paterson, NJ	7	8	17	244	12	40	18	244
Inglewood, CA	8	16	9	208	5	91	74	222
Santa Ana, CA	9	26	1	224	2	244	14	240
San Bernardino, CA	10	21	24	27	26	153	2	39
Pomona, CA	11	29	4	185	8	226	11	215
Cleveland, OH	12	6	238	156	65	4	134	50
Baltimore, MD	13	7	233	213	45	8	189	116
New Haven, CT	14	12	221	226	69	17	22	181
St Louis, MO	15	5	243	216	74	2	202	87
Buffalo, NY	16	4	244	239	114	1	142	188
Hialeah, FL	17	39	5	192	7	225	65	223
Flint, MI	18	9	239	67	79	9	153	20
New York, NY	19	22	32	243	3	29	235	242
Providence, RI	20	17	173	241	50	21	20	231

Exhibit 6

Current Entitlement Formula: Targeting to the Needs Index



Note: R-square: 0.323; Slope: 7.311.

The chart in exhibit 6 orders entitlement grantees left to right from least needy to most needy based on the needs index. The solid line represents how many dollars a jurisdiction would get on a per capita basis if the grant funds were allocated using the needs index. The "bouncing" line represents how many dollars jurisdictions get on a per capita basis with the current formula. A number of very low-need grantees on the left side of the chart get high per capita grants relative to their need under the current formula. Some very needy grantees on the right side of the chart receive relatively low per capita grants. More striking is that a great number of grantees with similar need, as demonstrated by each "spike," receive very different grant amounts. These spikes essentially represent the r-square. The higher the r-square, the greater the fairness in the allocation. Graphically, as the r-square increases, the "spikes" on the chart would get smaller.

Another measure of targeting is characterized by the "slope" of the allocation. With regression analysis, the slope implies how much a per capita grant increases for each standard deviation difference in need. That is, on average, a grantee funded under the current formula who is one standard deviation from the mean gets $7.31 more per capita than a grantee with average need gets. The needs index line shown on the chart in exhibit 5 represents a slope of 12. That is, if the needs index were used to allocate funds, a grantee with one standard deviation of need greater than the mean gets $12 more per capita than the average grantee gets. Setting the slope of 12 for the needs index line in the chart is a policy decision to set an aggressive goal for differentiating grants between the more and less needy.

The goal behind developing an alternative formula is to both improve fairness (r-square) and slope. In May 2006, the Bush administration proposed to Congress that it consider adopting a formula that would do both.

Exhibit 7 shows the proposed formula. A single formula rather than a dual formula, the proposed formula uses variables identified through the factor analysis as having the strongest targeting to the needs index, and it eliminates the 70/30 split between entitlements and nonentitlement grantees, with the full appropriation allocated to all grantees under this single formula.

The proposed formula is calculated in three steps. The first step is to allocate the funds based on each community's proportional share of the four variables representing community distress. That is, 50 percent of the appropriated funds would be distributed to grantees based on each grantee's proportional share of the national population in poverty, 30 percent to grantees based on each grantee's proportional share of housing 50 years or older and occupied by a poverty household, 10 percent on female-headed households with minor children, and 10 percent on overcrowded housing units. The second step is to increase or decrease the resulting "base" grant using the ratio of a metropolitan area's per capita income relative to an entitlement community's per capita income.[9] The rationale for the per capita income adjustment is two-fold. It makes general adjustments for cost-of-living differences between metropolitan areas and it adjusts for fiscal capacity differences between communities.[10]

The third step is to apply a pro rata adjustment if the resulting grants are more or less than total appropriations. Exhibit 8 uses the grant calculation for Providence, Rhode Island, as an example of how the proposed formula works mechanically.

Exhibit 7

The Bush Administration's Proposed Formula*

Entitlement Communities and States (Nonentitlements) Under a Single Formula

$$\left[0.5\ \frac{\text{Povncol (a)}}{\text{Povncol (ALL)}} + 0.1\ \frac{\text{FHHKIDS (a)}}{\text{FHHKIDS (ALL)}} + 0.1\ \frac{\text{Ocrowd (a)}}{\text{Ocrowd (ALL)}} + 0.3\ \frac{\text{Agepov (a)}}{\text{Agepov (ALL)}}\right] \times \text{total appropriation}$$

The calculation is then adjusted by the ratio of per capita income (PCI) of the metropolitan statistical area (MSA) divided by the PCI for the jurisdiction (PCIMSA/PCILocal), with caps such that no grant is adjusted either upward or downward by more than 25 percent. All state grants are assigned a PCIMSA/PCILocal ratio of 1. Pro rata reduction is used to bring the total grant into line with appropriation.

Where—
- *(a)* is the value for the jurisdiction.
- *(ALL)* is the value for all 50 states, the District of Columbia, and Puerto Rico.
- *Povncol* is the number of people living in poverty excluding college students.
- *Ocrowd* is the number of overcrowded housing units.
- *Agepov* is the number of housing units 50 years or older and occupied by a poverty household.
- *FHHKIDS* is the number of female-headed households with children under the age of 18.

** The administration's proposal also includes a minimum funding threshold. Specifically, an entitlement grantee must receive a formula grant in excess of 0.058 percent of appropriation or lose entitlement status. The argument for this is administrative: roughly $500,000 (which represents approximately 0.058 percent of appropriation in fiscal year 2006) is the minimum grant needed to run an efficient program. As such, for purposes of maintaining an "apples to apples" comparison, this discussion of relative community needs does not drop grantees from this analysis who fall below the threshold.*

In Richardson (2005), the variables used for the allocation were identified by examining UFactors 1 and 2 and identifying variables, particularly within UFactor 1, that might represent unique characteristics of need not captured by poverty. In Richardson (2005), female-headed households with children under 18 and housing 50 years or older occupied by a poverty household are identified as variables within UFactor 1 representing some unique characteristics of need independent of poverty. As it turns out, by rotating the factor analysis, we get the same result. RFactor 2 shows housing 50 years or older and occupied by a poverty household and female headed households with children under 18 representing a unique dimension of need that has only a modest correlation with poverty. Further, the rotated factor analysis reinforces the importance of overcrowding as a measure of need through its strong association with other measures of need in RFactor 1. Finally, RFactor 3 gives support for using the per capita income adjustment factor (the per capita income of the metropolitan area divided by the per capita income of a local jurisdiction) as a means to target community development needs.

As shown on the chart in exhibit 9, the administration's proposal relative to the overall needs index does substantially improve fairness—the r-square improves from the current 0.323 to 0.733 as demonstrated by the smaller spikes among similarly needy places. The slope increases from 7.131 to 10.151; so, on average, the more needy grantees receive an increase in funding relative to the funding the less needy grantees receive.

Exhibit 8

Example of the Bush Administration's Proposed Formula Mechanics

Step 1. Proportional allocation:

	Providence	Nation	Providence's Share	National Appropriation	Providence's Base Grant ($000)
Poverty (excluding college students)	41,463	33,497,806	0.001238	0.5 * $3.704 billion	$2,292
50-year-old housing with poverty householder	8,517	3,301,057	0.002580	0.3 * $3.704 billion	$2,867
Female-headed households with minor children	8,748	7,462,421	0.001172	0.1 * $3.704 billion	$434
Overcrowding	5,225	6,252,299	0.000836	0.1 * $3.704 billion	$310
"Base" Grant total					$5,903

Step 2. Per capita income adjustment:

	Providence	Providence Metropolitan Area	Ratio (Metro Area PCI/ Local Area PCI)	Base Grant ($000)	Adjusted Grant ($000)
Per capita income	$15,525	$21,448	1.38 (capped at 1.25)	$5,903	$7,379

Step 3. Pro rata adjustment:

The total dollar amount for all adjusted grants is $3.900 billion, but appropriations are only $3.704 billion. As a result, every community's grant is multiplied by the ratio of $3.704 billion divided by $3.900 billion or 0.949704.[a] This is a reduction of 5 percent for all grantees.

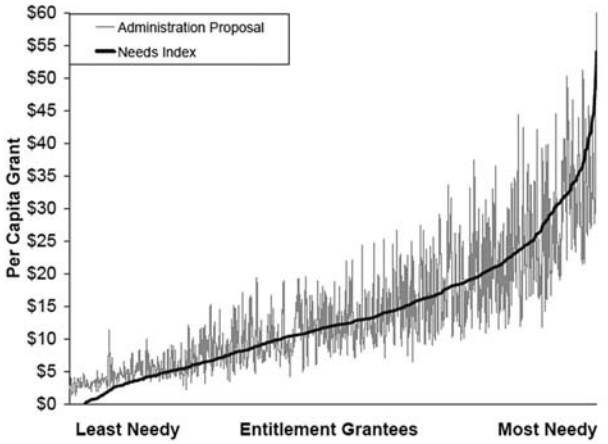
Providence's final allocation is $7,379,000 * 0.949704 = $7,008,000.

PCI = per capita income.

[a] The pro rata adjustment has the effect of reducing grants overall. Thus, if a community's PCI adjustment factor is 1, its grant does not change under Step 2, but, because overall Step 2 increases allocations more than it reduces allocations, the pro rata reduction results in a real decrease of 5 percent for grantees with PCI ratios of 1.

Exhibit 9

The Bush Administration's Proposed Formula: Targeting to the Needs Index



Note: R-square: 0.733; Slope: 10.151.

What Types of Need Are Better Targeted?

On the needs index developed for Richardson (2005), the administration's proposal clearly improves targeting to needs. It comes at a significant cost, however. More than half of entitlement grantees would have reductions in funding, some quite dramatically, if the administration's proposal were implemented. So the question is, on average, what types of needs are being targeted better?

One way to answer this question is to look at the individual factors created through both the unrotated and rotated factor analyses discussed previously. Exhibit 10 shows how the regression results change when the individual unrotated factors are regressed as independent variables against the per capita grants of the current formula and the administration's proposed formula. Exhibit 11 shows the same information for the factors created using the Varimax rotation.

Exhibit 10 shows that, compared with the current formula, the administration's proposal increases targeting on all three of the unrotated factors. Its targeting to UFactor 1, poverty/age/decline, increases from $7.19 per standard deviation to $8.94 per standard deviation and, although UFactors 2 and 3 continue to have a negative relationship to the formula, the negative targeting is less so than under the current formula. This concept of reducing the negative targeting on UFactor 2 is a bit difficult to conceptualize. The Varimax rotated factor analysis might help resolve this conceptualization a bit because RFactor 1 captures the overcrowding associated with distress without capturing the overcrowding associated with growth observed with UFactor 2. The administration's proposal substantially improves targeting to this factor. In contrast, with RFactor

Exhibit 10

Comparing the Current Formula With the Bush Administration's Proposed Formula on the Factors Generated Through the Unrotated Factor Analysis

UFactors	Current Formula	Administration's Proposal
Constant	14.916	13.971
UFactor 1—poverty/age/decline	7.194	8.944
UFactor 2—overcrowding and growth	– 4.903	– 2.284
UFactor 3—concentrated poverty and declining poverty rates	– 3.046	– 1.179

Note: R-square for the current formula is 0.774; 0.927 for the administration's proposal.

Exhibit 11

Comparing the Current Formula With the Bush Administration's Proposed Formula on the Factors Generated Through the Varimax Rotated Factor Analysis

RFactors	Current Formula	Administration's Proposal
Constant	14.920	13.970
RFactor 1—overcrowding/segregation/low education	2.048	4.194
RFactor 2—old housing and population loss	8.864	7.151
RFactor 3—declining incomes/high deprivation relative to metropolitan area	1.790	4.166
RFactor 4—concentrated poverty and declining poverty rates	– 0.639	0.737

Note: R-square for the current formula is 0.787; 0.927 for the administration's proposal.

2 of the rotated factor results, the old housing and population loss factor actually has a reduction in targeting compared with the current formula, while RFactor 3 on declining incomes and high deprivation relative to the metropolitan area has a very large increase. This change in emphasis in targeting between RFactor 2 and RFactor 3 is a direct result of moving away from growth lag in the current formula to the per capita income adjustment factor in the proposed formula.

Are There Other Policy Choices?

Embedded within the analysis in Richardson (2005) are a number of policy choices:
1. Selecting variables for the needs index.
2. Using the factor analysis method.
3. Weighting the factors.
4. Selecting variables for alternative formulas.
5. Weighting alternative formulas.

Richardson (2005) attempts to discuss and justify each of those choices. Nonetheless, there is always room for other ideas and improvements. The Government Accountability Office has begun a project (in the fall of 2006) to update and improve on the needs index used in Richardson (2005) and likely suggest some other improvements. To that end, here are some thoughts about possible improvements.

Variables Selected for the Needs Index

Concerns about variables used in the needs index generally focus on what needs may not be accounted for in the index, including better measures of abandoned buildings, high housing costs, economic decline, and poverty adjusted for different costs of living. In addition, for the nonentitlement needs index, better measures of infrastructure needs would be highly desirable.

The need index for Richardson (2005) was developed in 2003. Since that time, the combination of new data becoming available and legitimate criticisms of the current index point toward the following potential changes to the needs index:

1. In place of the "people in poverty living in families or elderly households" variable, use the special tabulation of census 2000 data, "people in poverty less unrelated college students."
2. In place of "population loss between 1960 and 2000" (and "population loss between 1990 and 2000"), use "number of households lost between 1960 and 2000."
3. Take advantage of the new economic census and add new measures for change in retail and manufacturing employment between 2002 and 2007.
4. Use a new data set created for HUD by the U.S. Postal Service on "vacant addresses" to proxy abandoned housing.
5. Explore using fair market rents to adjust poverty counts for cost-of-living differences between communities.

The Factor Analysis Method and Weighting the Factors

The analysis in this article suggests that using several different factor analysis methods can be useful for refining the policy choices and helping to decide how to weight the resulting factors. The unrotated factor analysis can provide one very strong factor and thus reduce the need to make difficult policy decisions on how to weight the data. A rotated factor analysis, however, creates more distinct groups and gives greater flexibility in making deliberate policy choices about what types of need the CDBG program should target as priorities.

Selecting Variables for Alternative Formulas

The analysis in this article also demonstrates that using multiple methods of factor analysis can help narrow what variables to consider for alternative formulas. This article reinforces the choices made in Richardson (2005) to include poverty, housing 50 years or older and occupied by a poverty household, overcrowding, and female-headed households with children under 18 as the base variables. It also reinforces the use of the per capita income adjustment factor in an alternative formula.

Nonetheless, if modifications are made to the needs index, other variables may be identified as better variables or additions to the ones proposed in Richardson (2005).

Weighting Alternative Formulas

The weights in the formula, just as the weights on the factors, are clear policy choices about how funds should be distributed. This article shows that poverty is an excellent measure of general community distress, overcrowding targets toward growth/immigration/segregation, housing 50 years older and occupied by a poverty household and female-headed households with children under 18 target toward aging communities with population loss, and the per capita income adjustment factor targets toward income decline. By simply adjusting the weights on the administration's proposal for formula reform to Congress, one can shift the targeting to focus more strongly on one of those items over another.

Conclusion

The CDBG formula has not changed since 1982. As a program that allocates billions of dollars each year, it is important that those funds be targeted as efficiently as possible to the places with the greatest community development needs. To first understand how well the current formula targets to these needs and then to identify ways to better target the funds first require giving each community a score to represent its relative level of community development need. Because community development need is a function of many different things, it requires using a dozen variables or more to construct such a score.

Since 1976, using the statistical procedure factor analysis, HUD has developed and published in a series of reports a community development needs index. The first index was developed with 1970 data and subsequent indexes have used 1980, 1990, and 2000 census data. Factor analysis can be used in different ways to reduce many variables into a few variables measuring different

patterns of distress. This article compares two approaches with the 2000 census data and reaches the same basic conclusions about what key variables are important for demonstrating community development need. A wider range of policy choices on how to weight those variables exists, however, regarding what types of need are higher priority for funding than others. It is in the weighting of the variables used in the Bush administration's proposal for changing the formula, rather than the formula variables themselves, that the debate on improving the formula should focus.

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Notes

1. $196 billion in 2006 dollars.
2. Growth lag is the shortfall in population that a city or county has experienced when comparing its current population with the population it would have had if it had grown at the rate that all metropolitan cities have grown since 1960. If a city or county grew at a rate greater than the rate for all metropolitan cities, it receives a growth-lag value of 0. Cities receive growth-lag funding based on their share of total growth lag for all cities, while urban counties receive growth-lag funding based on their share of total growth lag for all entitlements (urban counties and cities).
3. Under the Community Development Block Grant (CDBG) program, the balance of counties, after excluding CDBG entitlement cities and other jurisdictions not wanting to participate with the county with populations greater than 200,000, receive grants under the CDBG program.
4. The state needs index, not discussed in detail in this article, includes 10 variables.
5. The solution is obtained using principal component analysis with no rotation. The extract is restricted to eigenvalues greater than 1. The solution is orthogonal.
6. In both cases, a factor must have an eigenvalue of 1 or greater to be included. This eigenvalue restriction is intended to limit the number of factors created.

7. Bunce, Neal, and Gardner (1983: 57) noted using 1980 data that "poverty is now a much broader indicator of community development problems than in 1970." They observed that the "poverty rate fell in many growth areas and increased in many older declining areas; now it is a better proxy for problems such as unemployment and slow growth in retail sales." These trends have clearly continued and made poverty an even stronger indicator of community need.

8. Richardson (2005) does not discuss this factor due to the factor correlating with economic improvement and no indicator of decline.

9. The per capita income adjustment is capped so that it cannot be more than 1.25 or less than 0.75. This "cap" is intended to prevent the adjustment from creating serious anomalies in allocations relative to similarly needy places. In the current formula, the "growth lag" variable was developed to allocate large shares of money to the most needy places. Because growth lag has no cap, however, it has created serious anomalies between similarly needy places.

10. Cost-of-living adjustment between metropolitan areas = metro area per capita income/ national per capita income. If the community is in a metropolitan area with relatively higher per capita incomes, it is presumed that the cost for the grantees in the metropolitan area to provide services is higher in this area. Also, it presumes that the cost to poor people to buy goods and services is higher in these metropolitan areas.

    Fiscal capacity adjustment between communities = national per capita income/entitlement community per capita income. If the community has lower per capita income than the nation as a whole, it is presumed that it has relatively less ability to raise revenues to address its needs.

    By combining these two adjustments, national per capita income cancels itself out, leaving the ratio of metro per capita income / entitlement community per capita income.

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The Value of the Sunshine Cure: The Efficacy of the Real Estate Settlement Procedures Act Disclosure Strategy

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This article reflects the views of the author and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

This article examines the efficacy of the disclosure strategy of the Real Estate Settlement Procedures Act (RESPA). Four questions are critical in evaluating the efficiency of federally mandated disclosure by itself as a regulatory strategy: whether lending and title fees are large enough to be worth regulating; whether the Good Faith Estimate mandated by RESPA is an unbiased and consistent estimator of lending and title fees; whether state law has a negligible effect on fees (and therefore only national regulation is pertinent to the problem RESPA addresses); and whether RESPA achieves fairness, in the sense that disclosure so strengthens the negotiating position of buyers and sellers relative to service providers that the principals' personal characteristics do not influence the fees they pay. This article presents preliminary tests on these issues from a small and somewhat unrepresentative sample of FHA-insured loans.

Introduction

The Real Estate Settlement Procedures Act (RESPA) regulates the provision of services involved in the sale of most single-family homes in the United States. Its declared intent is to protect the consumers of those services. The academic literature on the effects of RESPA is rather limited, and most of what has been written is not empirical. This neglect of the effects of regulation on transactions contrasts strangely with the heavy academic attention given to the regulation of transactions in other financial service sectors, such as securities or insurance.

RESPA is a form of sunshine regulation. That is, it regulates not the quality, cost, or other characteristics of the service itself but rather the completeness and timing of disclosure to customers. My goal in this article is to pose what I believe to be four essential empirical questions about the effects of RESPA, a federal regulatory regime, on social welfare:

1. Whether lending and title fees are large enough to be worth regulating.
2. Whether the Good Faith Estimate (GFE) mandated by RESPA is an unbiased and consistent estimator of lending and title fees.
3. Whether state law has a negligible effect on fees (and therefore only national regulation is pertinent to the problem RESPA addresses).
4. Whether RESPA achieves fairness, in the sense that disclosure so strengthens the negotiating position of buyers and sellers relative to service providers that the principals' personal characteristics do not influence the fees they pay.

I do not claim to provide satisfactory answers to these questions. The data analyzed here, a small sample of mortgages insured by the Federal Housing Administration (FHA), are insufficient for that purpose. This article should be viewed as simply a starting point, given the paucity of analytic empirical studies. It is a demonstration that the current regulatory regime merits serious scrutiny but does not itself amount to definitive analysis.

The next section of this article explains the provisions of the statute. The following section reviews the relevant literature and the social welfare implications of sunshine regulation in general. The third section places RESPA in several contexts: it discusses the services for which fees are charged, the constraints on buyers and sellers, and the conceivable alternatives to RESPA. The four propositions above are developed within this context for empirical testing. The fourth section describes the data, the fifth section presents the results of the analysis, and the article ends with concluding remarks.

The Law

RESPA regulates the conduct of service providers when a single-family home is bought with a loan that (1) comes from a federally insured depository institution or a federally regulated lender; (2) is insured by a federal agency; or (3) will be sold to Fannie Mae, Ginnie Mae, or Freddie Mac. RESPA therefore governs most single-family mortgages in the United States.

The declared purposes of RESPA are as follows:

1. "… (M)ore effective advance disclosure to home buyers and sellers of settlement costs;"
2. "… (E)limination of kickbacks or referral fees that tend to increase unnecessarily the costs of certain settlement services;"
3. "… (R)eduction in the amounts home buyers are required to place in escrow accounts….;"
4. "… (S)ignificant reform ... of local record keeping of land title information."

This article analyzes the efficiency of the regulatory strategy inherent in the first goal and, to some extent, the second goal. The treatment of escrow is outside my present scope and so is reform of title recordation by local governments, which, in any case, has not occurred to any meaningful extent.

The relevant substantive provisions of RESPA are as follows:

- Section 4 of the act provides that the U.S. Department of Housing and Urban Development (HUD) must prescribe a standard form for the statement of settlement costs. The person conducting the settlement, who is usually an attorney or escrow agent, must give the form to the borrower at settlement or, on request, 1 day before. This document is the HUD-1.
- Section 5 states that within 3 days of receiving a loan application, the lender must make a GFE of the settlement costs the buyer is likely to incur. The GFE does not have a prescribed form but usually follows in part the format of the HUD-1, in which the corresponding actual costs are detailed.
- Section 8 states that no person may give or receive a kickback, fee, or any other thing of value in return for referring business to a settlement provider. The penalty for violating this provision is a fine of up to $10,000 or a prison term of not more than 1 year. The prohibition does not apply to payments for services actually performed.

Sunshine Regulation

The body of RESPA scholarship by economists is fairly short: Bourdon (1994); Colwell and Kahn (2001); Crowe, Simonson, and Villani (1981); Guttentag (2000); Hofflander and Shulman (1977); Lee and Hogarth (2000); Lexecon, Inc. (1995); Mills (1994); Peat Marwick Mitchell & Co. with Grundfest (1980); Shroder (1997); Villani and Simonson (1982); Weicher (2001, 1997); White (1984); and Woodward (2003). Of these 15 papers, only Guttentag, Lexecon, Shroder, and Woodward attempt to analyze individual data on observed RESPA-regulated behavior.

Lexecon's 1995 study compares settlement fees charged to two groups of homebuyers doing business with particular large brokerages: those who use subsidiaries of the brokerages for title services and those who get title services from independent providers. They find the two groups pay about the same. My 1997 paper views RESPA through the lens of principal-agent theory and has a microscopic sample. Guttentag (2000) and Woodward (2003) document enormous price discrimination by mortgage brokers, conduct that is lawful under RESPA but possibly indicative of failure to achieve the declared regulatory intent, because the "more effective disclosure" fails to deter the discrimination.

This article differs from the previous papers mentioned in analyzing RESPA as a regulatory strategy relying on federally mandated information disclosure. Regulation by disclosure is a common strategy in the United States. Examples include requirements for financial disclosure by publicly held corporations and banks, labeling laws for food and pharmaceuticals, statutes requiring prior notice of plant closings, informed-consent prerequisites for medical experiments, and obligations on car repair garages to provide initial estimates of the cost of repair.

The common theme of such regulation is that the less informed party must receive some minimum information from the more informed party before the transaction is considered lawful.

In regulation by publicity, government does not prohibit any type of transaction as inherently unfair, given the information provision. Louis Brandeis stated the rationale in 1913 in a quote much beloved of lawyers and regulators: "Publicity is justly commended as a remedy of social and industrial diseases. Sunlight is said to be the best of disinfectants; electric light the most efficient policeman." (1914).

Brandeis' language is rather loose: sunlight is not the most powerful of disinfectants (try chlorine or iodine), nor do electric lights have the power to arrest perpetrators. Publicity is often a less costly policy instrument than enforcement, however, so we can read Brandeis as arguing that sunshine regulation may have greater net social benefits, given enforcement costs, than any regulatory alternative, including laissez-faire.

The economic theory of enforcement, summarized recently in Polinsky and Shavell (2000: 70), holds that optimal enforcement "tends to be characterized by some degree of under-deterrence [in that...] by lowering the probability of detection from a level that would lead to first-best behavior, the state reduces enforcement costs, and although more individuals commit the harmful act, these individuals do not cause social welfare to decline substantially because their gains are approximately equal to the harm."

Perhaps in the case of the RESPA kickback rule, the government has, in conformity with theory, implicitly chosen a low probability of detection. From 1995 through 2000, for example, HUD issued no press releases announcing enforcement actions under Section 8 of RESPA, the criminal portion of the statute,[1] although one should note that since about 2003 HUD has been considerably more active in prosecuting referral claims.[2]

On the other hand, the same theory holds that harsh financial penalties for proven offenders should substitute for the low probability of detection. RESPA clearly breaks that rule: nobody ever goes to jail for RESPA violations, and the maximum statutory fine of $10,000 has not been raised since 1974. According to the Bureau of Labor Statistics' inflation calculator, $10,000 in 1974 was worth $40,872 in 2006. Actual penalties can be inferred from the cases detailed in note 3. HUD policymakers and staff may spend thousands of hours annually trying to define what "kickbacks" and "referral fees" mean for thousands of ethical service providers working in a highly complex business environment, but the consumer dealing with an unethical provider must look essentially to the disclosure requirements and his or her own resources for protection.

The general effect of sunshine regulation in a competitive market is to increase the price of the service, with an ambiguous effect on quantity sold. The regulation does nothing to reduce the cost of providing the service; on the contrary, the required disclosures require some effort—how much is an empirical question— and therefore raise the cost.

Nevertheless, the regulation, to the degree that it is effective, ensures that the consumer knows what he or she is purchasing. He or she becomes more confident—how much is an empirical question. The net effect on quantity purchased is ambiguous: the effect of the price increase may offset the greater consumer confidence in the service. The effect on consumer welfare is similarly ambiguous. To characterize the net social benefits of RESPA, we need to look more closely at the market that it regulates.

Character of Settlements and Regulatory Alternatives

Sunshine is a poor remedy if ignorance is not the problem. Consumer ignorance is certainly a factor in the market, because most people do not buy and sell real estate more than half a dozen times in their lives; but two other problems should be noted—timing and control.

Regulated transactions involve three principals: a buyer, a seller, and the ultimate lender and/or that lender's insurer. The settlement services discussed in this article consist of a series of certifications and guarantees provided by agents at the demand of the lender/insurer and sometimes the buyer:

- The buyer's credit history, income, debt load, and net liquid assets must meet minimum standards.
- The buyer must not be paying more than the property is worth, given prices on comparable recent transactions.
- The seller must have the right to sell the property.
- The property must not be encumbered or subject to disputes with neighbors.
- For FHA-backed loans, the habitation must not be subject to sudden depreciation: minimum structural standards must be met, the property must not be in the 100-year flood plain, and the building must not be infested with termites.
- The paperwork associated with all these determinations must be processed on time.
- The lender/insurer and sometimes the buyer must themselves be insured against error, oversight, or fraud in the previously mentioned determination that the seller has the right to sell the property and that it is not encumbered.

These certifications require heterogeneous expertise. An assortment of agents must deliver them competently and punctually. Service quality and timing, as well as price, are considerations for the buyer and the seller.

The buyer and seller usually endure considerable awkwardness or inconvenience if the closing is delayed. Many sales are motivated by divorce, disability, or death, and many purchases by new jobs or household formation. Much may be extracted from people in a hurry, even if they are well informed.

Because most of these services are demanded by the ultimate lender/insurer, it is often the mortgage banker or broker who will select the responsible agent to perform them, yet the banker/broker does not bear the cost. Moreover, two parties—the buyer and the seller—customarily share these expenses. The normal vigilance that consumers maintain over their own spending may be relaxed not only by ignorance and urgency but also by the reflection that somebody else will pay for part of it.

In 1974, the leading legislative alternative to the bill enacted was "lender-pay," under which the lender would be responsible for all settlement costs. Although these costs would then be passed on to the borrower (and indirectly to the seller), competition among lenders would give each lender a strong incentive to control settlement provider fees.

In 1998, HUD and the Federal Reserve Board (the Fed) (Board of Governors and HUD, 1998) endorsed a somewhat modified version of the lender-pay proposal, under which the lender would be required to offer all settlement services as a single package at a fixed price. The lender would have been permitted to offer other pricing alternatives but required to offer a package price as well. If the borrower selected a package price, unexpected deviations in the cost of services would come at the expense of the banker/broker, who would, however, have both the knowledge and the incentive to control them. Many large creditors, as well as HUD and the Fed, advocate legislation to this effect because they consider Section 8 of RESPA an obstacle to profitable offerings of fixed-price closing fees. The prohibition on kickbacks, referrals, and unearned fees might be applied to the volume discounts they would try to obtain from the service providers in a fixed-price context.

Small creditors and service providers oppose this proposal, for essentially the same reason. The ability of large creditors to demand and obtain volume discounts would enhance their competitive position relative to smaller firms and would reduce the prices charged by service providers.[3]

Any consideration of regulatory alternatives should take into account the role of the states. State law defines the rights of the property owner and whether those rights have transferred. I distinguish in this article between "title" services, which follow almost entirely from the rules of the property game defined by the several states, and the other "lending" services, which are defined by national standards. In most cases, the fees for these services are distinct.

Thus, there are at least three conceptual alternatives to the status quo—laissez-faire, lender-pay, and state law reform. The next step is to set out an empirical research agenda around a set of propositions that represent necessary conditions for the status quo to be better than these or other alternatives.

The reader is asked to stipulate that a significant national goal is for most Americans to own their own homes,[4] and that the purpose of regulation is to support that goal by ensuring a fair market in single-family residential transactions. We wish to determine whether mandated federal disclosure is by itself an efficient regulatory strategy. The following propositions follow naturally from the thesis that it is.

Proposition One. Lending and title fees are large enough to be worth regulating.

If the fees were trivial, then mandated disclosure would add to cost without adding enough to consumer surplus to make regulation worthwhile.

Proposition Two. The GFE is an unbiased and consistent estimator of lending and title fees on the HUD-1.

If lenders disclosed expected costs but their predictions were generally wrong, mandated disclosure would not be an effective approach.

Proposition Three. State law has a negligible influence on fees.

If state law had a major role in influencing fees, then state reform would be, at least, a necessary complement to federal statute and, possibly, a replacement for it.

Proposition Four. Disclosure so strengthens the negotiating position of buyers and sellers relative to service providers that the principals' personal characteristics do not influence the fees they pay.

RESPA seems designed to promote equity among principals so that all purchasers of settlement services have a common minimum access to relevant information. Although social science has no universally accepted definition of "fairness," a working definition for empirical purposes might be that people with different identifiable characteristics should not pay different fees for the same services unless those characteristics are linked to higher costs of service provision. If individual characteristics not linked to cost are associated with differences in the level of fees, then disclosure regulation might less efficiently protect some principals than other forms of regulation would.

Data

For this study I examined GFEs, HUD-1s, and credit reports in FHA insurance binders. Two hundred cases were randomly selected by the Urban Institute from the universe of FHA detached single-family home sales in the United States with closing dates in June 1997. The number entering the dataset is 146. A few cases were omitted because the closings did not occur in June, the property was not detached single-family (contrary to the data in the FHA central file), or only the buyer's or seller's costs in the transaction were revealed in the HUD-1; these deletions may be treated as random. A larger number of cases were omitted because the binders could not be retrieved from storage, and these omissions are not random. I have no cases from New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, or Wyoming because of retrieval failure. Delaware, Hawaii, Montana, Vermont, West Virginia, and Wisconsin did not have any cases that fell into the sample, so my findings do not apply at all to 13 states.[5]

A few words are in order on the relationship of the universe from which this sample was taken to other populations that might be of interest. FHA borrowers are less wealthy and more likely to be African American or Hispanic than their conventional counterparts are. They may be more likely to finance a large portion of the settlement cost, rather than pay it at closing. FHA home prices are generally lower than Fannie Mae, Freddie Mac, or jumbo-loan home prices. The FHA may require certain certifications, such as appraisals or home inspections, that other lenders do not require. FHA market share varies from state to state for reasons that are not always clear. Finally, the sampling of transactions from a particular period of time overweights states such as Arizona, where the real estate market was unusually active relative to the total number of homeowners. Exhibit 1 displays the distribution of the sample by state.

Measurement of transaction costs needs to be scaled to the size of the transaction. The putative sales price of the home is misleading, because the seller may agree to a lower (or higher) price in return for a smaller (or larger) share of the closing costs. By agreeing to a $1,000 increase in his or her share of the fees, for example, the buyer can perfectly compensate the seller for a $1,000 reduction in the sales price. In this article, I scale the transaction by the "value to seller" (VTS), which is the net change in the seller's financial assets as a result of the transaction; that is, net cash *plus* payoff of debt. "Debt" includes all mortgages, unsecured debt, ex-spouse's share of the proceeds, delinquent property taxes, unpaid child support, and the like. Debt excludes payments for improvements to the property to meet FHA standards or the buyer's demands; such payments are also not counted as settlement fees.

Exhibit 1

Sample Distribution by State

State	N	State	N	State	N
Alabama	3	Indiana	2	New Hampshire	2
Alaska	1	Iowa	4	New Jersey	4
Arizona	9	Kentucky	1	New York	5
Arkansas	2	Louisiana	4	North Carolina	5
California	27	Maryland	4	Ohio	8
Colorado	2	Massachusetts	2	Oregon	2
Connecticut	3	Michigan	5	Pennsylvania	5
District of Columbia	1	Minnesota	3	South Carolina	1
Florida	10	Mississippi	1	Tennessee	3
Georgia	6	Missouri	1	Virginia	5
Idaho	4	Nebraska	1	Washington	3
Illinois	3	Nevada	3	Total	146

In an arm's-length transaction with third-party financing, there is no on-the-books compensation that would leave the seller indifferent to a reduction in VTS. Suppose, for example, that the sales price is $120,000 with $9,000 in closing costs charged to the seller and an $80,000 mortgage payoff. The VTS is $111,000—the sum of the seller's net cash ($31,000) and the $80,000 payoff. The seller would be just as happy with a sales price of $123,000 and closing costs of $12,000—the price would have changed, but the VTS would be the same.

VTS in the sample averages $84,278, with a standard deviation of $33,470.

The settlement fees analyzed here are those that belong in the 800, 1100, and 1300 series of the HUD-1, with a few exclusions.[6] Essentially the intent is to exclude obvious choice variables, either seller's choices or buyer's. Fees to real estate agents are not of interest, because the seller made a choice about whether to market the property himself or herself. Points paid to the lender, whether for "origination" or for buying down the interest rate, are also not of interest, because the buyer chooses them. How many points, if any, to pay is the essence of the mortgage shopping decision for most people. Payment of the FHA mortgage insurance premium (MIP) at closing ("upfront MIP") rather than over time is also excluded. Taxes to state and local governments are not within the scope of RESPA, and funds paid into escrow are not within the scope of this article.[7]

Title and settlement agent services are frequently performed by the same or related parties and are reported together in the 1100 series. All fees properly reported there, or reported elsewhere and paid to a title or settlement agent, are treated as "title" fees. All the remaining fees are "lending" fees.

Results

Proposition One: Lending and title fees are large enough to be worth regulating

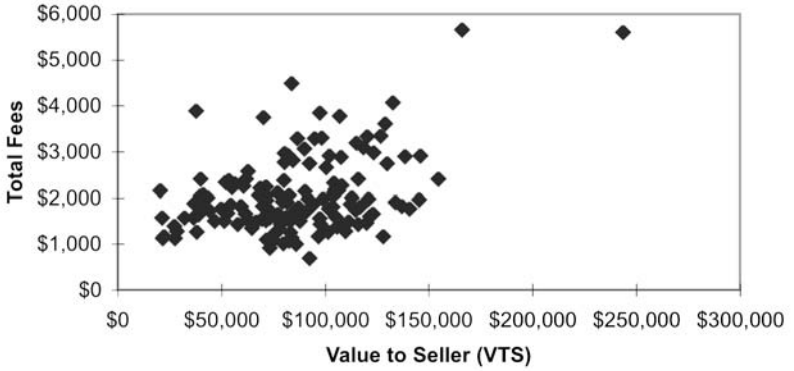
VTS averaged $84,278 in this sample while total lending and title fees averaged $2,060, or 2.4 percent. To repeat, these fees do not include either points or commissions to real estate agents. This

amount is clearly substantial. Lending and title fees vary between $692 and $5,671, or between 0.7 percent and 10.6 percent of the VTS.

Exhibit 2 depicts the scatter plot of VTS against fees. The relationship is linear in a very rough way. At least one important fee, the title insurance premium, is charged per dollar of the sales price or mortgage principal. Other significant fees, however, are in principle based on the time the agent spends on the service, that time being essentially unrelated to the size of the transaction.

Exhibit 2

VTS and Total Fees



The substantial fixed-cost element to settlement fees has the same impact as a regressive tax would on smaller transactions. In terms of efficiency, it rewards the buyer for engaging in larger transactions—for buying a new home, for example, rather than purchasing and renovating an existing one or for buying in high-priced jurisdictions rather than low-priced ones. In terms of equity, the regressivity favors buyers and sellers of more costly homes over less costly ones; however, buyers and sellers of cheap homes tend to have lower incomes than do buyers and sellers of expensive units.

In short, lending and title fees are large in absolute terms, have a structure that may distort the housing market, and will tend to work a disproportionate burden on the least affluent participants in the market. If regulation would do any good—a point that we cannot take for granted—these fees are worth regulating.

Proposition Two: The GFE is an unbiased and consistent estimator of lending and title fees on the HUD-1

The GFE is present in 47 of the 146 FHA binders. It is unfortunate that the sample is so small, but the FHA stopped requiring a copy of the GFE for underwriting purposes in 1996.

Data loss of this extent raises some natural suspicion of selection bias, but such bias is probably negligible. A lender who submitted the GFE in 1997 was either unaware of the rule change or, if aware, decided deliberately that it would be less costly to transmit the GFE than to take the trouble to separate it from the mass of papers that are still required for underwriting. All lenders, however

well informed they might be about the rules, would have known from experience that FHA underwriters were not using the data in the GFE to decide whether the loan met FHA standards, much less to police lending and title fees. While researching my 1997 paper, which was based on 1994 binders, I often discovered binders with no GFEs, although these documents were in theory required at that time, and some GFEs that were present in the binders were illegible. I have conducted one very simple test for bias: in a regression holding VTS constant, presence of a GFE in the binder is not significantly related to total lending and title fees actually paid.[8]

The GFE is for the benefit of the buyer, not the seller. At the point of the loan application the buyer may not have made arrangements with the seller about settlement fees, or this arrangement may be subject to further negotiation. The analyst must interpret whether the line items in the document refer to full costs or to the buyer's costs alone. Some GFEs explicitly separate seller's costs from buyer's costs, but most do not. For this analysis, I have compared the GFE with two versions of the outcome: total lending and title fees on the one hand, and lending and title fees paid by the buyer only on the other. I have assumed that the GFE estimates apply to the alternative where the absolute value of the difference between the estimate and the realization is the smallest.

Regression of the test variable (realized total lending and title fees or the buyer's share of same, whichever is closer to the GFE estimates) on the GFE estimates had the following result (standard errors in parentheses):

GFE test = 290.24 + .825 * GFE, R^2= .276 N=47
(277.63) (.199)

In this regression, a perfect estimator would yield an intercept of 0 and a slope of 1.0. The F-statistic for (0,1) being the true intercept and slope coefficients, respectively, is 189, so we can reject the null hypothesis that the true parameters are, in fact, 0 and 1 at conventional confidence levels, even if we cannot reject the parameters individually.

To put these results in plain English, the GFE is right "on average," but many GFEs are off by a lot. The average value of the difference between the test variable and the GFE estimate is just 75 cents, but the mean of the test variable is $1,832 and the mean of the GFE estimate is $1,332. In this sample, most buyers got, on average, small overestimates (29 cases too high out of 47) and a minority received, on average, large underestimates. The average absolute value of the error is $328, so the typical estimate is off by about 18 percent.

My 1997 paper, based on a smaller and more heterogeneous sample, reported that the GFE is unbiased but imprecise. The average absolute value of the error reported in that paper, by coincidence, was also $328. Upon further study, I now believe the GFE is usually biased, but that the bias is conditional on factors that may not be observable. Many lenders seem to prefer small overestimates of the title and lending fees to make sure the buyer will have enough money on hand to close. More troubling are the minority of cases in which very large underestimates occur. Lenders also routinely fail to forecast fees arising from delays in underwriting. I have yet to see a prediction of a courier or fax fee in a GFE, although these fees are common.

Proposition Three: State law has a negligible influence on fees

I believe this proposition is not true. Common sense would warn any analyst that title fees, in particular, are highly sensitive to state law, if only because the clarity of state law determines the clarity of the title that is being transferred.

It is not easy to make the commonsense case with data from a small sample with a large number of states. Exhibit 3 shows average fees and VTS in the five states with at least six observations in the sample; but, on casual inspection, the HUD-1 forms from these states do not exhibit striking deviations from the norm.[9]

In the examination of mortgage insurance binders, two states stood out. Title determinations in New Jersey seem to require much higher involvement by attorneys, with their higher-than-average wage rates, and much higher premiums per dollar of title insurance coverage than in other states. The office of the state treasurer has assumed responsibility for title insurance in Iowa, and, from casual inspection, premiums appear to be lower there by hundreds of dollars than they are in other states. Exhibit 4 reports regression results that tend to support this impression. (Note from exhibit 1 that there are only four Iowa cases and five New Jersey cases, so high standard errors are to be expected.) Iowa fees are lower and New Jersey fees are higher than one would otherwise expect.

Exhibit 3

Lending and Title Fees in Best Represented States

State	Fees	Average Percentage of VTS	VTS	N
United States	$2,060	2.8%	$84,278	146
Arizona	$2,217	3.0%	$78,652	9
California	$2,870	3.0%	$105,144	27
Florida	$2,382	3.6%	$70,272	10
Georgia	$2,190	3.3%	$71,961	6
Ohio	$2,052	2.6%	$84,948	8

VTS = value to seller.

Exhibit 4

Effects of State Law on Title Fees

Explanatory Variable	Coefficient	Standard Error
Constant	589.9	90.03
VTS	0.00644 **	0.000944
New Jersey	529.49 **	181.33
Iowa	– 232.96	201.23
N	146	
R^2	0.299	

VTS = value to seller.
*** Significant at the 99-percent confidence level.*
Note: Dependent variable is title fees.

Proposition Four: Disclosure so strengthens the negotiating position of buyers and sellers relative to service providers that the principals' personal characteristics do not influence the fees they pay

Wild variation occurs in the detailed fees charged. For example, the credit report is a standard national, largely automated, service that typically costs about $50, but charges range from $25 to $100. The scatter plot in exhibit 2 confirms huge deviations in total lending and title fees paid for transactions with similar VTSs.

What can explain these differences? I present two different regression models.

Title vs. Lending Fees

Consider some alternative approaches to deviant fees. One hypothesis is that a high fee for one service is completely independent of the fee for another service because these fees are quite distinct in character. In that case, there would be zero correlation between one fee category total and another.

A second hypothesis is that compensation occurs within the overall transaction, an apparent overcharge on one line effectively paying for other services. In that case, there would be a negative correlation between one fee category total and another.[10]

The third hypothesis might be termed the Eli Wallach version of reality, from the reasoning of the bandit leader in *The Magnificent Seven*—"If God had not meant them to be sheared, he would not have made them sheep." In this line of reasoning, a sheep can be sheared on one side (for lending fees) and on the other side, too (for title fees), because some people are candidates for high fees in both title and lending. It would follow that there would be a positive correlation between these categories.[11]

Exhibit 5 indicates that holding VTS constant, $1 more of lending fees translates into another 24 cents worth of title fees as well. Cross-fee compensation is not occurring, and the fees for different services are not independent of each other. This result does not prove but is consistent with the sheep-shearing hypothesis.

Exhibit 5

Mutual Dependence of Lending and Title Fees

Explanatory Variable	Coefficient	Standard Error
Constant	411.69	94.9
VTS	0.00611**	0.000985
Lending Fees	0.238**	0.0614
N	146	
R^2	0.321	

VTS = value to seller.
*** Significant at the 99-percent confidence level.*
Note: Dependent variable is title fees.

Effects of Individual Characteristics

A more comprehensive approach to this proposition would require an effort to explain the level of title and lending fees as a whole. I hypothesize that title and lending fees should be a function of the VTS, of state law, and of buyer and seller characteristics.

Successful builders and developers who plan on a large number of similar transactions can capture whatever economies of scale exist in lending and title processes. For example, some new home sales do not appear to have appraisal or survey fees, possibly because of special banking arrangements that the seller has made, and some appear to have reduced title fees. A dummy variable (New Home) shows whether the seller is a homebuilder.

The Troubled variable has a value of unity if the sale appears motivated by a divorce, or if there is substantial delinquency on property taxes. This variable could raise fees by one of three routes—by increasing the complexity of the transaction; heightening the time pressure on the seller, who must pay bonuses to speed up the process; or reducing the seller's resistance to agent opportunism.

