Reduction of Worst Case Housing Needs by Assisted Housing

Assisted Housing
Research Cadre Report

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PD&R

Preface

This report investigated what impact additional units of HUD-assisted housing would have on the number of the number of worst case needs (WCN) within a particular market. This issue affects policy discussions about the impact of current HUD assistance for 5.06 million units and the marginal impact of devoting additional resources.

The report found that housing assistance does reduce worst case needs for housing, confirming prior work that used basic methods. Simple bivariate models were used on metropolitan level American Housing Survey data to compare WCN as a percentage of very low-income renters to assisted housing as a percentage of such renters. Similar prior work covering extremely low-income families with children during the 1990s found a reduction of 76 WCN households for each 100 additional assisted units in the market.

A literature review found numerous market forces that potentially affect the relationship of assistance levels to WCN.   This literature indicates that scarcity of housing units that are eligible for assistance; price levels and affordability; condition of units; and local regulations are market conditions that will affect this relationship. This literature also indicates that income levels and poverty; unemployment and labor supply; educational attainment; minority concentrations; household types; and 'gentrification' of neighborhoods also affects this relationship. Other factors that can affect this relationship are: absorption of assisted housing, including potential displacement of unsubsidized stock by subsidized units; location of assisted units; voucher success rates; price effects of vouchers; and fragmented administration of voucher resources.

The report concludes that the overall estimated reduction in WCN was 68 households per 100 units of assistance. Metropolitan regression models were tested that control for factors identified in the literature review that influence the incidence of WCN. These analyses increased the estimates of the reduction in WCN attributed to incremental units, in the range of 80 to 90 households per 100 new assisted housing units. Metropolitan areas with income or rent levels above national averages show evidence of greater reduction in WCN than metropolitan areas with income or rent levels below national averages. However, a discussion of the implications of these estimates for program operations was beyond the scope of this report.

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EXECUTIVE SUMMARY

This report seeks to answer the question, when units of assisted housing are added to a market, is there a commensurate reduction in the number of households with Worst Case Needs (WCN), defined as unassisted renter households with very low-income (VLI) who pay more than 50 percent of income on housing or live in severely inadequate conditions or both?

Findings

• Simple bivariate models were constructed comparing WCN as a percent of VLI renters to assisted housing as a percent of VLI renters.

o Prior work examined metropolitan areas in the 1990s and found a reduction in WCN of 76 households for each 100 additional assisted units in the market.
o This work was replicated with more recent data and finds a reduction in WCN of 68 households per 100 units of assistance.

• The study of metropolitan areas was expanded to build models predicting the reduction in WCN controlling for many of the supply and demand conditions that influence the incidence of WCN.

o The estimated reduction in WCN rose to 87 households per 100 incremental assisted units with an Ordinary Least Squares model.
o The estimate reduction rose still further to 94 households with a Weighted Least Squares model with weights based upon the size of the rental population.

• Sensitivity tests were made to see if the estimated reduction varied as a function of income levels and prices within the metropolitan areas.

o Metropolitan areas with above national average income levels show evidence of greater reduction in WCN.
o Metropolitan areas with above national average rent levels show similar evidence of greater reduction in WCN.

• Because about 85 percent of assisted households are drawn from the VLI population, it seems likely that among the available estimates made of the reduction in WCN per 100 incremental assisted units, the best estimates are in close proximity to this figure, in the range of 80 to 90 households per 100 new assisted housing units.

Chapter 1. INTRODUCTION

The purpose of this study is to identify and document relevant factors affecting the impact of incremental changes in the count of HUD-assisted housing on the number of very low-income renter households that have worst case housing needs within a housing market. Specifically, if the number of assisted households is increased in a housing market, will there be a commensurate decrease in the number of renter households with worst case needs?

Worst case housing needs (WCN) are experienced by unassisted very low-income renters who either: 1) pay more than one-half of their monthly income for rent; or 2) live in severely inadequate conditions; or 3) both. HUD defines "very low-income" (VLI) as household income below 50 percent of the local area median income (AMI) (Hardiman et al., 2010).

The extent of Worst Case Needs in the United States is defined in HUD's periodic reports to Congress.   A recent report analyzes data from the 2007 American Housing Survey (Hardiman et al., 2010). The number of households with worst case housing needs in 2007 was 5.91 million households, containing 12.97 million individuals. This count of households was a slight (and statistically insignificant) decrease from the 5.99 million worst case needs in 2005. The small decrease in worst case needs from 2005 to 2007 occurred following a large and statistically significant increase during the 2001 to 2005 period. The number of households with worst case needs increased from 5.01 million in 2001, to 5.18 million in 2003, to 5.99 million in 2005. The latest report analyzes data for 2009 and finds a 20 percent increase in WCN households to 7.1 million. This sharp increase reflects the challenging housing conditions brought about with the recession of 2008 to 2010 (Steffen et al., 2011).

Assisted households are those households served by the various HUD rental assistance programs including the project-based programs of public housing, Section 8 New Construction/Substantial Rehabilitation, Section 236 plus a few other multi-family programs, as well as the tenant-based Housing Choice Voucher program.

The current inventory of HUD assisted households and housing units is estimated to be 5.06 million units and households (U.S. Department of Housing and Urban Development, 2008). The largest of these programs is the Housing Choice Voucher (HCV) program with 2.21 million households. (See Exhibit 1.) The remaining 2.85 million units are distributed across various project-based programs with public housing the largest at 1.16 million units. Note that the Low-Income Housing Tax Credit (LIHTC) program, with 1.67 million units, is not under HUD supervision and serves households whose income generally places them within the range of 30 to 60 percent of the AMI. Thus, many of these households may have higher income than the very low-income households served by the various HUD programs. In addition, many LIHTC units are occupied by households with Housing Choice Vouchers. For these reasons, the LIHTC units are not included in this analysis.

Exhibit 1.   **Count of Assisted Housing and Households Under HUD Supervision 2008**

Housing Program	Units or Households (000s)
Housing Choice Vouchers	2,210
Public Housing	1,156
Section 8 New Construction/Substantial Rehabilitation	1,116
HUD Miscellaneous Multifamily Programs	329
Section 236	225
Section 8 Moderate Rehabiliation	27
TOTAL	5,063

Source: U.S. Department of Housing and Urban Development, 2008.

Note: Funded units may include counts of vacant as w ell as occupied units.

It is estimated that, among the assisted households, 84.6 percent had incomes below the very low-income threshold (Hardiman et al., 2010). Thus, 4.28 million very low-income households are assisted by HUD programs. In the absence of assistance, a very large proportion of these households would be among the WCN population. Thus, 4.28 million very low-income renter households receive assistance in 2008 while a larger 5.91 million unassisted households suffer from worst case housing needs at that time.

It is worth noting that these estimates of WCN are based on data from the American Housing Survey (AHS) which relies upon self-reporting of income and housing assistance. This reporting has been found to contain both false positive and false negative responses (Shroder & Martin, 1996). With changes in the AHS questions, the reporting of income and assistance is now more reliable (Gordon, Chipungu, Bagley, & Zanakos, 2005).

Housing affordability problems can be the manifestation of insufficient income or scarce housing with high prices, or both of these conditions. Katz and Turner (2007) suggest that affordability problems are made worse by a combination of rising income inequality and constrained housing supply that is evident throughout the country, but these problems play out differently in different metropolitan contexts. The problems can be particularly intense in economically prosperous areas, where expanding employment opportunities attract in-migration. Areas with weaker labor markets do not face the same growth pressures, keeping housing costs from rising as fast. In these markets, unemployment is higher and wages are lower. However, housing affordability problems can be just as severe in low-wage markets as in high-wage markets. As a consequence, in markets across the country, growing shares of low- and moderate-income households are paying rent burdens that are considered unaffordable by federal standards. In 2007, about 40 percent of all renter households with annual income below $30,000 were paying more than 50

percent of their income towards housing costs (U.S. Department of Housing and Urban Development & U.S. Department of Commerce, 2008).