The Premium variable denotes a reported payment outside of closing by the lender to the broker for an above-average interest rate on the mortgage. Mortgage brokers—but not bankers—are obliged to report all such payments on the HUD-1.[12] These "service release" or "above par" premia are substantial, ranging from 1 to 4 percent of the loan principal in this sample.[13] Perhaps such premia are paid in exchange for discounts on closing fees; other things being equal, their disclosure on the HUD-1 should strengthen the bargaining position of the buyer. If, however, they merely reflect the buyer's naïveté or some high value of time relating to his or her situation, there will be no compensation in lower lending fees.[14]

One version of the model also regresses fees on credit score variables. Credit scoring has become a standard, although far from definitive, method of summarizing and evaluating the large amounts of data in a borrower's credit record. Pennington-Cross and Nichols (2000: 330) report that credit history "plays an important role in determining the FHA-conventional mortgage choice," so credit history might affect the type of lender available to the borrower.

Lenders differ in their loan standards, and some are more willing to work with lower scoring applicants than others. Borrowers with bad credit presumably represent more work for the lender and a higher risk that the loan will not pass muster with the FHA. It seems plausible that higher risk borrowers might be sorted with higher cost lenders. In this scenario, the lower cost lenders would screen out applicants with poorer credit so they can remain competitive in serving higher credit, cheaper-to-serve borrowers.

The value I recorded for credit score is the median of all credit scores reported for all applicants on the loan. Scores are often separately available from each of the national credit reporting agencies (Equifax, TRW, and TransUnion). A husband and wife, for example, might each have one score from each agency, so it is common to find six scores for one application.[15] If the buyer's median credit score was in the lowest quintile for the sample (below 611), the dummy variable Bad Credit takes a value of 1. The dummy variable Good Credit is determined symmetrically, if the buyer's median score is in the highest quintile (above 722). The dummy variable No Credit Score captures the cases in which there is no credit score, usually because the buyer has no credit history.

Exhibit 6 shows that lending and title fees go up about one penny per dollar of VTS, with a $1,200 intercept indicating a substantial fixed cost unrelated to the transaction scale. Coefficient estimates for New Jersey and Iowa are consistent with the previous findings but do not reach statistical significance.

Exhibit 6

Effects of Buyer and Seller Characteristics on Total Fees

Explanatory Variable	Coefficient	Standard Error	Coefficient	Standard Error	No. Cases Where Value=1
Constant	1192.58	164.49	1163.82	174.85	
VTS	0.00984**	0.00182	0.00993**	0.00184	
New Jersey	295.47	330.58	318.31	345.04	6
Iowa	– 310.98	35.25	– 260.52	371.41	4
New Home	– 385.07*	219	– 369.32*	223.53	12
Troubled	1053.44**	263.19	1036.15**	266.17	8
Premium	120.18	217.65	100.96	221.92	12
Bad Credit			55.58	169.74	26
Good Credit			– 81.86	168.71	26
No Credit Score			247.28	202.71	15
N	146		146		
R^2	0.294		0.304		

VTS = value to seller.
** Significant at the 90-percent confidence level.*
*** Significant at the 99-percent confidence level.*
Note: Dependent variable is total lending and title fees.

Fees for new home sales average about $400 less than fees for sales of existing homes, all things being equal. Current institutional arrangements for property transfer amount to an unplanned suburbanization policy—a differentially higher tax on existing homes.

Sale by a troubled seller leads, on average, to another $1,000 to $1,100 of fees, presumably at the seller's own expense. It is difficult to understand how marital or property tax troubles could so inflate title costs.

I find no evidence that FHA borrowers receive any relief in fees when they borrow at above-market rates: the coefficient on the Premium variable is insignificantly positive. The absence of disclosure by mortgage bankers biases the coefficient toward 0. It is suggestive that the coefficient takes a relatively high positive value in these circumstances rather than the negative value that indirect compensation would dictate. It seems that the premium must reflect either exploitation of the buyer's ignorance of the market or an urgent need on the buyer's part for some unmeasured characteristic of performance, such as speed, by service providers.

The pattern of coefficient signs for the credit variables is roughly consistent with the notion of sorting among lenders suggested above, with high-scoring borrowers paying a bit less, low-scoring borrowers a bit more, and borrowers with no scores quite a bit more in fees. None of these coefficients, however, reaches statistical significance.

Conclusion

At first glance, lending and title fees seem to be appropriate targets for regulation. The federal government created and, through a variety of means, maintains the long-term amortizing home mortgage market; the services for which fees are paid are often federally mandated, and title services are intended to verify that state law on the transfer of property is satisfied. Thus, the federal and state governments require that lending and title services should be performed, and these governments have some responsibility for the orderly functioning of the market for services and the underlying market for housing.

This argument does not necessarily support the current RESPA regime, a form of sunshine regulation implicitly founded on the proposition that the only problem in the market is consumer ignorance, solved by federal action. Consumer ignorance might not be the only problem in the market, and nonfederal action might be preferable.

Sunshine regulation raises costs and may or may not increase consumer surplus. For the current regime of mandatory federal disclosure to be an *efficient* and *sufficient* regulatory strategy, four empirically testable propositions, which vary from the previous four propositions, must follow: (1) lending and title fees are large enough to be worth regulating, (2) mandated fee estimates are consistent and unbiased, (3) state action is ineffectual, and (4) disclosure neutralizes the effects of buyer and seller personal characteristics on the level of fees.

From the small sample analyzed in this article, only tentative conclusions about these propositions are possible. The topic deserves a much deeper research effort than this one. When that deeper effort occurs, I would expect it to confirm the following results:

1. Title and lending fees create a large wedge between what the buyer pays in a transaction and what the seller receives, amounting to perhaps 2.4 percent of VTS on average, but sometimes much more. These fees are worth regulating, if regulation can be efficient.

2. A test of the GFE as an unbiased and consistent estimator of fees fails. In practical terms, the GFE is a reasonably good guide to fees for most people (with a tendency, if anything, to overestimate the fees), but, for some borrowers, realized fees are much higher than the estimates. If any form of regulation is needed, its benefits might well reside primarily in the protection of some minority that substantially overlaps this latter group.

3. State action is not ineffectual. For better (Iowa) and for worse (New Jersey), state action appears to strongly influence title fees. Actions to improve the clarity, simplicity, and accessibility of title records could lower fees in many locations, as would reforms such as Iowa's that address inefficient oligopoly structures in the title insurance business. The sample size in the current study is not adequate for an investigation of interstate differences, and additional research into the extent and causes of cost differences among states could have large policy value.

4. Disclosure may not make the market fair, in that buyers' and sellers' characteristics seem to lead to differences in fees for transactions of equal size. Lending and title fees paid for new home sales are notably lower than fees for existing homes, presumably because builders and developers can capture some economies of scale. To the extent that Section 8 of RESPA inhibits

lenders from realizing such economies and passing them on to consumers, this represents a previously unrecognized distortion in the housing market, lowering the prices of new (mostly suburban) homes relative to existing residences.

Buyers' and sellers' characteristics of other sorts also affect market outcomes. Transactions in which the seller pays off an ex-spouse or is seriously delinquent in property taxes seem to generate much higher fees. There does not appear to be any reduction in fees in transactions in which the mortgage broker receives a "service release" or "above-par premium" from the ultimate lender for obtaining an above-market interest rate; in a fair market there probably would be a fee reduction.

In my 1997 paper, I suggested a sunset clause for RESPA, a fate that might be entirely suitable (as well as poetic) for sunshine legislation. The law is inherently informational in character and the delivery of information in our era is undergoing revolutionary change. But lack of information does not appear to be the only problem in this market. The present ambiguous language of Section 8 of RESPA, which prohibits kickbacks and referral fees, neither allows for effective enforcement of violations nor offers sufficient deterrence to violation, although it may deter lender actions that would lower fees to consumers. Both buyers and sellers need transparency and simplicity, and neither is identical with disclosure.

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Notes

1. Strictly speaking, a low frequency of detection does not necessarily imply a low probability of detection. We do not know how many Real Estate Settlement Procedures Act violations are undetected.

2. See the website www.hud.gov for the following examples:

   http://www.hud.gov/offices/hsg/sfh/res/tulsamcgraw.pdf (Tulsa, Oklahoma; $325,000 fine; four firms and six individuals).

   http://www.hud.gov/offices/hsg/sfh/res/downinghomes.pdf (Cordova, Tennessee; $1,382 fine; one firm).

   http://www.hud.gov/offices/hsg/sfh/res/eastwest.pdf (Worcester, Massachusetts; $150,000 fine; one firm).

http://www.hud.gov/offices/hsg/sfh/res/znet.pdf (Atlanta, Georgia; $15,000 fine and $400 rebate per affected consumer; two firms).

http://www.hud.gov/offices/hsg/sfh/res/allied.pdf (national mortgagee; $370,000 fine; one firm).

http://www.hud.gov/offices/hsg/sfh/res/fametitsettl.pdf (Memphis, Tennessee; $680,000 fine; one firm).

3. Whether the savings would be passed on to consumers would depend on the structure of the mortgage market. In the current, highly competitive state of the market, it is plausible that most savings would eventually be passed on.

4. More than two out of three U.S. households own their own homes.

5. U.S. Department of Housing and Urban Development's Office of Policy Development and Research has commissioned a closing costs study with hugely larger sample size. Its reports and data are expected in the near future. Researchers interested in replicating this study should be warned that abstracting data from Federal Housing Administration binders is labor intensive.

6. They may belong in those series of the HUD-1, but they are often inserted elsewhere. I have carefully inspected all parts of the HUD-1 and the Good Faith Estimate for lending and title fees that were omitted from these sections, so that all fees would be captured. Whenever any of these records showed contributions from the lender toward settlement fees, I have subtracted those contributions from total fees paid.

7. Woodward (2003) and in a subsequent personal communication reports that payment of points is associated with higher lending and title fees and that higher real estate commissions are associated with higher title fees.

8. The insignificant coefficient on the Good Faith Estimate (GFE) dummy is positive, which is not consistent with the idea that only the more honest lenders are submitting GFEs.

9. Note that the "average percent fee" is the average of all percentages, not the ratio of the average fee to the average value to seller.

10. All other things being equal, there should be a negative correlation because, in deciding whether some of the miscellaneous fees constituted a "lending" or a "title" fee, I undoubtedly made random errors, and a dollar added mistakenly to one category is necessarily subtracted from the other. Also, more (or less) care in document preparation by the lender leads to less (or more) care required of the escrow agent, and so forth.

11. It is also possible that regional differences in wage levels could introduce positive correlation between the lending and title fees. In a larger sample, one could address this issue by using dummy variables for the states on the right-hand side of the regression. In a personal communication, Woodward reports that she obtained the same parameter estimate (24 cents on the dollar) in her large sample as I have in this small sample, but that when she included state dummies, she obtained an estimate of 12 cents on the dollar, "still too large and too systematic to imagine the lenders and title agents as operating entirely independently."

12. The differential disclosure requirement for mortgage brokers is controversial.

13. I do not count these premia as fees paid by the buyer or seller; first, because they are paid by the ultimate lender, and, second, because they depend directly on the interest rate, which I treat throughout as of the essence of the loan rather than a fee.

14. Above-market rates do not compensate for higher risk borrowing. All Federal Housing Administration borrowers are treated equally in the secondary market.

15. Credit scores in the sample are highly variable, with a range from 502 (very bad credit) to 793 (very good credit); scores are missing for 15 cases, or about 10 percent. The mean score for those with scores is 666, the median 661, and the standard deviation is 66.

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Does Housing Discrimination Exist Based on the "Color" of an Individual's Voice?

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This article reflects the views of the author and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

Does housing discrimination exist based on the "color" of an individual's voice? Linguistic profiling occurs when people make judgments over the telephone about the character of the individual with whom they are talking. This study uses a logit model regression to determine if the race of a person searching for housing has any correlation with whether he or she is able to make an appointment over the phone. The data used for this analysis come from the Housing Discrimination Study (HDS) 2000 Phase I that was sponsored by the U.S. Department of Housing and Urban Development, which measured the patterns of racial and ethnic discrimination in urban housing markets across the United States through paired testing. HDS 2000 found statistically significant evidence that unacceptable levels of housing discrimination still persist across the nation. Although it is important to note that the paired tests used to measure levels of housing discrimination in HDS 2000 are based on the physical race of the tester and not whether the tester had a linguistic speech pattern commonly associated with a specific race or ethnicity, this research finds that there is little association between race and the ability to make an appointment over the phone. It was found that the predicted probability of making an appointment to inquire about a rental or sales unit is similar across racial and ethnic groups, varying slightly around 97 percent. These results suggest that while there may be minor differences among racial groups in the ability to make an appointment over the phone to inquire about a rental or sales housing unit, none of these differences are statistically significant. Although these initial findings indicate that linguistic profiling is probably not a major factor in measuring housing discrimination, it is crucial that further research be conducted in this area to more accurately determine whether and to what extent linguistic profiling affects levels of housing discrimination.

Introduction

Does housing discrimination exist based on the "color" of an individual's voice? Linguistic profiling occurs when people make judgments over the telephone about the character of the individual with whom they are talking. While the U.S. Department of Housing and Urban Development (HUD) has sponsored several national housing discrimination studies in which paired tests (audits) have been used to measure levels of housing discrimination, and although other audit studies have been conducted in various cities around the United States, no analysis of housing discrimination based on linguistic profiling in metropolitan housing markets across the United States had been conducted. This study uses a logit model regression to examine if the race of people searching for housing has any correlation with whether they are able to make an appointment over the phone. The data used for this analysis come from the Housing Discrimination Study 2000 (HDS 2000) Phase I, which HUD sponsored and which measured the patterns of racial and ethnic discrimination in urban housing markets through paired testing. HDS 2000 found statistically significant evidence that unacceptable levels of housing discrimination still persist across the nation.

Even though HDS 2000 provides evidence that unacceptable levels of housing discrimination still exist, fair housing advocates such as the National Fair Housing Alliance (NFHA) have argued that levels of housing discrimination for African Americans and Hispanics may in fact be higher than the measures presented in HDS 2000 suggest. This discrepency, they argue, is due to factors of linguistic profiling—factors that were not accounted for in the original measure of housing discrimination (adverse treatment) for HDS 2000. This research provides initial answers to this debate.

For the purpose of this article, it is important to note that the paired tests used to measure levels of housing discrimination in HDS 2000 were not specifically designed to examine whether the tester had a linguistic speech pattern commonly associated with a particular race or ethnicity.

The research addressed in this article finds that little association exists between race and the ability to make an appointment over the phone. It finds that the predicted probability of making an appointment to inquire about a rental or sales unit is similar across racial and ethnic groups, varying slightly around 97 percent. These results suggest that, although minor differences may occur among racial groups in the ability to make an appointment over the phone to inquire about a rental or sales housing unit, none of these differences are statistically significant. These initial findings indicate that linguistic profiling is probably not a major factor in measures of housing discrimination.

The Housing Discrimination Study 2000

HDS 2000, the third national study that HUD sponsored, was conducted by the Urban Institute to measure patterns of racial and ethnic discrimination in metropolitan housing markets (HUD, 2002a). Preceding HDS 2000, HUD sponsored the 1979 Housing Market Practices Study and the 1989 Housing Discrimination Study, both of which found significant levels of racial and ethnic discrimination in rental and sales markets nationwide (HUD, 1979; HUD, 1989).

HDS 2000 Phase I found that discrimination still persists nationwide in both the rental and sales markets of large metropolitan areas but that the incidence of discrimination generally has declined since 1989. The study concluded that only Hispanic renters face essentially the same incidence of discrimination today as they did in 1989, and while the incidence of consistent adverse treatment against minority home seekers has declined over the past decade, it is still significant.

In terms of metropolitan rental markets nationwide, African Americans still face discrimination when they search for rental housing. The overall incidence of consistent White-favored treatment in seeking rental housing dropped by 4.8 percentage points, from 26.4 percent in 1989 to 21.6 percent in 2000. Hispanics renters nationwide also still face significant levels of discrimination. Non-Hispanic Whites were consistently favored in 25.7 percent of tests.

In terms of metropolitan sales markets, African-American homebuyers continue to face discrimination in metropolitan housing markets nationwide. The overall incidence of consistent White-favored treatment (compared to African Americans) in homebuying dropped by 12.0 percentage points, from 29.0 percent in 1989 to 17.0 percent in 2000. Hispanic homebuyers also face significant levels of discrimination. The overall incidence of consistent non-Hispanic White-favored treatment (compared to Hispanics) in homebuying dropped by 7.1 percentage points, from 26.8 percent in 1989 to 19.7 percent in 2000.

Literature Review

Title VIII of the Civil Rights Act of 1968, The Fair Housing Act, prohibits discrimination in the sales, rental, and financing of housing based on race, color, national origin, religion, sex, familial status, or disability. In 2002, HUD conducted a study that assessed public awareness of and support for fair housing laws and individuals' perceptions concerning whether they had ever experienced housing discrimination. The findings show that widespread knowledge of and support for most fair housing protection and prohibitions exists. The public, however, understands and supports some areas of the law more than others. (HUD, 2002b)

Housing discrimination studies are crucial for determining how fair housing policy can most effectively provide equal housing opportunities for all. Before paired testing, research findings for housing discrimination typically came from studies using multivariate analyses. In these studies the analyst would control for factors such as age and education, factors that could reasonably be expected to account for the outcomes observed for majorities and minorities separately. The analyst would then identify a residual difference between the two groups. Some unknown share (possibly all) of the residual could be suspected of being due to discrimination, but the exact share would not be known. Many problems emerged, however, in attempting to fully specify such multivariate models, which introduced uncertainty about whether the magnitude of the residual itself was correct. Furthermore, such studies could not report the incidence of discrimination, only the magnitude of the resulting impact. In conclusion, a good deal of uncertainty about the level of discrimination was the rule in such studies (Fix, Galster, and Struyk, 1993). The solution to this problem was paired testing.

The Housing Market Practices Study (HMPS) was the first national audit study of housing availability to use paired testing. In the HMPS study, more than 3,200 audits/paired tests were

conducted in 40 randomly selected metropolitan areas to measure the level of discrimination against African Americans in the rental and sales markets across the country (HUD, 1979). In the Housing Discrimination Study of 1989 (HDS 1989), approximately 3,800 paired tests were conducted in the summer of 1989 in 25 metropolitan areas to measure the level of housing discrimination against African Americans and Hispanics. African American/White tests were conducted in 20 of these sites, while Hispanic/non-Hispanic White tests were conducted in 13 sites (HUD, 1989). The basic testing protocols in HDS 2000 were modeled from HDS 1989 in order to yield comparable measures of differential treatment between 1989 and 2000. Testers visited rental and sales offices in person to inquire about the availability of advertised units so rental and sales agents could actually see the race or ethnicity of the testers (HUD, 2002a).

Paired testing is a tool of fair housing enforcement that detects and documents individual instances of discrimination. In a paired test, one minority and one White tester pose as home seekers with identical backgrounds, aside from their obvious race/ethnic differences, and visit rental and sales agents to inquire about availability of advertised housing units. This methodology provides direct evidence of differences in the treatment minorities and Whites experience when they search for housing. Major advantages to paired testing include the comparative level of confidence its results inspire, the political persuasiveness of those results, its ability to detect subtle forms of discrimination, and its efficiency as an enforcement tool (Fix, Galster, and Struyk, 1993).

There are measurement issues, however, associated with paired testing. As stated in HDS 2000,

> The simplest measure of adverse treatment with paired testing is the share of all tests in which the white tester is favored over the minority tester, or in the rare cases where the minority tester is favored over the white tester. While these gross measures are straightforward, they usually overstate the frequency of systemic discrimination since differential treatment may occur during a test because of random differences in the circumstances of their visit to the rental/sales office rather than because of differences in race or ethnicity. Gross measures of white-favored and minority-favored treatment include both random and systemic factors, and therefore, provide an upper-bound estimate of systemic discrimination. One strategy for estimating systemic discrimination, cases where non-discriminatory random events are not responsible for differences in treatment, is to subtract the incidence of minority-favored treatment from the incidence of white-favored treatment to produce a net measure. The net measure reflects the extent to which the differential treatment that occurs is more likely to favor whites than minorities and provides lower-bound estimates of systemic discrimination (HUD, 2002a).

This article addresses a novel issue in the world of fair housing: whether housing discrimination exists based on the "color" of an individual's voice. The debate surrounding this matter revolves around the concept of linguistic profiling. John Baugh provides the definition of linguistic profiling in the article "Racial Identification by Speech." Linguistic profiling is based on auditory cues that people may use to identify an individual as belonging to a linguistic subgroup within a given speech community, including a racial subgroup, when they make judgments over the telephone about the character of the individual with whom they are talking. Baugh notes that linguistic profiling becomes illegal when people discriminate based on such judgments (Baugh, 2000).

The article "Perceptual and Phonetic Experiments on American English Dialect Identification" by Baugh et al. (1999) discusses how the ability to detect the use of nonstandard dialect often gives enough information to determine a speaker's ethnicity, and speakers may consequently suffer discrimination based on their speech. The article details four experiments that present evidence that housing discrimination based solely on telephone conversations can occur, because dialect identification is possible using the word "hello" and phonetic correlations of dialect can be discovered. This article is critical to this research topic because it provides evidence that linguistic profiling is possible. (Baugh et al., 1999)

In the article "Use of Black English and Racial Discrimination in Urban Housing Markets," Massey and Lundy (2001) further argue that racial discrimination in housing markets does not need to involve personal contact between agents and renters. To test this hypothesis, Massey and Lundy designed an audit study in Philadelphia to compare male and female speakers of White Middle-Class English, Black Accented English, and Black English Vernacular. Their study found significant racial discrimination that was often exacerbated by class and gender. (Massey and Lundy, 2001)

Baugh bases his argument for the existence of linguistic profiling on the fact that there are concrete differences in linguistics for people from different ethnic backgrounds—especially for African Americans and Hispanics, with distinctions in Black and Chicano vernacular. Linguistic differences include dialect differences, grammar differences, and phonological differences (different pronunciations of particular sounds) (Baugh, 1983).

The variety of English can be influenced by regional or national norms and explains why Chicano English Vernacular in New York may sound different from Chicano English Vernacular in California. Besides local dialects of English, features of English repeat themselves in different local communities and have been associated with socioeconomic differences within communities. An example is the unstressed sound of "ing" in words such as "talkin(g)," which has been found to be used more frequently among lower socioeconomic status speakers than among higher socioeconomic status speakers in the same community (Wald, 1984).

Data and Research Design

Data Description

The HDS 2000 Phase I data provide national estimates of adverse treatment against African Americans and Hispanics from 4,600 paired tests conducted in 20 metropolitan areas.

The results of HDS 2000 Phase I are based on a nationally representative sample of 20 metropolitan areas with a population greater than 100,000 and with significant African American and/or Hispanic minority populations. The sample of sites was selected from the 25-site sample of metropolitan areas covered by HDS 1989. In Phase I of HDS 2000, African American/White testing was conducted in 16 of the 20 sites and Hispanic/non-Hispanic White testing was conducted in 10 of these metropolitan areas. Tests were conducted during the summer of 2000.

To conduct the tests, random samples of advertised housing units were drawn each week from major metropolitan newspapers from the designated sample sites. Each week the sampled ads were assigned to paired testers, and testers visited the sampled rental and sales offices to inquire about the availability of these advertised units. Both minority and White testers were assigned income, asset, and debt levels to make them equally qualified to buy or rent the advertised housing unit. Paired testers were also assigned comparable family circumstances, job characteristics, education levels, and housing preferences. They visited sales and rental agents and recorded the information and assistance they received about the advertised unit, including location, quality and condition, rent or sales price, as well as other terms and conditions. (For more information and further details on the sampling methodology of metropolitan areas and advertised housing units, see the HDS 2000 report [HUD, 2002a].)

The subsample used for this practicum consisted of paired-tests in which testers needed to call and make an appointment before visiting the rental or sales unit being tested. These steps occurred for all sales tests and for rental tests in which the test coordinator had predetermined from an initial advance call by a nonminority individual that an appointment was necessary. In addition, testers made calls for rental tests if only a phone number (no address) appeared in the advertisement, in which case it would have not been realistic for the tester to show up without calling to find out the address.

Cases in which no appointment was necessary were dropped from this study.[1] Because all testers were not required to make an appointment before visiting a test site, some testers may have recorded a disposition of an appointment being unnecessary as not being able to make an appointment; this discrepancy is most likely due to inconsistent reporting by testers and test coordinators in the field. This problem was addressed by looking at a sample of actual test report files to evaluate the pattern of recording among testers and to assess the extent of misrecording. It was found that in the majority of sample cases in which testers initially indicated they were unable to make an appointment but subsequently went to the test site, an appointment was not necessary, and these cases were recoded as being able to make an appointment.[2]

Another issue addressed in cleaning the data was that because testers may have called multiple times before they actually made contact with a housing agent, only the last call and final outcome were considered. The last call was determined by the number of calls to the agent and by the date and time of the calls. Looking at only the last call, cases were dropped in which the final outcome indicated the tester did not make an appointment but it had been previously recorded that the tester was able to make an appointment. For rental tests, this would not be logical under any circumstance and 42 cases were dropped. For sales tests, it could have been the case that the tester was able to make an initial "casual appointment" but then was unable to make a second appointment in which he or she needed to be prequalified. Of the sales tests, 164 cases were dropped due to time constraints, since it would have been extremely time consuming to determine the exact circumstances of each of these cases.

In addition, only cases in which the housing agent heard the tester's voice were included. In these cases, the agent spoke with the tester and told him or her no appointment was necessary to visit, the agent would not make an appointment for the tester, or the agent told the tester no

other housing was available. These cases also included an "other" situation in which the tester's voice may have been heard; for example, when the tester left a message on the agent's voicemail/answering machine or the tester was told by the agent to call back. Cases that were excluded in which the voice of the tester would not have been heard included cases where the tester was directed to terminate the test by the test coordinator, the tester had the wrong number, there was no answer, or the telephone number was disconnected.

Ultimately, the dependent variable of whether a tester was able to make an appointment was kept in the sample based on incorporating information on the disposition of cases. Looking at the final outcome, cases were kept only if the disposition matched up with whether the tester made an appointment. For instance, cases were dropped if it was recorded that an appointment was not made but the disposition was recorded that an appointment was made.

Finally, before creating the final sample, it was determined whether it mattered if a tester called first or second within a paired test. A new variable was created, incorporating information on the date and time of the call, as well as the Tester ID, and the Control Number of the test. After running a logit regression with this newly created variable, it was found that whether the tester called first or second did not have any statistically significant impact on the tester's ability to make an appointment and, therefore, this variable was ultimately dropped from the final regression model.

Analytic Methods

The study discussed in this article tests the hypothesis that linguistic profiling affects levels of housing discrimination by incorporating the APPTCALL data set from HDS 2000 Phase I, which recorded information on whether an appointment was made or not by a tester, with the ASSIGNMT data set, which has information on the tester's race. After merging these two data sets together, based on the Tester ID and Control Number of a test, the study analyzes whether a tester's race has any impact on his or her ability to make an appointment.

Since the dependent variable for this study has only two possible outcomes (whether a tester can or cannot make an appointment over the phone), a logit model was used. Regression models for binary outcomes enable a researcher to explore how each explanatory variable affects the probability of the event occurring.

Although discreteness of a dependent variable does not in itself mean that a linear probability model (LPM) is inappropriate, logit models can overcome the shortcomings of the LPM. Instead of using ordinary least squares to estimate the LPM models, this study used the maximum likelihood estimation (MLE). For estimating limited dependent variable models, maximum likelihood methods are indispensable since MLE is based on the distribution of y given x, and the heteroskedasticity in Var $(y \mid x)$ is automatically accounted for.

$P(y=1 \mid \mathbf{x}) = P(y=1 \mid x1, x2, \ldots xK)$ where **x** denotes the full set of explanatory variables.

In this study, y is the indicator of whether an appointment was made, and the vector **x** contains individual characteristics of race, gender, and age, which are possible characteristics that could be determined strictly by linguistic profiling of an individual over the phone.

Results

Descriptive Statistics

The following information describes the testers in this subsample who participated in HDS 2000 Phase I in terms of race, gender, and age and whether they were able to make an appointment over the phone or not.

Testers who participated in HDS 2000 Phase I comprised different races and ethnicities. As shown in exhibit 1, White testers outnumbered minority testers because they were paired with all minority testers. White testers were able to make an appointment over the phone in 97.45 percent (2,213) of the cases in the study, African-American testers were able to make an appointment in only 96.73 percent (1,271) of the cases, and Hispanic testers in 98.33 percent (941) of the cases. Although differences exist among the three races, it is important to note that these differences in race are not statistically significant, not holding all other factors constant.

Exhibit 1

Race

Race	Frequency of Appointments Made	Percent of Appointments Made
White	2,213	97.45
African American	1,271	96.73
Hispanic	941	98.33

The lower percentage of appointments made for African-American testers could have been because African Americans have a distinct tone in their voice or may use Black English Vernacular, which rental and sales agents are able to linguistically profile and discriminate against when African-American testers call to inquire about a housing unit. The fact that Hispanic testers were more likely to be able to make an appointment than White testers, however, is surprising since Hispanics might be linguistically profiled due to distinguishable accents and the use of Chicano English Vernacular. One explanation for why Hispanic testers were able to make more appointments than White testers may be due to the fact that the individuals who participated in HDS 2000 were from higher educational and social class backgrounds and were less likely to have accents or use Chicano English Vernacular. Hispanic testers were required to have no problems communicating in English, but this is not a reality for all Hispanics.

In terms of gender, as shown in exhibit 2a, among the testers in the subsample, 97.71 percent of males (1,962) were able to make an appointment, and 97.35 percent of females (2,426) were able to make an appointment. Even though subtle differences appear in the results between genders, it is important to note that these differences are not statistically significant, not holding all other factors constant.

When analyzing gender by race (see exhibit 2b), of White testers, 97.70 percent of males (978) were able to make an appointment over the phone, and 97.44 percent of females (1,219) were able to make an appointment. For African-American testers, only 96.53 percent of males (529) were able to make an appointment over the phone, while 97.05 percent of females (724) were able to

Exhibit 2a

Gender

Gender	Frequency of Appointments Made	Percent of Appointments Made
Male	2,426	97.35
Female	1,962	97.71

make an appointment. Finally, of Hispanic testers, a surprising 99.13 percent of males (455) were able to make an appointment over the phone and only 97.58 percent of females (483) were able to make an appointment. Again, it is important to note that, although there were differences in the results between gender and among race, these observed differences are not statistically significant, not holding all other factors constant. The lower percentage of African-American males who were able to make an appointment may be due to the fact that it is easier to linguistically profile African-American men due to their distinguishable tone of voice. The lower percentage of Hispanic females who were able to make an appointment, compared to the males in their subgroup, may be due to the fact that rental agents may assume that women who call to inquire about a housing unit may be more likely to have children or to be single parents with children.

Exhibit 2b

Gender by Race

Race	Frequency of Appointments Made by Females	Percent of Appointments Made by Females	Frequency of Appointments Made by Males	Percent of Appointments Made by Males
White	1,219	97.44	978	97.70
African-American	724	97.05	529	96.53
Hispanic	483	97.58	455	99.13

Testers in the subsample who participated in HDS 2000 Phase I ranged in age from 18 to 73 years, while the mean age of testers was 37 years. As shown in exhibit 3a, of the young testers (2,094), ages 18 through 36, 97.40 percent were able to make an appointment over the phone. Of middle-age testers (2,083), ages 37 through 65, 97.34 percent were able to make an appointment over the phone. Although the results differed between the two age groups, it is important to note that these differences between the age groups are not statistically significant, not holding all other factors constant. The similarity in percentages of young and middle-age testers being able to make an appointment may be due to the fact that it is difficult to determine the age of an individual over the phone.

Exhibit 3a

Age

Age	Frequency of Appointments Made	Percent of Appointments Made
Young (18–36)	2,094	97.40
Middle Age (37–65)	2,083	97.34

When analyzing age by race (see exhibit 3b), of White testers, only 97.07 percent of young testers (1,062) were able to make an appointment over the phone, while 97.83 percent of middle-age testers (1,035) were able to make an appointment. For African-American testers, 97.01 percent of young testers (551) were able to make an appointment and 96.19 percent of middle-age testers (632) were able to make an appointment. For Hispanic testers, 98.57 percent of young testers (481) were able to make an appointment and 97.88 percent of middle-age testers (416) were able to make an appointment. Again, it is important to note that even though there were differences between the percentage of appointments made by testers of different ages and race, these observed differences are not statistically significant, not holding all other factors constant.

Exhibit 3b

Age by Race

Race	Frequency of Appointments Made by Young Testers	Percent of Appointments Made by Young Testers	Frequency of Appointments Made by Middle-Age Testers	Percent of Appointments Made by Middle-Age Testers
White	1,062	97.07	1,035	97.83
African American	551	97.01	632	96.19
Hispanic	481	98.57	416	97.88

Regression Results

Exhibit A-1 in the appendix presents the logistical regression results. The logit model findings suggest that the race of a person has no statistically significant effect on whether one is able to make an appointment over the phone to inquire about a rental or sales housing unit. Results suggest there are only minor differences among racial groups in their ability to make an appointment over the phone to inquire about a rental or sales housing unit. None of these differences are statistically significant.

Odds Ratio Estimates

As expected, in general, it was found that African Americans are less likely to be able to make an appointment over the phone than Whites. Specifically, African Americans are 27 percent less likely to be able to make an appointment over the phone than Whites, with a statistical significance of 0.1481. This finding means there is approximately an 85 percent chance that this result will occur as a result of random variation and, therefore, lacks statistical significance. Surprisingly, however, Hispanics were found to be more likely to be able to make an appointment than Whites. This unusual finding may be due to the smaller sample size of Hispanic testers and the fact that the testers who participated in HDS 2000 were from a higher social class and, therefore, less likely to have strong accents or to speak in Chicano English Vernacular. Specifically, it was found that Hispanics are 39 percent more likely to be able to make an appointment than Whites, with a statistical significance of 0.2564. This finding means there is approximately a 74 percent chance that this result will occur as a result of random variation and, therefore, also lacks statistical significance.

As for gender, females were found to be less likely to be able to make an appointment than males. This finding again may be due to the fact that rental or sales agents may be more cautious about renting to females because they are more likely to have children or be single parents with children. Specifically, females are 11 percent less likely to be able to make an appointment than males, with a statistical significance of 0.5549. This finding means that there is approximately a 45 percent chance that this result will occur as a result of random variation and, therefore, lacks statistical significance.

Finally, in terms of age, middle-age individuals (ages 37 through 65) were found to be slightly more likely to be able to make an appointment than younger individuals (ages 18 through 36). This finding may be due to the fact that younger individuals are more likely to have young children and rental or sales agents are more likely to discriminate against younger families, although it is probably more likely to be harder to determine someone's age over the phone than a person's race. Specifically, middle-age testers were 0.4 percent more likely to be able to make an appointment by phone than were younger individuals, with a statistical significance of 0.9835. This finding means there is approximately only a 2 percent chance that this result will occur as a result of random variation and, therefore, lacks statistical significance. This result makes sense, however, since it is more likely to be harder to determine a person's age over the phone than a person's race.

Predicted Probability Estimates

$PP= \Sigma\ [\exp(Aj+Bx)]/(1+[\exp(Aj+Bx)])$

Based on the following predicted probabilities, it can be concluded that the ability of an individual to make an appointment over the phone to inquire about a rental or sales housing unit is similar across racial and ethnic groups. Results suggest that there are only minor differences among racial groups in their ability to make an appointment over the phone to inquire about a rental or sales housing unit.

- The predicted probability of a young, White female being able to make an appointment over the phone is 97 percent, whereas the predicted probability of a young, White male being able to make an appointment over the phone is 98 percent.
- The predicted probability of a middle-age, White female being able to make an appointment over the phone is also 97 percent, whereas the predicted probability of a middle-age, White male being able to make an appointment over the phone is higher, at 98 percent.
- The predicted probability of a young, African-American female being able to make an appointment over the phone is the same for a young, African-American male being able to make an appointment over the phone, which is 97 percent.
- The predicted probability of a middle-age, African-American female being able to make an appointment over the phone is the same for a middle-age, African-American male being able to make an appointment over the phone, which is 97 percent.

These results show that White males, regardless of age, are most likely to be able to make an

appointment over the phone, at 98 percent.

The predicted probabilities for Hispanics were not as expected. Although the differences were similar, the predicted probability for Hispanic females was higher than for White and African-American females, and the predicted probability for Hispanic males was the same for White males. The predicted probability of a young, Hispanic female being able to make an appointment over the phone is the same for a young, Hispanic male, at 98 percent. Similarly, the predicted probability of a middle-age, Hispanic female being able to make an appointment over the phone is the same for a middle-age, Hispanic male, at 98 percent.

Limitations

Limitations of this study include the fact that even though HDS 2000 collected and recorded appointment call information, tests were not set up to reveal the race of a tester over the phone and, therefore, testers' voices may not have had auditory cues for a rental or sales agent to determine the race of a tester and discriminate by linguistic profiling. In addition, HDS 2000 most likely included individuals with higher educational levels than those individuals who have thicker accents and/or who speak in Black English Vernacular or Chicano English Vernacular. Since HDS 2000 testers were probably composed of individuals from higher educational levels, the final results could have been underestimated and there could be an interaction of race and class that is not captured in this model. This limitation should be considered in future research, especially since Massey and Lundy's study found that racial discrimination through linguistic profiling was often exacerbated by class. The findings in this research contradict previous studies regarding linguistic profiling and housing discrimination, suggesting there are only minor differences among racial groups in their ability to make an appointment over the phone to inquire about a rental or sales housing unit. It is crucial, however, that further research, which incorporates factors such as class and region be conducted in this area. It is critical that future studies of housing discrimination experiment with different methods to measure levels of housing discrimination and address the issue of linguistic profiling in their research models.

In addition, this study uses a logit regression model to analyze whether a tester could make an appointment over the phone on an individual case basis. Future research could analyze these data as paired tests, finding the share of all tests in which the White tester is favored over the minority tester in attempting to make an appointment over the phone to inquire about an advertised housing unit.

Conclusion

These research findings suggest that the race of a person has no statistically significant effect on whether one is able to make an appointment over the phone to inquire about a rental or sales housing unit. Logit regression results suggest that there are only minor differences among racial groups in their ability to make an appointment over the phone to inquire about a rental/sales housing unit, varying slightly around a 97 percent predicted probability. As noted before, however, none of these differences were statistically significant, and, as previously discussed, it is crucial that further research be conducted in this area to more accurately determine whether linguistic profiling affects levels of housing discrimination and to what extent.

Appendix

Exhibit A–1

Logistical Regression Results

	Estimate	Odds Ratio Estimate	95% Wald Confidence Intervals
Intercept	3.7571 (0.001)	—	—
African American	– 0.3090 (0.1481)	0.734	0.483–1.116
Hispanic	0.3278 (0.2564)	1.388	0.788–2.444
Female	– 0.1175 (0.5549)	0.889	0.602–1.313
Middle age	0.00406 (0.9835)	1.004	0.683–1.475

Dependent Variable:

Was the tester able to make an appointment?
CAPPOINT—able to make an appointment **1=yes, 2=no**

CDISPTN—outcome of phone call for appointment. Bolded numbers indicate cases in which the tester's voice could have been heard and are cases that were considered in the sample.

Appointment Call Completed:

Appointment made	**05**
Appointment not made	
Told no appointment necessary to visit	**21**
Agent will not make appointment	**22**
No other housing available	**23**
Other, no appointment (specify)	**24**
Tester is directed to terminate by the test coordinator	09

Appointment Call Not Completed:

Left message on voicemail, answering machine, or pager	**11**
Wrong number	12
No answer	13
Telephone number disconnected	14
Told to call back	**15**
Other, appointment call not completed (specify)	**16**

Independent Variables:

ARACE1—race of tester
AGENDR1—gender of tester
AAGE1—age of tester

CDATE_D—date of call (day)
CDATE_M—date of call (month)
CDATE_Y—date of call (year)
CTIME_AM—time of call (am/pm)
CTIME_H—time of call (hour)
CTIME_M—time of call (minute)

All of the above **C_** variables were combined to create a variable FIRST to determine which tester called first. It was ultimately determined that this variable had no impact on outcome and was dropped from the model.

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Notes

1. In cleaning the APPTCALL data set from Housing Discrimination Study 2000 Phase I, cases were dropped if CAPPOINT=0 (3,449 cases) and/or CDISPTN=21 (131 cases).
2. Recoded cases that had CDISPTN=21 and CAPPOINT=2 to CAPPOINT=1 (101 cases).

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Ten Years of Smart Growth: A Nod to Policies Past and a Prospective Glimpse Into the Future

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This article reflects the views of the author and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

Smart growth policies seek to remove barriers to homeownership, adequate public facilities, and employment opportunities by providing access to valuable land resources in suburban and urban centers. As of 2006, nearly 20 states have implemented smart growth-oriented directives, and many local and regional entities have also incorporated smart growth practices into their comprehensive master plans. As more states continue to grapple with ways to tackle urban sprawl, many of them have begun to experiment with various policy tools, such as urban growth boundaries, limitations on exclusionary zoning, and impact fees. This article traces the historical development of smart growth in the United States, looking at past state and local growth management policies that eventually led to the smart growth movement. The article then turns to a discussion on how smart growth policies have guided state and local governments in their challenge to mitigate the effects of urban sprawl. The article concludes by highlighting best practices and innovative approaches that governments at all levels have implemented to address various land use issues for the future.

Introduction

A growing chorus of advocates has rallied behind state and local governments to push for comprehensive land use reforms. These constituencies—mostly from urban planning, environmental, and corporate entities—are calling for innovative strategies to combat urban and suburban sprawl,

a pattern of land use characterized by randomly dispersed and low-density development. A new, more integrative approach to land use practices is being advanced, with state and local government entities assuming the lead. Smart growth has become one policy alternative that has received nationwide attention at all levels of government. In the most general sense, "smart growth" is defined as a growth management policy that addresses sprawl by directing land development away from metropolitan areas that experience accelerated growth and reinvesting valuable resources to depressed urban and suburban neighborhoods. Smart growth policies have three defining characteristics: (1) they generally encourage compact designs and high-density development, (2) they typically place strict limitations on building projects in sprawling communities, and (3) they usually involve comprehensive approaches to land use planning decisions.

Since the inception of smart growth nearly a decade ago, advocates celebrate the fact that well over a dozen states and numerous local and regional governments have instituted policies that resemble defining characteristics of smart growth. A number of state and local governments have all but rejected smart growth, however, due in large part to disagreements involving ways to implement comprehensive land use public policies. This article explores state and local-level responses to urban sprawl by looking to smart growth as a policy alternative. It traces the origins of smart growth and provides a comprehensive overview of current-day smart growth practices. Finally, the article concludes by highlighting current smart growth initiatives and offers a critique of future smart growth endeavors.

Before proceeding, the reader should be aware of the following caveats. First, this article does not advocate or offer normative judgments about the merits, desirability, or necessity of smart growth. Although it is certainly true that smart growth has gained widespread attention—acclaim in some circles, disdain in others—it is also a topic of considerable debate. This discussion does not provide an indepth analysis on the nature or nuances of sprawl nor does it devote too much attention to the negative-versus-positive consequences of sprawl. Finally, the article acknowledges that smart growth is controversial, in part, because little consensus has been reached regarding the impact of smart growth in terms of its effectiveness in achieving the broader goal of stopping sprawl or addressing other issues of importance, such as housing, transportation, or environmental justice. Although advocates are now beginning to focus their efforts on issues other than the environment, there is no explicit response to other sprawl conditions that are unrelated to the environment, such as the housing affordability crisis or inefficient transportation systems.

The reader should also be aware that, although smart growth has made great strides in terms of reaching a broad range of constituencies and creating consensus-building coalitions around smart growth objectives, little agreement has been reached regarding what smart growth is and how to define it, and disagreement abounds over how to identify its general physical characteristics. Though we can be sure that smart growth exists and has caught on well within the urban planning and environmental communities, the greater challenge for researchers interested in smart growth is being able to identify and classify existing smart growth policies across the board. This challenge may be met in large part through a clearer definition of what smart growth is and what it is not.

With these objectives and caveats in mind, this article is divided into three sections. The first covers the general, historical developments in land use planning and then presents a more indepth discussion on the evolution of smart growth. The second section provides a narrative on the

origin and evolution of the smart growth movement in the United States and a progress report on present-day smart growth practices. Finally, the article concludes by offering a preview of what is likely to come in the next few years as state and local governments and regional planning entities continue to consider smart growth policies.

The Historical Underpinnings of Growth Management Systems in the United States

The history of growth management and land use planning generally reflects a tug of war between local governments and their state government counterparts about how best to address problems that often stem from accelerated population growth. At issue is ascertaining which level of government is best suited for making these most critical planning decisions that will affect the lives of ordinary citizens. In the earliest part of the nation's history, growth management decisions came directly from local government units, such as townships and other smaller government entities. Growth-related conditions and problems, however, spilled over into nearby jurisdictions, and fragmented and uncoordinated efforts made it nearly impossible to have a coherent land use policy that sufficiently addressed these issues. State governments recognized these uncoordinated activities and began to consider measures that would assist local governments streamlining the planning process.

State land use planning dates as far back as the 1920s when then-Secretary of Commerce, Herbert Hoover, spearheaded the enactment of the landmark Standard City Planning Enabling Act and Standard State Zoning Enabling Act (Levin, Rose, and Slavet 1974; American Planning Association, 2002a). The primary purpose of these model acts was to protect private property at the local level but also to help local governments advance their growth management objectives. The prevailing notion was that local governments are, and should remain, the primary decisionmakers of land use policies and that states should assume a less central role in the planning process. In addition, the acts determined that local governments would remain responsible for enforcing local zoning ordinances.

Before the enabling acts, states had attempted to preempt the zoning powers of local governments. The argument for enhanced state involvement in growth and planning decisions was that local governments were ineffective at managing growth due to fragmented city and county governments with diffuse enforcement powers. As a result, states issued three main objectives for state intervention in land use control. First, states would implement regulatory statutes that established clearly defined objectives and administrative roles for statewide comprehensive planning. Second, land use decisions would be devoid of provisions that invoke controversy or place unfair burdens on builders or consumers. Finally, after regulations were established, the land would regulate itself unless a need arose for further regulatory controls (Levin, Rose, and Slavet 1974).