This research explores the effectiveness of federal rental housing assistance as a means to remedy these housing affordability problems. The model being explored relates the incidence of renters with WCN to the incidence of federal housing assistance in housing markets across the nation.

This study examines metropolitan areas. Models were fitted to estimate the extent to which the incidence of households with WCN declines with increases in the incidence of federal rental housing assistance. The expectation was that each additional household helped with rental housing assistance would reduce the count of worst-case needs households. This reduction is the primary impact of incremental increases in housing assistance on the count of worst-case needs.

Market forces as well as program characteristics could influence the primary impact. Any factor that can either significantly explain variation in the count of worst case renter households in a marketplace or significantly affect the capacity of a marketplace to absorb additional HUD housing assistance could influence the relationship. These factors operate as a set of secondary processes in the relationship between assisted housing and the WCN households. These secondary factors were entered as controls in the various models. These control variables operate on either the supply side or the demand side of the market.

On the supply side, potential control variables may describe the:

- Scarcity of units assessed in terms of vacancy rates and price levels.
- Condition of the stock in terms of its quality and location.
- Usage of the stock in terms of the number of occupants in units.
- Local government constraints that limit the capacity of suppliers to add units.

On the demand side, potential control variables may describe the:

- Income levels of households and the incidence of poverty.
- Labor supply and unemployment levels.
- Human capital accumulation of the households.
- Racial and ethnic composition of the households.
- Incidence of female-headed, disabled and elderly households.
- Presence of a gentrification process.

As part of the provision of housing assistance, control variables may potentially describe the:

- Success rates of placing assisted households into private housing.
- Fragmented administration of housing assistance.
- Composition of assisted housing.
- Price response to the presence of vouchers.

Finally, the structure of the metropolitan market itself may influence the relationship between housing assistance and WCN. As the metropolitan market segments into separate individual housing markets, the substitutability of housing between individual submarkets will influence the effectiveness of housing assistance. Within a metropolitan area, VLI renters may not have ready access to all rental housing priced at a level affordable to them. Barriers may exist due to distance from schools, transportation or services. Barriers may exist due to race or ethnicity. Barriers may exist due to differences in the willingness of landlords to accept vouchers as a means of payment. These barriers can break up the metropolitan rental market into submarkets. Ideally, these submarkets would be the unit of analysis for any research on the elasticity of WCN. If the unit of analysis is the entire metropolitan area, the true relationship between WCN and housing assistance may be hard to determine because of an inability to properly delineate submarkets.

Chapter 2. PRIOR RESEARCH

The Direct Impact of Assisted Housing on WCN

The theory of the direct impact is straight forward; each additional assisted household, whether assisted through a voucher or through production subsidy, should take a household out of the WCN category, at least to the extent that households who enter into housing assistance programs are drawn from the WCN population. This simple relationship was estimated by Shroder (2002a) and again by Khadduri, Shroder and Steffen (2003). They find for a set of metropolitan areas the expected, statistically significant negative correlation between the percentage of assisted families and the percentage of worst case needs. The coefficient was estimated at -.76. This suggests that the elasticity at the mean is -.83.[1] Given the scales of the two populations, with WCN larger at 5.91 million households and assisted households smaller at 5.16 million, it would be expected that a one percent rise in assisted households would generate less than a one percent decline in WCN. However, at -.76, the coefficient does suggest that incremental assisted housing is causing a less than a one-for-one reduction in WCN households. The less than one-for-one reduction may be the result of a variety of secondary market forces.

The Secondary Impacts of Market Forces

Many economic factors may affect the supply and demand of units affordable to very low-income renters. Each of the factors may influence the relationship between housing assistance and WCN.

Supply conditions

Problems with housing affordability are very much a function of the adequacy and pricing of the supply of housing in a marketplace. A great deal of research addresses the problems surrounding the supply side of a rental housing market.

• **Scarcity**

Theory: If a housing market is tight, especially with a shortage of units in the segment of the market serving very low-income renters, this could exacerbate the count of WCN. Too many very low-income households may be competing for too few appropriately priced units, causing more of these households to accept poor quality housing or to suffer a severe housing cost burden.