In 1925, New Jersey, Vermont, and Wisconsin began to implement planning strategies at the state level (Linowes and Allensworth 1975). By 1934, 36 states established planning boards, commissions, and other minor regulatory agencies. By 1936, all states except Delaware had instituted full-time, specialized state planning agencies. These state planning agencies were central gatekeepers of land use decisions. They also had political advantages, having close ties to governors, legisla-

tive committees, and special interest groups. In most states, the governor appointed heads of the planning commission and controlled the budget. State assemblies provided the legislative mandate and could delegate specific administrative tasks to various agencies. Special interest groups were equipped with specialized information about how the planning and zoning process worked. By and large, however, states failed to achieve their regulatory objectives under the enabling acts because of local government claims to autonomy and home-rule constitutional powers.

Centralized planning by the states became unpopular and disagreement arose over the jurisdictional responsibilities of local regulatory agencies. Localities were more concerned with increasing their tax base, and attempts by higher levels of government to incorporate land use controls were futile, especially if no financial incentive (or penalty) was in place to encourage the local agencies to comply. Local governments feared that publicly owned land would depress land values and discourage potential industries from investing in the economy. By the end of the 1930s, all attempts at comprehensive planning at the state level failed and those functions devolved to the local governments.

In the 1940s and 1950s, urban revitalization movements took center stage as a response to the Great Depression and the Second World War. Postwar advancements in information and technology required a skilled labor force. The emergence of the automobile led to the expansion of highways and mass transit systems. In response to booming populations, there was a corresponding increase in demand for housing. These economic and social conditions attracted and lured investors and workforce employers to the suburbs and away from central cities, where the prospects of job creation, land for residential and commercial construction, and lucrative corporate enterprises were greatest. Urban areas, by contrast, were losing manufacturing jobs and higher skilled employment opportunities to these new suburban promise lands. By the 1960s, the federal government began to take notice.

The federal government appropriated funding in the form of community development grants and, to tackle the ills of urban America, undertook a host of experiments geared toward improvements in housing and transportation. The U.S. Department of Housing and Urban Development and the U.S. Department of Transportation were created, and preserving open space, improving transit systems, fulfilling critical housing needs, and ensuring better public facilities became primary goals. States assumed little responsibility in these policy areas (Levin, Rose, and Slavet 1974).

In the 1970s, state-level planning activities were still limited to just that—planning and nothing else—while local governments' primary responsibility was zoning. The federal government continued its presence by taking a direct role in enforcing clean air and water standards. A few states, such as Hawaii and Vermont, were successful at direct state planning and zoning responsibilities (American Planning Association 2000). By 1974, Hawaii and Vermont, along with Maine, Florida, and Oregon, had mapped out plans for comprehensive state land use policies. Mapping and geographic systems were created to identify areas for growth management. That same year, Congress passed the Land Use Planning Act of 1974, which provided grants to states to assist local governments with planning efforts (Burchell, Listokin, and Galley 2000; Linowes and Allensworth 1975).

Local governments had already established independent planning commissions that oversaw the growth management process. The efforts by these independent agencies constituted a separate political enterprise from housing, transportation, and environmental administrative processes. These agencies, however, also had a say in the area of land use planning. How the states would

deal with these complex jurisdictional issues was unclear. Hawaii was one of only a few states where state centralized control worked. The success of comprehensive planning in Hawaii was due to fragmented and weak local government enforcement and policing powers. Moreover, there was no contention between various constituencies and stakeholders, such as rural versus urban or public versus private ownership. Farmers were not a strong political force in Hawaii and private ownership was not widespread (Linowes and Allensworth 1975).

As metropolitan areas continued to experience rapid growth, families relocated to outer-ring suburbs to escape the hustle and bustle of sprawling central cities. Cars made it easier for those who could afford them to literally buy into the American Dream. That dream was not realized in congested, urban cities; it was a dream that could be achieved only in the suburban communities, where land was plentiful and cheap. As socially mobile families continued to migrate to suburban enclaves, businesses and industry followed. Construction development also leaped to the suburbs. Urban areas became stricken with poverty, homelessness, and substandard schools. Growth declined in urban centers but accelerated in suburbia, producing many undesirable economic and social conditions in suburban areas such as traffic congestion and overcrowded schools.

By the 1980s, states began to realize that problems related to sprawl spilled over into other jurisdictions as a direct consequence of leapfrog or excessive outward development. Florida, with its 1985 historic land use planning statutes, made some of the first attempts at reforming growth management at the state level. The emphasis of the Florida statutes was to protect open land from encroaching development, particularly along the coast and environmentally sensitive areas (American Planning Association 2002a). By the end of the decade, other states, including New Jersey, saw a need for either direct intervention or more centralized control. Some advocates called for smart growth-oriented policies that incorporated comprehensive strategies to address a host of environmental and land use development concerns.

The Emergence of the Smart Growth Movement

Smart growth is an elusive term, and, yet, the concept has generated thoughtful discussions and debates within policymaking circles. Initially, the movement began primarily with conservationists motivated by a desire to address environmental hazards that they attributed to excessive development and sprawl. Today, smart growth has become associated with many different constituencies that have advanced their own agendas based on their interpretations of what smart growth is. While disagreements linger, the basic idea of smart growth is to deter development away from communities that are experiencing the most detrimental impacts of sprawl and to target those areas in most need of infrastructure improvements. Smart growth encourages more compact, mixed-use, and pedestrian-friendly designs and emphasizes high-density rather than low-density development. Strict emphasis is placed on more efficient transit systems with less reliance on the automobile as the primary mode of transportation.

As Americans begin to take notice of the social and economic costs of sprawl, state governments are responding by putting forth aggressive campaigns aimed at reducing sprawl-induced conditions. One strategy involves containing growth in areas where development has been excessive and redirecting valuable resources to areas of greatest need, particularly in cities and older suburbs. For many smart growth advocates, this strategy describes what smart growth is all about.

According to many supporters, smart growth seeks to address sprawl-related problems by slowing growth in outer-ring urban, suburban, or rural areas. Smart growth advocates have developed a set of policy elements in response to interrelated conditions that affect the lives of everyday citizens, which they believe sprawl has caused, such as traffic congestion (see exhibit A-1 in the appendix). Supporters generally agree that the purpose of smart growth is to limit outward expansion of development where sprawl or low-density development is rampant (Downs 2001; Knaap 2003). They tend to agree that the goal of any smart growth policy should focus on land preservation and open space protection, farmland and wetlands, and other natural resources (see exhibit A-2 in the appendix). Finally, supporters argue that any development that is "smart" should be in the form of mixed land uses and higher densities and should offer citizens a wide variety of amenities that are easily accessible (for example, parks, town centers, and biking trails).

Advocates view successful smart growth policies as those that encourage a variety of transportation choices that lessen the dependence on the automobile. Perhaps the most controversial smart growth concept is that the costs of construction projects that have the effect of intensifying sprawl conditions ought to be placed on industries that build in sprawling areas and should not be borne by citizens. The implication of the proposal is that governments ought to pass smart growth policies that place limitations for construction projects that induce or worsen sprawl conditions. Thus the politics of smart growth has created two opposing camps. On one side, antigrowth or slow-growth interests support many smart growth strategies that specifically target sprawling communities by placing caps on land development in those areas. These constituencies consist primarily of environmentalists, urban planners, some farming groups, and politically active suburban residents who blame sprawl for traffic congestion and other ills that plague their neighborhoods. In the other camp are progrowth constituencies and many homebuilding and developer stakeholders who are suspicious that smart growth practices involve heightened restrictions on construction through increased regulations and unwanted government intervention. These stakeholders also tend to be skeptical that smart growth policies merely constitute a prescriptive approach to sprawl that may not be solved in a comprehensive fashion but are adequately addressed through market strategies that focus on incentives for building in depressed areas.

In the mid-1990s, the smart growth concept was first introduced by the American Planning Association (APA), the Environmental Protection Agency, the Henry M. Jackson Foundation, the Natural Resources Defense Council (NRDC), and the Surface Transportation Policy Project (STPP) (Burchell, Listokin, and Galley 2000). The first smart growth alliance was charged with encouraging states to pass growth management laws that promoted open space preservation, improved transportation systems, and protected critically designated environmental areas. Resulting from this collaboration of diverse stakeholders, all having a vested interest in better growth management practices by state and local governments, came *Growing Smart*, a guidebook that helps officials design comprehensive plans that arm them with the necessary policy tools for reducing sprawl. The second coalition, formed by NRDC and STPP, sponsored a smart growth toolkit that provides a comprehensive list of proposals for public officials, planners, and builders to use to address each negative aspect of sprawl, including traffic congestion, poor air and water quality, inadequate or dilapidated housing, and decaying building structures and brownfield development (Ibid).

In 1997, Maryland became the first state to establish a smart growth program. The cornerstone of its smart growth plan places limitations on new construction in communities most affected by sprawl and redirects valuable resources to areas in greatest need of new infrastructure projects. In addition, the hallmark of the smart growth program focuses on the rehabilitation of existing structures, incorporating revitalization strategies that are cost effective.[1] Other states followed suit—Rhode Island, Colorado, and New Jersey with its landmark New Jersey State Development and Redevelopment Program. In 1999, smart growth met with increased public attention, awareness, and interest and received major news magazine coverage. The states of Pennsylvania and Massachusetts, among others, were acknowledged for their leadership in brownfield redevelopment, and Georgia was heralded as a pioneer in the area of smart growth in transportation. By the end of the decade, nearly 20 states followed with their own smart growth laws. States incorporated innovative strategies to combat sprawl (for example, urban growth boundaries, transfer of developers' rights, multimodal transportation systems, incentive-based reward systems to discourage leapfrog development in suburban areas, and mixed-used residential and commercial development).[2] In sum, while the original concept of smart growth is not novel, what is innovative about smart growth is this integrated approach to growth management, in which the planning process fuses policies that address sprawl-related problems in a variety of policy domains, such as transportation, housing, urban renewal, and the environment.

At the federal level in the 1990s, the Senate took up the smart growth issue, and President William Clinton and Vice President Albert Gore promoted their "Livable Agenda," which highlighted various aspects of smart growth policies (APA 2000). In this new, innovative approach to growth management, planning that was not solely focused on local zoning powers was the primary focus. Planning strategies, instead, took cues from the new urbanism movement, which approaches the reduction of sprawl by focusing on types of development in residential neighborhoods (Downs 2001).

New urbanists argued for more compact forms of development, such as townhouses rather than detached, single-family homes. This approach is now modified to incorporate mixed-use development with a variety of densities that pertain not just to residential development but also to commercial development. New urbanists contend that housing and public amenities should be easily accessible and closely located. This "smarter" mode of growth management, they argue, would lessen the impact of sprawl by cutting down commute times, save energy by reducing the reliance on cars, encourage social interaction, and reduce air pollution—all the while conserving valuable land resources. The initial focus on the new urbanism dimension of smart growth led many to believe that smart growth was not really comprehensive or multifaceted. Most advocates agree that smart growth should focus on future challenges to sprawl. The objective is not to stop growth completely but to deter sprawl by making better use of existing infrastructure and to target future development to areas that have the greatest need.

Smart Growth Today: An Assessment

In recent years, a broad coalition of supporters has come to view the smart growth movement as the preferred policy solution to sprawl. Since 1997, 20 states have either considered or fully adopted comprehensive growth management plans. The Environmental Protection Agency (EPA),

which evaluates and recognizes local and regional smart growth best practices, has given high marks and awards to the Massachusetts Office for Commonwealth Development (OCD), which administers state-funded programs that foster new urbanist ideals of compact development and walkable communities. The cornerstone of the state's OCD programs is its financial incentive package for builders to encourage them to participate in urban renewal programs and create mixed-use design that is also accessible to transit centers and other valuable amenities.

In Kansas, the city of Wichita has upgraded its smart growth program to include new, bold initiatives to redevelop its older suburban enclaves. Focusing on fostering partnerships with local for-profit entities, Wichita has transformed several old, decaying residential and commercial structures through infill development. As many of these local programs do, the program in Wichita offers generous incentive packages to local construction companies to help promote redevelopment efforts. Wichita has also won smart growth EPA awards for its commitment to smart growth principles.

Many examples of smart growth projects also exist at the regional level. The most notable of these is the Coalition for Smarter Growth, a diverse group of developers, civic associations, urban planners, and environmental organizations, which operates in the Washington, D.C. metropolitan area. The mission of the coalition is to address problems stemming from the rapidly growing and developing regions around Washington, D.C. A targeted focus is on the fastest growing metropolitan areas in Virginia and Maryland, specifically Loudon and Fairfax Counties in Virginia and Montgomery and Prince George's Counties in Maryland. The Coalition for Smarter Growth has been fairly successful at promoting regionally based smart growth efforts, particularly those related to transit. Because traffic congestion is a major problem in the Washington metropolitan area, the organization has developed strategies to promote new policy tools that support transportation choices; for example, instituting a car-sharing program.[3]

Other notable examples of regional smart growth efforts have taken place in Delaware and Idaho. The Delaware Valley Smart Growth Alliance (DVSGA) is composed of nonprofit and for-profit organizations, citizens groups, and governing officials from Delaware, the greater Philadelphia area, and Trenton, New Jersey. The DVSGA promotes smart growth by encouraging construction projects and other proconservation efforts by providing grant opportunities to local construction companies that direct residential and renewal projects to declining neighborhoods in urban areas. Idaho Smart Growth (ISG) focuses on redevelopment projects in Treasure Valley, an older suburban community outside the Boise city corridor. Relying on infill development strategies, ISG works with community development leaders to implement renewal programs.[4]

Smart Growth at the State Level

Many smart growth policy ideas are conceived at the state level, generally with state executive agencies directing planning and land use regulations at the local and municipal levels. Legislative actions undertaken by state legislatures have guided smart growth-related public policies as well. Exhibit 1 provides an overview of state land use policies currently in existence. Note that these states have instituted policies that contain some smart growth characteristics that are not necessarily described explicitly as smart growth.

Exhibit 1

State Actions or Programs in Support of Smart Growth Goals

State	Year	Title	Law
Florida	1972	Environmental Land and Water Management Act	Fla. Stat. 380 et seq.
	1984–85	Omnibus Growth Management Act	
	1998–99	Criteria for land use plans, infill development	
Hawaii	1961	Hawaii Land Use Law	Hawaii Rev. Stats Ch. 205
	1978	Hawaii State Plan	Act 100
Oregon	1973	Land Conservation and Development Act	S.B. 100, Oregon Stats. 197
Vermont	1970	Environmental Control Act	Act 250, 10 Vermont Stats. 151
	1988	Growth Management Act	Act 200, 24 Vermont Stats. 117
	1990	Amendments to Ch. 117	Act 280
Maine	1988	Comprehensive Planning and Land Use Regulation Act	30 M.R.S.A. Sec. 4960
Washington	1990	Growth Management Act	Sub. House Bill 2929
	1991	Amendments to 1990 Growth Management Act	H.B. 1025
New Jersey	1985	State Planning Act	NJSA 52-18A-196 et seq.
	1999	Smart Growth Planning Grants	
	2001	State Development and Redevelopment Plan	
	2005	Smart Growth Tax Credit Act	A.B. 1356
Georgia	1989	Coordinated Planning Legislation	O.C.G.A. 50-8-1 et seq.
	1992	Amendments to Planning Law	
Rhode Island	1988	Comprehensive Planning and Land Use Regulation Act	Rhode Island General Laws, Ch. 45-22
	2000	Referenda on developer rights, open space	
Maryland	1992	Economic Growth, Resource Protection and Planning Act	
	1997	Smart Growth Areas Act	
	2001	GreenPrint Program	H.B. 1379
Arizona	1998	Growing Smarter Act, transfer development rights act	S. 1238, Ch. 145
	2000	Growing Smarter Plus Act	
New Hampshire	2000	Smart Growth Bill	H.B. 1259
Pennsylvania	2000	Growth Area Legislation, transfer development rights	H.B. 14 (Act 67); S.B. 300 (Act 68)
Tennessee	1998	Growth Policy Law	Public Chapter 1101
Wisconsin	1999	Growth Management Law	A.B. 133
	2005	Smart Growth	S.B. 375

Exhibit 1

State Actions or Programs in Support of Smart Growth Goals (continued)

State	Year	Title	Law
Delaware	2001	Comprehensive Plans and Annexation Law	H.B. 255
		Planning Coordination	S.B. 105
		Graduated Impact Fees	H.B. 235
		Reality Transfer Tax for Conservation Trust Fund	H.B. 192
Louisiana	2004	Neighborhood Enhancement Program	H.B. 1720

Sources: American Planning Association, 2002a; Sellers, 2003; Bollens, 1992; National Conference of State Legislatures' Growth Management Legislative Database

The most recent smart growth activity at the state level is Louisiana's Smart Growth Neighborhood Enhancement Program, administered by the Department of Culture, Recreation, and Tourism. In response to the Hurricane Katrina disaster, this program focuses almost entirely on neighborhood revitalization, particularly for those areas around urban Main Street business districts. The premise of the program is to promote a "live near your work" strategy that addresses the spatial mismatch between job centers and housing.

Also recently enacted is Wisconsin's Smart Growth bill, S.B. 375, which requires local municipalities to approve only those construction or infrastructure funding projects that comply with communitywide comprehensive plans. The bill specifically targets zoning ordinances that mandate lot sizes and design requirements for single-family, detached housing. In addition, the bill encourages the use of impact fees to reduce excessive development in existing sprawling or fast-growing communities.

A number of state legislative actions are currently being considered; some are pending and others have failed. In Connecticut, property tax advocates celebrated the enactment of H.B. 6044, which establishes a study commission to assess the impact of property taxes on land conservation. In California, however, Smart Growth bill A.B. 463, which would have required a more pedestrian-friendly design to be included in comprehensive plans that use state transportation funds, was soundly rejected. Smart growth advocates in Massachusetts also experienced a setback in the legislature when the assembly rejected density bonuses, which would have awarded home builders for incorporating smart growth strategies, such as cluster zoning and the transfer of developer rights, into their projects. Finally, in New York and Michigan, legislation to provide tax credits for local construction entities that promote more mixed-use, compact development designs is pending.[5]

Smart Growth for the Future: Looking Ahead

The leading proponents of the smart growth movement can thank the American public for their support at the polls. During the midterm elections of 2006, voters elected or reelected leaders who are vocally supportive of smart growth efforts. Voter discontent with sprawl has helped to propel smart growth to the top of the governmental agenda (see exhibits A-3 through A-5 in the Appendix).

Reelected in Arizona, Governor Janet Napolitano continued the state's famed Growing Smarter enterprise that was implemented by her predecessor, Jane Hull, in 1998. Napolitano pledged to carry out former Governor Hull's legacy to strengthen open space preservation laws. Connecticut reelected Governor Jodi Rell, who instituted an executive agency, Office for Responsible Growth, to help administer her Livable Community agenda directed at urban renewal policies. In California, Proposition 84, which earmarks approximately $5 billion for coastline preservation and parks and recreation, was accepted by a majority of voters. California citizens also approved state bond measures that allocate millions in state funds for investments in transportation, housing, and infill development. The newly elected governor of the Commonwealth of Virginia, Tim Kaine, has recently promised that Virginia would become a leader of the smart growth movement; he is pushing to expand multimodal transportation and transit opportunities that will promote a variety of commuting choices for Virginians.[6] Finally, in Massachusetts, the outgoing governor, Mitt Romney, implemented the Commonwealth Capital Program to aid local governments in incorporating smart growth principles into their community master plans. Local governments are, in turn, rewarded with grants for other infrastructure projects that promote conservation and affordable housing efforts (Knox 2005).

With the success of recent proposals, smart growth supporters must recognize that they face formidable challenges. The movement has failed to offer smart growth as a viable and coherent solution. In other words, while there is some agreement about smart growth as a concept, there is no consensus about how smart growth policies create sound solutions to sprawl-related problems. For instance, smart growth has not yet provided a clear answer to the housing affordability problem and has not adequately addressed the charge that smart growth policies have the unintended consequence of raising housing prices. Smart growth has not sufficiently provided a solution to the notorious traffic conditions that exist in communities such as Fairfax County, Virginia, or Montgomery County, Maryland, which have instituted numerous local smart growth initiatives.

Smart growth has also often failed to convince public officials, builders, and other stakeholders on the best approach to implementation. A variety of smart growth formulas do exist and have been attempted; however, with no clear definition of what smart growth is and disagreements about how to proceed, the idea is often put forth without a coherent or unambiguous directive for how to implement the policy. With this shortcoming in mind, there is an emerging, highly organized countermovement that smart growth advocacy groups must contend with.

This countermovement argues that smart growth has attempted to hinder the market from functioning and prospering in a rapidly growing global economy (American Legislative Exchange Council, 2001; Staley, 2001a, 2001b). Opponents argue that smart growth fails to offer a coherent policy solution—that the reliance on a comprehensive approach to combating urban sprawl promises too much and overburdens local governments, and that smart growth does not allow the market to correct instances in which accelerated growth has created negative externalities. Developers contend that stringent or even moderate forms of land restrictions, primarily developers' fees, hinder them from building new subdivisions or single-family dwellings that consumers want, thus limiting profit. In essence, smart growth does not effectively deal with the concept of choice and how demand for housing will continue to stimulate growth. Smart growth, they assert, must deal with these realities and address them head on.

Concluding Remarks

The nascent but fast-growing smart growth movement has captured the attention of government officials, real estate developers and other private entities, environmentalists, urban planners, and many Americans. Of the 20 or so states that have adopted smart growth priorities, Maryland, Oregon, New Jersey, and Arizona have implemented some of the most innovative programs. A number of states that do not have smart growth programs, however, have co-opted some smart growth ideals. These ideals are certainly not new since most elements of smart growth, such as the incorporation of urban growth boundaries, have been around for decades. Nevertheless, the smart growth label has enjoyed broad appeal across the country. State legislatures have passed more than 400 growth-related ballot measures; many of them were concerned with implementing more efficient approaches to land use zoning ordinances, preserving popular tourist and historic attractions, protecting natural resources, and brownfield redevelopment. All these measures were adopted to address urban sprawl. Although more than half of the 50 states have not adopted state-level smart growth programs, the growth management ballot trend continues across the country, focusing mainly on local area growth issues.

At the federal level, President George W. Bush signed the Small Business Liability Relief and Brownfields Revitalization and Environmental Restoration Act (S.B. 350), which provides liability protection for landowners and earmarks federal funds to preserve the Superfund program and $200 million for brownfield cleanup. Members of Congress have established a bipartisan alliance to protect open space and forestlands. For example, Maine Senator Susan Collins authored a bill to preserve forests threatened by encroaching development.[7] Virginia Representative Virgil Goode introduced the Tax Credits for Conservation Act (H.R. 1607), and the late Georgia Senator, Paul Coverdell, introduced the Homestead Open Space Preservation and Conservation Act (H.R. 2036). Both measures passed overwhelmingly, providing tax credits for qualified conservation expenditures.[8]

In sum, smart growth has received harsh criticism for two main reasons. First, there is no universal definition for smart growth. To urban planners, smart growth means one thing, but to conservationists, it means something different. In a general sense, smart growth as a catchall phrase that has been used to describe a growth management policy that incorporates comprehensive planning and state and locally imposed sanctions against developers who build in sprawling communities. According to supporters, the goals of smart growth are to contain sprawl by limiting excessive development in low-density suburbs and by redirecting construction projects to designated urban and suburban areas that are in greatest need of capital or infrastructure improvements. Opponents charge that smart growth is really an attempt on behalf of advocates to involve government in market affairs. To them, smart growth really means “no growth.”

Over the past several years, supporters and opponents have debated back and forth over this highly charged political issue. In some instances, advocates have won; in many others, smart growth opponents have enjoyed success and have continued to gain the advantage. Whoever wins or loses the debate, however, largely depends on the political, social, and economic context in which these players find themselves.

The success of smart growth in the future cannot be predicted, but one can safely assume that the current trend of state and local governments looking for sprawl-busting solutions will continue. Although smart growth has taken a back seat to other issues currently being debated in state legislatures, its advocates have not given up hope. Former Maryland governor and architect of one of the first smart growth programs, Parris Glendening, is now the head of the Smart Growth Leadership Institute in Washington, D.C., a nonprofit organization committed to advancing the smart growth agenda throughout the Washington, D.C. metropolitan area. Glendening continues to put forth smart growth ideas and strategies at speaking engagements across the country, and he often appears before the APA and the National Governor's Association, another organization he once headed. His goal is to speak to state and local officials, urban planners, corporate entities, and others on how to promote the smart growth agenda, dispel misgivings about smart growth, and offer technical assistance to states and localities on implementing growth reforms.

Other administrative officials from the Glendening administration have also become prominent figures in the smart growth movement, including former Maryland Planning Department head, Harriet Tregoning, who until recently presided over Smart Growth America, which is responsible for marketing smart growth ideals to urban planners and other important stakeholders throughout the country. Finally, Maryland has continued smart growth efforts, even in the face of economic hardships. The University of Maryland at College Park established its National Center for Smart Growth Research and Education in 2002 to tackle regional growth issues across the state. The center continues its research efforts and produces widely-cited publications on planning and growth management issues.

Smart growth research and development efforts continue across the country, albeit sporadically. Michigan Governor Jennifer Granholm has recently teamed with Republican counterparts from the previous state administration to establish the Land Use Leadership Council to investigate the effect of land use patterns on sprawl. Newly elected governors in Pennsylvania, Massachusetts, and Tennessee continue to push for smart growth in their respective states. But smart growth enthusiasts still have a long way to go to convince the broader decisionmaking public that smart growth could offer the solution to the pervasive problem of urban sprawl. That challenge continues even in the face of a staunchly aggressive countermovement that is just as committed, if not more so, to the goal of stopping smart growth in its tracks.

Appendix

It is generally accepted that smart growth programs contain some or all of the following policy elements described in exhibit A-1. These policy elements all target urban sprawl.

Exhibit A–1

Smart Growth Policy Elements

Policy element 1	Preserve open space (farmland, historical, or cultural resources)
Policy element 2	Environmental protection/conservation of natural resources (water, air, energy, wildlife, habitat, etc.)
Policy element 3	Developing infill sites/brownfield redevelopment
Policy element 4	New urban designs (pedestrian-friendly architecture)
Policy element 5	Include citizens in land use decisionmaking ventures/consensus-building strategies
Policy element 6	Provision for creating widespread affordable housing
Policy element 7	Encourage regional governing solutions to urban/suburban sprawl (e.g., tax-base revenue sharing)
Policy element 8	Reduce automobile dependence by increasing emphasis on mass transit/light rail systems
Policy element 9	Promote compact, high-density or mixed-use development
Policy element 10	Create fiscal incentive structure to encourage cooperation from local/regional governments and planning organizations
Policy element 11	Impose the social costs of new development onto real estate developers (cost of new infrastructure, environmental, developer fees, impact fees, urban growth boundaries, etc.)

Sources: American Planning Association (2002a); Downs (2001); Florida Department of Community Affairs (2000); Hirschhorn (2000; 2002b); Myers and Puentes (2001)

Exhibit A–2

Making the Connection Between Sprawl and Smart Growth, 2002–2005

Sprawl Feature	Smart Growth Remedy	Land Use Control Strategy	State Examples
Low-density, widely dispersed development	Higher density residential and commercial development	Restrictions on runaway development; impact fees; urban growth boundaries	OR, WA
Urban blight	Infill development; urban service areas	Brownfield redevelopment in existing sprawling location; rehab codes	PA, NJ, CT, MI, ME
Homogenous, nonmixed residential/commercial development	Compact, mixed-used planning designs (high and low-density, pedestrian friendly)	Both single-family and multifamily housing development; mixed commercial and public facility developments with accessible designs	IL, MA, CO
	Multimodal transit systems	Light rail systems	MD, WA, OR
Accelerated development	Open space protection; historic site preservation	Transfer of development rights; coordinated zoning ordinances	MD, NJ, TN
Excessive development in critical areas	Conservation easements	Priority funding areas; smart codes; possibly tax increment financing (CA)	MD, NJ, NH
Poor air and water quality; soil erosion	Environmental standards	Designated critical areas barring development	NJ, MD, FL, CA
Unaffordable housing	Technical assistance to local governments; housing located near job centers	Local zoning review for ordinances that prescribe land uses; density restrictions; minimum lot size requirements; building code requirements modifications	PA, NJ, ME, MN, RI

Sources: Smart Growth America (2004b); Smart Growth News, 2003–2005, www.smartgrowthnetwork.org; Sellers (2003)

Exhibit A–3

Ten-Year Assessment of Smart Growth: LandVote Database Measure Summary 1994–2006

Year	Number of Measures	Number of Measures Passed	Total Funds Approved ($ in billions)	Land Conservation Funds Approved ($ in billions)
1994	43	30	$1.0	$0.6
1995	38	29	$1.2	$1.1
1996	93	73	$5.4	$1.2
1997	70	57	$2.4	$0.6
1998	184	150	$7.9	$6.4
1999	105	93	$2.5	$2.2
2000	212	175	$11.5	$4.8
2001	199	139	$1.9	$1.6
2002	194	143	$8.7	$5.5
2003	133	99	$1.7	$1.2
2004	219	164	$2.6	$4.1
2005	140	111	$2.7	$1.2
2006	180	134	$2.7	$6.8
Total	**1,810**	**1,397**	**$75.8**	**$37.3**

Source: The Trust for Public Land, Conservation Finance Program LandVote Database, 1994–2006

Exhibit A–4

Ten-Year Assessment of Smart Growth: LandVote Database Measure Summary, 1997–2006, by Finance Mechanisms

Finance Mechanisms	Number of Mechanisms	Number of Measures Passed	Total Funds Approved ($ in billions)	Conservation Funds Approved ($ in billions)
Property tax	502	364	$4.4	$3.3
Bond	385	324	$23.2	$13.7
Sales tax	88	62	$27.9	$4.1
Other	60	49	$2.6	$2.3
Income tax	35	28	$0.2	$0.1
Total	**1,070**	**827**	**$58.3**	**$23.5**

Source: The Trust for Public Land, Conservation Finance Program LandVote Database, 1994–2006

Exhibit A–5

Ten-Year Assessment of Smart Growth: LandVote Database Measure Summary, 1997–2006, by Jurisdiction Type

Jurisdiction Type	Number of Mechanisms	Number of Measures Passed	Total Funds Approved ($ in billions)	Conservation Funds Approved ($ in billions)
State	27	25	$16.8	$10.5
County	189	148	$31.3	$7.7
Municipal	814	631	$9.9	$5.0
Special district	40	23	$0.3	$0.3
Total	**1,070**	**827**	**$58.3**	**$23.5**

Source: The Trust for Public Land, Conservation Finance Program LandVote Database, 1994–2006

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Notes

1. Backed by a powerful legislature, urban planners, environmentalists, and many in the construction and real estate industry, Maryland's landmark Smart Growth and Neighborhood Conservation Act was signed into law on October 1, 1998. The five main pillars of the Maryland smart growth initiative are (1) the Smart Growth Priority Funding Areas Act of 1997, (2) the Rural Legacy program, (3) the Brownfields Voluntary Cleanup and Revitalization Incentive Program, (4) Job Creation Tax Credits, and (5) Live Near Your Work. Maryland's smart growth initiatives are centered around three core objectives: (1) to save valuable natural resources, (2) to support existing communities and neighborhoods by targeting state resources to support development in areas where the infrastructure is already in place, and (3) to prevent sprawl by redirecting state funds to encourage development projects where there is greatest need.
2. Goode, Collaton, and Bartsch (2001) and the American Planning Association's (2002a) updated *State of the States* handbook give an overview of each state's history of growth management laws.
3. Washington, D.C.'s District Department of Transportation has recently teamed with transportation officials and planning communities in Virginia to establish the Zipcar and Flexcar programs to help relieve problems associated with inadequate parking and traffic congestion in the region. Residents can rent cars at designated Metrorail stations and other locations. Seattle, Washington, and Portland, Oregon, also have car-sharing programs that serve as alternatives to the time-consuming and financial burdens of car ownership. See the Coalition for Smarter Growth website, http://www.smartergrowth.net, for more information on car-sharing programs and their relation to smart growth principles.
4. For more information, see Idaho smart growth news website, http://www.idahosmartgrowth.org/projects/transportation/index.htm.
5. All current smart growth activity at the state level can be accessed through the National Conference of State Legislatures' Growth Management Legislation Database, which is updated frequently at http://www.ncsl.org/programs/natres/growthmgt.htm.

6. See State of the State address to the Virginia State General Assembly, September 22, 2006, "A Second Opportunity to Move Forward on Transportation." The entire address to the Joint Assembly can be accessed at http://www.governor.virginia.gov/AboutTheGovernor/FromTheGovernorsDesk/AnotherTranspoOpp.cfm.

7. S.B. 1208, FY 2004.

8. For a complete discussion, see Northeast-Midwest Institute's website, http://www.nemw.org/index.html.

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Public Service Expenditures as Compensating Differentials in U.S. Metropolitan Areas: Housing Values and Rents[1]

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Abstract

The research presented in this article is motivated by four questions: Do public service expenditures help explain interregional variation in the cost of housing? What types of spending make the most difference? How does the effect of these expenditures on housing values compare to their effect on rents? Finally, do these effects change over time? These questions are investigated through an econometric analysis of housing values and rents in a national data set of metropolitan counties. A two-equation model is estimated using seemingly unrelated regression to enable contemporaneous correlation across the error terms. The initial model, containing per household total direct spending, is used to develop coefficients that are restricted in subsequent models so that alternative service expenditures and different time lags can be tested while holding all else constant. The findings suggest that police protection makes the most difference for owners and renters alike, with education and fire protection, respectively, being close seconds. Homeowners place greater weight on expenditures that affect exchange value, while renters place greater weight on factors that affect use value; and certain services have a more enduring effect than others. This article adds to the existing body of knowledge by linking a broad spectrum of public goods and services to the place-to-place cost of

Abstract (continued)

housing. Future research should focus on the connections between intermediate and final outputs from an interregional perspective and, as an extension, how they relate to the pace of economic growth and other measures of regional well-being.

Introduction

A great deal of research in the field of urban and regional economics focuses on *intraregional* variation in housing values and rents. Most of these studies draw on hedonic price models to examine the marginal influence of various structural characteristics, neighborhood attributes, proximity to the central business district and/or metropolitan subcenters, and the capitalization of nonmarket goods, including public services and environmental amenities, on housing costs. Meanwhile, comparatively less research has been done on *interregional* variation in housing values and rents—especially regarding public services. Although extensive empirical evidence shows that natural amenities have a substantive influence on migration flows and that compensating differentials account for interregional housing price and wage differences, very little is known about the specific role of public service expenditures. The issue, which was first examined more than a decade ago, is an important one because, unlike a particular region's inherent endowment of natural amenities, public service expenditures may be directly influenced by public policy (Gyourko and Tracy, 1989, 1991). Does public spending matter from an interregional perspective? Which types of expenditures make the most difference? How does the effect of these expenditures on housing values compare to their effect on rents? Finally, do these effects change over time?

This article investigates these questions through an econometric analysis involving a national data set of metropolitan counties. Following the introduction, the article is organized into three main sections. First, the background discussion explains how and why public services are capitalized into housing values and briefly reviews previous research on migration, household welfare, and compensating differentials. Second, the empirical analysis constructs a series of econometric models for examining how different types of public services affect interregional variation in median housing values and rents. In the first step, a two-equation system is estimated using seemingly unrelated regression (SUR) to enable contemporaneous correlation across the error terms. The initial model, containing per household total direct spending, is used to develop coefficients that are restricted in subsequent models so that alternative service expenditures and different time lags can be tested while holding all else constant. This research design enables observation of how 11 individual measures of public spending—capital facilities, education, fire protection, housing and community development, libraries, natural resources, parks, police protection, roadways, sewerage, and trash collection—affect the cost of housing at the county level and provides evidence of how their influence changes over time. Finally, the results of the analysis are used to derive a set of policy-relevant conclusions and directions for future research.

Background

The Capitalization of Public Services

The meaning of capitalization in the context of public services is straightforward: the value of a given property is defined as the fully discounted stream of future benefits and costs that are expected to accrue to the owner or user, including *nontraded* amenities and disamenities. Nontraded amenities are those that are not produced, sold, purchased, or consumed in the traditional sense but, instead, are attached to a commodity (such as a house) that is. For example, it is well known that, other things being equal, buyers and renters alike expect to pay a premium for housing located in high-quality school districts. A casual reading of the real estate section of nearly any local newspaper bears this out, with owners commonly advertising such benefits as a partial justification for the asking sales price or rent. It should be clear, however, that an individual acting on their own has little or no control over the quality of local school districts and other public services that may affect the value of his or her property. In this sense, such benefits are attached to the actual commodity being traded—the house—due to its location; therefore, the benefits end up being reflected in the sales price or rental amount of the house without being purchased directly.

Location is particularly important to the process of capitalization because of spatial variation in the availability of various attributes. In the case of natural features, such as views or microclimates, quality is affected by topography, the character of the surrounding built environment, and numerous other factors. Likewise, benefits related to public services vary across space, usually as a result of differences in offerings among jurisdictions. What emerges is an underlying price landscape that reflects how housing values and rents differ from place to place based on the level of utility (disutility) people receive from location-specific, nontraded amenities (disamenities), some of which are controlled by local governments. In other words, within real estate markets a relative value exists above and beyond the value of the property itself, a significant part of which is attributable to public service expenditures.

The primary point of departure for understanding how capitalization works is Tiebout's (1956) well-known public choice theory, which equates people's locational decisions within large, politically fragmented metropolitan areas to a shopping trip, in which the people select among numerous jurisdictions that offer different combinations of public services. In this way, people *vote with their feet*, maximizing their utility subject to a budgetary constraint, by locating in communities that offer the best combination of benefits for the lowest possible price. Here, the price involved is the cost of purchasing a home or paying rent and, for homebuyers, the ongoing cost of paying property tax. Property taxes are negatively capitalized because they raise the cost of holding a house over time and, in doing so, lower the amount that people, including landlords, are willing to pay for it (Rothenberg et al., 1989). In this way, the property tax represents a key component of the stream of anticipated costs associated with the ownership of homes and/or rental properties. Nevertheless, if a public service is efficiently provided, its benefits and costs should roughly offset one another via capitalization. This prospect was born out by Oates (1969) in one of the earliest—and, to this day, one of the most powerful—tests of the Tiebout Hypothesis, which illustrates that per capita spending on public schools raises housing values even as the property tax lowers them.

More recently, researchers have refined the theory of capitalization by examining the specific role it plays in local public finance and by developing further and more detailed empirical evidence that capitalization takes place. In particular, capitalization has been shown to arise as a result of movers bidding up the price of housing with desirable attributes; given that all households may eventually move, existing households' preferences for tax-service combinations are identical in longrun equilibrium (Yinger, 1982). Meanwhile, the median voter rule ensures that homeowners, who represent the most politically active bloc of residents (DiPasquale and Glaeser, 1999), exert pressure on their local governments in an effort to secure the value of their assets (Fischel, 2001). So, at any given time, a homeowner's ideal level of public spending reflects a combination of his or her own preferences and those of prospective buyers (Brueckner and Joo, 1991). In short, by voting, people work to ensure that their communities provide public services in a way that maximizes the exchange value of their homes.[3]

Using hedonic price models is by far the most common method of measuring the effects of capitalization on the exchange value of housing within regions. For example, using variations of this general framework, numerous recent studies illustrate that the quality of public school systems has a significant effect on residential property values: Haurin and Brasington (1996) find that housing sales prices increase 0.5 percent per every 1-percent increase in the pass rate of ninth grade proficiency exams; Bogart and Cromwell (1997, 2000) find significant variation in housing values, ranging between $186 and $2,171, depending on school quality, and that disruption, as a result of redistricting, lowers home sales prices by nearly 10 percent; and Downes and Zabel (2002) find that homeowners are more concerned with schools' final outputs, such as test scores, than with intermediate output, such as spending. Further, within regions, the capitalization of school quality is stronger in smaller communities, because the costs and benefits are spread over fewer people (Brasington, 2001; Hoyt, 1999), and in communities that are closer to the central business district, where the supply of housing is relatively inelastic (Brasington, 2002). These and other studies illustrate that the capitalization of public services has a measurable impact on real estate markets within regions but, from a wider view, the question remains: How do service expenditures affect interregional variation in housing values and rents?

Household Welfare and Compensating Differentials

Just as amenities are positively capitalized into property markets at the intraregional scale, they positively affect household welfare at the interregional scale. An observable outcome of this influence is that, other things being equal, people are willing to pay more for housing and accept lower wages to live in attractive places; conversely, people pay less for housing and demand higher wages in areas offering a comparatively lower quality of life (Mulligan, Carruthers, and Cahill, 2004). This behavior is owed to *compensating differentials*, factors that enhance the utility people receive from living in a given area and, therefore, raise the level of costs they are willing to incur and wages they are willing to forgo to stay there. Just like housing, places are a package deal, composed of different combinations of desirable and undesirable characteristics, all of which affect the cost of living in them. In the same way that cities exhibit an underlying value landscape attributable to location-specific amenities, so, too, do wider geographical areas, all the way up to the national and, possibly, international levels.

Porell (1982) and Graves (1983) advanced early empirical evidence of the value of location-specific amenities in analyses demonstrating that quality-of-life factors have a significant influence on interregional migration flows. These and subsequent studies suggest that the effect of location-specific amenities is so strong that migration models specified without them may suffer from omitted variable bias (Knaap and Graves, 1989; Clark and Cosgrove, 1991; Clark and Hunter, 1992). Recent research has born this prospect out, revealing, for example, that improvements in air quality positively affect population growth (Kahn, 2000); recreational opportunities have a significant effect on people's locational choice (Deller at al., 2001; Colwell, Dehring, and Turnball, 2002; Florida, 2002); places with warm, dry climates attract disproportionate shares of population growth (Glaeser and Shapiro, 2003); and incomplete compensation may be responsible for in-migration to high-amenity regions (Clark et al., 2003). Just as people choose environmentally attractive locations, they move away from locations in which the quality of life has deteriorated. Factors that contribute to this include rapid population growth, underinvestment in infrastructure, traffic congestion, and air pollution (Gabriel, Mattey, and Wascher, In press).

In addition to influencing where people choose to live, quality-of-life factors measurably affect wages and housing prices. In a groundbreaking theoretical and empirical analysis, Roback (1982) finds that disamenities, including crime, heat, snow, and poor weather, raise wages and, to some extent, lower rents. Likewise, Henderson (1982) finds that amenities (disamenities) are negatively (positively) capitalized into wages, an effect that is robust across three alternative measures of the dependent variable and among different occupations. Each of these findings is consistent with the theory that compensating differentials mediate the place-to-place cost of living. Further research has reinforced this theory, illustrating that (1) climatic, urban, and environmental characteristics all affect wages and rents (Hoehn, Berger, and Blomquist, 1987; Blomquist, Berger, and Hoehn, 1988; Clark and Kahn, 1989); (2) the effects are consistent for commercial, residential, and mixed-use communities (Voith, 1991); and (3) people exhibit a measurable willingness to pay to live in areas with mild climates (Cragg and Kahn, 1997, 1999). Together, these and other related studies demonstrate that, in addition to influencing where people choose to live, natural amenities act as compensating differentials by shaping the financial tradeoffs people face in their decisionmaking processes.

Finally, through an extension of Roback's (1982) quality-of-life framework, public services have also been revealed to act as compensating differentials. More specifically, in a pair of articles, Gyourko and Tracy (1989, 1991) find that differences in locally produced amenities, including police, health, and fire services, positively influence rents and negatively influence wages; the cost of paying for amenities (via various taxes) has an offsetting effect by lowering people's willingness to pay for housing and causing them to demand higher wages; and each of these factors contributes directly to an interregional quality-of-life ranking. Overall, the evidence suggests that fiscal conditions—which are directly influenced by public policy—have almost as large of an effect as natural amenities. Nevertheless, the role of public spending patterns as compensating differentials has not been directly addressed since Gyourko and Tracy first called attention to it more than a decade ago.

This lack of attention is a significant shortcoming, given the strength of public services' influence. For example, drawing on a national data set of metropolitan counties (described in the following

section), exhibits 1a and 1b illustrate that per household total direct spending by itself may account for as much as 13 percent of the interregional variation in both housing values and rents. Although this and previous evidence signal that public spending matters from an interregional perspective, what types of expenditures make the most difference, how their individual effects differ between ownership and rental markets, and whether their influence changes over time remain unknown. These questions are explored in the following empirical analysis.

Exhibit 1a

Relationship Between Median Housing Value and per Household Total Direct Spending

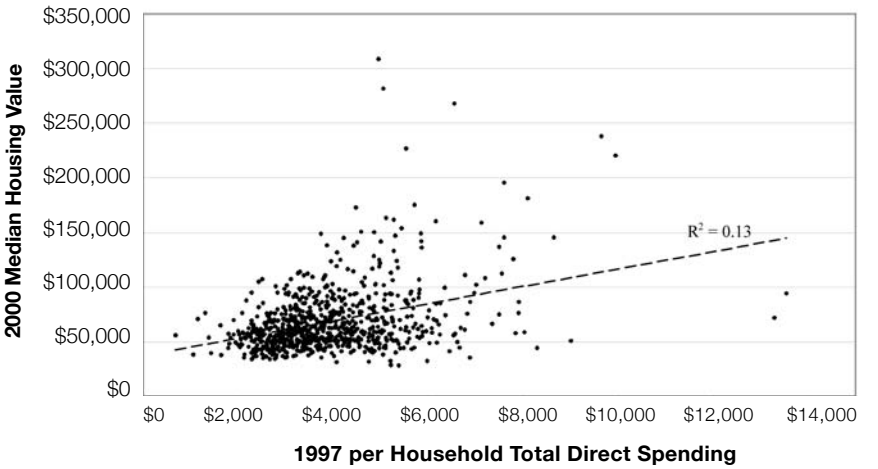
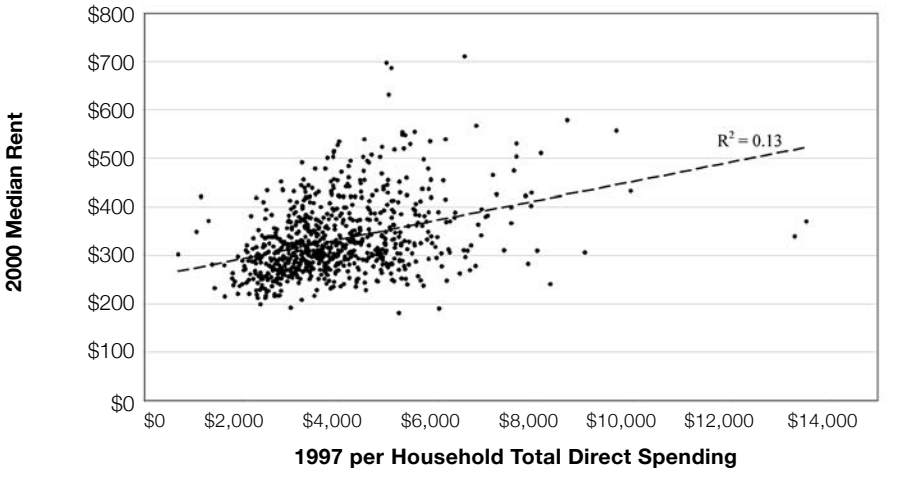


Exhibit 1b

Relationship Between Median Rent and per Household Total Direct Spending



Empirical Analysis

Econometric Framework

Whereas most (although not all) of the research reviewed in the preceding section focuses on individuals or households, the present analysis is concerned with aggregate measures of housing values: metropolitan counties are the unit of analysis, and the dependent variables are 2000 median housing value[4] and 2000 median rent. To enable correlation between the ownership and rental markets, the empirical model is specified as a pair of SUR equations (Zellner, 1962), where the dependent variables are functions of a set of appropriate explanatory variables, including public service expenditures. Ozanne and Thibodeau (1983), Izraeli (1987), and Potepan (1996) applied similar data and analytical frameworks to examine the sources of variation in metropolitan housing values during the 1970s and 1980s, but none of these studies deals specifically with the influence of public services.

The core hypothesis of the analysis is this: public spending is expected to positively influence both dependent variables by contributing to metropolitan areas' quality of life and, therefore, the relative costs people are willing to incur to live in those areas.[5] The process of testing this proposition first for aggregate and then for specific types of public spending involves four steps.

In the first step, a system of two regression equations is specified in which 2000 median housing value, **H**, and rent, **R**, are functions of 1997 per household total direct spending on public services, **P**, and a set of additional exogenous variables, **X**:

$$\begin{aligned} \ln \mathbf{H} &= \mathbf{X}\boldsymbol{\alpha} + \alpha_1 \mathbf{P} + \boldsymbol{\varepsilon}, \\ \ln \mathbf{R} &= \mathbf{X}\boldsymbol{\beta} + \beta_1 \mathbf{P} + \boldsymbol{\upsilon}. \end{aligned} \tag{1}$$

In these equations, $\boldsymbol{\alpha}$, α_1, $\boldsymbol{\beta}$, and β_1 are estimable parameters and $\boldsymbol{\upsilon}$ and $\boldsymbol{\varepsilon} \sim N(0, \sigma)$ represent the stochastic error terms. The matrix **X** includes indicator variables for each of the 47 states involved in the analysis, plus Washington, D.C.; Texas is omitted to avoid perfect multicollinearity with the overall constants.[6]

Next, the second step disaggregates total direct spending into 11 individual types of spending. The identity

$$\mathbf{P} = \mathbf{P}_k + (\mathbf{P} - \mathbf{P}_k) \; \forall \, k = 1,...,13 \tag{2}$$

divides total direct spending into public expenditure of type k, $\mathbf{P}_k$, and all other public expenditures, $(\mathbf{P} - \mathbf{P}_k)$. In this way, each of the 11 measures of public spending—per household expenditure on capital facilities, education, fire protection, housing and community development, libraries, natural resources, parks, police protection, roadways, sewerage, and trash collection—can be isolated and tested individually. Exhibit 2 provides a description of the measures, as defined by the Census Bureau survey form used to collect the data.

Exhibit 2

Description of Public Expenditure Variables

Variable	Variable Description
Total direct expenditures	Sum of direct expenditures, including salaries and wages
Capital facilities	Sum of capital outlays, including construction, equipment, land, and structures
Education	Expenditures on local schools
Fire protection	Expenditures incurred for fire fighting and fire prevention, including contributions to volunteer fire units
Housing and community development	Expenditures on urban renewal, slum clearance, and housing projects
Libraries	Expenditures on municipal and nongovernmental libraries
Natural resources	Flood control and soil and water conservation, drainage, irrigation, forestry and forest fire protection, agricultural fairs, and any other activities for the promotion of agriculture and conservation of natural resources
Parks	Expenditures on parks and recreation, including playgrounds, golf courses, swimming pools, museums, marinas, community music, drama, celebrations, zoos, and other cultural activities
Police protection	Expenditures on municipal police agencies, including coroners, medical examiners, vehicular inspection activities, and traffic control and safety activities
Roadways	Expenditures for construction and maintenance of municipal streets sidewalks, bridges and toll facilities, street lighting, snow removal, and highway engineering, control, and safety
Sewerage	Expenditures for construction, maintenance, and operation of sanitary and storm sewer systems and sewage disposal plants
Trash collection	Expenditures on street cleaning and the collection and disposal of garbage

Source: Census of Governments, form F-21 (2000) 2000 Annual Survey of Local Government Finances

In the third step of the analysis, a set of additional equations is specified:

$$\ln \mathbf{H} = \mathbf{X}\hat{\boldsymbol{\alpha}} + \lambda_k \mathbf{P}_k + \pi_k(\mathbf{P} - \mathbf{P}_k) + \boldsymbol{\varepsilon}, \forall k = 1,...,13$$
$$\ln \mathbf{R} = \mathbf{X}\hat{\boldsymbol{\beta}} + \omega_k \mathbf{P}_k + \psi_k(\mathbf{P} - \mathbf{P}_k) + \boldsymbol{\varepsilon}, \forall k = 1,...,13 \quad (3)$$

where $\hat{\boldsymbol{\alpha}}$ and $\hat{\boldsymbol{\beta}}$ denote the estimated parameters of the model shown in (1). Model (3) is estimated via ordinary least squares (OLS), yielding sets of estimates of λ_k and ω_k for the effects of public expenditure of type k on median housing values and rents, respectively. Note here that the estimation does not impose the restrictions $\lambda_k + \pi_k = \alpha_1$ and $\omega_k + \psi_k = \beta_1$. Instead, to check for consistency in the estimations, the sum of the elasticities for $\mathbf{P}_k$ and $(\mathbf{P} - \mathbf{P}_k)$ is later compared to the elasticity of $\mathbf{P}$ derived from model (1).

Finally, in the fourth step, the model is reestimated using public service expenditure data from 1992, again using the already estimated parameters $\hat{\boldsymbol{\alpha}}$ and $\hat{\boldsymbol{\beta}}$.[7] To be clear, the series of steps just

described enables each individual service expenditure to be examined; simply including all of them at once results in severe multicollinearity and yields unintelligible results.

Relevant variables were collected for all 777 metropolitan counties (1999 definition) in the continental United States, plus Washington, D.C.[8] All counties involved in the analysis are shown in exhibits 3a through 3c, which illustrate the spatial distribution of 2000 median housing values, 2000 median rents, and 1997 per household total direct public service expenditures. For ease of

Exhibit 3a

Spatial Distribution of 2000 Median Housing Values

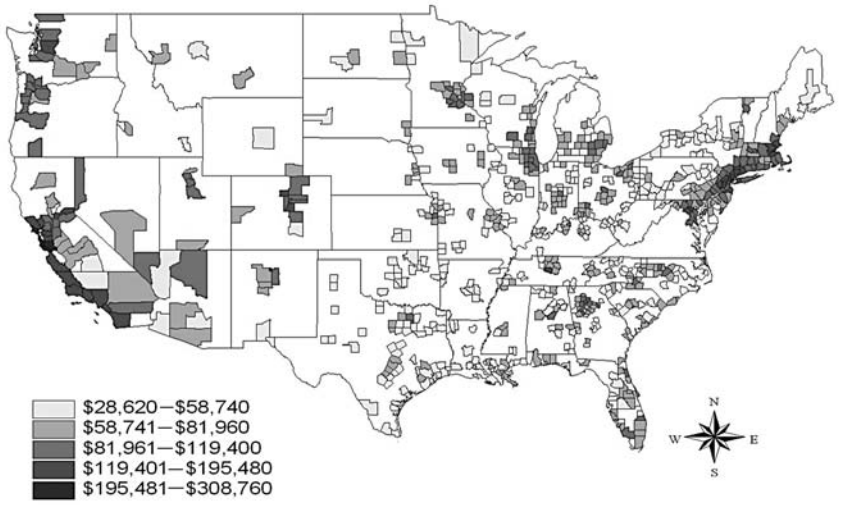


Exhibit 3b

Spatial Distribution of 2000 Median Rents

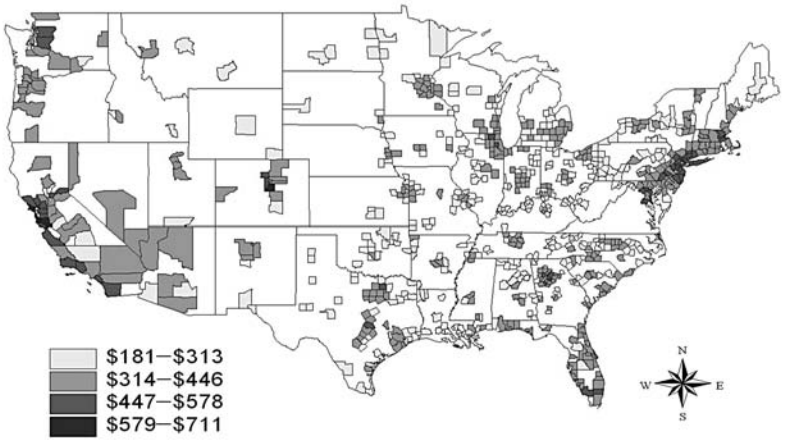
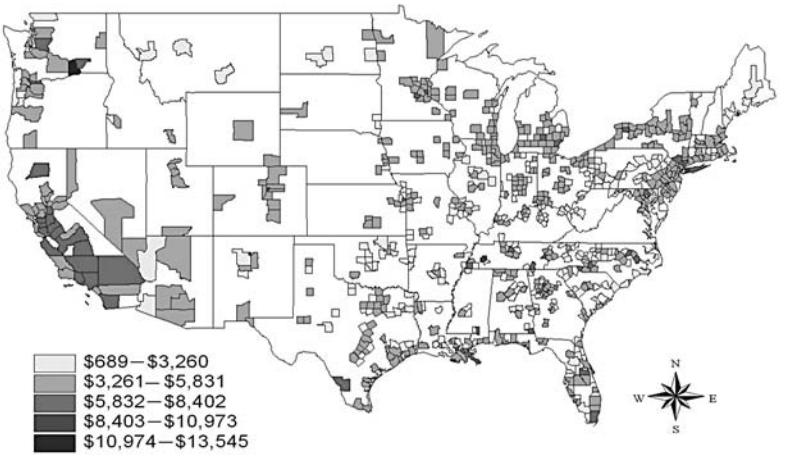


Exhibit 3c

Spatial Distribution of 1997 per Household Total Direct Expenditures



exposition, the individual explanatory variables that comprise **X** are organized into four groupings: *Housing Market Characteristics*, *Demographic Characteristics*, *Economic Characteristics*, and *Political Structure and Fiscal Characteristics*. Exhibit 4 provides the definition and sources of all variables and exhibit 5 provides descriptive statistics for each variable.

It is worth pointing out at this juncture that, between 1990 and 2000, median rent increased nationally by just 0.6 percent per year, but the average annual increase in median housing value was more than twice as high, amounting to 1.3 percent per year.[9] Between 1992 and 1997, total direct expenditures rose by 1.2 percent per year but, as shown in exhibit 6, this increase was not equally distributed across all types of public spending. In particular, with an average annual growth rate of 1.9 percent during the 5-year period from 1992 to 1997, per household spending on education increased significantly, while spending on most other services remained about constant. Further, education spending is by far the most important public expenditure; it accounts for more than 40 percent of total direct expenditures and is more than twice as large as the next largest form of spending, capital facilities.

Exhibit 4

Variable Definitions and Sources

Variable	Definition	Source
Housing Market Characteristics		
Median Rent	Median county rent	United States Census, 2000
Median Housing Value	Median county housing value	United States Census, 2000
Median Number of Rooms	Median number of rooms in houses	United States Census, 2000
% Housing Built Before 1939	Proportion of housing that was built prior to 1939	United States Census, 2000
% Owner Occupied	Proportion of housing that is owner occupied	United States Census, 2000
% Single-Family Housing	Proportion of single-family housing	United States Census, 2000
% Vacant	Proportion of unoccupied housing	United States Census, 2000
Demographic Characteristics		
Population	County population	United States Census, 2000
Population Change	Population change, 1990–2000	United States Census, 1990 and 2000
Per Capita Income	Income divided by population	Regional Economic Information System 1997
% Population >18 Years Old	Proportion of population that is younger than 18 years	United States Census, 2000
% African American	Proportion of population that is African American	United States Census, 2000
Economic Characteristics		
Cost of Living Index	Relative cost of living	*Places Rated Almanac, 1997*
Construction Cost Index	Relative cost of construction	*RS means Building Construction Cost Data: 58th Annual Edition*
Natural Amenity Index	Natural amenity score	Economic Research Service, 1993
Political Structure and Fiscal Characteristics		
Suburban Indicator	1 if yes, 0 if no	n/a
Per Capita Municipalities	Number of municipal governments divided by population (1,000s)	United States Census, 1990 and 2000; Census of Governments, 1992 and1997
Property Tax Burden	Per household property tax divided by median housing value	United States Census, 1990 and 2000; Natural Resources Inventory; Census of Governments, 1997
Per Household Total Direct Expenditures[a]	Expenditure divided by estimated number of households	United States Census, 1990 and 2000; Census of Governments, 1992 and1997

[a] *Includes all 11 other measures of public spending.*
n/a = nonapplicable.

Exhibit 5

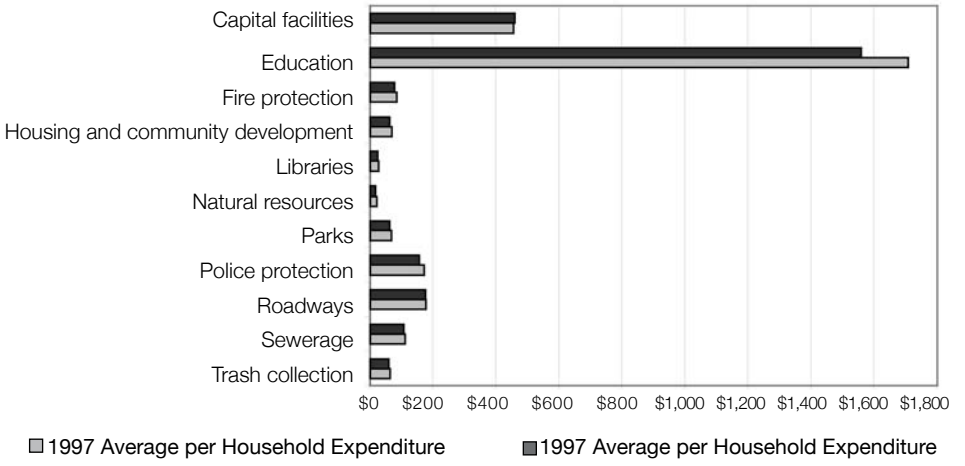
Descriptive Statistics

Variable	Mean	Median	Standard Deviation
Housing Market Characteristics			
Median Rent, 2000	$331.71	$316.20	$114.00
Median Housing Value, 2000	$68,527	$60,180	$60,178
Median Number of Rooms	5.53	5.50	0.38
% Housing Built Before 1939	14.01 %	9.90 %	5.89 %
% Owner Occupied	65.35 %	65.98 %	7.51 %
% Single-Family Housing	66.44 %	67.50 %	9.48 %
% Vacant	8.27 %	7.04 %	5.23 %
Demographic Characteristics			
Population	279,817	126,638	1,220,419
Population Change	1.05	1.04	0.06
Economic Characteristics			
Per Capita Income	14,854.37	14,273.55	3,980.54
% Population >18 Years Old	25.85 %	25.83 %	3.11 %
% African American	9.49 %	5.01 %	12.17 %
Cost of Living Index	50.36	51.35	31.60
Construction Cost Index	92.36	91.50	15.82
Natural Amenity Index	0.33	– 0.01	3.51
Political Structure and Fiscal Characteristics			
Suburb Indicator	0.48	0.00	0.46
Per Capita Municipalities	0.0921	0.0630	0.0624
Property Tax Burden	1.55 %	1.42 %	0.36 %
Per Household Total Direct Expenditures, 1997/1992	$3,930/$3,709	$3,694/$3,471	$1,722/$1,793
Per Household Spending on Capital Facilities, 1997/1992	$455/$459	$415/$362	$246/$309
Per Household Spending on Education, 1997/1992	$1,707/$1,559	$1,630/$1,499	$447/$557
Per Household Spending on Fire Protection, 1997/1992	$84/$78	$77/$73	$59/$58
Per Household Spending on Housing and Community Development, 1997/1992	$70/$63	$51/$44	$98/$97
Per Household Spending on Libraries, 1997/1992	$27/$24	$23/$20	$21/$17
Per Household Spending on Natural Resources, 1997/1992	$21/$18	$6/$5	$73/$51
Per Household Spending on Parks, 1997/1992	$67/$62	$49/$48	$76/$61
Per Household Spending on Police Protection, 1997/1992	$172/$157	$154/$142	$90/$85
Per Household Spending on Roadways, 1997/1992	$177/$176	$155/$157	$69/$65
Per Household Spending on Sewerage, 1997/1992	$111/$107	$95/$89	$88/$108
Per Household Spending on Trash Collection, 1997/1992	$63/$59	$53/$48	$46/$41

Note: All dollar values adjusted to 1982 constant dollars.

Exhibit 6

1997 and 1992 Average per Household Expenditures



Estimation Results

The results of the first step of the empirical analysis are presented in exhibit 7.[10] Nearly all the variables are statistically significant and, where the direction of influence was anticipated in advance (denoted by the one-tailed hypothesis tests), each coefficient carries its expected sign. Moreover, the adjusted R^2 values of 0.88 and 0.84 show that the model does very well at explaining variation in the two dependent variables. Because the models were estimated in semilog form, elasticities were calculated to enable easier interpretation of the coefficients.[11] Working down through the four groupings of explanatory variables, the following paragraphs elaborate on the estimation results.

The *Housing Market Characteristics* reveal that housing with more rooms is associated with higher values and rents; it costs less to live in areas with high proportions of old housing stock; the percentage of owner-occupied housing negatively affects housing values and rents; that the percentage of single-family housing negatively affects housing values but positively affects rents; and higher vacancy rates lead to lower values. All variables are statistically significant and, except where the direction of influence was not anticipated in advance, each carries its expected sign.

The most interesting results here come from the two two-tailed hypothesis tests. First, the percentage of owner-occupied housing is negative and strongly significant in both the ownership and rental markets. At first glance, this sign pattern is counterintuitive because areas dominated by owner-occupied housing are generally more expensive to live in—a condition that is often enforced by exclusionary land use controls (Ulfarsson and Carruthers, 2006). Bearing in mind, however, that the model also controls for tax burden and public spending, both of which are closely linked to local land use regulation, the result is logical: housing values and rents are lower in areas with high proportions of owner-occupied housing after factoring in the costs and benefits of residing in them. Second, the alternating sign pattern on the percentage of single-family housing suggests that

Exhibit 7

SUR Estimates of Median Housing Value and Rent[a]

Variable	2000 Median Housing Value			2000 Median Rent		
	α	η	*t–statistic*	β	η	*t–statistic*
Intercept	9.30E+00 †††	n/a	56.90	4.62E+00 †††	n/a	39.98
Housing Market Characteristics						
Median Number of Rooms	1.38E-01 ***	0.763	6.42	1.45E-01 ***	0.801	9.52
% Housing Built Before 1939	– 4.15E-03 ***	– 0.058	– 5.44	– 4.83E-03 ***	– 0.068	– 8.94
% Owner Occupied	– 2.60E-01 †††	– 0.170	– 2.33	– 7.17E-01 †††	– 0.468	– 9.06
% Single-Family Housing	– 1.29E-03 †	– 0.086	– 1.66	1.01E-03 ††	0.067	1.85
% Vacant	– 4.12E-01 ***	– 0.034	– 3.42	– 4.50E-01 ***	– 0.037	– 5.29
Demographic Characteristics						
Population	1.70E-08 ***	0.005	1.95	5.32E-09 n/s	0.001	0.86
Population Change, 1990–2000	4.63E-01 ***	0.486	5.01	3.13E-01 ***	0.329	4.79
Per Capita Income, 1997	4.30E-05 ***	0.639	20.23	2.06E-05	0.306	13.66
% Population >18 Years Old	– 4.57E-01 ***	– 0.118	– 1.92	8.27E-02 n/s	0.021	0.49
% African American	– 3.01E-01 ***	– 0.029	– 5.20	– 1.14E-01 ***	– 0.011	– 2.78
Economic Characteristics						
Cost of Living Index, 1997	2.94E-03 ***	0.148	9.98	2.10E-03 ***	0.104	10.05
Construction Cost Index	6.53E-03 ***	0.603	6.35	4.62E-03 ***	0.427	6.35
Natural Amenity Index	2.19E-02 ***	0.007	5.31	1.30E-02 ***	0.004	4.44
Political Characteristics and Fiscal Characteristics						
Per Capita Municipalities, 1997	6.83E-02 n/s	0.006	1.12	– 1.74E-01 ***	– 0.016	– 4.02
Suburb Indicator	1.08E-02 n/s	n/a	0.88	3.75E-03 n/s	n/a	0.43
Property Tax Burden, 1997	– 1.07E+01 ***	– 0.166	– 10.58	– 1.47E+00 ***	0.015	– 2.05
Per Household Total Direct Expenditures, 1997	8.70E-06 ***	0.034	1.80	6.28E-07 n/s	0.002	0.18
Adjusted R^2			0. 88			0.84
n			777			777

SUR = seemingly unrelated regression.
[a] All fixed effects have been suppressed in order to conserve space.
**One-tailed test, statistically significant at p < .10.*
***One-tailed test, statistically significant at p < .05.*
****One-tailed test, statistically significant at p < .01.*
† Two-tailed test, statistically significant at p < .10.
†† Two-tailed test, statistically significant at p < .05.
††† Two-tailed test, statistically significant at p < .01.
n/s Denotes not statistically significant.
n/a = Denotes not applicable.

it captures a density/congestion effect in the housing market but picks up a premium in the rental market. This explanation is plausible, given that low residential densities result from low land values, but fewer opportunities are available for renters to find housing in such areas, leading to higher housing values via competition over scarce units.

The results for the *Demographic Characteristics* group show that more populous metropolitan areas have higher housing values (rents are unaffected); rapid growth and high per capita income lead to increased values in both the ownership and rental markets; areas with large proportions of families with children, measured as the percentage of people less than 18 years of age, have more affordable owner-occupied housing (rental housing is unaffected); and areas with high proportions of African-American residents have lower housing values and rents. Each of these findings is consistent with expectations, except for the two insignificant coefficients in the rental market. It may be, however, that larger metropolitan areas have greater amounts of rental housing, so that population does not have a meaningful effect on the rental market and that, because renters generally have fewer options than homeowners, the market is insensitive to family structure.

In the *Economic Characteristics* group, the cost of living index, construction cost index, and natural amenity index are all positive and highly significant in the two equations, illustrating the important role that these factors play in contributing to place-to-place variation in the cost of living.

Finally, in the *Political Structure and Fiscal Characteristics* group, municipal fragmentation, measured as the per capita number of municipalities, has no effect on housing values but negatively affects rents; the suburban county indicator variable is insignificant in both the ownership and rental markets; property tax burden lowers the value of housing; and public spending, measured in this first step as per household total direct expenditures, positively affects the ownership market but does not affect the rental market. It is a bit puzzling that the coefficient on municipal fragmentation is insignificant in the ownership and negative in the rent equation given that other research has shown it to raise property values (Carruthers and Ulfarsson, 2002). It may be, though, that fragmentation offers renters more choice, even as selection and exclusivity offset each other in the ownership market. The finding that public expenditures (on the whole) are capitalized into the ownership market but not the rental market is consistent with expectations: homeowners, by far, bear most of the costs and enjoy the financial benefits of service provision while renters, by and large, do not. The elasticities for the property tax variable, which show that the effect is *10 times* (0.166 *versus* 0.015) as large in the ownership market, bear out this explanation.

The Influence of Individual Public Service Expenditures

As an overarching finding, the positive effect of total direct expenditures in the homeownership market lends good support to the hypothesis that public services account for a significant proportion of interregional variation in housing values. So far, no evidence indicates that the same is true for rents. Even so, certain types of spending are viewed as more beneficial than others, causing their influence to vary by type through the two markets and necessitating the need to isolate their individual effects. This step is achieved via the remaining three steps of the modeling framework, the results of which are summarized in exhibit 8 and shown graphically in exhibits 9a, 9b, 10a, and 10b. Specifically, exhibit 8 shows elasticities calculated from OLS estimates of the parameters λ_k and ω_k in model (3) and their associated *t*-statistics, and exhibits 9a through 10b map out the statistically significant elasticities for easy visual comparison.[12] Together, the table and graphics in the exhibits respond directly to the three remaining research questions: What types of spending make the most difference? How does the effect of expenditures on housing values compare to their effect on rents? Do these effects change over time?

Exhibit 8

Elasticities for Individual Public Expenditures[a]

	2000 Median Housing Value				2000 Median Rent			
	1997 Spending		1992 Spending		1997 Spending		1992 Spending	
	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*
Capital Facilities								
Per Household Expenditure	0.028 ***	3.32	0.006 ***	1.89	0.017 ***	2.95	0.002 n/s	0.66
Per Household Expenditure on Other Services	0.007 n/s	0.80	0.028 ***	5.98	– 0.015 ***	– 2.44	0.000 n/s	– 0.12
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Education								
Per Household Expenditure	0.025 ***	3.13	0.028 ***	3.80	0.002 n/s	0.41	0.001 n/s	0.17
Per Household Expenditure on Other Services	0.010 *	1.38	0.008 n/s	1.17	0.000 n/s	– 0.07	0.000 n/s	0.06
Sum of Elasticities	0.036	n/a	0.036	n/a	0.002	n/a	0.001	n/a
Fire Protection								
Per Household Expenditure	0.007 n/s	1.01	0.001 n/s	0.20	0.011 ***	2.10	0.009 **	1.80
Per Household Expenditure on Other Services	0.027 ***	3.35	0.033 ***	4.10	– 0.009 *	– 1.54	– 0.008 *	– 1.39
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Housing and Community Development								
Per Household Expenditure	0.008 ***	1.95	0.004 n/s	0.92	0.003 n/s	1.01	0.001 n/s	0.44
Per Household Expenditure on Other Services	0.026 ***	4.41	0.030 ***	5.48	– 0.001 n/s	– 0.32	0.000 n/s	– 0.04
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Libraries								
Per Household Expenditure	0.007 *	1.39	0.010 ***	2.15	0.006 *	1.54	0.005 *	1.46
Per Household Expenditure on Other Services	0.027 ***	4.29	0.024 ***	4.06	– 0.004 n/s	– 0.83	– 0.004 n/s	– 0.86
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Natural Resources								
Per Household Expenditure	0.000 n/s	– 0.28	0.000 n/s	0.31	– 0.002 *	– 1.54	0.000 n/s	– 0.02
Per Household Expenditure on Other Services	0.035 ***	8.51	0.034 ***	8.42	0.003 n/s	1.19	0.001 n/s	0.41
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a

[a] *Derived from seemingly unrelated regression parameter estimates.*

* *One-tailed test, statistically significant at $p < .10$.*

** *One-tailed test, statistically significant at $p < .05$.*

*** *One-tailed test, statistically significant at $p < .01$.*

n/s *Denotes not statistically significant.*

Exhibit 8

Elasticities for Individual Public Expenditures[a] (continued)

	2000 Median Housing Value				2000 Median Rent			
	1997 Spending		1992 Spending		1997 Spending		1992 Spending	
	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*	η	*t–statistic*
Parks								
Per Household Expenditure	0.008 **	1.66	0.004 n/s	0.82	0.006 *	1.57	0.005 *	1.55
Per Household Expenditure on Other Services	0.026 ***	4.01	0.030 ***	4.76	– 0.004 n/s	– 0.87	– 0.004 n/s	– 0.99
Sum of Elasticities	0.034	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Police Protection								
Per Household Expenditure	0.034 ***	3.38	0.027 ***	2.86	0.018 ***	2.52	0.020 ***	2.91
Per Household Expenditure on Other Services	0.000 n/s	0.03	0.007 n/s	0.68	– 0.016 ***	– 2.13	– 0.018 ***	– 2.56
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Roadways								
Per Household Expenditure	0.012 **	1.63	0.009	1.37	0.005 n/s	0.98	0.004 n/s	0.82
Per Household Expenditure on Other Services	0.023 ***	2.93	0.025 ***	3.49	– 0.003 n/s	– 0.53	– 0.003 n/s	– 0.49
Sum of Elasticities	0.035	n/a	0.035	n/a	0.002	n/a	0.001	n/a
Sewerage								
Per Household Expenditure	0.010 **	1.68	0.010 ***	1.94	0.011 ***	2.60	0.004 n/s	1.10
Per Household Expenditure on Other Services	0.024 ***	3.41	0.024 ***	3.77	– 0.009 ***	– 1.84	– 0.003 n/s	– 0.64
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a
Trash Collection								
Per Household Expenditure	0.006 n/s	1.18	0.005 n/s	0.91	– 0.004 n/s	– 0.95	0.001 n/s	0.17
Per Household Expenditure on Other Services	0.028 ***	4.35	0.029 ***	4.75	0.005 n/s	1.17	0.001 n/s	0.12
Sum of Elasticities	0.035	n/a	0.034	n/a	0.002	n/a	0.001	n/a

[a] *Derived from seemingly unrelated regression parameter estimates.*

** One-tailed test, statistically significant at $p < .10$.*

*** One-tailed test, statistically significant at $p < .05$.*

**** One-tailed test, statistically significant at $p < .01$.*

n/s Denotes not statistically significant.

Exhibit 9a

Influence of 1997 Expenditures on 2000 Median Housing Value

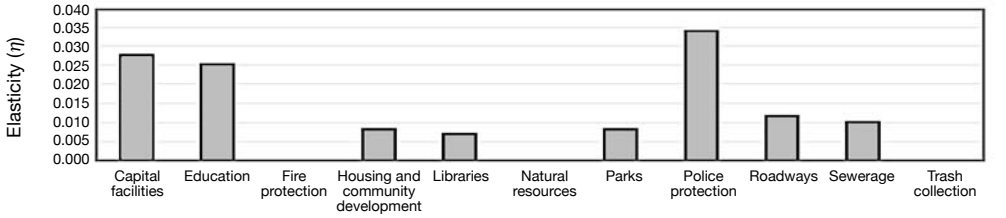


Exhibit 9b

Influence of 1992 Expenditures on 2000 Median Housing Value

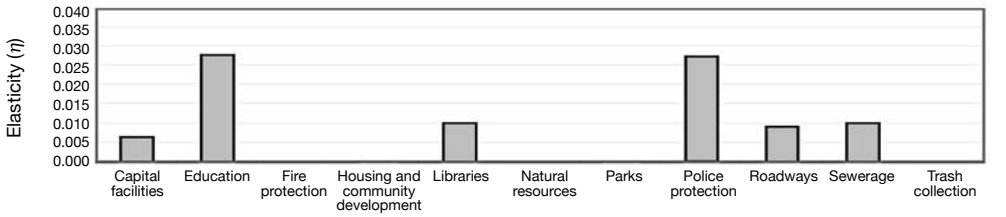


Exhibit 10a

Influence of 1997 Expenditures on 2000 Median Rent

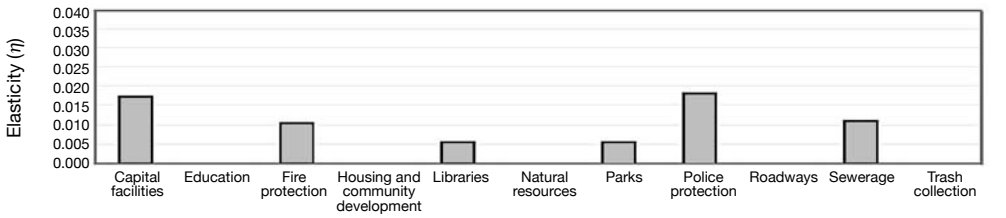
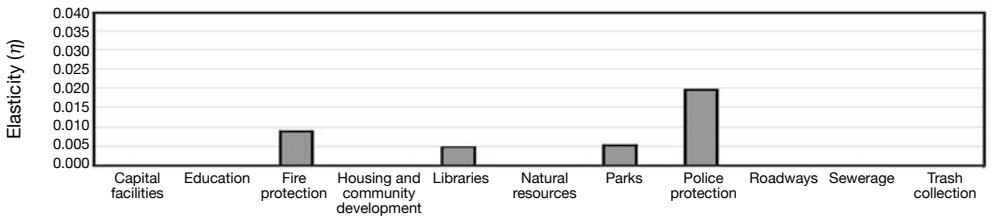


Exhibit 10b

Influence of 1992 Expenditures on 2000 Median Rent



Expenditures that make a difference in the homeownership market—that is, expenditures that are statistically significant—are capital facilities, education, housing and community development, libraries, parks, police protection, roadways, and trash collection. Each of these categories of spending positively contributes to a metropolitan area's median housing value. In the rental market, capital facilities, fire protection, libraries, parks, police protection, and sewerage make positive contributions. In terms of size, as measured by the elasticities for 1997 levels of spending, police protection (0.034), capital facilities (0.028), and education (0.025) by far make the most difference in the ownership market, followed by roadways (0.012) and sewerage (0.010). In the rental market, police protection (0.018) and capital facilities (0.017) also make the most difference, followed closely by fire protection (0.011) and sewerage (0.011).

Several important differences are apparent between the two markets. Spending on police protection and on capital facilities makes large contributions to both housing values and rents, but the effect of spending deviates from there. In particular, the salient differences suggest that the ownership market responds to factors affecting the exchange value of housing (such as education and roadways, which can enhance accessibility), while the rental market responds more to factors that affect the use value of housing (such as fire protection and parks). These differences are interesting because they speak to what residents get out of the different kinds of services. Although renters clearly benefit from the factors that affect the ownership market, they do not as often pay a premium for doing so because they are not directly invested. For example, homeowners benefit from high-quality schools whether they have children or not because buyers will pay more for their housing if they choose to sell, but renters gain nothing, unless family members make use of public education. Meanwhile, it is possible that homeowner's insurance insulates homeowners from concern over fire protection even as they rely heavily on police protection to maintain the safety of their neighborhoods and viability of their assets. A final important difference is the negative effect of natural resources in the rental market, but this seems likely to be a spurious correlation.

To illustrate how the effect of spending changes though time, exhibits 9b and 10b show elasticities derived by estimating model (4), with public service spending lagged by 8 years instead of 3. In the median housing value equation, the differences are that housing and community development and parks drop out of statistical significance. In the median rent equation, capital facilities and sewerage become insignificant. In both equations, the overall trend is downward through time, with most types of spending having a lesser effect, as measured by the elasticities. Important exceptions to this are education, libraries, and police protection in the ownership market and fire protection and police protection in the rental market. The key finding here is that the benefits of certain public expenditures are more enduring in the two markets. That spending 8 years past on a broad spectrum of services raises home values is evidence of the large stake homeowners have in locally provided public goods and services via the exchange value of their property. On the other hand, the comparatively smaller range of services that matter from 8 years past in the rental market illustrates the more immediate kind of use value that renters place on public spending.

Summary and Conclusion

This article demonstrates the important role that public service expenditures play in explaining interregional variation in housing values and rents. Generally speaking, police protection makes the most difference for owners and renters alike, with education and fire protection, respectively, being close seconds. Each of these findings is consistent with the theory of compensating differentials, which predicts that people will incur greater costs to live in areas that offer perceived benefits. The differences between the two markets, in which homeowners apparently place greater weight on expenditures that affect exchange value and renters place greater weight on factors that influence use value, are also logical and consistent with theory of human behavior (Logan and Molotch, 1987). Finally, in both markets, certain services (such as police protection) have enduring effects over time while others do not. The temporal decay of benefits captured by the test statistics and elasticities in both markets serves as further and corroborating evidence that homeowners are concerned with expenditures that affect exchange value while renters are concerned mainly with use value. Several conclusions and directions for future research follow from these findings.

Reexamining exhibit 7, it is noteworthy that, although property tax burden and total direct spending are both significant in the median housing value equation, the elasticities suggest that costs (–0.166) are felt at a rate five times as high as benefits (0.034). If services were fully compensating, the two would offset one another, so this discrepancy indicates either that services are inefficiently provided or that owners at least *perceive* a substantially higher share of the costs than the benefits of public spending. For example, a service may be negatively capitalized via its contribution to the property tax burden but not positively capitalized if people take it for granted or do not want it in the first place. Future research should look more deeply into this conclusion because perceived benefits are what ultimately dictate taxpayers' willingness to pay for services and, in turn, the flow of revenues that local governments have to work with.

The results presented here highlight the importance of this point by providing substantive evidence that public policy may be used to directly influence the relative attractiveness of regions. Although much research has focused on the influence of natural features on migration flows, property values, and wages, the present analysis reveals that, contrary to popular opinion, the elasticities of most public service expenditures by far outweigh those of the natural amenity index in both the ownership and rental markets. This finding is particularly compelling, given that good evidence shows that recent economic development has not bypassed older cities located in the Northeast and Midwest; despite having comparatively fewer environmental attractions, these places continue to capture significant proportions of economic growth (Drennan, 2002). Because it is impossible for any region to alter its inherent endowment of natural amenities, fiscal factors will become increasingly important in years to come. This is true, too, of high-amenity areas currently attracting large numbers of people and firms: deteriorating public services as a result of poor growth management may eventually overwhelm an area's ability to remain competitive in the national economy.

Finally, it should be reiterated that, of all expenditures, those related to public safety (police and fire protection) and education emerged as being the most important. Nevertheless, inequities in the quality of these services in particular are on the rise in metropolitan areas nationwide, creating, in some cases, an intractable cycle of socioeconomic decline as the poor become increasingly cut off

from benefits enjoyed by the public at large (Orfield, 2002). If metropolitan areas become winners or losers based on their relative desirability as places to live—as this and much previous research suggests—their ability to avoid the problem of social polarization will become key to their long-term prosperity. Although the present analysis has focused on intermediate outputs (measured by spending), not the final outputs (measured by quality) that residents ultimately enjoy, it is fair to say that forward-looking urban policy should strive to maintain as high a level of public safety and human capital as possible (Glaeser, Scheinkman, and Shleifer, 1995).

The conclusions discussed in the preceding paragraphs illustrate the importance of public service expenditures to the well-being of contemporary metropolitan areas. In an era when compensating differentials have such a large impact on the outcome of regional development, fiscal planning should be viewed as fundamental to the growth process. Unfortunately, however, fiscal planning is all too commonly overlooked. Adding to the problem, most research conducted from an interregional perspective incorporates public services only tangentially; representative measures are usually included in migration models and other forms of analysis but rarely are they the center of attention. As a result, policymakers have little to go on in their fiscal planning processes and even less to act upon when calling on people to make financial sacrifices for the good of the whole. Although a great deal of additional research is needed to identify just how public services may be leveraged, this article has taken a step in that direction by linking a broad spectrum of public goods and services to the place-to-place cost of housing. Important next steps will be to examine the connections between intermediate and final outputs in this context and, as an extension, how they relate to the pace of economic growth and regional well-being.

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Notes

1. A previous version of this article, which is derived from Robyn Welch's master's thesis, was presented at the 2003 North American Meetings of the *Regional Science Association International* in Philadelphia, Pennsylvania.
2. Corresponding author.
3. Throughout this article, a distinction is made between *exchange value* and *use value*, where the former is a market construct that is generally expressed in sales prices and the latter is a social construct that is expressed in day-to-day utility (Logan and Molotch, 1987). Although

most economists would say that, in the end, these two terms amount to the same thing, some sociologists disagree: as Logan and Molotch (1987: 2) note, the distinction hinges on "financial return" versus "essential needs of life" and the maximization of one does not necessarily result in the maximization of the other. The two concepts are useful for present purposes because they shed light on differences in the ways that homeowners and renters value public services.

4. Median housing value is not an ideal substitute for the kind of prices that result from individual transactions but is often used as a proxy to meet specific research purposes; see, for example, Chay and Greenstone (2005). In the present case, broad geographic patterns, rather than the behavior of individuals, are of interest, so inferences are made in that spirit.

5. Mathematically, the expectation is that $\partial housing\ value/\partial public\ spending > 0$ and $\partial rent/\partial public\ spending > 0$.

6. The choice of states is arbitrary, but at least one fixed effect or the constant itself must be excluded in order to estimate the equations. Note that the two alternatives amount to the same thing: in these equations, the fixed effect for Texas is expressed by the constant.

7. The time lags are dictated by data availability; the public expenditure data come from the Census of Governments, which is conducted every 5 years (the 2nd and 7th year of each decade).

8. Virginia is not represented in the data because its unique political structure, which includes numerous independent cities, makes consistent data collection impractical.

9. All comparisons use 1982 constant dollars.

10. All fixed effects are suppressed to conserve space; because they reflect ignorance about unobserved characteristics associated with each state, they have no straightforward interpretation.

11. An elasticity is calculated as

$$\eta_i = \frac{\partial y}{\partial x_i}\frac{\bar{x}_i}{y} = \beta_i \frac{\bar{x}_i}{y}.$$

Here, the elasticity of y with respect to x_i (η_i) is estimated by multiplying the ratio of the sample means and the expected value of y at the mean values of *all* explanatory variables ($\bar{x}_i$ divided by $E[y|\mathbf{x}]$) by its coefficient, β_i. Because the regression coefficients in this case are based on the natural logs of the dependent variables, they drop out of the actual calculation, so $\eta_i = \beta_i \cdot \bar{x}_i$. The resulting elasticity is unit free, enabling easy comparison of the relative influence that each explanatory variable has on the dependent variables themselves, not their natural logs (Greene, 2000).

12. The sum of elasticities shown in the grey lines represents *a posteriori* tests of the restriction that the sum of each individual expenditure is equal to β_1 and α_1 from model (1), as specified in equation (2); in all cases, the numbers sum to essentially the same numbers shown in exhibit 7; where they do not, they deviate only by one-hundredth of a point.

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Duration of Rent Burden as a Measure of Need

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Abstract

A number of measures show that very-low-income households with a longer duration of severe rent burdens are more disadvantaged than other very-low-income renters who experience severe rent burdens for a shorter, or no, time. The rate of exit from severe rent burdened status is 56 percent in the first year of a spell, but falls to 32 percent in the second and later years. Renters with severe rent burdens in all years of a 3-year period were substantially more disadvantaged, according to a number of indicators, than those with fewer or no years of severe rent burdens. Very-low-income households with 1 or 2 years of severe rent burdens sometimes fell between those with 0 and 3 years, but by many measures they were quite similar to those with no rent burden in any of the three years, and by a few measures were actually less disadvantaged than very-low-income renters without any time in rent-burdened status. Various measures of disadvantage, such as nonemployment and the receipt of Supplemental Security Income (SSI) predict the persistence of rent burdens. Hence, targeting those with several years of severe rent burdens would target a needier population than targeting those with only a single rent-burdened year. At the same time, there are also some reasons not to direct assistance to the most needy population.

Introduction: 2003 Worst Case Needs Report

For the first time, the U.S. Department of Housing and Urban Development's (HUD's) *Report on the Significant Need for Affordable Housing in 2003* (formerly titled the *Worst Case Needs* report) included a discussion of rent burden dynamics. The main finding was that the rent-burdened population undergoes considerable turnover from year to year. HUD reported that among very-low-income renters who reported a severe rent burden (a rent burden above 50 percent of income) in 2001,

only about half (47.1 percent) continued to have a severe rent burden in 2002 (Martin, Susin, and Steffen, 2005: exhibit 3–10). It should be noted, though, that many renters may have continued to have affordability problems, particularly those whose rent burdens fell only modestly: to 40 to 50 percent of income (10.2 percent) or to 30 to 40 percent of income (12.7 percent). The rest ended their severely rent-burdened status by receiving housing assistance (8.5 percent), moving to owner-occupied housing (6.4 percent), or having their rent burden fall below 30 percent of income (15.2 percent).[1]

The 2003 report cautioned against reaching firm conclusions because of the limited earlier literature on rent burden dynamics and because there were some indications of reporting problems regarding rent. Measurement error, in this case misclassification of severe rent burden status, often leads to larger problems in longitudinal analyses than in cross-sectional studies. The second and third sections of this article describe the data, revisit these data quality issues, and discuss the steps taken to minimize these problems.

To a large extent, the motivation for examining this measure is to identify a group of especially needy households to receive assisted housing. In addition, HUD considers those with severe rent burdens to have "worst case needs," its traditional measure of the need for housing assistance. Although other groups, such as those living in substandard housing, are also considered to have worst case needs, the severely rent burdened make up the large majority. The fourth section of this article discusses the preferences and policies HUD uses to determine who will receive subsidized housing, one element of which is having a severe rent burden.

The fifth and sixth sections present new results on the dynamics of rent burdens, adding an additional year of data to the year-to-year transition analysis and presenting pseudo-hazard rates (the rate of exit from severe rent burden status after 1 year and after 2 or more years). The seventh and eighth sections present exploratory analyses describing the characteristics of those with persistent rent burdens, with the seventh section presenting summary statistics and t-tests and the eighth section providing a multivariate analysis.

The article concludes with a summary that includes a discussion of the logic behind targeting those with long-term rent burdens and a discussion of the potential uses of the logit models for targeting purposes.

Data Set

This article examines rent burdens in a national panel data set, the 2001 Survey of Income and Program Participation (SIPP). The SIPP follows approximately 40,000 households for 3 years, covering the period from February 2001 through January 2004. Households in the SIPP are interviewed every 4 months and are asked about their housing costs at the end of each year.[2]

The unit of analysis is the household, which is not easy to define in a longitudinal study because people can move in and out of a household over time. Here, we track the 2001 householder (a household member listed on the lease or mortgage) and consider households to consist of the people living in the same housing unit as this person, which can change over time. For example, in 2001 the household may consist of a mother and child, and this mother will be tracked for 3 years.

In 2001, household income will be the total income received by these two people. If the mother marries and moves into her husband's house in 2002, we continue to track the mother as the householder, and the 2002 household income will include the husband's income.

Much of the analysis here examines households that were renters, unsubsidized, and very low income and also had severe rent burdens. Very low income is defined by HUD as less than 50 percent of area median income (AMI). The SIPP does not identify areas (typically metropolitan statistical areas) as small as those used by HUD, so income limits defined by HUD for the metropolitan and nonmetropolitan portion of each state were used. A severe rent burden occurs when gross rent is more than 50 percent of income.

The measure of housing costs used here is gross rent, meaning contract rent plus utility costs. Utility payments reported in the SIPP tend to be substantially higher than those in the American Housing Survey (AHS). The AHS is likely to be more accurate due to its much more detailed set of questions about utility costs and its much more elaborate editing procedures. For this reason, and in order to improve the comparability with the rest of the *Worst Case Needs* report, which is mainly based on the AHS, SIPP utility costs are adjusted to be consistent with the AHS. To make this adjustment, nine percentiles of utility amounts were calculated for each of nine census divisions in 2001.[3] Then, the AHS percentiles were regressed on the SIPP percentiles. Finally, the SIPP utility amounts were replaced with the predictions from this regression. Where the regression procedure predicted a negative amount, that amount was replaced with 0.[4]

Cleaning Rent Data

The 2003 *Worst Case Needs* report raised concerns about the measurement of rent in the SIPP. In particular, the severe rent burden exit rate due to decreased rent seemed implausibly high. The first two data columns of exhibit 1 display exit rates, classified into the various ways in which rent burdens can be reduced. Of unsubsidized, very-low-income households with severe rent burdens in 2001, 13.3 percent ended their rent burdens 1 year later because of a decrease in rent. The rate of rent exits is about two-thirds the rate of income exits. Although this finding is consistent with Hill (2003), who also found a large role of rent changes in driving exits from severe rent burdens, it seems implausible. Furthermore, the exhibit also shows that about two-thirds of rent exits occurred without the householder moving. This circumstance is possible, even without the landlord explicitly reducing the rent, because gross rent includes utilities, but again it seems implausibly high.

A number of steps were taken to address this measurement problem. First, households in which rent was measured poorly were dropped. Specifically, these dropped households included those with rent not reported in any of the 3 years. Households that reported, inconsistently, that they paid a rent of $0 but did not report paying "no cash rent" were treated as nonreporters. Also dropped were households that reported that the rent was shared among the residents (for example, roommates splitting the rent). Examining these observations indicated that the survey respondents often seemed confused about whether to report their share of the rent or the total rent for the housing unit. Among these cases, it was typical for rent to vary widely from year to year. It did not seem possible to design a procedure to correct these misreports, so all households that reported sharing the rent in any of the 3 years were dropped.

Exhibit 1

2002 and 2003 Status of Renter Householders With Very Low Incomes and Severe Rent Burdens in 2001

	Consistent With 2003 Report (%)		Revised[a] (%)	
	2002	2003	2002	2003
Remained severely rent burdened (burden > 50%)	49.6	41.2	53.3	45.2
Exited from severe rent burden status	50.5	58.9	46.7	54.8
Reason for exit				
Rent decreased	13.3	13.9	8.1	10.0
Moved	4.2	5.5	2.8	3.9
Stayed	9.1	8.4	5.3	6.1
Income increased	19.7	22.2	23.3	23.7
Combination of rent and income	1.9	2.3	1.7	2.3
Assisted	7.2	7.4	6.8	7.3
In owner-occupied housing	7.1	11.7	5.7	10.0
Zero or negative income	1.2	1.4	1.3	1.5
Total	100.0	100.0	100.0	100.0
Households (in thousands)	3,443	3,443	2,791	2,791

[a] *Longitudinal imputation for rent and dropping those who shared rent with other houshold members or had rent imputed for all 3 years.*

Notes: Sample consists of renter householders with very low income and severe rent burdens (rent greater than 50% of income) in 2001. Weighted counts should be considered underestimates since they are about 600,000 households below the more reliable Survey of Income and Program Participation cross-sectional counts (see text).

Second, households where rent was imputed in some years but not in others can experience large fluctuations in measured rent because the imputations do not take into account rent in the surrounding years. To correct for these fluctuations, a simple longitudinal imputation procedure was adopted for the purposes of this study. When rent was not reported, it was imputed based on reported rent in the surrounding years and inflation. For example, if rent was reported to be $400 in 2001 but was not reported in 2002, the Census Bureau's imputed value for 2002 was replaced by $400×1.016 to reflect an inflation rate of 1.6 percent. Although this procedure probably creates rents that are excessively smooth, this stability seems likely to be closer to the truth than the excessively variable rents created by independent cross-sectional imputations.

The second two data columns of exhibit 1 indicate that after editing the data in this manner, the percentage of households that eliminated their 2001 severe rent burdens because of a decrease in rent in 2002 fell from 13.3 to 8.1 percent. The frequency of rent exits that occurred without the household moving fell proportionally, from 9.1 to 5.3 percent. The percentage of households remaining rent burdened from 2001 to 2002 rose from 49.6 to 53.3 percent. The weighted sample size fell from 3,443,000 households to 2,791,000, meaning that 19 percent of the sample was dropped. Overall, even after a substantial reduction in the sample, outcomes other than rent exits change only modestly, suggesting that misclassification errors do not bias the results too much.

It is important to keep in mind that the weighted counts reported in this study are underestimates of the true population, because households that shared rent or never reported it were dropped from this analysis. In addition, the full-sample estimate of 3,443,000 very-low-income households is itself considerably lower than the cross-sectional estimate of 4,049,000 households (not reported in the exhibits). Part of this discrepancy can be attributed to the fact that some householders leave the sample universe (for example, by death, leaving the country, or becoming institutionalized) over the 3 years of the SIPP survey. These cases are counted in the cross-sectional estimate but not in the longitudinal estimate presented in exhibit 1. Nonetheless, much of this discrepancy is probably caused by problems with the longitudinal weights. These weights are intended to adjust for sample attrition, inflating the smaller sample present in all 3 years to add up to the same totals as the larger cross-sectional samples. These are general-purpose weights, however, designed to apply to the whole sample, and they may well not apply to the small subset of the whole sample analyzed here. That is, the weights adjust for the probability of attrition, but this probability may be considerably different for very-low-income, unsubsidized renters than for the rest of the sample. Hence, this study emphasizes percentages and regression coefficients rather than weighted counts.[5]

Priorities for Housing Assistance

Assisted housing is not an entitlement; only about 4.3 million HUD-subsidized units are available. Housing assistance is means tested, but the income limits are high enough to cover several times more households than can actually be provided with subsidized housing. In the absence of binding income limits, housing assistance is rationed through a complicated set of preferences, waiting lists, and less formal mechanisms.

Until 1996, HUD gave priority (called "federal preferences") to households paying more than half their income in rent; those who had been involuntarily displaced, and those living in substandard housing, including those living in homeless shelters. Since 1996, federal preferences have been dropped, and local authorities are now free to adopt their own criteria for choosing among eligible applicants, subject only to federal income limits. In the voucher program, newly assisted households must have incomes below 50 percent of area median income (AMI), and local public housing authorities are required to allocate 75 percent of subsidies to households with incomes below 30 percent of AMI (roughly the poverty level). The other assisted housing programs have less stringent income limits: 40 percent of newly available units must be allocated to households with incomes below 30 percent of AMI, and none can be allocated to all households with incomes above 80 percent of AMI.

In 1999, 40 percent of public housing authorities, controlling 50 percent of housing assistance, continued to use the old federal preferences, usually in combination with other preferences. Other typical preferences include the elderly, disabled people, victims of domestic violence, and enrollees in self-sufficiency programs (often job training). Another 15 to 29 percent (depending on the program) of public housing authorities used only income limits and a waiting list administered on a first-come, first-served basis to allocate housing assistance. The remainder used some other need-based preferences but not the former federal preferences (Devine et al., 2000). In almost all cases, even households that qualify for a preference receive housing assistance only after time on a waiting list.

Finally, two other less formal screening mechanisms play a role. First, applicants must be familiar enough with HUD programs to apply for them and put their name on a waiting list, and they must be available when their names rise to the top of the list. Recipients of other aid programs, for example, are likely to be more familiar with subsidized housing programs. Second, many recipients of housing assistance receive vouchers that can be used to pay for rent in the private market. These households must find landlords willing to rent to them within several months or else give up their voucher. One study found that more disadvantaged households are somewhat less likely to succeed in finding housing through this program (Shroder, 2002).

Persistence of Rent Burdens

Reasons for Ending Rent Burden Status

The first row of exhibit 2 presents the 2-year experiences of unsubsidized very-low-income renters with severe rent burdens in 2001. One year later, there was significant turnover, and only 53.3 percent of this group still had a severe rent burden. The most common method of exit was an increase in household income, with 23.3 percent—about half of leavers—increasing their incomes by enough to eliminate their severe rent burdens, even if their rent stayed the same.

Even after the data cleaning discussed above, 8.1 percent of the severely rent burdened left that status due to a fall in gross rent (including utility payments). That is, their rent fell by enough to put them below the 50-percent threshold, even if their income had remained the same.[6]

The rest ended their rent burden status for other reasons, including because they began receiving housing assistance (6.8 percent), they bought their own home (4.1 percent), they moved into someone else's owner-occupied housing (1.6 percent), or their incomes fell to $0 or less (1.3 percent).[7]

The second row of exhibit 2 presents the 3-year experiences of the same group (unsubsidized, very-low-income renters with severe rent burdens in 2001). In 2003, 45.2 percent still had severe rent burdens, although some may have temporarily left that status in 2002. The breakdown into the other reasons for exiting from severe rent burden status was generally similar to the 2001/2002 comparisons, with the main exception being that the percentage of those who own their own homes doubled in 2003.

It is also notable that the percentage with housing assistance increased only slightly from 2002 to 2003. It would be naive to interpret this comparison as the difference between those in the initial stages of a rent burden spell and those in the later stages. It could be, for example, that the typical person with a rent burden in 2001 was in the fifth year of a spell, while the typical person who remained rent burdened 1 year later was in the sixth year.

Exhibit 2

Type of Exit From Severe Rent Burden Status in Specified Year Conditional on Status in Earlier Year

	Outcome Year	Type of Exit From Severe Rent Burden Status									
		Remained Severely Rent Burdened	Exited From Severe Rent Burden	Rent Decreased	Income Increased	Combination of Rent and Income	Assisted	Owner[a]	In Owner-Occupied Housing[b]	Zero or Negative Income	Households (1,000s)
Severe rent burden in 2001	2002	53.3	46.7	8.1	23.3	1.7	6.8	4.1	1.6	1.3	2,791
Severe rent burden in 2001	2003	45.2	54.8	10.0	23.7	2.3	7.3	8.2	1.7	1.5	2,791
Pseudo hazard rates											
1 year with a severe rent burden (rent burden 50% or less in 2001; severe rent burden in 2002)	2003	44.3	55.8	7.3	34.4	2.6	3.0	4.5	0.0	4.0	651
2 or more years with severe rent burden (severe rent burden in both 2001 and 2002)	2003	67.8	32.3	5.2	14.3	1.2	5.5	4.1	0.6	1.4	1,489

[a] *Householder or spouse owns housing unit.*

[b] *Someone else's owner-occupied housing unit.*

Notes: All sample members are unassisted very-low-income renters in the base year and are renters in 2001. Sample and data are revised as in exhibit 1.

Pseudo-Hazard Rates Describing the Reason for Exit From Rent Burden Status

The bottom panel of exhibit 2 presents a simple analysis of rent burden spells, rather than annual transitions, in the form of "pseudo" hazard rates. The first row is a true hazard, while the second is not. The first row presents the 2-year experiences of those who first became rent burdened in 2002. That is, they were not rent burdened in 2001 (although they had very low incomes). Of this group, 44.3 percent continued to be rent burdened into the second year of their spell (a 55.7-percent hazard rate). The second row presents the 2-year experiences of those with severe rent burdens in both 2001 and 2002. This is not a true hazard rate because we know only that this group had 2 or more years with high rent burdens; it is likely that many had been rent burdened for a number of years. One year later, 67.8 percent of this group still had severe rent burdens, meaning the hazard rate (more exactly, the pseudo-hazard rate) had fallen to 32.2 percent.

The natural interpretation of this falling hazard rate is that the pool of those who begin rent burden spells is heterogeneous. That is, certain types of people are prone to short spells (perhaps those with unstable incomes). After a year, most of these types leave, and the pool of those with severe rent burdens consists mainly of those with more severe disabilities (perhaps those with lower permanent incomes). This heterogeneity suggests that it may be possible to determine at the beginning of a spell who will be likely to have a long-term rent burden.

The usual alternative interpretation of falling hazard rates is duration dependence, meaning that something about the spell itself causes the exit rate to fall. Here, however, no compelling theory suggests duration dependence; perhaps many years of rent burdens use up savings, making it harder to find a job or put together a security payment for a cheaper apartment. In addition, these figures are not adjusted for background characteristics, so plenty of heterogeneity remains to explain differing hazard rates.

Comparing the reasons for exits after the first year and exits after 2 or more years is also instructive. Here, we see that income exits are much more common after the 1st year (34.4 percent of those with 1 year of severe rent burden) than after 2 or more years (14.3 percent). Exit rates to homeownership are about the same. In combination with the finding from the top panel of exits to ownership doubling after a second year (see exhibit 2), this finding suggests that severely rent-burdened, very-low-income renters do not become homeowners quickly after an increase in income, but instead wait 1 year or more to purchase homes.

Two- and Three-Year Outcomes for the Severely Rent Burdened and Other Groups

The top panel of exhibit 3 shows outcomes in 2002 for unsubsidized, very-low-income renters in 2001, broken down by rent burden status. The middle panel presents 2003 outcomes for the same groups of renters in 2001. Three findings are worth noting. First, 17.4 percent of those with moderate rent burdens of 30 to 50 percent in 2001 had severe rent burdens 1 year later. About the same percentage had severe rent burdens 2 years later. Because 50 percent of income is an arbitrary cutoff, it is likely that some of these householders had quite similar characteristics as those with 2 consecutive years of rent burdens. That is, focusing on multiple years of rent burdens as a measure of need (or any sharp cutoff) is likely to miss those close to the cutoff, who may be just as needy.

Exhibit 3

Rent Burden Outcome in Specified Year Conditional on Status in Earlier Year

	Outcome			Status of Those Not Severely Rent Burdened in Outcome Year						
	Outcome Year	Severely Rent Burdened	Not Severely Rent Burden	Rent Burden 30–50%	No Rent Burden	Owner [a]	Owner-Occupied Housing [b]	Assisted	Zero or Negative Income	Households (1,000s)
2001 to 2002										
Severe rent burden in 2001	2002	53.3	46.7	24.4	8.6	4.1	1.6	6.8	1.3	2,791
Rent burden 30–50% in 2001	2002	17.4	82.6	45.2	23.8	5.0	1.5	6.8	0.3	2,537
Rent burden less than 30% in 2001	2002	7.4	92.6	11.8	60.5	7.5	0.9	11.5	0.3	2,228
2001 to 2003										
Severe rent burden in 2001	2003	45.2	54.8	20.7	15.3	8.2	1.7	7.3	1.5	2,791
Rent burden 30–50% in 2001	2003	16.5	83.5	39.3	26.0	8.5	1.2	8.2	0.4	2,537
Rent burden less than 30% in 2001	2003	9.0	91.1	10.8	54.4	11.3	1.5	12.1	1.0	2,228
2003 outcomes of 2002 leavers										
One year without a severe rent burden (severe rent burden in 2001; rent burden 50% or less in 2002)	2003	19.9	80.1	29.2	29.2	14.6	3.5	1.7	1.9	1,114

[a] *Householder or spouse owns housing unit.*

[b] *Someone else's owner-occupied housing unit.*

Notes: All sample members are unassisted, very-low-income renters in the base year and are renters in 2001. Sample and data are revised as in exhibit 1.

Second, the number of very-low-income renters entering severe rent burden status is roughly half the number of those leaving. This calculation implies that many very-low-income, rent-burdened households had not been very low income in the previous year.[8] This group (those with severe rent burdens in one year but relatively high incomes a year earlier) may be likely to have short rent burden spells.

Third, in both of the first two panels, those without rent burdens in 2001 are actually more likely to start receiving housing assistance 1 or 2 years later than those with severe rent burdens. For example, 7.3 percent of those with severe rent burdens receive assistance 2 years later, while 12.1 percent of those with rent burdens below 30 percent began receiving assistance. As discussed above, rent burdens are not the only criteria for receiving housing assistance, a point this exhibit makes dramatically clear.

The bottom panel of exhibit 3 shows 2-year outcomes for leavers, meaning those who had severe rent burdens in 2001 but not in 2002. By 2003, nearly 20 percent of this group again had severe rent burdens, which should remind us of the dangers of using an arbitrary cutoff. This group, which did not have severe rent burdens in 2002, did have such burdens in both the previous and following years. Of course, most of leavers (80.1 percent) remained without severe rent burdens. Also notable is the fact that 14.6 percent became homeowners in the second year after ending their severe rent burden spell, more than triple the homeownership rate after 1 year.

Background Characteristics by Years With Rent Burdens

Exhibit 4 presents the background characteristics, measured in 2001, of very-low-income renter households that were never subsidized from 2001 to 2003. The first column shows the levels of the characteristics for those who never had severe rent burdens. The other three columns show the differences between the first group and those with 1, 2, or 3 years of severe rent burdens. The general finding is that those with 3 consecutive years of rent burdens were considerably more disadvantaged than those with 2 years or less of rent burdens. In fact, those households with 1 or 2 years of rent burdens were in some ways less disadvantaged than those that were never rent burdened.

In the program receipt panel, households with 3-year burdens received Supplemental Security Income (SSI), welfare, food stamps, and Medicaid at statistically significant higher rates than those with no rent burden. Many of these differences are large: more than twice as high a rate for receipt of SSI and welfare and almost twice as high a rate for receipt of food stamps (16 percentage points above the 19-percent rate for those without rent burdens). The middle groups (those with 1 or 2 years of severe rent burdens) received SSI and Medicaid at similar rates and, in some cases, even lower rates, as those households that never had a rent burden. The middle groups had rates of food stamps receipt between the rates of the 0-year and 3-year rent burden groups. Welfare was the one program in which the middle groups were more like the 3-year rent burden group than the 0-year group.

Exhibit 4

Proportions and Means in 2001 of Background Characteristics by Years With Severe Rent Burden

	Number of Years With Severe Rent Burden			
	0 Years	1 Year	2 Years	3 Years
	Proportion or Mean	Difference vs. Zero Years		
Program receipt in household				
Supplemental Security Income	0.098	– 0.034 *	0.036	0.134 ***
Welfare	0.044	0.058 ***	0.072 ***	0.054 **
Food stamps	0.188	0.074 **	0.081 **	0.157 ***
Medicaid	0.420	0.004	– 0.035	0.096 **
Free lunch	0.244	– 0.033	0.009	– 0.029
Education of householder				
< High school	0.311	– 0.122 ***	– 0.149 ***	– 0.006
High school	0.332	0.041	0.067	– 0.024
Some college	0.269	0.026	0.023	– 0.017
College	0.064	0.050 **	0.045 *	0.026
Graduate degree	0.023	0.005	0.013	0.021
Householder enrolled full time	0.092	0.101 ***	0.076 **	0.066 **
Household type				
Married with children	0.213	– 0.033	– 0.080 **	– 0.123 ***
Married without children	0.114	– 0.028	– 0.034	– 0.055 **
Single female with children	0.161	0.044	0.023	0.070 **
Single female without children	0.281	– 0.088 ***	0.029	0.090 **
Single male	0.233	0.105 ***	0.062	0.017
Householder age				
< 25	0.081	0.085 ***	0.019	0.025
25–34	0.214	0.050	0.027	– 0.053 *
35–44	0.198	0.006	0.024	0.026
45–54	0.154	– 0.035	0.026	– 0.042
55–64	0.079	– 0.001	0.037	0.005
> 64	0.191	– 0.106 ***	– 0.068 **	0.048
Householder race/ethnicity				
Hispanic	0.224	– 0.060 **	– 0.065 *	– 0.051
White, non-Hispanic	0.555	0.001	0.034	0.049
African American, non-Hispanic	0.171	0.055 *	0.038	– 0.021
Other, non-Hispanic	0.051	0.005	– 0.007	0.023
Disabilities in household				
Partial or full	0.258	0.021	0.072 *	0.112 ***
Full (work-preventing disability)	0.150	0.031	0.053	0.147 ***
Household income, earnings, employment, and assets				
Business	0.064	0.019	0.029	0.014
No car	0.303	0.041	0.073 *	0.209 ***
Income	15,965	– 3,955 ***	– 3,074 ***	– 6,538 ***
Earnings	12,089	– 3,144 ***	– 3,462 ***	– 7,909 ***
No earnings (nonemployment)	0.232	– 0.031	0.032	0.291 ***
Rent burden (topcoded at 100%)	0.253	0.288 ***	0.351 ***	0.558 ***
Sample size	616	267	158	181

** = Statisically significant at the 10% level.*
*** = Statisically significant at the 5% level.*
**** = Statisically significant at the 1% level.*

Notes: All sample members are unassisted, very-low-income renters in 2001. Sample excludes those subsidized in any year. Sample and data are revised as in exhibit 1.

Regarding household type, those with 3 years of rent burdens were less likely to be married than those without rent burdens and more likely to be single mothers. The middle groups are much more similar to those without rent burdens. A similar pattern emerges in the rates of disabilities, car ownership, and nonemployment. For example, the nonemployment rate among those with 3 years of rent burdens was more than double the rate among those with 0 years, 1 year, or 2 years of rent burdens.

The continuous variables (income, earnings, and rent burden as a percentage of income) indicate that the middle groups were more disadvantaged than the unburdened group but less disadvantaged than the group that has 3 years of rent burdens. For example, income in the 1- and 2-year rent burden groups was $3,000 to $4,000 lower than in the unburdened group while income in the 3-year rent burden group was $6,500 lower. One striking statistic is that, in 2001, those with 3-year rent burdens had an average rent burden of 81 percent.

Logistic Regression for Exit From Rent-Burdened Status

Exhibit 5 presents results predicting exit from rent burden status for unassisted, very-low-income households with severe rent burdens in 2001. Many of the results are unsurprising. Households without earnings or with SSI receipt are less likely to end their rent burden status 1 or 2 years later than are households with earnings or without SSI receipt. Also more likely to have a persistent rent burden are single females, with or without children, compared with single men or married couples without children. These household composition estimates, however, are statistically significant in only 1 of the 2 years.

The size of these effects is sometimes striking. Those without earnings are 34 percent (41 percent in 2003) as likely to exit as those with earnings. Households with an SSI recipient are 24 percent (50 percent in 2003) as likely to exit as those without. Households without a car are 63 percent as likely to exit by 2003 as those with one.[9]

One variable for which the a priori prediction is less obvious is having a rent burden above 75 percent in 2001. Those with rent burdens above 75 percent are only 46 percent (62 percent in 2003) as likely to shed their rent burden as those with rent burdens of 50 to 75 percent. Rent burdens above 75 percent are hard to imagine, and one might assume that they reflect a temporary situation or some sort of reporting error. The results suggest, however, that these difficult situations are not temporary, and if they are due to reporting error, that error is consistent.

There are two surprising results for which there is no obvious explanation. First, African-American householders were 1.8 times more likely (2.7 in 2003) than White householders to end their severe rent burdens. To investigate the hypothesis that African Americans' higher exit rates were due to having a less stable income, I regressed the standard deviation of household income across the 3 years, on the same explanatory variables as those in exhibit 5. The regression found, however, that African-American householders had more stable incomes, with a lower standard deviation, than did householders of other races.[10]

Exhibit 5

Logistic Regressions (Odds Ratios) for Exit From Severe Rent Burden Status

	No Rent Burden in 2002	No Rent Burden in 2003, by Reason				
		Total	Income Increased	Rent Decreased	In Owner-Occupied Housing	Moved
Age 65+	1.22	0.62	0.45 *	1.20	0.54	0.71
Hispanic	0.76	1.05	0.71	0.60	0.71	1.02
African American, non-Hispanic	1.77 *	2.70 ***	2.01 **	3.02 ***	0.71	1.11
Other race, non-Hispanic	0.64	0.61	0.66	1.96	1.31	1.15
White, non-Hispanic						
Married with children	0.69	1.23	1.17	1.63	2.47 *	1.11
Married without children	1.07	0.84	1.26	1.30	1.53	0.53
Single female with children	0.54 **	0.78	0.60	1.37	1.83	0.58
Single female without children	0.60 *	0.81	0.53 **	1.64	0.88	0.69
Single male						
No high school degree	0.63	0.80	0.58	2.01 *	0.72	1.33
No earnings in household (nonemployed)	0.34 ***	0.41 ***	0.37 ***	0.90	0.61	0.38 **
Rent burden > 75%	0.46 ***	0.62 **	0.51 ***	0.28 ***	1.14	1.10
Median area income (logarithm)	0.40	1.03	1.44	0.35	0.07 ***	0.40
Supplemental Security Income receipt in household	0.24 ***	0.50 *	0.49 *	0.26 *	0.58	0.19 **
Business in household	0.85	0.52 *	0.48 *	0.41	1.09	0.58
No car	0.81	0.63 **	0.74	0.43 **	1.09	0.58 *

** = Statisically significant at the 10% level.*
*** = Statisically significant at the 5% level.*
**** = Statisically significant at the 1% level.*

Notes: Sample size is 460. Exhibit reports odds ratios. All equations include a constant. Sample consists of householders with very low income and severe rent burdens in 2001; who were never assisted from 2001 to 2003. Sample and data are revised as in exhibit 1.

Another surprising result is that households with a business were 52 percent as likely to exit in 2003, although this coefficient is not statistically significant in 2002. One might expect the exit rates of these business-owning households to be higher rather than lower if their incomes were more variable; however, the regressions predicting the standard deviation of income indicated that their incomes were not more variable. To investigate the hypothesis that those with businesses had lower incomes on average, which might be true if the typical business in this population were low-paid self-employment, such as babysitting or housecleaning, I regressed average household income over the 3 years on the same set of explanatory variables. The effect of a business on household income was small and statistically insignificant, however. An intriguing possibility is that businesses allow more scope for tax deductions. If this is so, then income reported to the Internal

Revenue Service, and on the survey, might be lower than the amount available for consumption.[11] There is no direct evidence for this theory, however. Another possibility, suggested by the fact that the 2002 result is not statistically significant, is that there is no true effect, and the significant 2003 business coefficient is due to chance or bias, as discussed in the next section.

Finally, it is worth noting that indicators for receipt of programs, such as food stamps, were not included in the logit models because these variables were rarely statistically significant. Although the receipt of various means-tested transfers is strongly associated with persistent rent burdens (as indicated in exhibit 4), these variables are presumably highly correlated with other variables in the model such as nonemployment and household type.

Specification Check

The relatively parsimonious logit equation in exhibit 5 was chosen after considerable experimentation with a longer list of explanatory variables. Although this type of experimentation is routine in econometric studies, especially exploratory studies such as this one, it does present the risk of "data mining," or, more formally, pre-test bias. The best guarantee against pre-test bias is to use one data set for experimentation and model specification and an independent data set for testing. Here, we have data on 2 years of outcomes, 2002 and 2003. Hence, the model was developed to predict 2003 outcomes and was estimated on 2002 data only after a model had been chosen. This test is not perfect because 2002 and 2003 outcomes are likely to be considerably correlated. In addition, logit models predicting 2002 and 2003 outcomes may differ for substantive reasons, not only because of bias. Nonetheless, this check for pre-test bias is better than those usually available in econometric studies, and so it ought not be scorned.

In general, we should have more confidence in results that are similar in both 2002 and 2003 than in those that differ. In particular, coefficients on age 65 or older and median area income differ considerably between the two equations, in addition to being statistically insignificant.

Discussion

Predicting Long-Term Rent Burdens

The logit regressions indicate that it is quite possible to predict who will have a persistent rent burden; however, the usefulness of this model for allocating subsidized housing is less clear. HUD already uses many variables that strongly predict persistent rent burdens in one form or another. Other variables that could be used to target housing assistance have strong potential drawbacks. HUD already gives preferences to the elderly and disabled in many instances. Although there is no formal preference for single mothers, this group occupies a substantial portion of subsidized housing, presumably because many single mothers meet the income limits and possibly also because they are more likely to apply for subsidized housing. Targeting subsidized housing toward particular races would be illegal. Lack of a car is not a requirement for subsidized housing, but instituting such a requirement would provide an incentive for applicants to sell their cars, presumably in-

creasing dependence and making it more difficult to maintain or find employment. Other means-tested programs, such as welfare (currently called Temporary Assistance for Needy Families), that once had stringent limitations on car ownership have since relaxed those rules for this reason.

These considerations leave three candidates for new preferences for the allocation of housing assistance: low education, nonemployment, and business ownership. The lack of a high school degree has never been a formal preference for the receipt of housing assistance, but the widespread preferences given by local public housing authorities to those in job training or other self-sufficiency programs may well select for low education. That those with a business are more likely to have persistent rent burdens is an intriguing finding, although the mechanism behind this effect is not clear.

Nonemployment is often associated with low income, which is an important part of eligibility. There has long been a tension in HUD's rules between selecting the very poor who do not work and choosing the working poor, who may serve as role models or "pillars of the community." Some local authorities now give preference to those with jobs, and, nationally, HUD has allowed policies such as ceiling rents (rents that do not rise with income above a certain level) aimed at retaining more workers. Given the salience of this criterion to HUD's targeting policy, it is worth noting that nonemployment is a powerful predictor of persistent rent burdens. Even conditional on age and the receipt of SSI, nonemployment reduces the likelihood of exit by 59 to 66 percent.

Targeting Those With Long-Term Rent Burdens

This study is motivated by the idea that housing subsidies should assist the most needy households; that is, households with low permanent incomes, not merely those with low incomes in a particular year.[12] It is presumably because those with severe rent burdens are likely to be needy that HUD considers them "worst case needs" and that many local public housing authorities target housing assistance to those with high rent burdens.

This study demonstrates that those with a severe rent burden for only 1 year (out of 3) do not appear to be much more needy than those with no severe rent burden over a 3-year period. Although they are more likely to receive welfare and food stamps and have about 25-percent lower incomes, they do not appear to be more needy by many measures and are actually less needy by some measures. Households with a single year of rent burden are not more likely to receive Medicaid, to be disabled, or to lack a car or a job. They are younger, more educated, more likely to be in school, and less likely to be receiving SSI than those who never experience a severe rent burden.

Persistent rent burdens appear to be a much better measure of need. Those with severe rent burdens in all 3 years examined in this study are considerably worse off, in numerous dimensions, than those who never experience a rent burden (see exhibit 4). For example, they are more than twice as likely to receive welfare (9.8 percent versus 4.4 percent) or be jobless (52.3 percent versus 23.2 percent), are twice as likely to have a work-preventing disability (29.7 percent versus 15.0 percent), and have an average income of $9,500 compared with $16,000 for those without rent burdens.

Targeting Those With Short-Term Rent Burdens

It should also be considered that targeting the poorest of the poor is not the only possible goal of a public transfer program. Social Security and Medicare are obvious examples of more broad-based programs. It is not even obvious that those with long-term rent burdens should be favored over those with temporary rent burdens. For example, unemployment insurance and housing assistance for disaster victims are specifically aimed at those with temporary needs. Unemployment insurance typically lasts for 6 months and disaster vouchers last for 18 months. Economists often argue that these types of transfers to people who are not low income can improve welfare by replacing missing insurance markets. In addition, while those with a single year of severe rent burden are better off than those with more persistent rent burdens, they are far from wealthy. Their average annual income is $12,000, 42 percent have a household member receiving Medicaid, and 18 percent have a household member with a work-preventing disability.

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Notes

1. These figures differ slightly from those in this article because the 2003 report used a slightly different sample (householders present in months 1 through 28 of the 2001 Survey of Income and Program Participation [SIPP]), while this article examines households present in months 1 through 36 (the complete SIPP).

2. The Survey of Income and Program Participation is described in detail at http://www.sipp.census.gov/sipp/intro.html.

3. Census divisions are groups of states, such as New England and the Middle Atlantic. The percentiles were the 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 99th.

4. Plotting the percentiles of two distributions is a graphical method of assessing their equality or relationship (Gerson, 1975; Wilk and Gnanadesikan, 1968). Where the distributions differ only in their mean and variance, the plot of one against the other will show a straight line and the regression procedure will be appropriate. The adjusted Survey of Income and Program Participation distribution appeared quite similar to the American Housing Survey (AHS) distribution, as confirmed by the fact that all the regressions had R2s of 0.98 or

above. Therefore, it appears that the adjustment procedure was able to replicate the AHS distribution of utility bills.

5. While the weights do adjust for a set of background characteristics, this set is necessarily limited. Whatever the main source of the underestimate of the true population, a simple adjustment would be to inflate the counts presented by about 45 percent (4,049/2,791).

6. Although these definitions of rent exits and income exits are not mutually exclusive, each observation appears in the exhibit only once. In the case in which the increase in income and the decrease in rent both were large enough by themselves to end the severe rent burden, the household is classified as exiting due to a rent decrease.

7. HUD's definition of severe rent burden excludes those with $0 or negative income.

8. The number entering is 607,000 (=.174×2,537,000 +.074×2,228,000), and the number leaving is 1,302,000 (=.47×2,791,000). Strictly speaking, the number of leavers must equal the number of entrants only when the number of severely rent-burdened households does not change from 2001 to 2002, which is only approximately true.

9. Strictly speaking, because these figures are odds ratios rather than relative risks, one ought to say the odds of exit, rather than the probability of exit, were a certain percentage lower.

10. Regressions of the standard deviation of log income on the same explanatory variables yielded similar results.

11. For example, depreciation allowances reduce income on paper but do not reduce the amount available for consumption.

12. The question of why assistance should be given in kind, in the form of housing assistance, despite the standard microeconomic argument that households can always be made better off with an equivalent amount of cash assistance, is beyond the scope of this study. One possible justification is that the aim is to help children, and housing is especially important for children; another is the idea that poor housing conditions generate negative externalities such as the spread of disease.

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Is There Enough Housing To Go Around?[1]

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This article reflects the views of the author and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

Most studies of rental housing affordability concentrate on households and the burdens they must bear in order to be properly housed. The most popular housing assistance program—vouchers—implicitly assumes that housing problems could be solved if households only have the ability to pay. This approach, however, begs the question of whether the stock of rental housing is sufficient to house all renters at costs they can afford. This article uses American Housing Survey data to examine the distribution of housing supply relative to demand. We begin by naively assuming that we can assign housing to households on the basis of affordability and thereby identify the shortages and surpluses of rental units affordable to households in different income ranges. Next, we recognize that not all affordable units are available because of prior occupation by higher income renters. Finally, we restrict the discussion to units that are affordable, available, and adequate. We use this analytical framework to examine specific issues: the rental supply by income class, variation by location, the sufficiency of the Fair Market Rent standard, changes in housing supply over the period 1985 to 2003, and the relationship between supply and crowding. This paper is based on a chapter written for the U.S. Department of Housing and Urban Development's recent Affordable Housing Needs *report.*

Introduction

Most of the analysis of housing affordability focuses on the demand side of the housing markets: the distribution of households by income and demographic characteristics, what households can afford to pay, and what they do pay as a proportion of their incomes. Most housing assistance programs, such as those providing vouchers, work on the demand side of the market. Vouchers

are intended to provide households with the buying power to compete for privately managed units in the marketplace. Because the stock of such housing is not infinite, however, it is worthwhile asking whether the supply of rental housing is sufficient to provide an affordable home for every household. This article examines the relationship of housing supply to housing need, by income level and other variables.

The article's most important conclusions include:

- Although the sheer number of rental housing units is sufficient to provide affordable housing to households with incomes above about 45 percent of area median income (AMI),[2] the distribution of the *available* stock is sufficient only for households with incomes above about 65 percent of AMI. Moreover, if one excludes units with moderate or severe defects, the affordable, available, and *adequate* stock is sufficient to house only about 89 percent of all rental households.
- Nonmetropolitan areas tend to have the best match of rental housing stock to households, followed by central cities and then suburban areas.
- The Midwest region has the best match of housing stock to demand, followed by the South, the Northeast, and the West.
- Very little change has occurred in the ratio of affordable, available rental housing units to the number of households over the past two decades.
- Although a sufficient number of units rent for less than the fair market rent (FMR) to house all households that can afford no more than the FMR, after units occupied by higher income households are subtracted, only about 80 percent of such lower income households can be accommodated. After inadequate units are subtracted, the stock is sufficient for less than 70 percent of households.
- About 5 percent of all renter households live in crowded housing, with more than one person per room. The incidence of crowded housing is well above average only for households with five or more people. The stock of rental housing with five or more rooms is many times more than what is necessary to house such households at every level of income. Nevertheless, after subtracting units occupied by smaller households, the remaining stock of units affordable to extremely low-income (ELI) and very low-income (VLI) households is too small to accommodate the large households at these income levels. After removing inadequate units, the remaining stock of large units is sufficient for only about 60 percent of the households that need them.

Analytic Framework

This article analyzes the rental housing stock relative to the number of renter households. The three key concepts are *affordability*, *availability*, and *adequacy*.

Affordability measures the extent to which a sufficient supply of rental housing units exists at different costs to place each household into a unit that it can afford (based on the 30 percent of income standard). Affordability is the broadest measure of housing stock sufficiency. If housing units could simply be allocated to households based on cost, would there be enough housing to

go around? Because a household would be content to spend less than 30 percent of its income for housing if it could, this is a cumulative analysis. For each level of income, how does the number of housing units affordable at that income or less compare with the number of households earning that income or less? The affordable stock includes both vacant and occupied units.

Availability measures the extent to which sufficient rental housing units exist, given that some are already occupied by households of higher income. Because households can choose not to spend as much as 30 percent of their incomes on rent, some occupy housing that is affordable to households of lower income. These units are thus not available. The availability measure also effectively removes units whose rents are artificially low, because they are occupied as a benefit of employment (by caretakers, for example) or because they are owned by relatives or friends of the occupants.[3] To summarize, a unit is considered to be available at a given level of income if it is affordable at that level and is either (1) occupied by a household with that income or less or (2) vacant. Thus, "available" is shorthand for "affordable and available."

The *adequacy* measure recognizes that households care about housing quality as well as cost. The American Housing Survey (AHS) rates housing units using a three-level measure: adequate, moderately inadequate, and severely inadequate.[4] In this article, the *adequate* stock at a given level of income includes those units that are affordable, available, and rated as adequate by the AHS. Adequacy and affordability are not independent of one another. Virtually all housing units are adequate when first constructed. They become inadequate through neglect. One common reason for such neglect is that the rental income derived from the unit is not enough to pay for repairs and maintenance. Thus, more affordable units are more likely to be inadequate. In most cases, such units can return to the adequate stock by performing repairs. To the extent that this is true, the adequacy measure may be unduly pessimistic. To summarize, the adequacy measure captures those units that are affordable, available, and adequate.

Note that the measures of sufficiency are cumulative. For example, "the affordable stock at 45 percent of AMI," means all the units that are affordable at that level of income or less. Thus, "the number of units per 100 households that are affordable at 45 percent of AMI" compares the stock of qualifying rental housing units to the number of renter households with incomes equal to 45 percent of AMI or less.

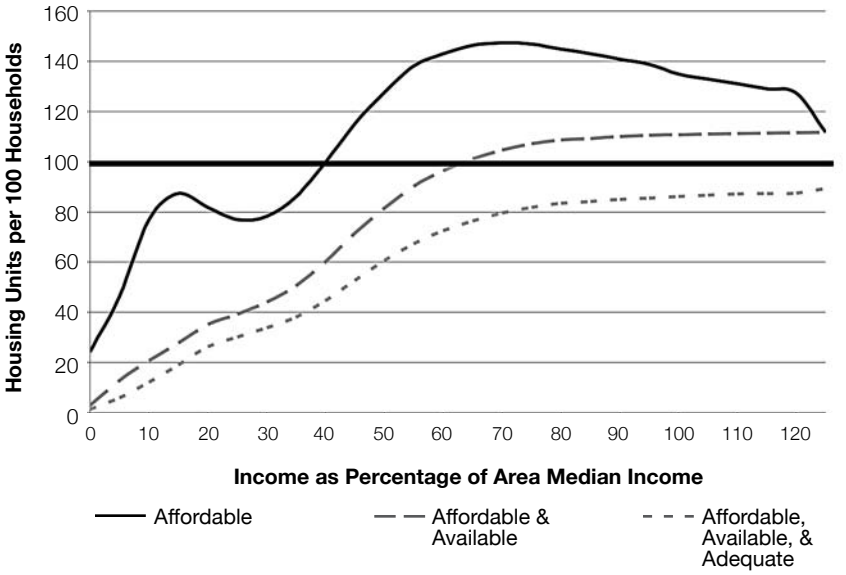
The results presented in this article are large-scale measures that compare the entire housing stock with the entire rental population. Although this article presents more geographically restricted measures, housing demand and supply are local phenomena that cannot be captured by such large-scale measures. Thus, readers should view these results with some caution, as they are national or regional indicators based on underlying local housing markets. More severe shortages or generous surpluses can occur in specific markets, despite these national and regional findings.

National Measures of Sufficiency

This study applies the analytical framework described in the previous section to rental housing data taken from the 2003 national AHS.[5] This analysis divides income and affordability into intervals representing 5 percent of AMI. The results are shown in exhibit 1.

Exhibit 1

Is the Rental Stock Sufficient?



The exhibit shows that the number of affordable units rises steeply until it reaches about 87 units per 100 households at 15 percent of AMI.[6] Then it declines to about 77 at 25 percent of AMI, after which it climbs steadily. The curve crosses 100 at 40 percent of AMI, showing that a sufficient supply of affordable units exists for all households at this income level. The curve peaks at 147 units per 100 households at an income level of 75 percent of AMI. Beyond this, more households than housing units are being added, and so the curve falls, because higher income renter households choose not to spend as much as 30 percent of their income on housing. The final point on the curve shows that there are approximately 112 units per 100 households for the entire population of renters.

The line representing affordable and available housing shows a different story. It is below the affordable line, showing that households that could afford to spend more on housing occupy a considerable proportion of even the most affordable housing. This means that there is insufficient available stock to house the lower income renters. The available stock does not reach 100 units per 100 households until 65 percent of AMI. Shortly after that, it levels off at about 112 units. Note that the affordable line and the available line meet at the highest income level, just as a matter of arithmetic.

The line that represents affordable, available, and adequate housing shows the effect of removing inadequate units from consideration. The distance between this line and the available line is a measure of the cumulative number of inadequate units at each level of income. The most striking feature of the adequate line is that it never reaches 100 units per 100 households, ending instead at around 89 units. Thus, there simply are not enough adequate rental units to house all rental households. The fact that the adequate line and the available line diverge until about 75 percent

of AMI shows that most of the inadequate units are affordable at that level of income or lower. Beyond that income, the two lines are parallel, showing that few, if any, inadequate units require more than 75 percent of AMI to afford.

Sufficiency by Income Class

As one might expect, the housing stock is least sufficient for the lowest income households. Exhibit 2 illustrates this by presenting the housing stock measures for some standard income groups. Only about 8 affordable units exist for every 10 ELI households. Available units amount to about half this number. The stock of affordable, available, and adequate units is sufficient to house only about a third of ELI households.

Although there are sufficient units to house all households at the VLI level, this sufficiency disappears after subtracting the units that are not available. Only about 8 in 10 units remain. This number is further reduced when adequacy is taken into consideration, with enough units to house about three-fifths of households with incomes below 50 percent of AMI.

At the higher levels of income, the available rental stock is sufficient to house all renters. Of course, the surplus is higher at the moderate-income level than at the low-income level. As noted earlier, the stock of adequate units is never enough to house the entire rental population, although the inadequate units are concentrated at the lower affordability levels.

Exhibit 2

Rental Housing Stock by Income Level, 2003

Income Level	Housing Units per 100 Households		
	Affordable	Available	Adequate
ELI (≤30% AMI)	78.20	44.03	33.88
VLI (30–50% AMI)	127.48	81.37	60.52
LI (50–80% AMI)	144.81	108.73	83.43
MI (>80% AMI)	111.79	111.79	89.40

AMI = area median income; ELI = extremely low income; LI = low income; MI = moderate income; VLI = very low income.

Sufficiency by Location

The rental stock in nonmetropolitan areas is somewhat more generous than in central cities or suburbs, as is illustrated in exhibit 3. The available stock is larger in nonmetropolitan areas at all levels of income, reaching 100 units per 100 households at 50 percent of AMI. In suburban areas, by contrast, the supply is less ample, particularly in the range of 10 to 80 percent of AMI. The rental stock in both central cities and suburbs reaches 100 available units per 100 households at around 65 percent of AMI.

Using the affordable and adequate measures, one sees the same patterns as those illustrated using the standard income categories in exhibit 4. Nevertheless, suburban areas show a somewhat better stock of adequate rental housing at upper income levels compared with central cities.

Exhibit 3

Available Rental Units by Metro Status

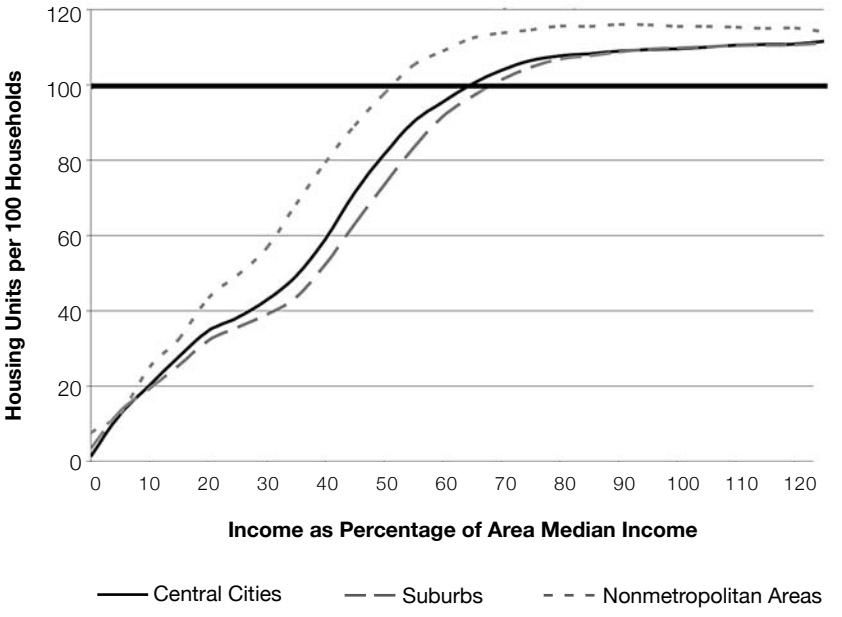


Exhibit 4

Rental Housing Stock by Income Level and Metropolitan Status, 2003

Income Level by Metropolitan Status	Housing Units per 100 Households		
	Affordable	Available	Adequate
Central cities			
ELI (≤30% AMI)	65.59	42.95	32.40
VLI (30–50% AMI)	120.34	81.49	59.96
LI (50–80% AMI)	137.39	107.71	81.74
MI (>80% AMI)	111.58	111.58	87.81
Suburbs			
ELI (≤30% AMI)	74.53	39.08	30.97
VLI (30–50% AMI)	121.17	73.29	56.82
LI (50–80% AMI)	149.56	106.87	84.54
MI (>80% AMI)	111.03	111.03	91.46
Nonmetropolitan areas			
ELI (≤30% AMI)	121.45	56.74	43.80
VLI (30–50% AMI)	160.26	97.60	69.64
LI (50–80% AMI)	155.13	115.58	85.72
MI (>80% AMI)	114.11	114.11	88.94

AMI = area median income; ELI = extremely low income; LI = low income; MI = moderate income; VLI = very low income.

On a regional basis, the Midwest shows the best rental stock sufficiency, at least above 35 percent of AMI. There are sufficient available units in the Midwest for renters with incomes of 50 percent of AMI and higher. The next best rental stock is found in the South, where the mark of 100 units per 100 households is reached at 60 percent of AMI. The Northeast achieves this mark at about 75 percent of AMI, and the West at 80 percent. Except for the West, very little difference exists among regions at low incomes, with all following about the same pattern in the 0- to 30-percent range. The West shows fewer units relative to households at all income ranges below 90 percent of AMI.

Exhibit 5 details the affordable, available, and adequate stocks relative to demand in the four regions for each of the standard income categories. Likewise, exhibit 6 shows the same pattern in the variation of affordable and adequate stocks by region, with the Midwest having the most generous supply, followed by the South and Northeast. The West has considerably fewer units per 100 households than the other three regions do.

Exhibit 5

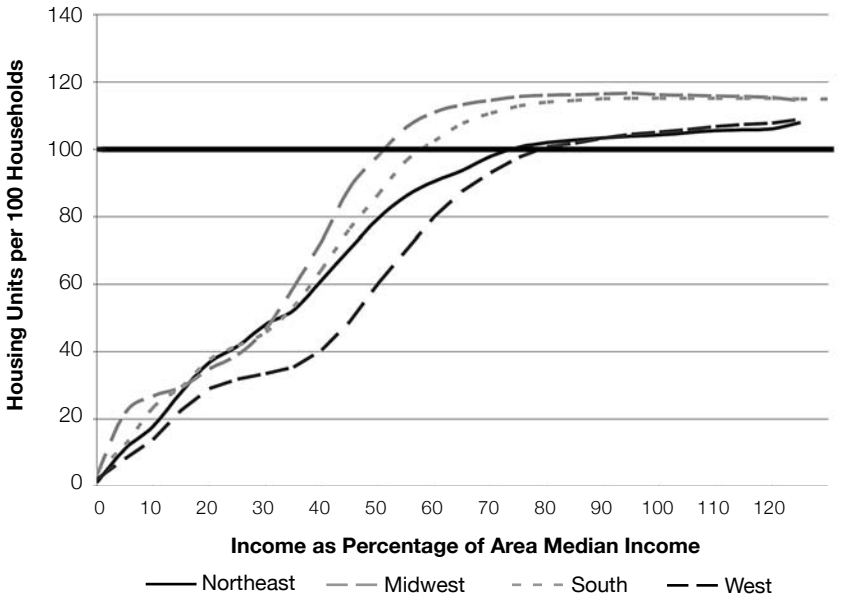
Rental Housing Stock by Income Level and Region, 2003

Income Level by Metropolitan Status	Housing Units per 100 Households		
	Affordable	Available	Adequate
Northeast			
ELI (≤30% AMI)	80.10	48.09	38.58
VLI (30–50% AMI)	120.76	79.42	62.89
LI (50–80% AMI)	136.85	101.93	81.66
MI (>80% AMI)	107.92	107.92	88.46
Midwest			
ELI (≤30% AMI)	81.41	46.86	36.31
VLI (30–50% AMI)	157.60	98.03	72.99
LI (50–80% AMI)	149.54	116.11	89.12
MI (>80% AMI)	114.45	114.45	91.69
South			
ELI (≤30% AMI)	82.80	45.89	33.93
VLI (30–50% AMI)	134.80	86.57	60.49
LI (50–80% AMI)	153.12	114.08	82.68
MI (>80% AMI)	114.86	114.86	87.89
West			
ELI (≤30% AMI)	65.24	33.49	26.00
VLI (30–50% AMI)	95.23	60.14	46.74
LI (50–80% AMI)	136.04	100.76	81.08
MI (>80% AMI)	108.83	108.83	90.47

AMI = area median income; ELI = extremely low income; LI = low income; MI = moderate income; VLI = very low income.

Exhibit 6

Affordable and Available Rental Units by Region



Sufficiency Relative to Fair Market Rent

The FMR is an important threshold for many housing assistance programs. Because such programs will generally pay no more than the FMR for assisted units, a useful question is the extent to which the stock of below-FMR housing is adequate to meet the needs of households that can afford to pay no more than the FMR. In a sense, this is a thought experiment to see whether a "super voucher program," structured as an entitlement, would be able to house all qualifying households at the FMR.

As exhibit 7 illustrates, the answer is "no." Although enough affordable units exist in all regions and metropolitan conditions, the number of available units is sufficient to house only 73 to 83 percent of the households, depending on location. Moreover, if adequate quality were a stipulation of such a program, only 66 to 72 percent of households could find affordable, adequate units. This analysis is, of course, overly simplistic. It does not account for the change in rents that is caused by such a massive increase in housing demand—although FMRs would then rise as well.

Trends in Rental Stock Sufficiency

The basic outlines of the sufficiency of the rental stock have changed very little over the past two decades. Exhibit 8 shows the number of available rental units per 100 households for the four standard income categories during the period from 1985 to 2003.[7] A mild increase in the availability of rental units for ELI and VLI households occurred in the period from 1985 to 1991, followed by a reversal in the period from 1993 to 1995. Nevertheless, the available stock of units

Exhibit 7

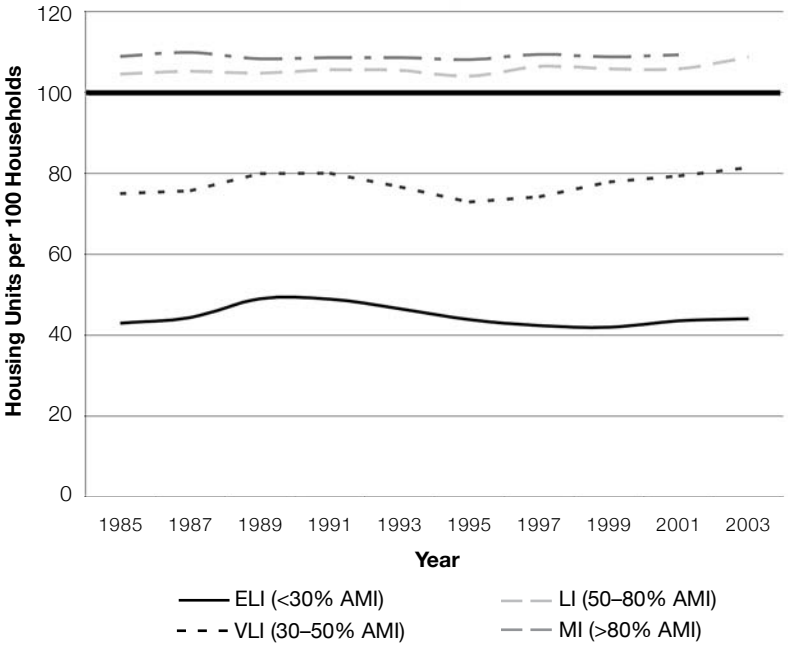
Below-FMR Housing Supply, 2003

Location	Households (thousands)	Units (thousands)			Units per 100 Households		
		Affordable	Available	Adequate	Affordable	Available	Adequate
All	18,745	21,997	14,750	12,923	117.35	78.69	68.94
Northeast	4,333	5,107	3,608	3,145	117.87	83.28	72.58
Midwest	3,362	3,968	2,461	2,233	118.01	73.19	66.43
South	6,132	7,325	4,837	4,129	119.45	78.87	67.34
West	4,918	5,597	3,844	3,416	113.82	78.16	69.46
Central cities	9,009	10,237	7,190	6,171	113.63	79.81	68.50
Suburbs	6,923	8,268	5,414	4,892	119.42	78.19	70.65
Nonmetropolitan areas	2,813	3,492	2,146	1,861	124.16	76.30	66.15

FMR = fair market rent.

Exhibit 8

Available Rental Units, 1985–2003



affordable to ELI renters has remained in the range of 42 to 49 units per 100 households for the entire period. Similarly, the variation for the VLI renters has been in the range of 73 to 81 units per 100 households. For higher income groups, the available stock has always been above 100 units, with even less variation.

Crowding

Crowding (defined here as more than one person per room) can be a symptom of affordability problems and housing-related stress. Households may double up, and young adults or newlyweds may delay forming new households because of an inability to afford their own units. This section examines the extent of crowding by income and location and also analyzes the supply sufficiency of large units relative to the number of large households.

About 5 percent of renter households are crowded, as shown in exhibit 9. Although the incidence of crowding is inversely related to income, ELI households show less crowding than VLI households do, perhaps because ELI households include a greater proportion of one-person households (which, by definition, cannot be crowded). Households in nonmetropolitan areas have the lowest incidence of crowding, followed by the suburbs and then central cities. The regional incidence of crowding parallels the data in the previous supply sufficiency section. The highest incidence of crowding is in the West. The other three regions are more similar to one another, with the Midwest being the region with the lowest incidence of crowding.

Exhibit 9

Crowded Households

Household Demographic Characteristics and Location	Households (thousands)	Incidence per 100 Households
All renters	1,615	4.81
Income level		
ELI (≤ 30% AMI)	522	5.75
VLI (30–50% AMI)	464	7.05
LI (50–80% AMI)	366	4.91
MI (> 80% AMI)	263	2.51
Metropolitan status		
Central cities	837	5.54
Suburbs	594	4.60
Nonmetropolitan areas	185	3.29
Region		
Northeast	328	4.56
Midwest	149	2.26
South	431	3.76
West	708	8.44
Household size		
1 person	NA	NA
2 people	54	0.61
3 people	44	0.85
4 people	205	5.39
5 people	552	30.96
6 people	408	53.90
7+ people	352	84.06

AMI = area median income; ELI = extremely low income; LI = low income; MI = moderate income; NA = not applicable; VLI = very low income.

Not surprisingly, larger households have a higher incidence of crowding than smaller ones do. A distinct increase occurs in the incidence of crowding for households with five or more people. Contrary to what might be expected, this increased incidence of crowding is not caused simply by a lack of large units. As exhibit 10 illustrates, the sheer number of affordable units with five or more rooms is two to five times greater than the number of households with five or more people. The main cause of crowding is the lack of available units.[8] The available supply is less than 100 units per 100 households at incomes below 65 percent of AMI. The supply of adequate units is lower still. Thus, crowding does not appear to be caused by a lack of large units but by the fact that smaller households prefer these large units as well.

Exhibit 10

Large Unit Problem Is Availability, Not Affordability

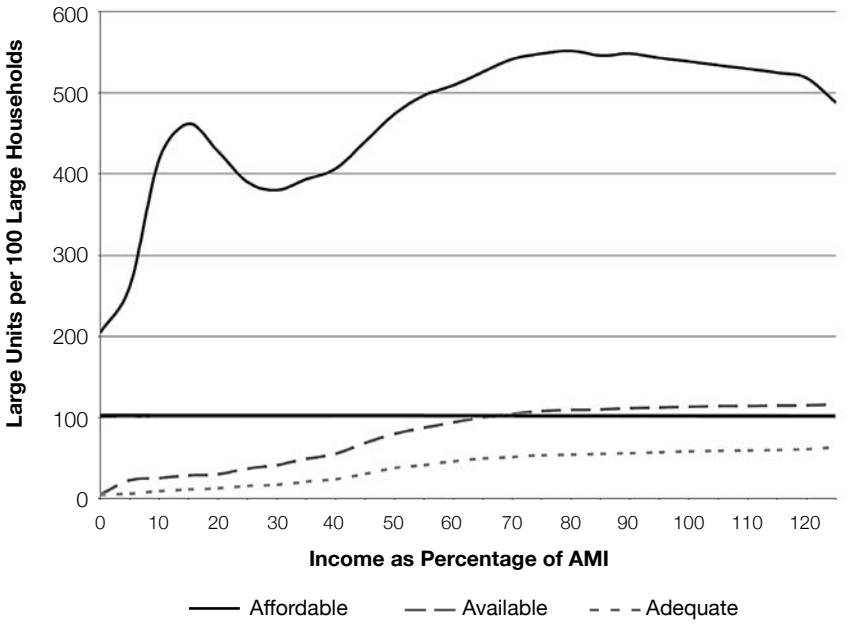


Exhibit 11 summarizes the supply sufficiency for rental units with five or more rooms relative to households with five or more people by income level and location. Even at 30 percent of AMI, there are almost 4 large units for every household, and this supply increases to 5 or more large units per household at higher incomes. Nevertheless, only 4 large units are *available* for every 10 ELI households that need larger units to avoid crowding. Even for VLI renters, there are only 9 units for every 10 households. The relative supply of adequate units shows another sharp drop, with ELI-affordable units sufficient to cover fewer than one household in five. Even at the highest income levels, less than two-thirds of large households will be able to find adequate large units. The supply patterns are much the same by location, although the numbers vary, much along the patterns discussed earlier in this article, with the greatest supply in the nonmetropolitan areas and the Midwest.

Exhibit 11

Supply Sufficiency for Rental Units With Five or More Rooms Relative to Households With Five or More People by Income Level and Location

Income Level by Metropolitan Status and Region	Affordable	Available	Adequate
Nation			
ELI (≤30% AMI)	379.80	41.10	16.82
VLI (30–50% AMI)	508.78	94.28	45.81
LI (50–80% AMI)	551.30	109.27	54.05
MLI (>80% AMI)	487.63	116.17	63.19
Central cities			
ELI (≤30% AMI)	267.30	37.36	17.95
VLI (30–50% AMI)	421.34	86.87	45.13
LI (50–80% AMI)	467.69	98.54	51.14
MLI (>80% AMI)	431.40	105.53	59.22
Suburbs			
ELI (≤30% AMI)	349.81	39.56	13.84
VLI (30–50% AMI)	510.14	85.42	42.91
LI (50–80% AMI)	566.89	105.79	53.33
MLI (>80% AMI)	506.29	116.15	64.69
Nonmetropolitan areas			
ELI (≤30% AMI)	928.68	60.94	20.89
VLI (30–50% AMI)	792.21	140.23	55.18
LI (50–80% AMI)	769.02	150.49	64.71
MLI (>80% AMI)	599.02	145.44	70.61
Northeast			
ELI (≤30% AMI)	419.11	45.77	26.48
VLI (30–50% AMI)	557.92	85.97	51.89
LI (50–80% AMI)	573.06	94.65	54.00
MLI (>80% AMI)	504.91	100.39	62.13
Midwest			
ELI (≤30% AMI)	436.55	57.55	21.97
VLI (30–50% AMI)	716.76	150.61	63.09
LI (50–80% AMI)	744.47	160.67	69.99
MLI (>80% AMI)	625.51	154.91	73.76
South			
ELI (≤30% AMI)	403.18	44.73	16.26
VLI (30–50% AMI)	620.25	115.11	48.74
LI (50–80% AMI)	678.78	135.06	56.91
MLI (>80% AMI)	593.32	140.93	64.30
West			
ELI (≤30% AMI)	271.05	19.35	6.27
VLI (30–50% AMI)	258.98	48.26	30.27
LI (50–80% AMI)	323.38	67.79	43.58
MLI (>80% AMI)	317.03	84.03	57.88

AMI = area median income; ELI = extremely low income; LI = low income; MI = moderate income; VLI = very low income.
Note: Units per 100 households, 5+ people and 5+ rooms only.

Conclusion

A comparison of the distributions of rental housing stock and renter households shows an absolute shortage of housing that is affordable to households earning less than 40 percent of area median income. Moreover, if one subtracts the housing occupied by households that could afford more expensive units, there are insufficient *available* units that are affordable to households earning less than 65 percent of AMI. There are simply not enough *adequate* rental units to house all renter households. These conclusions hold true, with minor variations, if one considers rental markets by region and metropolitan status. The conclusions have been true, again with some variation, since at least 1985. Of particular interest to policymakers is the fact that not enough rental units are available at fair market rents to house all households that can afford no more than the FMR. Finally, although the stock of affordable large units (five+ rooms) is more than sufficient to house large households (five+ people), the available stock is too small at the lower income levels, and the available and adequate stock is too small at all levels.

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Notes

1. The material in this article was published in substantially similar form as Chapter 4 of *Affordable Housing Needs: A Report to Congress on the Significant Need for Housing* (U.S. Department of Housing and Urban Development, 2005; available at http://www.huduser.org/publications/affhsg/affhsgneed.html).

2. The Department of Housing and Urban Development's Economic and Market Analysis Division annually estimates area median income, fair market rent, and related "income limits" for all metropolitan areas and nonmetropolitan counties; see the links at http://www.huduser.org/datasets/pdrdatas.html. For a detailed description of how these estimates are matched to American Housing Survey records, see the Housing Affordability Data System documentation at http://www.huduser.org/datasets/hads/hads.html.

3. The 2003 American Housing Survey (AHS) estimates that 2.2 million (6.6 percent) renter households occupied units while paying no rent. The AHS does not provide estimates of the number of households paying a positive but below-market rent because of employment or other reasons.

4. For details on these measures, see the entry for the variable ZADEQ in the *Codebook for the American Housing Survey, Public Use File: 1997 and Later*. The most recent version is available for download at http://www.huduser.org/datasets/ahs/ahsprev.html.

5. More specifically, the data set was the 2003 file of the Housing Affordability Data System (HADS). The HADS is a set of American Housing Survey-based files that measure housing affordability and housing cost burden in a consistent way over the period 1985 to 2004, with plans to extend the files into the future as more AHS data sets become available. The data files are available for download at http://www.huduser.org/datasets/hads/hads.html.

6. This rising section includes "no cash rent units," which have zero rent but positive utility costs. Thus, their monthly costs are low but not zero.

7. The source of this exhibit is custom tabulations of the American Housing Survey national data sets, for odd-numbered years in the period.

8. As noted in the introduction, however, this analysis does not capture local markets. The large families and bigger units may not be in the same place.

Geographic Information Systems Supporting Disaster Response and Recovery

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This article reflects the views of the authors and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

Disasters do not comply with traditional geographic boundaries. Geographic Information Systems (GIS) enable policymakers and planners to overlay the impacted disaster areas over existing data sources to estimate the severity of the disaster on the area and to determine to what extent federal and local resources might be required to facilitate long-term recovery. GIS also enables policymakers to test the costs and benefits of policy options. In the aftermath of Hurricanes Katrina, Rita, and Wilma, the U.S. Department of Housing and Urban Development (HUD) used GIS more extensively than it had for any previous disaster to calculate risk of housing damage to HUD-assisted and HUD-insured housing and to estimate actual damage to all housing in the affected states. This analysis was critical for making decisions about how many resources for long-term recovery to use and where to target those resources. The analysis has also been critical for local officials in their design of programs that address the long-term recovery needs in their communities.

Introduction

Like clockwork, in August, September, and October 2005, a major hurricane struck the Gulf Coast States. The first and most devastating—Hurricane Katrina—stormed into Alabama, Louisiana, and Mississippi on August 29 and devastated portions of those states, including the metropolitan area of New Orleans, America's 35th largest metropolitan area. Less than a month later, on September

24, Hurricane Rita came ashore and caused serious damage in east Texas and western Louisiana. Finally, on October 24, Hurricane Wilma swept across Florida.

Although the U.S. Department of Housing and Urban Development (HUD)—America's housing agency—is not generally a "first responder" to disasters, it often plays a variety of roles in supporting the long-term recovery of communities following a disaster. The Office of Policy Development and Research (PD&R) at HUD provides information to senior policy officials and program office staff to support HUD's response to natural disasters. Among the core pieces of information PD&R provides are analyses of the extent of the housing damage and identification of the households most affected by the storms. Oftentimes PD&R is asked to obtain and analyze data to help the Secretary of HUD make allocation decisions about how much funding from Community Development Block Grant (CDBG) supplemental appropriations should be provided to individual jurisdictions or states to facilitate long-term disaster recovery.

After Hurricane Katrina (later followed by Hurricanes Rita and Wilma), the Secretary's Office at HUD asked PD&R to provide information on the magnitude of the disasters in terms of both the overall housing stock and the HUD-insured and HUD-assisted housing stock. This request was followed by a request from the White House Hurricane Katrina Task Force on Housing and Relocation Policy to provide a detailed analysis of how the storms affected the New Orleans metropolitan area specifically and to offer some thoughts on what major issues would affect its long-term recovery. Finally, after Congress appropriated $11.5 billion in December 2005 for the CDBG program to support long-term recovery, PD&R obtained data from the Federal Emergency Management Agency (FEMA) and the Small Business Administration (SBA) on the extent and type of housing damage the storms caused. This data enable PD&R to help the Secretary with his decision on how the funds should be divided among Alabama, Florida, Louisiana, Mississippi, and Texas. After a second supplemental appropriation of $5.2 billion in CDBG funds in June 2006, PD&R again provided data to the Secretary of HUD to help divide those funds among the five affected states. For all these activities, PD&R made extensive use of Geographic Information Systems (GISs).

Timeline and Overview

Over time, following Hurricanes Katrina, Rita, and Wilma, different types of data became available. Each new source of data enabled HUD to achieve a better understanding of the extent of damage, specifically where the damage was concentrated and which households were most affected by the storms. The table in exhibit 1 offers a brief timeline of when data became available in the context of when the hurricanes struck and when Congress provided supplemental appropriations for disaster recovery.

Declared Counties

The first type of data that became available after Hurricane Katrina struck was simply information about which counties and parishes were declared eligible for federal Individual Assistance (IA) and Public Assistance (PA) grants.

Exhibit 1

Timeline of Housing Damage Estimates

2005	
August	Hurricane Katrina makes landfall on August 29.
	President Bush declares 8 counties in Alabama, 31 parishes in Louisiana, and 49 counties in Mississippi as eligible for FEMA IA grants.
September	HUD prepares estimates on population and the number of housing units and HUD-assisted housing in disaster-affected counties.
	Hurricane Rita makes landfall on September 24. FEMA declares 22 counties in Texas and 22 parishes in Louisiana as eligible for IA grants.
	HUD obtains American Red Cross preliminary estimates of the total number of housing units damaged by Katrina.
	HUD obtains MAC remote sensing data from FEMA.
October	HUD links FEMA remote sensing data to Census 2000 Block Groups for demographic analysis.
	HUD obtains flood depth data (as of August 31) for Orleans Parish from NOAA.
	HUD links flood depth data to Census 2000 Blocks and Block Groups to calculate the number of units and other demographic characteristics by flood depth in Orleans Parish.
	Hurricane Wilma makes landfall in Florida on October 24. FEMA declares 13 counties eligible for IA grants.
November	HUD obtains updated American Red Cross estimates of housing damage by county and parish.
December	Congress appropriates $11.5 billion in CDBG funds to assist states impacted by Hurricanes Katrina, Rita, and Wilma with long-term recovery.
2006	
January	HUD obtains home inspection data and other registrant characteristics from FEMA and the SBA.
	HUD makes formula allocation to five states.
February	HUD obtains updated home inspection data from FEMA.
	President Bush requests an additional $4.2 billion in CDBG funds for recovery in Louisiana.
April	HUD and DHS release formal estimates of housing damage in Gulf Coast States based on FEMA home inspection data.
	The USACE prepares estimates of costs to repair and improve levees by hydraulic areas. HUD provides estimates on population and the number of housing units within hydraulic areas.
June	Congress makes an additional $5.2 billion CDBG appropriation for recovery in the Gulf Coast States.
July	HUD allocates $4.2 billion of CDBG funds for Louisiana.
August	HUD announces formula allocation to Alabama, Florida, Mississippi, and Louisiana using FEMA inspection data and data provided by the states on unmet needs.

CDBG = Community Development Block Grant.
DHS = U.S. Department of Homeland Security.
FEMA = Federal Emergency Management Agency.
HUD = U.S. Department of Housing and Urban Development.
IA = Individual Assistance (grants).
MAC = Mapping and Analysis Center (FEMA).
NOAA = National Oceanic & Atmospheric Administration.
SBA = Small Business Administration.
USACE = U.S. Army Corps of Engineers.

To show the total number of households that had been in harm's way, PD&R obtained data from the 2000 census and HUD administrative data systems on the affected counties. This information provided an estimate of the risk for HUD's assisted and mortgage-insured housing stock—public housing, Housing Choice Vouchers (HCVs), multifamily insured and assisted households, and the Federal Housing Administration (FHA) single-family insured portfolio. Because HUD maintains geographic information (latitude, longitude, state, county, tract) for each housing unit in its programs, the data could be linked quickly to the affected counties and aggregated. This information gave senior policymakers a quick picture of what portion of the HUD inventory had been in the paths of the storms.

American Red Cross Damage Data

The actual level of damage resulting from the storms would be less than the number of households in harm's way. HUD found that the best early source of data on the total number of damaged housing units was from the American Red Cross. The American Red Cross uses a combination of on-the-ground field staff and geospatial analysis of aerial photographs to estimate the number of damaged housing units. Almost immediately after the storms occurred, the American Red Cross assembled estimates of damage to determine where to deploy its staff to offer immediate disaster assistance. Over time, the American Red Cross refined its damage estimates. The table in exhibit 2 shows the October 2005 housing damage estimates for Hurricanes Katrina and Rita from the American Red Cross.[1]

The American Red Cross Disaster Assessment (ARC 30-3049) regulations for making damage assessments provides the following definitions:

- **Destroyed.** The dwelling is currently uninhabitable and cannot be made habitable without extensive repairs that would prove to be too costly (for example, total loss of structure or complete failure to major structural components).
- **Major Damage.** The dwelling is not currently habitable but can be made habitable with repairs (for example, substantial failure to structural elements such as floors, walls, or foundation).
- **Minor Damage.** The dwelling has sustained damage and will require repairs, but it is currently habitable whether or not the occupants have chosen to remain in the dwelling following the disaster event (for example, minor structural damage, damage to small section(s) of the roof, numerous broken windows, and missing roofing and siding).
- **Affected.** The dwelling has sustained "extremely minor" damage mostly considered nuisance damage (for example, a few shingles blown off, a couple of broken windows, debris in the yard or on or near the dwelling, and minor contents damage).
- **Inaccessible.** Access to the dwelling is impossible because of standing water, destroyed bridges, impassable roads, or other such conditions. This rating is also used for homes that have been evacuated because of an imminent threat (for example, mudslides, overflow of sewers, or inoperative basic utilities). (American Red Cross, 2003).

Exhibit 2

Varying Estimates of Housing Damage—Hurricanes Katrina and Rita

	Number of Units in All Counties and Parishes	Number of Units in Orleans Parish	Number of Units in All Other Counties and Parishes
American Red Cross Estimates			
Destroyed	208,174	75,578	132,596
Major damage	145,857	51,870	93,987
Minor damage	183,480	35,092	148,388
Affected	209,891	64,083	145,808
Inaccessible	2,882	0	2,882
Subtotal	750,284	226,623	523,661
HUD Estimates Using FEMA Remote Sensing Data			
Catastrophic	22,244	183	22,061
Extensive	4,545	258	4,287
Moderate	18,151	629	17,522
Limited	78,008	3,839	74,169
Flooding	273,615	165,448	108,167
Subtotal	396,563	170,357	226,206
HUD Estimates for Orleans Parish Using Flood Depth			
Flooding of more than 7 feet	NA	19,829	NA
Flooding of 4 to 7 feet	NA	48,284	NA
Flooding of 2 to 4 feet	NA	35,399	NA
Subtotal	NA	103,513	NA
HUD Estimates Using FEMA Damage Inspections			
Severe damage	124,289	78,810	45,479
Major damage	157,621	26,345	131,276
Minor damage	651,004	29,189	621,815
Subtotal	932,914	134,344	798,570

FEMA = Federal Emergency Management Agency; HUD = U.S. Department of Housing and Urban Development; NA = not applicable.

FEMA Mapping and Analysis Center Remote Sensing Files

Although the American Red Cross estimates provided an excellent picture of the overall level of damage, they did not provide detailed information (by tenure, income, insurance status, and household type) about the specific households affected. The information also did not indicate how much of HUD's assisted or insured housing stock was likely damaged.

One early source of geographic data that can help provide this information is FEMA "remote sensing" data. During disaster response, the FEMA Mapping and Analysis Center (MAC) receives satellite imagery or aerial photography from the National Geospatial-Intelligence Agency. The MAC

uses this remotely sensed data, in conjunction with on-the-ground gross assessments, to produce files categorizing the type of damage an area sustained. The MAC is permitted to share these files with the public. The primary purpose for making these data available is to enable various businesses with vested interests in the data to apply them to their particular needs. FEMA's MAC has four designations for damage:

- **Catastrophic Damage.** Most solid and all light or mobile structures are destroyed.
- **Extensive Damage.** Some solid structures are destroyed and most sustain exterior and interior damage (for example, roofs are missing and interior walls are exposed); most mobile homes and light structures are destroyed.
- **Moderate Damage.** Solid structures sustain exterior damage (for example, missing roofs or roof segments); some mobile homes and light structures are destroyed and many are damaged or displaced.
- **Limited Damage.** Generally superficial damage to solid structures (for example, loss of tiles and roof shingles); some mobile homes and light structures are damaged or displaced.

In addition, FEMA's MAC identifies areas where flooding or ground saturation has occurred. These areas can overlap with one or more of the damage categories.

To identify HUD-insured and HUD-assisted properties in these damage areas and to examine demographic characteristics of households in the areas most affected by the storms, we overlaid the FEMA damage areas on Census 2000 Block and Block Group data and on the latitude and longitude of HUD's properties. The table in exhibit 2 shows HUD's estimates of the number of housing units in each of the FEMA damage areas for Hurricanes Katrina and Rita.

Flood Depth

One limitation of FEMA's remote sensing data was that most of the affected housing units were in areas designated only as "flooded." The FEMA MAC data provided no indication about the flooding depth—whether it was 1 foot or 10 feet. In October 2005, HUD received from the National Oceanic & Atmospheric Administration (NOAA) a file that showed flood depths for Orleans and St. Bernard Parishes. For those two parishes, we were able to overlay this file with both 2000 census data and HUD's administrative records to determine how many units were likely in areas of deep flooding versus shallow flooding.

FEMA Inspections

In December 2005, Congress appropriated $11.5 billion toward addressing unmet recovery needs in the five states affected by Hurricanes Katrina, Rita, and Wilma. To help the Secretary of HUD determine how to allocate the CDBG supplemental appropriation among the five states, HUD obtained FEMA data on registrants for its IA grant program. Included with this data was information reported from damage inspections conducted by FEMA contract inspectors. Because insurance may not cover all of an affected person's needs, most people register with FEMA for IA grants. FEMA conducts a housing inspection for most registrants. These data are a very direct measure of the extent of damage. Each unit is categorized into three levels of damage:

- **Severe.** The home is more than 50 percent damaged.
- **Major.** The cost to make the home habitable is more than $5,200 but the home is less than 50 percent damaged.
- **Minor.** The cost to make the home habitable is less than $5,200.

Moreover, because the FEMA IA data are at the registrant level and include information about the unit occupant, it was possible to estimate damage by type of damage (wind or flood), tenure, insurance status, income, and location (such as being inside or outside a flood zone). This information is very helpful when trying to allocate funds for unmet needs.

The table in exhibit 2 shows the number of units that sustained minor, major, or severe damage from Hurricanes Katrina and Rita based on HUD's analysis of a February 12, 2006, extract of FEMA IA data, the American Red Cross damage assessment data, and the result of overlaying Census 2000 data on the FEMA MAC remote sensing areas and the NOAA flood depth.

SBA Inspections

One downside to the FEMA direct inspection data is that the damage categories are very broad and do not take into account the varying costs to repair homes of different sizes. Inspections of homes by the SBA for individual owners who sought a low-interest disaster loan helped resolve some of the problems associated with the limited damage definitions from the FEMA inspections. SBA inspections provide detailed cost estimates of how much it would cost for a home to be repaired. Although far fewer SBA inspections are conducted than are FEMA inspections, it is possible to use SBA inspections to estimate how much it would cost to repair nearby housing units that FEMA had designated as having major or severe damage.

A combination of the FEMA and SBA data was used to inform the Secretary of HUD on likely unmet needs in the Gulf Coast States and guide the allocation of the $11.5 billion supplemental appropriation. These data also became the government's estimate of total damage. In April 2006, the U.S. Department of Homeland Security and HUD publicly released the aggregated data cross-tabulated by several need categories.[2]

Because FEMA damage data are based on direct inspections, they probably provide the most accurate and complete estimates. For early planning purposes, the American Red Cross estimates and the flood depth estimates for Orleans Parish proved to be reasonable estimates compared with the FEMA damage inspections. The remainder of this article provides details on how GIS was used in the activities described previously.

Counties Eligible for FEMA IA and PA

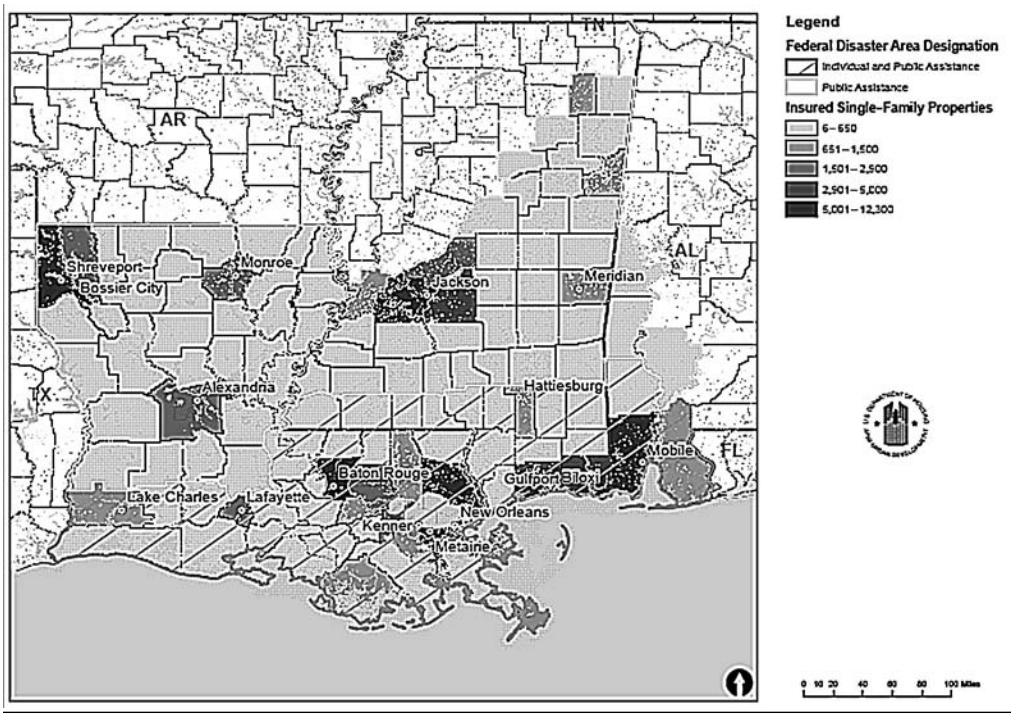
When a county is declared eligible for federal disaster assistance, it is generally declared as eligible for IA grants, PA grants, or both. Under the IA program, an individual whose home has been damaged or destroyed and whose losses are not covered by insurance may apply to FEMA for assistance with temporary housing, for small repair grants, and, sometimes, for other assistance, such as assistance to cover some medical costs. The PA program enables states, local governments,

and certain nonprofit organizations to obtain supplemental federal disaster grant assistance for the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private nonprofit groups. In the early stages after a disaster, PA funds are used extensively for debris removal.

Counties eligible for the IA program are usually the hardest hit counties where homes were more likely to experience significant damage. In its analysis of housing damage caused by Hurricane Katrina, HUD generally focused its attention on the IA counties. A total of 2,421,132 housing units were in the Katrina-related IA counties. Among the housing units in the affected IA counties were 106,945 homes with FHA single-family mortgage insurance. The map in exhibit 3 illustrates the type of information provided shortly after Katrina struck[3] to demonstrate the concentration of FHA single-family insured homes in the counties declared eligible for federal disaster assistance.

Exhibit 3

FHA Single-Family Insured Properties Affected by Hurricane Katrina



FHA = Federal Housing Administration.

American Red Cross

As noted previously, the American Red Cross uses GIS technology for a variety of tasks to better target its resources before, during, and after a disaster (ESRI, 2005). The American Red Cross has teams of staff and trained volunteers who begin working before a disaster and collect information

throughout the disaster to help the teams decide where to provide services. The teams immediately follow their decision by identifying where most of the damage is centered and which housing units are most affected (Hallman, 2004). When feasible, the American Red Cross bases its damage estimates on external physical assessments of units and collects this information on a block-by-block basis. For large disasters, such as Hurricanes Katrina and Rita, the American Red Cross identifies areas based on the likely level of damage and uses GIS to determine the number of housing units in the area. For Hurricanes Katrina, Rita, and Wilma, the American Red Cross supplemented its on-the-ground assessments with remote sensing data from the FEMA MAC. A comparison of the American Red Cross estimates of damage, which are available shortly after the disaster, with the direct inspection data from FEMA, available many months after the disaster, shows the aggregate damage totals from the American Red Cross data to be reasonably similar to the totals from the FEMA inspections. This observation tends to validate the reliability of the American Red Cross damage estimates as a good source of data to base early planning decisions for long-term recovery.

FEMA Remote Sensing Data

HUD's first major use of GIS to better understand the scope of the disaster and how HUD's insured and assisted units might be affected was with data obtained from FEMA's MAC. The FEMA MAC data used satellite imagery and "boots-on-the-ground" information to make assessments of areas impacted by the hurricanes.

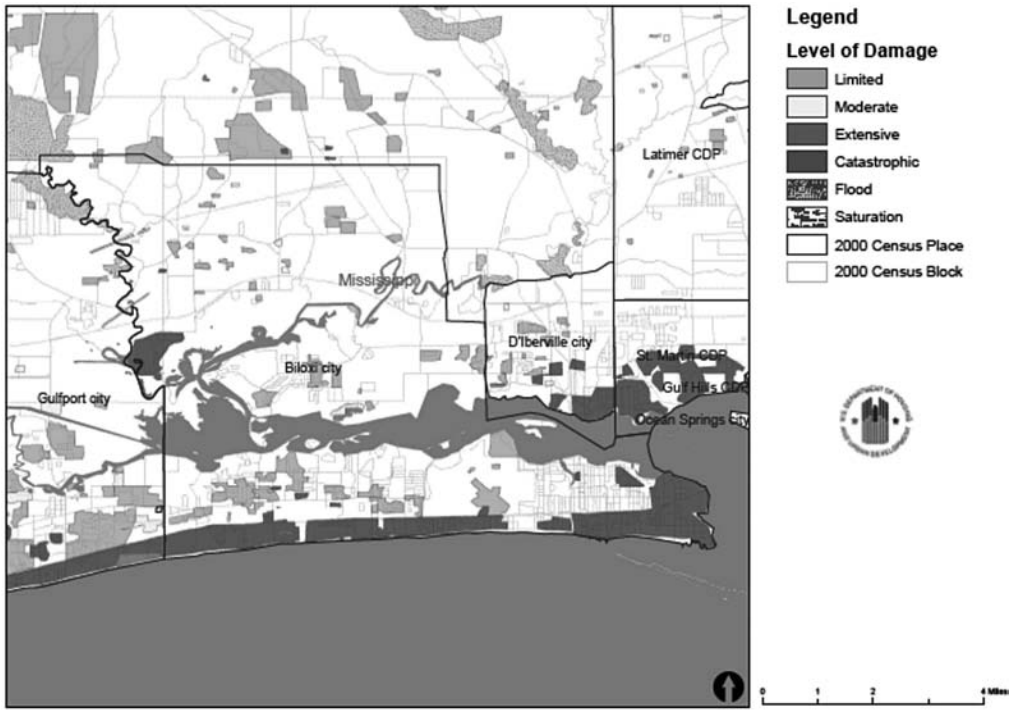
The map of Biloxi, Mississippi, in exhibit 4 shows the areas defined as damaged under the various categories. To calculate the number of housing units within each of those damage areas, we overlaid the damage areas with Census 2000 Blocks. If a damage area represented only a fraction of the block, we had to decide what fraction of the housing units in that block should be counted in each of the categories of damage. We considered three options:

1. Including of the housing units for that block.
2. Apportioning the data for the block by the percentage of the block represented by the damage area (for example, if the damage area represented 1 acre in a 10-acre block, then the number of housing units in the block would be multiplied by 1/10).
3. Adding in the street grid for the block and assuming the housing units are located near the streets. By "placing" the housing units in the block, we can then see how many of the housing units fall within the damage areas. The Oak Ridge National Laboratory conducted this analysis for HUD using a methodology developed as part of previous research for HUD.

Although the third option is probably the most accurate, it required many hours of data processing to accomplish. It did, however, lead us to a hybrid approach: for rural areas, all housing units in a damaged block are considered damaged (approach 1), while for urban areas, housing units are apportioned by area (approach 2). This hybrid approach yields nearly the same result as the third approach. As a result, for most of this analysis, we used the hybrid approach to estimate the number of homes in each of the FEMA remote-sensing damage areas.

Exhibit 4

Hurricane Katrina Damage Assessment, Biloxi, Mississippi, September 2005



To get detailed demographic information that is available only at the block group level, we aggregated the number of homes in each damage category from the block level to the block group level and assumed that the demographics of those households experiencing damage in a block group would be the same as the demographics of those not experiencing damage within a block group. This assumption resulted in tables such as the one in exhibit 5, which shows by income and tenure the number of households that lived in areas defined as having different levels of damage. The table in exhibit 5 shows this information for Biloxi, Mississippi, but similar tables were developed for the disaster areas as a whole and for each of the hardest hit communities.

Estimating damage to HUD's owned, insured, and assisted housing stock was considerably easier to do because HUD maintains a distinct point location for each property. All we needed to determine the damage to each property was a simple "point-in-polygon" overlay procedure, otherwise known as a "spatial join." After a damage category was assigned to each property, maps and reports were generated to inform HUD principal staff on the type and extent of damage to expect. (See exhibit 6.)

Exhibit 5

Income and Tenure Characteristics of Households in FEMA Damage Areas in Biloxi, Mississippi, by Number and Percentage of Households

Damage Category and Area Median Income Range	Owner	Renter	Total
Moderate, extensive, or catastrophic damage and/or flooding	**2,233**	**3,278**	**5,511**
0–30% AMI*	8%	19%	14%
31–50% AMI	9%	13%	11%
51–80% AMI	15%	23%	20%
81–95% AMI	8%	11%	10%
96% AMI plus	61%	35%	45%
Limited damage	**1,238**	**1,319**	**2,557**
0–30% AMI	4%	16%	10%
31–50% AMI	5%	13%	9%
51–80% AMI	8%	24%	16%
81–95% AMI	6%	10%	8%
96% AMI plus	77%	37%	56%

**Area median income as determined by HUD.*

Exhibit 6

HUD-Insured and HUD-Assisted Housing Units in Areas Damaged by Hurricane Katrina, by Geographic Area, September 23, 2005

Geographic Area and Type of HUD-Assisted and/or HUD-Insured Housing	Total Housing Units (no.)	Federally Declared Disaster Areas		Areas Eligible for Individual Assistance		In FEMA-Designated Damage Areas[a]		In FEMA-Designated Flood Areas[b]	
		Units (no.)	% of State Stock	Units (no.)	% of State Stock	Units (no.)	% of State Stock	Units (no.)	% of State Stock
Alabama									
LIHTC	15,547	4,452	29	2,577	17	0	0	0	0
Public housing	42,734	15,630	37	7,232	17	0	0	0	0
HCV	23,745	11,819	50	5,923	25	0	0	0	0
Multifamily insured and assisted	29,502	12,399	42	7,407	25	0	0	0	0
FHA single-family insured	77,876	33,599	43	15,097	19	60	0	1	0
Total	**189,404**	**77,899**	**41**	**38,236**	**20**	**60**	**0**	**1**	**0**

FEMA = Federal Emergency Management Agency; FHA = Federal Housing Administration; HCV = Housing Choice Voucher Program; LIHTC = low-income housing tax credit.

[a] FEMA-designated damage areas include categories of limited damage, moderate damage, extensive damage, catastrophic damage, flooding, and saturation.

[b] FEMA-designated flood areas do not indicate the extent of flooding. This designation, therefore, does not necessarily indicate units were under water. Federally declared disaster areas are as of September 10, 2005.

Notes: Data include only units with complete, verifiable addresses. Therefore, state totals may not be strictly comparable with other data sources. LIHTC data are as of 2003; public housing data are as of March 31, 2005; HCV data are as of June 30, 2005; single-family insurance data are as of September 7, 2005; and multifamily program data are as of September 13, 2005. Multifamily housing includes HUD-insured and HUD-assisted properties, Section 202 and Section 811 units, and HUD-held properties.

Exhibit 6

HUD-Insured and HUD-Assisted Housing Units in Areas Damaged by Hurricane Katrina, by Geographic Area, September 23, 2005 (continued)

Geographic Area and Type of HUD-Assisted and/or HUD-Insured Housing	Total Housing Units (no.)	Federally Declared Disaster Areas		Areas Eligible for Individual Assistance		In FEMA-Designated Damage Areas[a]		In FEMA-Designated Flood Areas[b]	
		Units (no.)	% of State Stock	Units (no.)	% of State Stock	Units (no.)	% of State Stock	Units (no.)	% of State Stock
Louisiana									
LIHTC	21,733	21,733	100	12,101	56	2,135	10	2,135	10
Public housing	29,672	29,672	100	19,631	66	8,383	28	8,383	28
HCV	31,365	31,365	100	20,752	66	7,297	23	7,287	23
Multifamily insured and assisted	33,918	33,918	100	21,783	64	6,160	18	6,160	18
FHA single-family insured	75,243	75,243	100	57,629	77	12,708	17	11,611	15
Total	**191,931**	**191,931**	**100**	**131,896**	**69**	**36,683**	**19**	**35,576**	**19**
New Orleans									
LIHTC	2,796	2,796	13	2,796	13	2,103	10	2,103	10
Public housing	10,420	10,420	35	10,420	35	8,247	28	8,247	28
HCV	8,066	8,066	26	8,066	26	6,657	21	6,652	21
Multifamily insured and assisted	6,464	6,464	19	6,464	19	4,767	14	4,767	14
FHA single-family insured	12,259	12,259	16	12,259	16	8,169	11	8,108	11
Total	**40,005**	**40,005**	**21**	**40,005**	**21**	**29,943**	**16**	**29,877**	**16**
Mississippi									
LIHTC	13,774	13,774	100	9,279	67	72	1	0	0
Public housing	14,933	14,933	100	10,158	68	162	1	0	0
HCV	14,820	14,820	100	10,927	74	286	2	12	0
Multifamily insured and assisted	29,827	29,827	100	20,595	69	752	3	0	0
FHA Single-family insured	49,714	49,714	100	34,219	69	1,306	3	51	0
Total	**123,068**	**123,068**	**100**	**85,178**	**69**	**2,578**	**2**	**63**	**0**
Grand Total	**504,403**	**392,898**	**78**	**255,310**	**51**	**39,321**	**8**	**35,640**	**7**

FEMA = Federal Emergency Management Agency; FHA = Federal Housing Administration; HCV = Housing Choice Voucher Program; LIHTC = low-income housing tax credit.

[a] FEMA-designated damage areas include categories of limited damage, moderate damage, extensive damage, catastrophic damage, flooding, and saturation.

[b] FEMA-designated flood areas do not indicate the extent of flooding. This designation, therefore, does not necessarily indicate units were under water. Federally declared disaster areas are as of September 10, 2005.

Notes: Data include only units with complete, verifiable addresses. Therefore, state totals may not be strictly comparable with other data sources. LIHTC data are as of 2003; public housing data are as of March 31, 2005; HCV data are as of June 30, 2005; single-family insurance data are as of September 7, 2005; and multifamily program data are as of September 13, 2005. Multifamily housing includes HUD-insured and HUD-assisted properties, Section 202 and Section 811 units, and HUD-held properties.

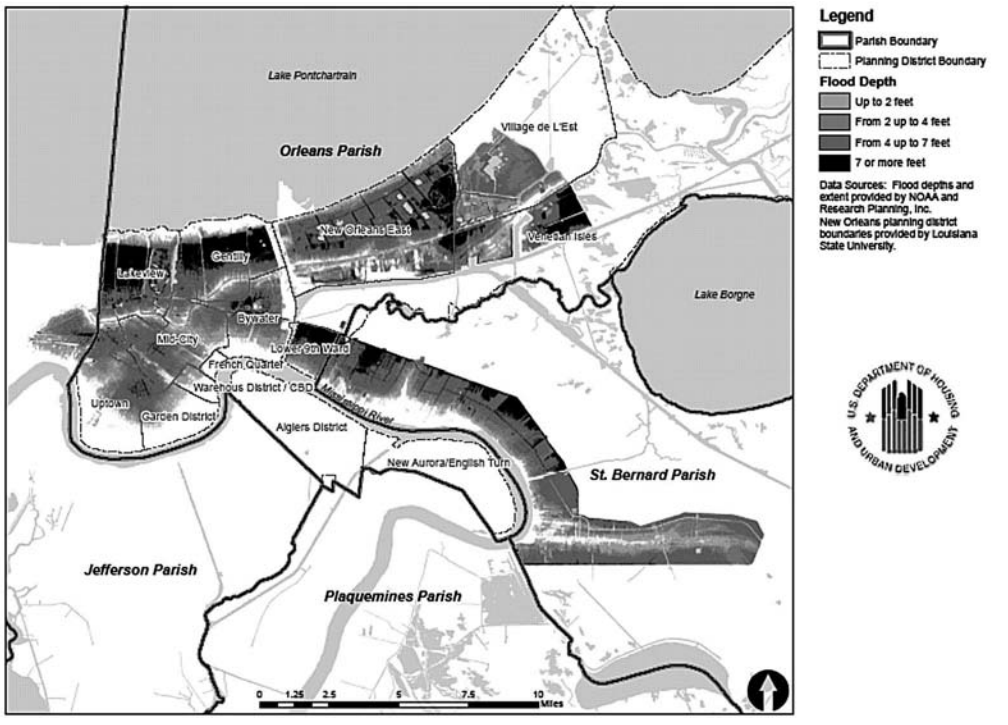
NOAA Flood Depths

The New Orleans metropolitan area had the highest concentration of households affected by Hurricane Katrina and was of special interest to HUD in understanding early on the extent of challenge that lay ahead. Unfortunately, as mentioned previously, the FEMA remote-sensing data showed only the areas that flooded, not the depth of the flooding. To get a better understanding of the extent of damage due to flooding, HUD obtained a flood-depth grid file from NOAA that showed the depth of the floodwaters on August 31, 2005. For the purpose of estimating damage, we attempted to categorize the severity of flooding as less than 2 feet, 2 to 4 feet, 4 to 7 feet, and more than 7 feet. Our hypothesis was that flooding of less than 2 feet was likely to cause minimal damage, whereas flooding of more than 7 feet would likely result in the demolition of the unit. The creation of the 2-to-4-foot and 4-to-7-foot categories of flooding was an attempt to distinguish moderate from severe flood damage.

The map in exhibit 7 shows the extent of flooding in Orleans Parish, St. Bernard Parish, and, to a small extent, Jefferson Parish according to these flood categories.

Exhibit 7

Estimated Extent and Depth of Hurricane Katrina Flooding, New Orleans, Louisiana, August 31, 2005



To estimate the number of housing units in each flood category, we employed a classic GIS overlay function called a union. First, a planning district was assigned to each census block. Because

planning districts and blocks tend to share boundaries, it was not difficult to determine the correct planning district to assign the block to. Flooded areas, however, do not follow block boundaries as neatly, so we had to employ an area-based allocation methodology to estimate the number of housing units in each block that were affected by flooding. A union of the census blocks and flood grid enabled us to calculate the percentage of the block area in each flood category. That percentage was then used as a weighting factor in the allocation of demographic attributes—in this case, housing units—to the damage area. This approach operates under the tenuous assumption that the demographic being studied is homogeneously distributed across the landscape. We selected the census block, the smallest level of census geography available, in an attempt to minimize the distortion caused by this assumption. The table in exhibit 8 provides an example of what this method told us about the number of housing units likely affected by the flooding.

Exhibit 8

Number of Housing Units by Area and Flood Depths of More Than 2 Feet in New Orleans City Planning District and St. Bernard Parish

Area	Flooding of 2 to 4 Feet	Flooding of 4 to 7 Feet	Flooding of More Than 7 Feet	Total Units With Flooding of More Than 2 Feet	Total Number of Units in District
Algiers District	0	0	0	0	20,053
Bywater	3,583	4,467	685	8,735	18,027
French Quarter	0	0	0	0	3,505
Garden District	2,964	1,558	2	4,524	24,000
Gentilly	2,691	4,679	6,792	14,162	17,343
Lakeview	1,116	2,949	5,648	9,713	11,722
Lower 9th Ward	1,131	2,332	2,721	6,184	7,138
Mid-City	12,519	10,745	386	23,651	35,582
New Aurora/English Turn	0	0	0	0	1,227
New Orleans East	5,387	14,013	2,625	22,025	27,986
Uptown	4,823	7,018	577	12,418	29,853
Venetian Isles	23	38	34	95	1,397
Village de L'Est	1,017	288	296	1,601	3,445
Warehouse District/CBD	56	1	0	57	1,183
No district defined	91	195	63	349	12,641
City of New Orleans total	**35,399**	**48,284**	**19,829**	**103,513**	**215,101**
St. Bernard Parish total	**5,738**	**9,310**	**2,371**	**17,420**	**26,790**

CBD = Central Business District.
Source: HUD overlay of National Oceanic & Atmospheric Administration August 31, 2005, data on flood depths over Census 2000 Block count data

We also overlaid the location of HUD's housing stock to estimate how many of these units were likely affected by the flooding. These procedures led to the creation of tables such as the one in exhibit 9, which shows the flood depths for households in the various assisted housing programs and indicates the number of properties covered by each of those programs and the number of units within those properties.

Exhibit 9

HUD-Assisted, LIHTC, and HUD Multifamily Units and Projects/Buildings by Flood Depths of More Than 2 Feet in the City of New Orleans

Type of Housing	Flooding of 2 to 4 Feet	Flooding of 4 to 7 Feet	Flooding of More Than 7 Feet	Total Units With Flooding of More Than 2 Feet	Total Number of Units
Individual units					
HCV	1,840	2,469	672	4,981	8,066
Public housing[a]	2,552	3,787	222	6,561	10,420
Multifamily assisted	894	2,058	0	2,952	5,485
LIHTC	289	1,057	108	1,454	2,796
Multifamily insured	152	765	56	973	1,774
Total	**5,727**	**10,136**	**1,058**	**16,921**	**28,541**
Properties, projects, and/or buildings					
Public housing	239	397	55	691	1,055
Multifamily assisted	11	11	0	22	43
LIHTC projects	8	6	1	15	37
Multifamily insured	2	4	1	7	19
Total	**260**	**418**	**57**	**735**	**1,154**

HCV = Housing Choice Voucher Program; HUD = U.S. Department of Housing and Urban Development; LIHTC = low-income housing tax credit.

[a] The actual number of public housing units under management by the New Orleans Housing Authority at the time Katrina struck was 8,279. The City of New Orleans had demolished units before Katrina that were still included in the "point" data file used to calculate the number of units by flood depth. As a result, the actual number of impacted public housing units is probably fewer than the number shown in exhibit 8.

Source: HUD data on property location with overlay of National Oceanic & Atmospheric Administration August 31, 2005, data on flood depths

FEMA and SBA Inspection Data

The early analysis described above was useful in framing the discussion about the breadth of long-term rebuilding needs. In late December 2005, President George W. Bush signed a supplementary appropriation into law that included $11.5 billion for the Community Development Block Grant program to provide "disaster relief, long-term recovery, and restoration of infrastructure in the most impacted and distressed areas" of the five states impacted by Hurricanes Katrina, Rita, and Wilma. HUD was charged with dividing the funds among Alabama, Florida, Louisiana, Mississippi, and Texas with the caveat that no state could receive more than 54 percent of the $11.5 billion.

HUD has received supplemental appropriations in the past to address long-term recovery needs. HUD's past experience identified a standard approach to developing a funding formula that can be quickly implemented to get the funds to the affected areas expeditiously.[4] HUD's approach has been to acquire detailed data from FEMA IA, FEMA PA, and the Small Business Administration Disaster Loan program to estimate the extent of needs not being met by these programs. The unmet needs are then summed up for each state and the allocation generally is made proportionally to that need, with some unmet needs getting higher priority for funding than others.

For a "normal" federally declared disaster, the primary sources of funding for long-term recovery of housing and businesses are (1) insurance, (2) SBA low-interest disaster loans, and (3) FEMA IA home-repair grants for owner-occupied housing and IA personal property grants for renters and owners. Recovery options for individuals who lack adequate insurance, are unable to qualify for an SBA disaster loan, and live in housing that has sustained more damage than what a FEMA home-repair grant would cover are limited to what state and local government or nonprofit groups may provide in the way of assistance. When Congress provides a supplemental appropriation of CDBG funds for long-term recovery activities, however, a fourth source of very flexible funding becomes available to address long-term recovery needs. Congress generally makes these allocations when the extent of the disaster is so large it has clearly overwhelmed the local capacity to fill in the "gaps" not addressed by the three other options. Congress usually states in the legislation its priority for funding, but that priority is nearly always associated with unmet housing, business, and infrastructure needs to facilitate long-term recovery.

HUD's allocation methodology is driven both by legislative direction and by the data available. In response to the supplemental appropriation, HUD assembled the most current data available on the extent of damage in each of the five hurricane-affected states. In addition to acquiring the data noted above, HUD obtained from FEMA its file of IA registrants, which included registrant characteristics and results of the home inspections conducted through December 31, 2005.[5] For most properties, FEMA contract inspectors make a direct assessment of housing unit damage. For some of the units impacted by Hurricane Katrina, FEMA did not do direct inspections but instead assumed a level of damage based on the flood depth.[6]

FEMA inspects properties to determine eligibility for real property and personal property assistance. FEMA real property assistance is determined as the cost to make a home habitable. If a home is less than 50 percent damaged, FEMA will provide up to $5,200 in repair assistance for damage not covered by insurance. If damage is greater than 50 percent, FEMA will provide $10,500 in repair assistance for damage not covered by insurance. FEMA will make similar assessments for personal property damage.

Because FEMA provides reimbursement at only three levels (less than $5,200, $5,200, and $10,500), for the table in exhibit 10 HUD categorized the inspection results into three categories of damage.

Minor Damage:

- Property inspection was conducted and found damage of less than $5,200; or
- If no real property inspection was conducted but an inspection of personal property was conducted and found damage of less than $5,195.76; or
- If no direct inspection was conducted but remote sensing finds water depth of 6 inches to 1 foot (for portions of Orleans, St. Bernard, and Jefferson Parishes).

Major Damage:

- Property inspection was conducted and finds damage of greater than or equal to $5,200 and less than $30,000; or

- If real property inspection was conducted and the inspector used the inspection default of $5,200 to indicated damage in excess of $5,200 but the property was less than 50 percent damaged overall; or
- If no real property inspection was conducted but a personal property inspection was conducted finding damage of greater than or equal to $5,195.76 but less than $30,000; or
- If no real property inspection was conducted but personal property damage inspection was conducted and the inspector used the inspection default of $5,195.76 to indicate personal property damage in excess of $5,195.76 but the property was less than 50 percent damaged overall; or
- If no direct inspection was conducted but remote sensing finds water depth of 1 foot to 2 feet (for portions of Orleans, St. Bernard, and Jefferson Parishes).

Severe Damage:

- Property inspection finds damage greater than or equal to $30,000; or
- If real property inspection was conducted and the inspection default of $10,500 was used to indicated property damage in excess of 50 percent; or
- If no real property inspection was conducted but a personal property damage inspection was conducted showing damage of greater than or equal to $30,000; or
- If no real property inspection was conducted but a personal property damage inspection was conducted and inspector used the inspection default of $10,391.51 to indicate the property was more than 50 percent damaged; or
- If no direct inspection occurred but remote sensing finds water depth of 2 feet or greater (for portions of Orleans, St. Bernard, and Jefferson Parishes).

Unfortunately, as is true with almost every source of data, data quality issues needed to be addressed with these otherwise extremely useful data. Because it was possible for multiple individuals to register for FEMA housing assistance for the same housing unit, we implemented a complicated set of procedures to identify individual housing units. For example, if a husband and wife both registered, or if an owner and his or her tenant both registered for the housing unit, we attempted to count the housing unit only once. The procedures we used, which depended heavily on geocoding the addresses, included the following:

- We included only records with a FEMA inspection. If the inspection was based on flood depth, we included only cases in which a grant was provided or the FEMA data indicated that the owner or renter had flood insurance.
- If we recorded duplicate registrant numbers with the same address, we retained the record with highest FEMA damage rating.
- If we recorded multiple registrants for the same address of a single-family property, then we retained the record with highest FEMA damage rating. If one registrant was an owner and the other was a tenant, we retained the owner registrant. We considered single-family records to be

duplicates for the same property if the U.S. Postal Service ZIP Code + 4 in combination with the delivery point bar code (DPBC) were the same (this is also referred to as the ZIP Code + 6). The ZIP Code + 6 proved to be the most valuable tool for identifying multiple records for the same address. For most single-family properties, the ZIP Code + 6 gives each property a unique numerical code, something similar to a Social Security number for a house. That is, each single-family home in the United States has its own unique 11-digit numerical code. This code turns out to be a powerful tool because it allows for easy identification of multiple registrants for the same address.

The challenge with the DPBC is to determine when it is used for a single-family home instead of a multifamily or mobile home. Fortunately, the DPBC for single-family homes is simply the last two numbers of the house address. Because the ZIP Code + 4 represents the block the house is on, the extra two digits pinpoint the DPBC at the house. If the DPBC matches the last two digits of the property address, we categorize the home as a single-family house. If not, we categorized the home as a multifamily or mobile home.

- Because many of the addresses for registrants who were living in apartments or mobile homes did not have apartment or lot numbers, it was not possible to use the ZIP Code + 6 method to limit those registrants to a single unit. Instead, multifamily and mobile home records were considered to have multiple registrants if the last names and addresses were the same.

Even with these procedures, double-counted units likely remained in the file. These units may have been offset, however, by likely undercounting. The data do not count vacant homes or second homes. They also do not include properties that had not yet had a FEMA inspection or reinspection as of February 12, 2006. If an individual did not register with FEMA, his or her damage would not be counted. In addition, our procedures to reduce multiple registrants for a single unit to one record may actually eliminate legitimate cases of independent units that were damaged.

A subset of FEMA registrants with real property damage applied to the SBA for loans to help repair their properties. If the applicants met some income and credit thresholds, SBA would have a contract inspector make a detailed assessment of the real property loss resulting from the disaster (referred to as "verified loss"). This verified loss is usually a more precise estimate than FEMA's estimate of what it would actually cost to repair the property.

Following Hurricanes Katrina, Rita, and Wilma, SBA conducted 184,361 inspections as of May 31, 2006. Because the FEMA data are more comprehensive in coverage—more than 1.3 million inspections—and the SBA data are more specific on dollar amount of the damage, they are linked together for this analysis. The units with both FEMA and SBA inspections are used to develop an estimate of the dollar amount of the damage for units inspected by FEMA but with no SBA inspection.

Basically, this estimation works as follows. At the census block level, the average SBA damage amount for a FEMA-designated "severe" damage property is applied to all the properties in the block with severe damage ratings from FEMA. The same process is repeated for properties with "major" damage ratings. The assumption here is that a property without an SBA inspection in the same block and same level of damage as determined by the FEMA inspection is likely to be of a similar structure type, value, and SBA damage level as a property with an SBA inspection. As a

Exhibit 10

Damage Estimates for Hurricanes Katrina and Rita Using February 12, 2006, FEMA Inspection Data, by Number of Units

	Owner-Occupied Housing Units				Renter-Occupied Housing Units	Total
	Insurance Status					
	Hazard & Flood	Hazard Only	No Insurance	Owner Subtotal		
Homes with flood damage						
Homes in FEMA 100-year flood plain						
Minor damage	5,272	2,108	1,465	8,845	8,386	17,231
Major damage	25,325	7,280	4,952	37,557	22,262	59,819
Severe damage and/or destroyed	36,286	7,640	8,014	51,940	35,338	87,278
Subtotal	66,883	17,028	14,431	98,342	65,986	164,328
Homes outside FEMA 100-year flood plain						
Minor damage	1,541	3,505	1,621	6,667	5,977	12,644
Major damage	7,098	13,128	3,623	23,849	14,514	38,363
Severe damage and/or destroyed	7,511	5,539	3,706	16,756	10,803	27,559
Subtotal	16,150	22,172	8,950	47,272	31,294	78,566
Homes with damage, but no flood damage (generally wind damage)						
Minor damage	51,262	231,450	160,327	443,039	178,090	621,129
Major damage	5,493	19,633	14,065	39,191	20,248	59,439
Severe damage and/or destroyed	792	1,619	3,581	5,992	3,460	9,452
Subtotal	57,547	252,702	177,973	488,222	201,798	690,020
Total	**140,580**	**291,902**	**201,354**	**633,836**	**299,078**	**932,914**
Summary totals						
Minor damage	58,075	237,063	163,413	458,551	192,453	651,004
Major damage	37,916	40,041	22,640	100,597	57,024	157,621
Severe damage and/or destroyed	44,589	14,798	15,301	74,688	49,601	124,289

FEMA = Federal Emergency Management Agency.

result, the property without an SBA inspection is assigned the same cost to repair as the property with the SBA inspection in that census block. If an SBA inspection did not occur in the block, then the next level of geography average (first census tract, then county) is used. Exhibit 11 provides the estimated per-unit amount to repair homes with major or severe damage, organized by the same categories as those in exhibit 10. A per-unit amount is not provided for minor damage because only a relatively small percentage of individuals whose properties sustain minor damage seek out SBA assistance.

Beyond providing the basic inspection data, the FEMA registrant file and other data available to HUD that could be matched to the FEMA registrant file provided useful information for understanding not only how much damage was incurred but also by which households. This information included the following:

Tenure

Owner-Occupied Housing Units and Renter-Occupied Housing Units

When individuals registered for FEMA assistance, they were asked if they were renters or owners. In approximately 10 percent of these cases, no tenure was indicated. Exhibits 10 and 11 assume that those individuals not indicating tenure were owner-occupants.

Type of Damage

The tables in exhibits 10 and 11 break out damage into two categories: homes with any flood damage and homes with no flood damage. If a home had flood damage and other types of damage, it is categorized as having flood damage. Most homes without flood damage had damage related to wind. Flood damage was determined if FEMA inspectors indicated damage was due to flooding or if the damage estimate was from remote sensing (which based damage on flood depth).

Exhibit 11

Per-Unit Repair Cost for Damage From Hurricanes Katrina and Rita Using March 30, 2006, SBA Data (in dollars)

	Owner-Occupied Housing Units			Owner- and Renter-Occupied Housing Units		
	Insurance Status					
	Hazard & Flood	Hazard Only	No Insurance	Owner Subtotal	Renter Occupied	Total
Homes with flood damage						
Homes in FEMA 100-year flood plain						
Major damage	81,210	72,789	69,744	78,214	81,355	79,567
Severe damage and/or destroyed	147,266	132,214	114,909	139,541	107,409	125,871
Homes outside FEMA 100-year flood plain						
Major damage	84,048	69,789	67,071	73,832	82,860	78,321
Severe damage and/or destroyed	149,050	119,433	103,677	127,975	116,477	123,731
Homes with damage, but no flood damage (generally wind damage)						
Major damage	44,499	36,225	32,827	36,876	47,670	39,382
Severe damage and/or destroyed	145,720	90,579	67,058	87,118	88,777	87,428
Summary average cost to repair						
Major	69,875	45,911	42,619	53,459	70,401	59,284
Severe	147,497	113,442	90,980	124,377	107,740	118,250

FEMA = Federal Emergency Management Agency; SBA = Small Business Administration.

Flood Plain Status

Using GIS, we performed an overlay operation known as a spatial join with the FEMA-registered housing units and the FEMA digital Q3 Flood Data (vector files developed by scanning the Flood Insurance Rate Map [FIRM] hard copy) to determine which units were inside (or outside) a FEMA 100-year flood zone.

Insurance Status

Insurance status was determined from FEMA data if the registrant indicated having hazard or flood insurance. In very few cases, no information on insurance status was recorded and "no insurance" was assumed.

Income Level

Income level was calculated by comparing the income and household size reported to FEMA at the time of registration with HUD's published income limits for the county in which the damaged property was located.

Assisted Housing

Assisted housing information is based on matching the FEMA registrants to HUD data on program participants in HUD's public housing, Housing Choice Voucher, and project-based Section 8 programs.

Geographic Identifiers

All the housing units were geocoded to include geographic identifiers of interest, including political divisions, such as county or place; congressional districts, so HUD could provide estimates to congressional staff; and the Orleans Planning Districts, so HUD could provide Orleans Parish the same identifiers as those used for the flood depth estimates described previously to provide estimates by planning district.

All this information was used to both facilitate the CDBG formula allocations and create detailed tables such as the one in exhibit 10, which shows the total number of units that sustained different types of damage, and the one in exhibit 11, which uses the SBA data to estimate the per-unit cost to repair housing units that sustained major and severe damage. Tables such as the one in exhibit 10 were produced for many different areas, including the most impacted counties and subareas of counties (such as Orleans Planning Districts). The tables are publicly available[7] and have been very helpful to the five states as they plan for long-term recovery of their housing stock (U.S. Department of Homeland Security and U.S. Department of Housing and Urban Development, 2006).

These data were also a key piece of information that the U.S. Department of Homeland Security's Office of the Federal Coordinator for Gulf Coast Rebuilding used in preparing its request to Congress in February 2006 for an additional $4.2 billion in CDBG funds for long-term recovery in Louisiana.

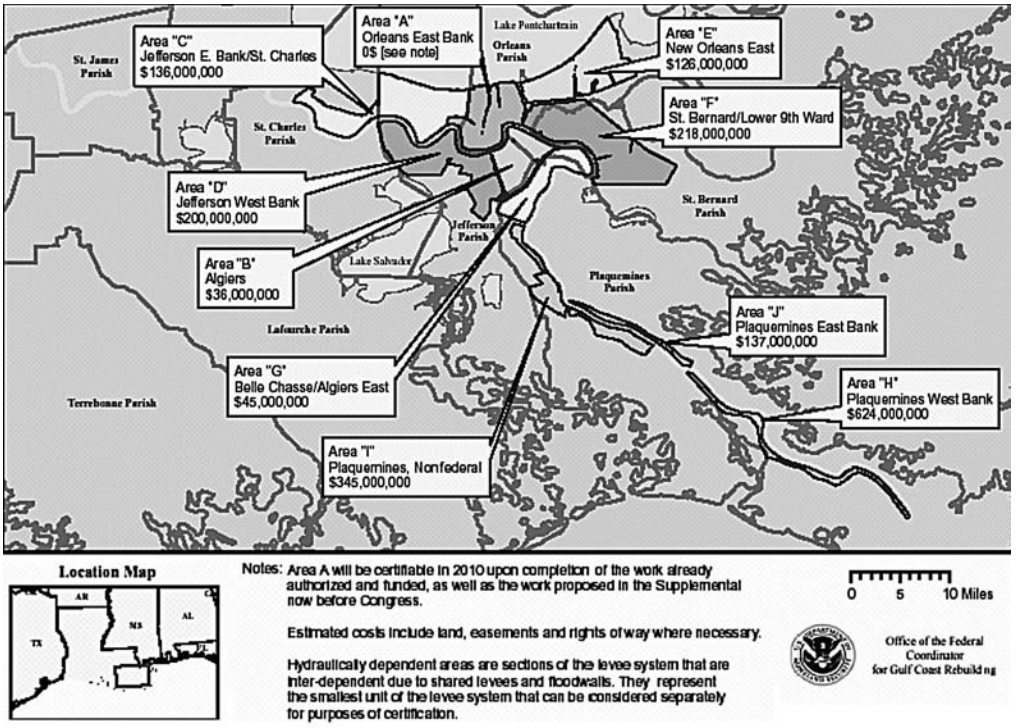
Hydraulic Areas and FEMA Base Flood Elevations

HUD also provided data support to the Office of the Federal Coordinator for Gulf Coast Rebuilding as the Office studied the cost to rebuild the levees in the New Orleans metropolitan area. The map in exhibit 12 shows hydraulic areas, each of which represents a basin protected by a series of levees. If any of the levees surrounding a hydraulic area fails, the basin will fill. The Office had received from the U.S. Army Corps of Engineers (USACE) the cost to repair or improve the levees so that the levees could be certified to protect against the 1-percent-annual-chance (100-year) flood. The Office wanted to know how many people lived in each of these basins and asked HUD to overlay the basin geography on the Census 2000 Block data to develop the estimate.

At the same time, the National Flood Insurance Program provided much-anticipated Advisory Base Flood Elevations (ABFEs). If the ABFEs are adopted by the local governments, a newly constructed home or a repaired home that had sustained more than 50 percent damage would be required to be elevated above the ABFE requirements or not be eligible for flood insurance. The ABFEs depend on the USACE's certifying the levees against a base flood. Without that certification, the ABFEs would be much higher. The ABFEs assume that the certified levees will hold and that any flooding is due to rainfall only, not levee failure.

Exhibit 12

Costs to Certify Levee Systems by Hydraulic Area



Source: U.S. Department of Homeland Security (http://www.dhs.gov/interweb/assetlibrary/GulfCoast_LeveeCosts.pdf)

For areas in a parish located within existing levees, FEMA has determined that "new construction and substantially damaged homes and businesses within a designated FEMA floodplain should be elevated to either the Advisory Base Flood Elevation (BFE)[8] or at least 3 feet above the highest adjacent existing ground elevation at the building site, whichever is higher; and new construction and substantially damaged homes and businesses not located in a designated FEMA floodplain should be elevated at least 3 feet above the highest adjacent existing ground elevation at the building site." (USDHS FEMA, 2006).

BFEs represent how many feet above sea level a home should be elevated to be safe from likely flooding. Regarding BFE, the Office of the Federal Coordinator for Gulf Coast Rebuilding asked a policy question: How many homes would have to be elevated and by how much? To make this estimate required converting the ABFEs and the U.S. Geological Survey topographical maps into vector format, overlaying them on each other and with Census 2000 Block data. The combined data were overlaid with the locations of the homes with severe damage (those that would likely be expected to be elevated because of damage greater than 50 percent). This analysis resulted in the creation of several tables similar to the one in exhibit 13.

Exhibit 13

Severely Damaged Owner-Occupied and Single-Family Renter-Occupied Housing by Parish, Hydraulic Area, and Advisory Base Flood Elevations From Ground Level[a] for Homes in 100-Year Flood Plains or Levee-Protected Areas, April 25, 2006

Parish and Hydraulic Area	2000 Census		Owner-Occupied and Single-Family Rental Units With Severe Damage[b]				
	Total Population	Number of Occupied Housing Units	Number of Units With Severe Damage[c]	Number of Units To Be Elevated 3 Feet	Number of Units To Be Elevated 4 to 6 Feet	Number of Units To Be Elevated More Than 6 Feet	Total Number of Units to be Elevated
Jefferson Parish							
Hydraulic Area A (part)	5,523	2,362	84	39	0	0	39
Hydraulic Area C	106,634	35,609	389	82	127	133	342
Hydraulic Area D (part)	83,515	30,290	169	17	102	29	148
Hydraulic Area K (part)	251,978	105,166	2,549	687	17	1,796	2,500
Damage data not block geocoded			215	0	0	0	0
Outside hydraulic areas	7,816	2,807	151	0	0	0	0
Subtotal	455,466	176,234	3,557	825	246	1,958	3,029

[a] Elevation levels are calculated by subtracting the average NAVD88 (North American Vertical Datum of 1988) ground level elevation from the Advisory Base Flood Elevation (ABFE). If the result is less than 3 feet, the elevation is set at 3 feet per the advisory.

[b] Some of the structures may have been elevated to or above the advisory elevations before the event occurred.

[c] Severe damage is a rough approximation of 50 percent damage. It is based on Individual Assistance inspections or flood depths, not substantial damage data. Local building code officials determine the actual number of units with substantial damage for purposes of the National Flood Insurance Program. Recent data suggest that local officials have designated far fewer homes as more than 50 percent damaged than is shown in this chart.

[d] Orleans Parish requires homes be elevated 18 inches above the road crown. Because of this requirement, homeowners in Orleans Parish, are asked to elevate their homes another 18 inches.

Note: Because some addresses are not geocoded to the block level and determination of elevation requirements is made based on the ABFE and elevation of a census block, it was not possible to estimate the need for elevation.

Exhibit 13

Severely Damaged Owner-Occupied and Single-Family Renter-Occupied Housing by Parish, Hydraulic Area, and Advisory Base Flood Elevations From Ground Level[a] for Homes in 100-Year Flood Plains or Levee-Protected Areas, April 25, 2006 (continued)

Parish and Hydraulic Area	2000 Census		Owner-Occupied and Single-Family Rental Units With Severe Damage[b]				
	Total Population	Number of Occupied Housing Units	Number of Units With Severe Damage[c]	Number of Units To Be Elevated 3 Feet	Number of Units To Be Elevated 4 to 6 Feet	Number of Units To Be Elevated More Than 6 Feet	Total Number of Units to be Elevated
Orleans Parish[d]							
Hydraulic Area A (part)	312,007	127,244	45,615	21,822	18,883	1,878	42,583
Hydraulic Area B	94,820	32,830	17,383	12,436	3,895	16	16,347
Hydraulic Area D (part)	55,635	20,310	126	49	3	0	52
Hydraulic Area E (part)	19,515	6,802	4,569	2,076	104	0	2,180
Hydraulic Area G (part)	1,147	375	13	11	0	0	11
Damage data not block geocoded			1,260	0	0	0	0
Outside hydraulic areas	1,550	690	484	0	0	0	0
Subtotal	484,674	188,251	69,450	36,394	22,885	1,894	61,173
Plaquemines Parish							
Hydraulic Area D (part)	837	313	2	2	0	0	2
Hydraulic Area F	1,812	463	214	149	0	0	149
Hydraulic Area G (part)	9,011	3,087	19	8	0	0	8
Hydraulic Area H	10,457	3,578	1,996	1,863	60	63	1,986
Hydraulic Area J	2,526	827	154	89	18	4	111
Damage data not block geocoded			1,222	0	0	0	0
Outside hydraulic areas	2,114	753	355	288	40	0	328
Subtotal	26,757	9021	3,962	2,399	118	67	2,584
St. Bernard Parish							
Hydraulic Area E (part)	66,092	24,698	11,908	4,425	2,323	457	7,205
Damage data not block geocoded			374	0	0	0	0
Outside hydraulic areas	1,137	425	315	0	0	0	0
Subtotal	67,229	25,123	12,597	4,425	2,323	457	7,205

[a] Elevation levels are calculated by subtracting the average NAVD88 (North American Vertical Datum of 1988) ground level elevation from the Advisory Base Flood Elevation (ABFE). If the result is less than 3 feet, the elevation is set at 3 feet per the advisory.

[b] Some of the structures may have been elevated to or above the advisory elevations before the event occurred.

[c] Severe damage is a rough approximation of 50 percent damage. It is based on Individual Assistance inspections or flood depths, not substantial damage data. Local building code officials determine the actual number of units with substantial damage for purposes of the National Flood Insurance Program. Recent data suggest that local officials have designated far fewer homes as more than 50 percent damaged than is shown in this chart.

[d] Orleans Parish requires homes be elevated 18 inches above the road crown. Because of this requirement, homeowners in Orleans Parish, are asked to elevate their homes another 18 inches.

Note: Because some addresses are not geocoded to the block level and determination of elevation requirements is made based on the ABFE and elevation of a census block, it was not possible to estimate the need for elevation.

Next Steps

Because GIS can link data from multiple sources, it has been a very important tool to inform policymakers and planners on the extent and concentration of housing damage, the cost to repair, and the design of long-term recovery strategies.

GIS should have a continued important role in long-term recovery. HUD is currently exploring the use of GIS technology to help identify problem spots that may be holding back individual neighborhood recovery. For the most affected states—Mississippi and Louisiana—their current housing recovery strategies are demand driven, because they depend on the demand by individuals who require assistance with rebuilding their homes and who apply to the state for assistance that is funded through HUD's CDBG Disaster Recovery assistance.

As recovery progresses, however, it is likely that long-term recovery will have to be considered not only as assistance to individuals but also as assistance to neighborhoods. It is also quite likely that, for some reason, many property owners will not repair their homes. Although home repair is an individual choice, a tendency for property owners not to repair their homes could have serious negative consequences for other proximate property owners who do wish to repair their homes. The challenge will be identifying those properties where no effort is being taken to repair damage and determining a strategy to return those properties to productive use so they are not a nuisance for neighboring properties.

The Office of Policy Development and Research is exploring whether it would be possible to link the FEMA damage inspection data by address to local parcel data in order to more accurately pinpoint the location of the damaged properties. After locating the properties, PD&R would set up a mapping system that could be linked to data on loans and grants provided for home repairs, and local data on building permits so local officials could track neighborhood recovery.

The idea is for local officials to look at a block and quickly see for each home that was damaged, which homes are under repair (using local permit data), and from this know which properties have no activity. For those with no activity, officials could see if a grant or loan was provided. If not, the state or local government could proactively seek out the property owner and find out what his or her plans are for that property. The state or local government could then use a variety of tools to determine what is preventing that property from being returned to productive use.

Conclusions

Disasters do not comply with traditional geographic boundaries. GIS permits policymakers and planners to overlay the impacted areas of a disaster over existing data sources to estimate the impact of a disaster and judge to what extent federal and local resources might be required to facilitate long-term recovery. GIS also permits policymakers to test the costs and benefits of policy options. With the aftermath of Hurricanes Katrina, Rita, and Wilma, HUD used GIS more extensively than it had for any previous disaster to calculate risk of housing damage to HUD-assisted and HUD-insured housing and to estimate actual damage to all housing in the affected states. This analysis was critical for making decisions about how many resources for long-term recovery to use and where to target them. The analysis has also been critical for local officials in their design of programs that address their long-term recovery needs.

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Notes

1. Later comparison of the American Red Cross's October 2005 estimates with direct inspection data by the Federal Emergency Management Agency (which was not available until several months later) shows the Red Cross estimates of housing units damaged to be reasonably reliable, at least for doing initial recovery planning.
2. See http://www.dhs.gov/xlibrary/assets/GulfCoast_HousingDamageEstimates_021206.pdf.
3. Note that this map was based on preliminary disaster designations made by FEMA; the final designations are somewhat different.
4. For example, in 1997, Congress was motivated by the damage caused by floods in the upper Midwest and Hurricane Fran to appropriate $500 million toward disaster recovery of individual communities impacted by any disaster that had occurred in the prior 13 months. The U.S. Department of Housing and Urban Development (HUD) made 110 grants using a formula. In 2004, motivated by the four hurricanes striking Florida and affecting dozens of other states, Congress appropriated $150 million to address disasters that had affected any states in the prior fiscal year. As a result of these funding appropriations, HUD made 10 grants.
5. The data reflected only occupants of housing units eligible for Federal Emergency Management Agency housing assistance. As such, the data do not reflect other types of damaged housing units, such as predisaster vacant units and summer homes or second homes.
6. These assumptions of damage were most often made for homes in Orleans, St. Bernard, and Jefferson Parishes in Louisiana. A smaller number of homes in Mississippi were assumed destroyed based on their proximity to the storm surge.

7. See http://www.huduser.org/publications/pdf/GulfCoast_HsngDmgEst.pdf.
8. An Advisory Base Flood Elevation is not required. Local officials must adopt the advisory elevations before they become the official Base Flood Elevations under which the National Flood Insurance Program will issue flood insurance.

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Evaluating Length of Stay in Assisted Housing Programs: A Methodological Note

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This article reflects the views of the author and does not necessarily reflect the views of the U.S. Department of Housing and Urban Development.

Abstract

This study uses new methods and approaches that augment findings from previously completed research on length of stay in assisted housing programs. This study differs from previous research in six areas. First, most previous research used mean and median calculations for a single program year; the present study, however, evaluates data from an 8-year period of time—1995 to 2002. Second, due largely to data limitations, the prior research has generally focused on currently assisted households that continue to receive housing assistance. This new research includes data for households that have exited the programs (former households) to gain a broader perspective on housing tenure. Third, this study identifies multiple program participants, or mixed households, that moved between public housing and housing voucher programs across the eight-year study period. Using an 8-year data file allows for this type of identification. Fourth, this study separately identifies the length of stay for participants with very short durations (less than six months). The existence of this group might reflect an administrative data collection problem, or it may suggest some other phenomenon among assisted housing recipients worthy of further investigation. Fifth, this study systematically identifies data gaps, logical inconsistencies, and out-of-range data in the file using a data quality process that goes beyond what has been done in past work. Last, and perhaps most importantly, this study presents tenure estimates for assisted households based on median survival time that may be more realistic than calculations that rely solely on mean and median summary statistics. Estimates based on the life-table method produces statistics, including the median survival time, that account for the current cases in making predictions *about housing tenure.*

Introduction

Accurate and reliable length-of-stay estimates are necessary to inform budget and policy debate about the appropriate use and duration of time limits for households in the U.S. Department of Housing and Urban Development's (HUD's) subsidized housing programs. Such debate is already under way. Recent legislation introduced in the U.S. House of Representatives, H.R. 1999, the State and Local Housing Flexibility Act of 2005, proposed that, beginning in 2008, public housing agencies (PHAs) be allowed the discretion to establish term limits of no less than 5 years for households assisted by the Housing Choice Voucher (HCV) Program.[1] According to the bill, which has not been enacted, elderly and disabled households would not be subject to this provision of the bill until January 1, 2009.

Valid tenure estimates are also relevant for addressing perceptions about the extent to which housing assistance patterns reflect a way of life for some recipients. Discussing the HCV Program before a congressional committee in 2005, Secretary of HUD Alphonso Jackson noted that its "current program design has made housing assistance a permanent support for some families (Jackson, 2005). At a 2006 congressional subcommittee hearing on the future of public housing, HUD Deputy Secretary Roy Bernardi noted in a written statement that "[i]n the interest of making the most of a limited asset and in transforming public housing from a lifetime entitlement to a temporary resource," PHAs participating in the Moving to Work program were already testing term limits, rent reform, and employment incentives (Bernardi, 2006).

This study presents new results on length of stay in assisted housing that rely on some modifications to traditional methods and on an entirely new approach. Previous research by Lubell, Shroder, and Steffen (2003) on tenure in public housing and tenant-based assistance are based on mean (average) and median (the middle of a sorted distribution) calculations. The present study, although informed by those methods, amends the methods in several important ways. First, the present research evaluates data from an 8-year period of time, from 1995 to 2002. The prior study analyzed household records submitted to HUD's Multifamily Tenant Characteristics System (MTCS) as of September 30, 2000 (a 9-month period). We have created a longitudinal file that crosses the 8-year period and matches records on individual households. This process permits a more comprehensive and accurate assessment of length of stay.

Furthermore, the prior study focused on current households only, while the present one adds former participants.[2] Current households have not yet left assisted housing. For each of these households, the departure date, and, therefore, the ultimate length of stay, is still an unknown. Instead of an exit date, which current recipients lack, the latest effective date in the housing record is used to project the household's tenure. We believe it is worthwhile to include households that have actually exited (former households) in order to gain a broader perspective on housing tenure. Our research also identifies households that are likely unrecorded exits, which further augments the number of former participants for study.

Along with public housing and tenant-based assisted households, this study also includes a new group that the Lubell, Shroder, and Steffen (2003) work could not address. This group consists of the mixed program participants, or mixed program households, identified as those that moved between public housing and tenant-based assisted programs across the 8-year study period. These

households may reflect a unique tenure dynamic compared with those that are solely public housing or tenant-based assisted recipients, which makes their separate analysis useful.

In another departure, this research distinguishes between households that have received housing assistance at least 6 months or longer and all program participants (including those staying less than 6 months). Participants with very short durations (less than 6 months) might reflect an administrative data collection problem, or these characteristics may suggest some other phenomenon among assisted housing recipients that is worthy of further investigation. In any event, the resulting tenure calculations—with and without tenants of less than 6 months—could be very different and are worth comparing. Moreover, every family that exits assisted housing, even those with the shortest stays (assuming reliable data), means another vacant unit that can house a family that has likely been on a long waiting list.

Also, we have systematically identified data gaps, logical inconsistencies, and out-of-range data in the file by using a data quality process that goes beyond what has been done in past work. The data quality work includes checking for missing or invalid unique identifiers, missing admission dates, conflicting (multiple) admission dates, participation in more than one program, and invalid End of Participation (EOP) reports.

Findings

Using data from a specially created longitudinal file, we have drawn a 5-percent sample for all cases reported by PHAs to the MTCS over the 1995-to-2002 period. Households reported in this file include, among other variables, households that were receiving assistance at the time of reporting (current participants) and households that had left the program, an event that is reported to HUD as an end-of-participation event, or EOP (former participants).

Exhibit 1 provides general summary statistics on mean and median length of stay for nonelderly, nondisabled households (with and without children) and for all households. In contrast to the subsequent exhibits, these data do not distinguish among participants who have resided in assisted housing for more than 6 months or current and former enrollees. Households living in public housing stay the longest, followed by the mixed program households; tenant-based assisted households stay the least amount of time. Nonelderly, nondisabled households (regardless of the presence of children) have shorter stays than do tenants in assisted housing overall. These tenure trends are true across all selected program types (public housing, tenant-based assistance, or a multiple program mix). Nevertheless, estimates can vary widely between mean and median calculations. Median estimates, less sensitive to extreme scores, are shorter than mean statistics.

Not all results of the Lubell, Shroder, and Steffen (2003) study and the present one are comparable; however, the broad findings in exhibit 1 on mean and median housing tenure in public housing and tenant-based assisted programs compare favorably with some statistics in the Lubell, Shroder, and Steffen (2003) report. According to mean estimates, both studies indicate that all public housing tenants stay nearly twice as long as tenant-based assisted recipients. In contrast, our estimates are slightly shorter because we also included exiting households, which stay for shorter terms than do current participants. For example, Lubell, Shroder, and Steffen (2003) calculated a

mean length of stay for public housing at 8.50 years versus 7.46 in the present study. Their mean tenure for tenant-based assisted recipients was 4.75 years compared with our 4.24 years. In both the Lubell, Shroder, and Steffen (2003) study and the present study, median tenure between the public housing and tenant-based assisted programs was not as divergent, but public housing participants still stayed longer than their tenant-based assisted counterparts. The earlier work estimated a median length of stay in public housing at 4.69 years versus 3.97 years. According to Lubell, Shroder, and Steffen (2003), tenant-based assisted households stayed 3.08 years, while findings from the present study indicate slightly less time at 2.75 years.

Nonelderly, nondisabled households (with and without children) were highlighted in the present study (Lubell, Shroder, and Steffen [2003] also provided tenure for elderly and disabled households). Both Lubell, Shroder, and Steffen (2003) and this study found that such households, regardless of the presence of children, spend less time in assisted housing (public housing or the tenant-based assistance program) than do all recipients. Lubell, Shroder, and Steffen (2003), however, reported shorter mean and median stays for these households with children than those without children. These tenure trends applied to both the public housing and tenant-based assistance programs. In the present research, the trends were not as clear. Median length of stay was actually slightly longer for households with children than for those without them (2.12 years versus 1.95 years for public housing and 2.07 years versus 1.03 years for the voucher program; the same trend held true for mixed program participants). Meanwhile, mean tenure calculations reflected a similar pattern for tenant-based assisted households, but not so for the other programs. The findings for public housing and mixed program households reflected the trends of the prior study. Households with children that participated in either public housing (3.86 versus 6.12 years) or mixed programs (5.40 years compared with 6.23 years) had shorter tenures than their family counterparts without children, which compares favorably with patterns found in the Lubell, Shroder, and Steffen (2003) research. Furthermore, the present study reports lower tenure estimates across all categories compared with the earlier work. For example, public housing households with children spend a mean length of stay of 3.86 years versus 5.59 years (Lubell,

Exhibit 1

Mean and Median Length of Stay Among Selected Household Types, by Program (in reporting period)

Reporting Years 1995–2002				
Program	Measure	Households: Nonelderly/Nondisabled		Households: All Types
		Without Children	With Children	
Public housing	Mean	6.12	3.86	7.46
	Median	1.95	2.12	3.97
Tenant-based	Mean	2.99	3.41	4.24
	Median	1.03	2.07	2.75
Mixed	Mean	6.23	5.40	6.33
	Median	4.18	4.79	5.25

Notes: Tenant-based includes the Section 8 tenant-based certificate and voucher programs and the subsequent tenant-based Housing Choice Voucher Program (a merger of the certificate and voucher programs). These statistics are based on 5-percent samples of public housing, tenant-based, and mixed program households.
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

Shroder, and Steffen, 2003), and the median is 2.12 years compared with 3.17 years (Lubell, Shroder, and Steffen, 2003). Tenure for tenant-based assisted households with children reflects similar findings: 3.41 mean years versus 3.95 mean years (Lubell, Shroder, and Steffen, 2003) and 2.07 median years compared with 2.63 median years (Lubell, Shroder, and Steffen, 2003).

Average Mean Length of Stay in Public Housing

In exhibits 2 through 7, results (based on mean and median length of stay) are examined in much greater detail for all households reported to the system by program type, including those that are currently participating in any given year and those that have left in any given year. The results are examined for all households and for nonelderly, nondisabled households (with and without children) by program type. Exhibit 8 reports a new statistic—estimated median survival time (a new approach)—for these same households and program types, which will be discussed in more detail later.

In exhibit 2 we display results for the 5-percent sample file by reporting year. For example, the 1999 cases presented in this exhibit are households whose status as a current or former participant was reported to HUD in calendar year 1999. As mentioned before, for all household types enrolled in public housing, the mean length of stay during the 1995-to-2002 period was 7.46 years (see exhibit 2).[3] Average tenure is reported for two subsets of all participants: nonelderly, nondisabled households without children and nonelderly, nondisabled households with children. Each subset is further divided into current participants and former participants. Current participants include households reported to HUD to be receiving assistance as of a particular year, say 1999. In that year, the average length of stay for current nonelderly, nondisabled households without children

Exhibit 2

Mean Length of Stay Among Selected Household Types: Public Housing Program Only* (in reporting years)

Reporting Year(s)	Households: Nonelderly/Nondisabled				Households: All Types				All
	Without Children		With Children		Current		Former		
	Current	Former	Current	Former	6+ Months	All	6+ Months	All	
1999	10.72	3.23	4.74	2.83	10.64	9.43	6.51	5.32	8.15
2000	9.29	3.03	4.53	2.94	10.06	8.82	6.33	5.32	7.73
2001	9.70	3.22	4.80	3.09	10.61	9.45	6.46	5.51	8.55
2002	8.62	3.71	4.82	3.62	10.60	9.51	6.59	6.18	8.81
1995–2002	7.85	3.49	4.21	3.19	9.85	8.44	6.08	5.44	7.46

** Nonelderly households are those in which the household head and/or spouse is age 62 or less. In nondisabled households, neither the household head nor his or her spouse is disabled. Households with children include household members age 17 and less (their disability status is not relevant in this study). Before extracting the 5-percent sample, the larger file of more than 2 million public housing records was examined for data quality. Suspect admission dates (for example, selected ones prior to 1960) and effective dates were treated as missing data. For household records in which a transaction type 5 (portability move-out) was reported, the corresponding admission and effective dates for those years were set to missing values. Household records in public housing, tenant-based, and mixed programs were dropped in cases in which the age of the household head was implausible and no admission dates were reported across all years from 1995 to 2002. (See Technical Appendix A.)*

Note: These statistics are based on a 5-percent sample of public housing households (n = 102,495).

Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

was 10.72 years and 3.23 years for those households that left the program, which are widely divergent results. The comparable statistics for nonelderly, nondisabled households with children were 4.74 years for current participants and 2.83 years for former participants (surprisingly low numbers).

For 1999 and the other years reported in exhibit 2, households with children do not stay long in public housing compared with all public housing participants. Households with children (distinguishing between both current and former participants) consistently have shorter lengths of stay than the nonelderly, nondisabled households without children. This trend is clearer than the trend for tenure in exhibit 1 that included both current and former participants in the equation. According to those mean statistics, households with children residing in public housing or in mixed program households stayed in assisted housing for less time than their childless counterparts did; but households with children in the voucher program stayed longer.

Another pattern that holds up consistently is that tenure for public housing households that leave the program is shorter than the average stay for current participants. In other words, there are households with rather lengthy stays, but many other households stay for a brief time only.

Moreover, the differences between mean tenure for current and former participants can be considerable and may be heightened by the sensitivity of the mean (unlike the median) to extreme scores. Obviously, these results measuring average tenure for either current or former participants do not by themselves accurately capture length of stay.

Once again, when results are examined for all households reported to the system, both currently participating households and those that have left, including all household types regardless of age, disability, or presence of children, the average length of stay during the 1995-to-2002 period was 7.46 years. This estimate understates the actual length of stay, however, for the following reasons:

- The estimate includes households that had resided in public housing for less than 6 months, including many newly admitted households. It is reasonable to exclude such households, and doing so increases the length of stay by approximately 1.25 years. It is not clear why people move into assisted housing and then leave within 6 months.
- The estimate measures participation only through the actual effective date in the report, not the end date of the year of reporting, which understates the length of stay by approximately 0.5 years.
- For the portion of the estimate measuring length of stay for currently assisted households, the estimate describes the length of stay that has occurred through the as-of date, not the ultimate length of stay. Let's use the 2001 statistic as an example. For current participants staying 6 or more months, the average length of stay was 10.61 years and counting. We do not yet know the average length of stay for these households, but we do know that many households (seniors and people with disabilities) are unlikely to move and are aging in place.

Median Length of Stay in Public Housing

Exhibit 3 presents a distribution of length of stay in the public housing program by number of years receiving assistance, as well as median statistics, for some major categories that focus on households with children. These data suggest some general findings. Confirming trends from exhibit 2, households that actually leave public housing tend to have relatively short stays. About half of the households that leave have stays of 2 years or less, and this frees up public housing for use by others. It seems particularly noteworthy that some of the shortest observed stays are among households with children. So, on the one hand, the findings show that there really are people who stay in public housing for long periods of time, but, on the other hand, the average stays are quite short for many households, resulting in an overall average that is perhaps lower than expected.

Tenure estimates based on median calculations are typically shorter (often significantly) than those for mean length of stay because, as previously mentioned, the median is not as sensitive to outlier values, unlike the mean. Data are presented separately for households with children, including both current participants and former participants (that is, households that had left the program). When we look at the distribution of length of stay by number of years in public housing, we find that the median length of stay is only 3.97 years (compared with a mean tenure of 7.46 years). This observation means that half the households stayed less than 3.97 years, while the other half stayed longer. Approximately one-third of households enrolled in the program for at least 6 months have received assistance for up to 3 years compared with closer to 40 percent for all households. For

Exhibit 3

Distribution/Median Stay Among Selected Household Types: Public Housing Program Only (in interval of years)

Interval of Years (1995–2002)	Households With Children: Nonelderly/Nondisabled Household Heads								Households: All Types (Current and Former)			
	Current				Former				6+ Months (%)		All (%)	
	6+ Months (%)		All (%)		6+ Months (%)		All (%)					
0–1	**10.2**	*10.2*	**30.4**	*30.4*	**17.5**	*17.5*	**28.1**	*28.1*	**8.3**	*8.3*	**20.5**	*20.5*
1–2	**27.7**	*37.9*	**14.8**	*45.2*	**24.5**	*41.9*	**21.3**	*49.4*	**17.6**	*25.9*	**12.1**	*32.6*
2–3	**12.4**	*50.3*	**11.0**	*56.2*	**15.5**	*57.4*	**13.5**	*62.9*	**10.0**	*36.0*	**9.1**	*41.7*
3–4	**9.2**	*59.6*	**8.2**	*64.3*	**11.0**	*68.4*	**9.6**	*72.5*	**8.0**	*44.0*	**7.3**	*49.0*
4–5	**7.6**	*7.2*	**6.7**	*71.0*	**7.3**	*75.8*	**6.4**	*78.9*	**6.8**	*50.7*	**6.2**	*55.1*
5–6	**5.7**	*72.9*	**5.0**	*76.1*	**6.3**	*82.1*	**5.5**	*84.4*	**5.7**	*56.4*	**5.2**	*60.4*
6–7	**4.4**	*77.3*	**3.9**	*80.0*	**4.1**	*86.3*	**3.6**	*88.1*	**4.7**	*61.2*	**4.3**	*64.7*
7–10	**9.0**	*86.3*	**8.0**	*88.0*	**7.5**	*93.8*	**6.5**	*94.6*	**10.7**	*71.9*	**9.7**	*74.4*
10–15	**7.4**	*93.8*	**6.6**	*94.5*	**4.2**	*98.0*	**3.7**	*98.3*	**10.5**	*82.4*	**9.5**	*83.9*
15–20	**3.2**	*97.0*	**2.8**	*97.3*	**1.2**	*99.3*	**1.1**	*99.3*	**6.1**	*88.4*	**5.5**	*89.5*
20+	**3.0**	*100.0*	**2.7**	*100.0*	**0.7**	*100.0*	**0.7**	*100.0*	**11.6**	*100.0*	**10.5**	*100.0*
Median	3.35		2.25		2.39		1.99		5.00		3.97	

Boldface *data = interval.*
Italicized data = cumulative.
Notes: These statistics are based on a 5-percent sample of public housing households (n = 102,495). Each variable displays both interval and cumulative percentages.
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

both groups (all households and those in the program for 6 months or more), about one-third have had stays of between 3 years and 10 years. About 25 percent of all participants stay more than 10 years. For those in the program for 6 months or more, the percentage is slightly higher.

Once again, we see that all current households with children have a shorter median length of stay (2.25 years) than all households (3.97 years). For such households that have participated 6 months or more, the median length of stay is 3.35 years and 5.0 years for all households in the program longer than 6 months. Exhibit 3 also confirms that nonelderly, nondisabled households that actually leave public housing have much shorter lengths of stay (1.99 years) than currently participating households (2.25 years). For such households participating at least 6 months, those numbers are 2.39 years and 3.35 years for former and current households, respectively. Although the differences for median tenure between current and former participants are not as divergent as the comparable mean statistics are in exhibit 2, they deviate nonetheless. As with calculating mean tenure, calculating median tenure for either current or former participants, although providing some insight, may not adequately capture the true length of stay.

Average Mean Length of Stay in the Tenant-Based Program

Turning to the tenant-based program, exhibit 4 displays results for the 5-percent sample by reporting year. As in exhibit 2, the mean length of stay is reported for the same household types: nonelderly, nondisabled households without children and nonelderly, nondisabled households with children. Each household type is grouped into current and former participants.

As with public housing recipients, tenant-based households that left the program generally had shorter average stays than did current participants. Sometimes the differences are significant. For example, in reporting year 1999, the average length of stay for current nonelderly, nondisabled households without children was 5.29 years. Their counterparts that left the program stayed only about half that time (2.46 years). Among nonelderly, nondisabled households with children, the comparable numbers for current and former participants were 3.72 and 2.88 years, respectively.

Although tenure among current and former tenant-based participants was not as divergent as in public housing, it was noticeable nonetheless. For example, in 2000, current tenant-based participants (nonelderly, nondisabled households without children) stayed 5.10 years on average, while former participants stayed 2.83 years. In the public housing program, the comparable family type received assistance for 9.29 years, while those formerly in the program averaged 3.03 years, a much wider range of difference.

Results are also reported for current and former participants, regardless of family type. Current and former participants are grouped according to whether the household participated in tenant-based assistance for 6 months or longer. In 1999, current participants who had been in the program at least 6 months averaged 5.54 years, while the entire population of current tenant-based households stayed, on average, 4.72 years. In 1999, the mean length of stay for all households was even less, at 4.31 years.

Tenant-based households with children—both current and former participants—reported relatively brief average lengths of stay. In fact, among current participants, they generally indicated some of

the shortest tenures. Households without children that left the program, however, spent the least amount of time in public housing. Between 1999 and 2002, their stays ranged from 2.46 to 2.83 years.

Exhibit 4 invites some other comparisons to the findings for the public housing program (exhibit 2). Examining all households reporting to the system, including current and former participants, regardless of household type, the average length of stay over the 1995-to-2002 period was 4.24 years (in contrast to 7.46 years in public housing). The duration for households in the tenant-based program was usually less across all years and categories than for households in the public housing program. Nonelderly, nondisabled households with children that have left the program, however, are the exception; they had a shorter stay in public housing than those in the tenant-based program (3.19 years versus 3.34 years, respectively).

Exhibit 4

Mean Length of Stay Among Selected Household Types: Tenant-Based Program Only* (in reporting years)

Reporting Year(s)	Households: Nonelderly/Nondisabled				Households: All Types				All
	Without Children		With Children		Current		Former		
	Current	Former	Current	Former	6+ Months	All	6+ Months	All	
1999	5.29	2.46	3.72	2.88	5.54	4.72	4.16	3.39	4.31
2000	5.10	2.83	3.85	3.13	5.74	4.87	4.44	3.75	4.53
2001	4.57	2.83	3.74	3.34	5.88	4.83	4.72	4.05	4.65
2002	3.76	2.79	3.79	3.84	5.89	4.84	4.84	4.59	4.79
1995–2002	3.46	2.10	3.44	3.34	5.56	4.43	4.06	3.74	4.24

** Before taking the 5-percent sample, the larger file of more than 3 million tenant-based records was reviewed for data quality. Erroneous admission dates (for example, those prior to 1975) and effective dates were treated as missing data. For household records in which a transaction type 5 (portability move-out) or transaction type 9 (voucher or certificate search) was reported, the corresponding admission and effective dates for those years were set to missing values. (See Technical Appendix A.)*
Notes: Tenant-based includes the Section 8 tenant-based certificate and voucher programs and the subsequent tenant-based Housing Choice Voucher Program (a merger of the certificate and voucher programs). These statistics are based on a 5-percent sample of tenant-based households (n = 120,805).
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

Median Length of Stay in the Tenant-Based Program

Similar to the distribution/median stay statistics for public housing participants shown in exhibit 3, exhibit 5 displays a distribution for length of stay in the tenant-based program, as well as median statistics, according to the duration for which assistance was received. Patterns are similar to those found in exhibit 3 for public housing. According to exhibit 5, households with children (current and former) have a lower median length of stay (2.03 years and 2.30 years, respectively) than all households combined (2.75 years.) Unlike the comparable statistics for public housing, however, the contrast between these medians for current and former participants is not particularly striking.

In the tenant-based program the length of stay is relatively low for households with children but also relatively low for all households. Among all households, about 40 percent received assistance for 2 years or less. Of all households participating in the tenant-based program for 6 months or

more, about 40 percent report stays of 3 years or less. Compared with the data in exhibit 3, the pattern for median length of stay among current and former participants is less clear. Former participants, at least among households with children, stayed slightly longer in the program than did their currently participating counterparts (2.30 years versus 2.03 years, respectively). Among those in the program for at least 6 months, the pattern is reversed; current households with children stayed 3.09 years, while tenure was 2.59 years for former households with children.

In general, median length of stay is shorter for participants in the tenant-based program than for those in public housing. Nonelderly, nondisabled households that left public housing, however, were the exception; their stay was slightly less (2.39 years for those who stayed 6 months or more and 1.99 for all lengths of stay) than that for their tenant-based counterparts (2.59 years for those who stayed 6 months or more and 2.30 for all lengths of stay).

Exhibit 5

Distribution/Median Stay Among Selected Household Types: Tenant-Based Program Only (in interval of years)

Interval of Years (1995–2002)	Households With Children: Nonelderly/Nondisabled Household Heads								Households: All Types (Current and Former)			
	Current				Former				6+ Months (%)		All (%)	
	6+ Months (%)		All (%)		6+ Months (%)		All (%)					
0–1	**8.7**	*8.7*	**30.5**	*30.5*	**15.7**	*15.7*	**22.6**	*22.6*	**9.2**	*9.2*	**24.8**	*24.8*
1–2	**22.1**	*30.8*	**16.8**	*47.3*	**23.7**	*39.4*	**21.7**	*44.4*	**19.5**	*28.7*	**16.2**	*40.9*
2–3	**15.0**	*45.8*	**11.4**	*58.7*	**16.2**	*55.6*	**14.9**	*59.2*	**13.7**	*42.4*	**11.4**	*52.3*
3–4	**11.4**	*57.2*	**8.7**	*67.4*	**12.1**	*67.7*	**11.1**	*70.3*	**11.0**	*53.4*	**9.1**	*61.4*
4–5	**8.7**	*65.8*	**6.6**	*74.0*	**8.4**	*76.1*	**7.7**	*78.0*	**8.5**	*61.9*	**7.0**	*68.4*
5–6	**6.7**	*72.6*	**5.1**	*79.1*	**6.4**	*82.5*	**5.9**	*83.9*	**6.8**	*68.6*	**5.6**	*74.0*
6–7	**5.8**	*78.4*	**4.4**	*83.5*	**4.7**	*87.2*	**4.3**	*88.2*	**5.6**	*74.2*	**4.6**	*78.7*
7–10	**11.6**	*89.9*	**8.8**	*92.3*	**7.5**	*94.6*	**6.8**	*95.1*	**11.6**	*85.8*	**9.6**	*88.3*
10–15	**7.6**	*97.6*	**5.8**	*98.2*	**4.3**	*98.9*	**3.9**	*99.0*	**9.3**	*95.1*	**7.7**	*96.0*
15–20	**1.9**	*99.5*	**1.4**	*99.6*	**1.0**	*99.8*	**0.9**	*99.9*	**3.4**	*98.5*	**2.8**	*98.7*
20+	**0.5**	*100.0*	**0.4**	*100.0*	**0.2**	*100.0*	**0.1**	*100.0*	**1.5**	*100.0*	**1.3**	*100.0*
Median	3.09		2.03		2.59		2.30		3.56		2.75	

Boldface *data = interval.*
Italicized data = cumulative.
Notes: Tenant-based includes the Section 8 tenant-based certificate and voucher programs and the subsequent tenant-based Housing Choice Voucher Program (a merger of the certificate and voucher programs). These statistics are based on a 5-percent sample of tenant-based households (n = 120,805).
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

Average Mean Length of Stay in a Mixed Program

Households in this sample participated in more than one housing assistance program (public housing, tenant-based, and/or moderate rehabilitation) across the 1995-to-2002 period. Mixed program participants constitute a very small share of all assisted housing recipients, relative to other housing program participants. Generally, their length of stay across all years and categories was shorter than that of households participating only in public housing but was longer compared with tenant-

based households' length of stay (see exhibit 6). In an exception to that pattern, former nonelderly, nondisabled households (with and without children) participating in mixed programs tended toward longer tenures than did former public housing tenants. Among mixed program participants (across both reporting years and household types), former recipients of assisted housing had shorter tenures than did current participants, but the differences were not striking. In a familiar pattern, during the 1995-to-2002 period, households with children (current and former) had a shorter average tenure (5.75 and 4.98 years, respectively) than did all households combined (6.33 years). The latter statistic is lower than for public housing (at 7.46 years) but higher than the overall tenure in the tenant-based program (4.24 years). Median length of stay varied widely between former and current participants, meaning that neither measure adequately captured length of stay.

Exhibit 6

Mean Length of Stay Among Selected Household Types: Mixed Program Only* (in reporting years)

Reporting Year(s)	Households: Nonelderly/Nondisabled				Households: All Types				All
	Without Children		With Children		Current		Former		
	Current	Former	Current	Former	6+ Months	All	6+ Months	All	
1999	5.86	3.02	3.86	3.11	5.81	5.19	4.31	3.79	4.48
2000	6.36	4.35	4.89	3.85	6.28	5.79	4.95	4.57	5.17
2001	6.91	4.80	5.15	4.47	6.84	6.50	5.60	5.26	5.92
2002	7.93	5.42	6.34	5.57	7.77	7.61	6.53	6.34	7.02
1995–2002	7.24	5.13	5.75	4.98	7.29	7.06	5.85	5.62	6.33

**Data quality was evaluated in the 100-percent file of more than 300,000 records before the 5-percent sample was drawn. Suspect admission and effective dates, depending on the program, were set to missing values.*
Notes: These statistics are based on a 5-percent sample of mixed program households (n=15,174). Households in this sample participated in more than one housing assistance program (public housing, tenant-based, and/or moderate rehabilitation) in the 1995-to-2002 period.
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

Median Length of Stay in a Mixed Program

Exhibit 7 displays a distribution for length of stay among mixed program participants. Similar to findings for public housing and tenant-based households, mixed program households with children (current and former) have a slightly shorter median length of stay (5.07 years and 4.43 years, respectively) than all households combined (5.25 years). As with the comparable statistics for the tenant-based program, the contrast between these medians is not particularly striking. Of the households participating in more than one assisted housing program, about one-third stay 4 years or less. Compared with exhibits 3 and 5, overall median stays for mixed program participants are longer than those for public housing or tenant-based households.

Median Survival Time (Life-Table Analysis)

Traditional research methods have relied on mean and median summary statistics. Such calculations may not capture true length of stay because many of these households have not yet exited assisted housing programs. Exhibit 8 introduces a new approach. It displays a measure for length of stay based on survival analysis, known as the estimated median survival time.

Exhibit 7

Distribution/Median Stay Among Selected Household Types: Mixed Program Only (in interval of years)

Interval of Years (1995–2002)	Households With Children: Nonelderly/Nondisabled Household Heads								Households: All Types (Current and Former)			
	Current				Former				6+ Months (%)		All (%)	
	6+ Months (%)		All (%)		6+ Months (%)		All (%)					
0–1	**2.2**	*2.2*	**6.0**	*6.0*	**3.2**	*3.2*	**6.9**	*6.9*	**2.6**	*2.6*	**6.2**	*6.2*
1–2	**8.6**	*10.8*	**8.3**	*14.2*	**9.2**	*12.4*	**8.9**	*15.8*	**8.3**	*11.0*	**8.0**	*14.2*
2–3	**11.6**	*22.4*	**11.1**	*25.4*	**14.6**	*27.0*	**14.0**	*29.8*	**10.5**	*21.4*	**10.1**	*24.3*
3–4	**12.1**	*34.5*	**11.6**	*37.0*	**15.0**	*42.0*	**14.4**	*44.2*	**11.9**	*33.4*	**11.5**	*35.8*
4–5	**12.5**	*47.0*	**12.0**	*49.0*	**13.0**	*55.0*	**12.5**	*56.7*	**11.6**	*45.0*	**11.2**	*47.0*
5–6	**10.6**	*57.6*	**10.2**	*59.2*	**13.5**	*68.5*	**13.0**	*69.7*	**10.7**	*55.6*	**10.3**	*57.3*
6–7	**9.8**	*67.4*	**9.5**	*68.7*	**10.0**	*78.5*	**9.6**	*79.3*	**9.1**	*64.7*	**8.7**	*66.0*
7–10	**20.0**	*87.4*	**19.3**	*87.9*	**14.3**	*92.8*	**13.8**	*93.1*	**19.2**	*83.9*	**18.5**	*84.5*
10–15	**9.4**	*96.9*	**9.1**	*97.0*	**5.4**	*98.3*	**5.2**	*98.3*	**10.2**	*94.1*	**9.8**	*94.4*
15–20	**2.4**	*99.2*	**2.3**	*99.3*	**1.2**	*99.5*	**1.2**	*99.5*	**3.3**	*97.5*	**3.2**	*97.5*
20+	**0.8**	*100.0*	**0.7**	*100.0*	**0.5**	*100.0*	**0.5**	*100.0*	**2.5**	*100.0*	**2.5**	*100.0*
Median	5.24		5.07		4.59		4.43		5.43		5.25	

Boldface *data = interval.*
Italicized data = cumulative.
Note: These statistics are based on a 5-percent sample of mixed program households (n = 15,174).
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

Exhibit 8

Estimated Median Survival Time Among Selected Household Types by Program (in reporting period years)

Program	Method	Reporting Years 1995–2002		
		Households: Nonelderly/Nondisabled		Households: All Types
		Without Children	With Children	
Public housing	Mean	6.12	3.86	7.46
	Median	1.95	2.12	3.97
	Survival	4.09	3.91	8.30
Tenant-based	Mean	2.99	3.41	4.24
	Median	1.03	2.07	2.75
	Survival	3.32	5.93	7.82
Mixed	Mean	6.23	5.40	6.33
	Median	4.18	4.79	5.25
	Survival	6.87	6.77	7.24

Notes: Tenant-based includes the Section 8 tenant-based certificate and voucher programs and the subsequent tenant-based Housing Choice Voucher Program (a merger of the certificate and voucher programs). These statistics are based on 5-percent samples of public housing, tenant-based, and mixed program households.
Source: Multifamily Tenant Characteristics System merged data file for reporting years 1995 to 2002

Computations that include current participants are inherently biased because they underestimate the actual overall length of stay for assisted households. Excluding these households from the analysis is not a viable option, however, because it introduces still more bias. Dropping current participants means that households with some of the longest tenures in assisted housing would be underrepresented among the remaining cases, while those with the shortest stays would be overrepresented. Still another strategy to address these problems is also flawed: it is impractical to wait until all of a group of recipients have left assisted housing before tallying the recipients' lengths of stay. To overcome these problems, a statistical methodology is needed that offers some estimates about housing tenures and also accounts for both current and former participants.

Survival analysis is a set of statistical tools that answers questions about probabilities relating to survival time. Primarily developed in the biological and medical sciences, survival analysis has been widely adapted for use in many areas, such as actuarial, demographic, and economic research. One of the most basic tools in survival analysis is the life table. Constructing a life table is one of the simplest ways to describe survival times within a population sample.

A life table is a kind of enhanced frequency table: it is a distribution of survival times (the length of time intervals between one event and another, such as births and deaths). Often the data for the life table includes some cases for which the second (or terminal) event (such as death) has not yet occurred, which are known as censored cases. In a life table, the array of survival times is divided into smaller intervals. Cases are then allocated among those smaller survival time intervals. Cases that are observed for at least a certain time period are used to predict the likelihood of an event occurring at that particular time. In turn, the probabilities estimated at each interval are invoked to assess the overall chances of an event happening at different points in time.

For many years, actuaries and demographers have constructed life tables to describe aspects of human mortality, such as the expectation of life (at birth). This term is defined as the mean number of years a person would live, given the age-specific death rates used to construct the table.

The analysis of survival times, however, can refer to many other types of events—not just mortality. For example, life tables can also address survival issues related to housing assistance tenures—such as the likelihood that a household will stay in assisted housing until a certain time and the timing of housing exits. The method derives its estimates from households that have actually left assisted housing and also those that have not yet exited. Distributions produced in a life-table analysis can complement (or even replace) conventional length-of-stay calculations for assisted housing.

A life-table analysis in Statistical Packages for the Social Sciences (SPSS) was conducted on a 5-percent sample of public housing, tenant-based, and mixed program recipients for the reporting years 1995 to 2002. The three data sets included households that had already left assisted housing and those that had not yet exited (censored cases). The life-table method produced various statistics, which are explained in greater detail in Technical Appendix B.

One of those estimates is especially useful in summarizing housing tenure: the median survival time. It is the estimated tenure at which exactly half the households would still be expected to survive as housing recipients while the other half would have exited.[4] Exhibit 8 compares median survival time with previously displayed statistics for mean and median length of stay. According to the table in this exhibit, all public housing households stay longer in assisted housing (8.30 years)

based on median survival time than do tenant-based (7.82 years) or mixed program recipients (7.24 years). The estimate of 8.30 years for public housing is similar to the mean statistics calculated by Lubell, Shroder, and Steffen (2003) (8.50 years) and the present study (7.46 years). The median survival time for tenant-based households (7.82), however, is much longer (by two to three times) than mean and median findings under Lubell, Shroder, and Steffen (2003) or this research. Under survival analysis, mixed program households, not voucher holders, have the shortest tenures (7.24 years). The differences between these estimates, however, are fairly narrow. Tenant-based households with children still stay longer (5.93 years) than their childless tenant-based counterparts (3.32). This finding is in contrast to Lubell, Shroder, and Steffen (2003) but is consistent with some of the trends found in the present research. Similar to the findings of the two studies, these households (with and without children) also have a shorter tenure when compared with all tenant-based households (7.82 years). Furthermore, the survival estimates often exceed most of the comparable mean and median length-of-stay estimates in both studies (especially median tenure). These lengthier survival time estimates contradict some trends from the previous two studies. For example, survival analysis indicates, in contrast to mean and median tenure calculations, that nonelderly, nondisabled tenant-based households with children stay longer by 2 years than do their counterparts in public housing (5.93 years for tenant-based participants versus only 3.91 years for public housing). According to mean and median estimates in the present study, households with children in public housing actually stayed slightly longer (3.86 and 2.12 years) than did their tenant-based counterparts (3.41 and 2.07 years). The Lubell, Shroder, and Steffen (2003) study also estimated a longer tenure for households with children in public housing 5.59 (mean) years and 3.17 (median) years, in contrast to their counterparts in the tenant-based program: 3.95 (mean) years and 2.63 (median) years.

Conclusion

Tenure estimates for assisted households based on median survival time may be more realistic than calculations that rely on mean and median summary statistics. Estimates based on mean and median length of stay make no assumptions about how long current participants will stay in assisted housing. The latter methods are more likely to underestimate tenure because current recipients have not yet left the program. On the other hand, the life-table method produces statistics, including the median survival time, that account for the current cases in making predictions about housing tenure. It is a relatively simple calculation that only requires a few variables. In addition to a variable indicating the number of years a household has received assistance (from which mean and median statistics are also derived), the only other variable needed to estimate median survival time is one that flags households that have exited assisted housing. The life table (and its associated median survival time statistic) should be seriously considered as a viable alternative method for more accurately and realistically measuring tenure in assisted housing programs.

Technical Appendix A: Data Quality and Scope

This study is based on samples drawn from merged Multifamily Tenant Characteristics System data for the years spanning 1995 to 2002. Before analyzing length of stay in the 5-percent sample files, an extensive data quality review was performed on the longitudinal data file (the 100-percent count). Suspect or unreliable household records were deleted, and some cell entries were either recoded or set to missing values. Some of the most important items addressed during the data quality check are admission dates, effective dates, age of the household head, mixed program participation, transaction types (portability move-out and voucher search), and unrecorded exits, all of which are discussed in the following sections.

Admission Dates

Unique identifiers for each household head in the 100-percent file were reviewed to determine whether each household had at least one admission date. About 16.8 percent of all household records lacked an admission date across all 8 years (from 1995 to 2002). These records were dropped because, without an admission date, calculations for length of stay would be impossible for these households.

Such records were also examined to assess the extent to which more than one unique admission date per household existed across the 1995-to-2002 period. Although most household records (68.6 percent) contained only one unique admission date for each household head, more than one unique admission date existed for some households. In those cases, the earliest admission date was used when calculating tenure for these households.

Admission dates were also checked for validity. Public housing admission dates before January 1, 1960, were especially scrutinized. Dates before January 1, 1938, were considered invalid and the values were set to missing values in the file. Likewise, erroneous admission dates for households that exited before January 1, 1975, for records in the voucher program were considered invalid and the values were set to missing.

Effective Dates

Suspect effective dates—those recorded after December 31st of a particular reporting year—were recoded as missing values. For example, for reporting year 1995, any effective date for the year 1996 was identified as a questionable cell entry and was set to missing value.

Household Head Age

Household records were dropped in cases in which the age of the household head was implausible. These were records in which the difference between the minimum and maximum household head age across the 1995-to-2002 period was 10 years or more.

Mixed Program Participation

Households in the longitudinal file were reviewed for the extent to which they were assisted by the same program (either public housing or vouchers) or by a mixed program across 1995 to 2002.

About 52.8 percent of all households resided in only public housing during these years, while 41.6 percent participated only in the voucher program. A mere 5.6 percent of households in this file participated in more than one of these programs (including moderate rehabilitation) over the 8-year period.

Transaction Types: Portability Move-Out and Voucher Search

In the public housing program, household records that included a transaction type 5 (portability move-out) for certain years were identified. The corresponding admission and effective dates for those years were set to missing values.

In the voucher program, household records in which a transaction type 5 (portability move-out) or transaction type 9 (voucher search) occurred in certain years were flagged. The corresponding admission and effective dates for those years were recoded as missing values.

Unrecorded Exits

Because some households may have left assisted housing without the public housing agency having generated an exit record, all household records in the public housing and tenant-based programs were evaluated for unrecorded exits. Households were recoded as exits (and added to the pool of former participants that already had an exit record) if an End of Participation (EOP) record was absent and reporting had lapsed for the past 2 or more consecutive years. For example, households that last reported in 2000, but failed to do so in either 2001 or 2002, fell into that category. If an EOP flag was also lacking, these households also qualified as unrecorded exits.

Technical Appendix B: Survival Analysis (Life Tables)

Interpreting the Life-Table Output

To illustrate the Statistical Packages for the Social Sciences (SPSS) life-table output, 1996 cohort data from the public housing program (based on the 5-percent sample file) were analyzed. A 1996 cohort in public housing is one that enters the program (for the first time) in 1996. This cohort has a 1996 admission date and either a new admission or an End of Participation code (a transaction type of either 1 or 6). SPSS produced both a table and graphs, as shown in exhibits B-1, B-2, and B-3, which require some detailed explanation.

Interval Start Time

The distribution of survival times is divided into a certain number of intervals. In the table in exhibit B-1, it represents length of stay in assisted housing according to 1-year time frames (0 to 1, 1 to 2, 2 to 3, etc.). For the 1996 cohorts, lengths of stay among individual households ranged from 0 to 6.86 years. Seven intervals capture that distribution.

Number Entering This Interval

This output is the number of households that were receiving assistance at least at the beginning of the interval. For example, 1,920 households received assistance for at least 1 year.

Exhibit B–1

Life-table Analysis of 1996 Cohorts: Public Housing Only (5-Percent Sample)

Interval Start Time	Number Entering This Interval	Number Withdrawn During Interval	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End	Probability Density	Hazard Rate
0	2,647	417	2,438.5	310	0.1271	0.8729	0.8729	0.1271	0.1358
1	1,920	141	1,849.5	237	0.1281	0.8719	0.7610	0.1119	0.1369
2	1,542	82	1,501	167	0.1113	0.8887	0.6763	0.0847	0.1178
3	1,293	76	1,255	141	0.1124	0.8876	0.6004	0.0760	0.1190
4	1,076	204	974	113	0.1160	0.8840	0.5307	0.0697	0.1232
5	759	306	606	115	0.1898	0.8102	0.4300	0.1007	0.2097
6	338	262	207	76	0.3671	0.6329	0.2721	0.1579	0.4497

The median survival time for these data is 5.3 years

Interval Start Time	Standard Error of Cumulative Proportion Surviving at End	Standard Error of Probability Density	Standard Error of Hazard Rate
0	0.0067	0.0067	0.0077
1	0.0090	0.0068	0.0089
2	0.0101	0.0063	0.0091
3	0.0108	0.0061	0.0100
4	0.0114	0.0063	0.0116
5	0.0125	0.0087	0.0194
6	0.0164	0.0151	0.0503

Exhibit B–2

Survival Function for 1996 Cohorts (5-Percent Sample)

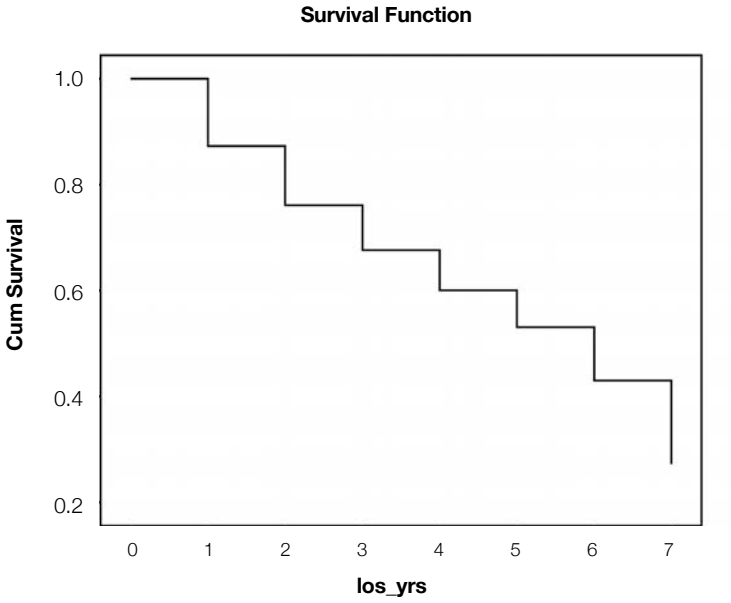
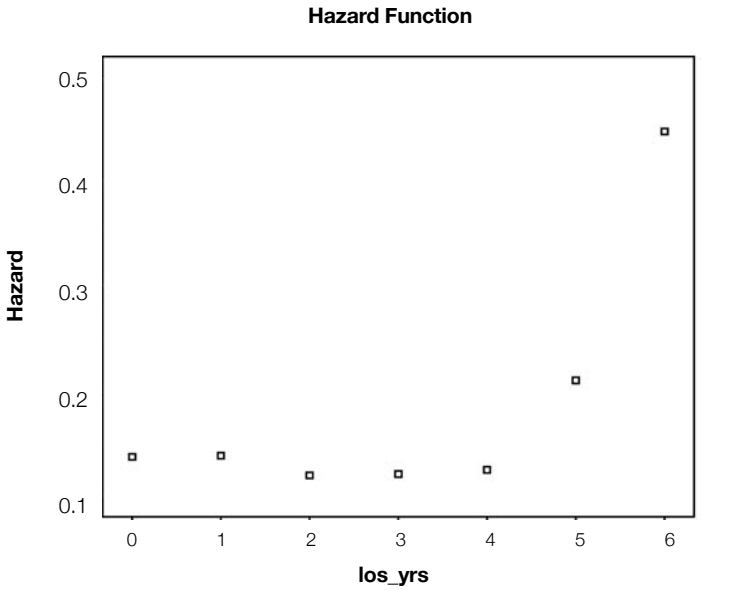


Exhibit B–3

Hazard Function for 1996 Cohorts (5-Percent Sample)



Number Withdrawn During Interval

This output is the number of current participants. As recipients for certain time periods, they have not yet left assisted housing. Known as censored cases because the terminal event (a housing exit) has not occurred, they are also termed withdrawn because they do not appear in later intervals (these cases are lost to observation). For instance, 141 cohorts are current recipients with tenures of at least 1 year but less than 2.

Number Exposed to Risk

This output is the estimated number of households entering an interval that are potentially at risk for exiting assisted housing. At the start of year 1, a projected 1,849.5 households are exposed to the risk of terminating housing assistance. The number exposed to risk is derived by subtracting half the withdrawn (censored) cases from the number entering the interval [1,920 – (141 / 2) = 1,849.5]. This estimate is notable because the last five columns in the life table are based either directly or indirectly on the risk set

Number of Terminal Events

This output is the number of former participants—the number of households that left assistance during a certain time interval. In exhibit B-1, 237 households left housing assistance after a stay of at least 1 year but less than 2 years.

Proportion Terminating

This output is the share of households that ended their stay during a certain year. Accordingly, 12.81 percent of households left after receiving assistance for at least 1 year but less than 2 years. The proportion terminating is calculated by dividing the number of terminal events (housing exits) by the number of cases at risk in the interval (237 / 1,849.5 = 0.1281).

Proportion Surviving

This output is the proportion of households that were current participants through a given year. Thus, 87.19 percent of households were still recipients with a length of stay of at least 1 year but less than 2 years. The proportion surviving is calculated by subtracting the proportion terminating from 1 (1 – 0.1281 = 0.8719).

Cumulative Proportion Surviving at End

Also known as the survival function, this output indicates the likelihood that a household will continue to receive housing assistance up to and through the end of a given year. For example, there is a 67.63-percent chance that a household will receive assistance at least through the end of year 2. The cumulative share of surviving households is computed by multiplying the prior cumulative proportion surviving at end value by the current proportion surviving (0.7610 * 0.8887 = 0.6763). So an estimated 67.63 percent of households remained on assistance (or survived) up to the end of year 2.

The graph in exhibit B-2 plots the survival function associated with this column. It shows that the estimated survivor rate declines a little more in the first few years than in years 3 and 4 and that a marked drop occurs by the end of year 6 (27.21 percent).

Probability Density

This output is the estimated probability of exiting assisted housing during a particular year. In year 2, a household had an 8.47-percent chance of ending its housing tenure. The probability density is derived by subtracting successive values in the column labeled "Cumulative Proportion Surviving at End" (0.7610 – 0.6763 = 0.0847).

Hazard Rate

This output is also known as the hazard function, or the estimated rate at which households exit assistance in a certain year. Stated another way, it is the likelihood that a household receiving assistance up to the beginning of a certain year will leave at the end of the year. For instance, households with a length of stay of up to 1 year have a 13.69-percent chance of terminating before year's end. (Because hazard rates can take on values greater than 1, they are not true probabilities.) The hazard rate is calculated by dividing values in the Probability Density column by averages of successive entries in the Cumulative Proportion Surviving at End column, as demonstrated for year 2 [2 * 0.0847 / (0.7610 + 0.6763) = 0.1178].

The graph in exhibit B-3 plots the hazard function (or exit rate) associated with this column. Among the 1996 cohorts, the graph shows that the estimated exit rates for public housing recipients were slightly higher in the first 2 years than for years 3 and 4, but they rose more sharply for years 5 and, especially, for year 6, in which the predicted exit rate rose to almost 45 percent.

Median Survival Time

This output is the point at which the survival function (the column for Cumulative Proportion Surviving at End) is equal to 50 percent (also known as the 50th percentile). It is the estimated tenure at which exactly half the households would still be expected to survive as housing recipients while the other half would have exited. According to the table in exhibit B-1, the estimated median survival time is 5.3 years.

Median survival time is constructed directly from the output column for Cumulative Proportion Surviving at End. The table indicates that the 50th percentile lies somewhere around years 4 and 5 (between 0.5307 and 0.4300). The following equation yields the median survival time for this life table: 5 + (0.5307 – 0.5) / (0.5307 – 0.4300) = 5.3 years.

Also, the median survival time can be visualized using the survivor function plot (see the figure in exhibit B-2). The vertical (or y axis) indicates the survival values. A horizontal line can be drawn at the 50th percentile and followed until it meets the curve: the point of intersection (as noted by the values on the x axis) is the median survival time. (The 50th percentile for the cumulative survival function is usually not the same as the point in time up to which 50 percent of the sample survived—this would be the case only if there were no censored observations before this time; that is, if those sample records had known outcomes.) Median survival time is commonly used to summarize the survivor function.

Standard Error of Cumulative Proportion Surviving at End

This output is the error associated with the cumulative proportion estimate. For year 2 (where the cumulative proportion surviving at end is 0.6763), the standard error is +/– 0.0101. At one standard deviation, there is a 68.26-percent chance that the cumulative proportion falls between 0.6662 (0.6763 – 0.0101) and 0.6864 (0.6763 + 0.0101).

Standard Error of Probability Density

This output is the estimated error surrounding the probability density. For example, in year 2, the probability density of 0.0847 has a standard error of +/– 0.0063. The resulting 68.26-percent confidence interval ranges from 0.0784 (0.0847 – 0.0063) to 0.091 (0.0847 + 0.0063).

Standard Error of Hazard Rate

For year 2, the error associated with a hazard rate of 0.1178 is +/– 0.0091. This means that at one standard deviation (68.26 percent), the estimated hazard rate lies between 0.1087 (0.1178 – 0.0091) and 0.1269 (0.1178 + 0.0091).

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Notes

1. State and Local Housing Flexibility Act of 2005, H.R. 1999, 106th Congress, 1st Session (2005). The text of H.R.1999 is posted at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:h1999ih.txt.pdf. An identical bill, S. 771, was introduced in the U.S. Senate at about the same time (April 2005). State and Local Housing Flexibility Act of 2005, S. 771, 109th Congress, 1st Session (2005). The text can be accessed at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:s771is.txt.pdf.

2. To support their case for using only current participants, Lubell, Shroder, and Steffen (2003) included in their appendix a few length-of-stay calculations comparing current recipients with those who had ended their participation.

3. All tenure calculations were informed by the difference between the latest effective date (for the last housing transaction in the file) and the earliest admission date for every household record across all years from 1995 to 2002.

4. In this context, *median survival time* does not relate to mortality; that is, it does not estimate a recipient's remaining life span. In this study, it merely estimates the time it will take for half of the recipients to leave assisted housing. (See Technical Appendix B for an expanded explanation of median survival time.)

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Additional Reading

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Freeman, Lance. 2005. "Does Housing Assistance Lead to Dependency? Evidence From HUD Administrative Data," *Cityscape: A Journal of Policy Development and Research* 8 (2): 115–134.

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