Often, shortfalls of low-rent units are cited as a rationale for housing assistance programs to expand the supply of affordable housing, but these calls for additional production often ignore surpluses found in market segments that are close substitutes (K. P. Nelson, 1994). At the time of Nelson's study, shortages were severe and growing for renter households with incomes below 30 percent of AMI. In contrast, there were growing surpluses of units affordable to renters with incomes between 50 and 80 percent of the AMI. This means that any model of rental markets should isolate the market scarcity conditions of the market segment that serves the target population of very low-income renter households.

This pattern identified by Nelson continues today. There were sufficient affordable units for all renter households with income below 50 percent of AMI in 2007, yet there were insufficient units available for the subset of those households with income below 30 percent of AMI, with the surplus only for the remainder with incomes from 30 to 50 percent of AMI (Hardiman et al., 2010). A surplus of units in the market segment serving very low-income households does not mean the units would be readily available if the income barriers to better housing consumption could be surmounted. In the analysis of WCN, affordable units are counted as available if they either were already occupied by very low-income renters or were vacant and available for rent. Any affordable unit occupied by a higher income household is not considered available. With this constraint, the number of both affordable and available rental units for very low-income renters was found insufficient. Thus, these households, if given vouchers, may have a lower success rate and may suffer higher search costs to the extent that affordable rental units are occupied by higher income households in their individual markets (Finkel & Buron, 2001; Shroder, 2002b).

Implication: A model of assisted housing and WCN should control for the level of vacancy and the availability of housing units serving the different income categories of renter households segmented by income.

- **Price levels and affordability**

Theory: As rent levels run higher in some marketplaces, there is a greater probability that VLI households will be pushed into the WCN category as housing costs command a greater percentage of income.

Blackley and Follain (1991) found that rental markets tend to follow normal economic behavior. The supply side of the market is found to be quite elastic with housing prices largely determined by input prices. Demand is also influenced by housing prices, and rental vacancies decline as rental prices increase.
Quigley and Raphael (2004) found that, for renters in the lower income categories, rents have been taking a larger share of income over time, measured either through rent as a percent of income or through the percent of renters paying more than 30 percent of income on housing. These problems are greatest among the two lowest income quintiles. Over time, the real price of rental housing has moved higher even controlling for housing quality. This price increase exacerbates the mismatch found between the number of units in a price range and the number of households by income category who can afford housing in this price range.
Kutty (2005) argues for a residual income approach to assessing the affordability of housing prices. This approach examines whether the consumer has enough income left after housing expenses to purchase a basket of non-housing goods that will keep it out of poverty. Taking this approach, Kutty found that variables describing the region of the country and the market's position in a central city versus a suburb are significant determinants of the probability of housing-induced poverty.
Implication: It is necessary to control for the price of rental housing relative to incomes in various submarkets serving very low-income households as well as the costs of non-housing goods and services in the marketplace.

- **Condition of rental units**

Theory: As the incidence of poor quality housing rises, the likelihood of worst case needs among the renter population increases.

The primary cause of worst case needs is severe rent burden. Of the 5.91 million households with worst case housing needs in 2007, 5.48 million had severe rent burden as their sole problem. A much smaller 190,000 households had worst case needs only because they lived in severely inadequate housing, and 240,000 households had both problems (Hardiman et al., 2010). Given the dominance of affordability over inadequate housing conditions, it appears that the presence of housing in poor physical condition is a much smaller problem than the mismatch between incomes and prices. However, the incidence of poor quality housing may explain some of the variation between housing markets in terms of the level of WCN.

Over time, different researchers have examined the quality of the nation's rental housing stock. Quigley and Raphael (2004) found that the quality of rental housing is improving over time. Malpezzi and Green (1996) made similar findings and suggested that government restrictions—chiefly land use regulations—may be the source of increases in the quality of housing as these restrictions do not permit poor quality units to be offered in the market. Thus, renters are living in higher quality housing, but they are paying higher prices for it.

It is possible that many households are consuming more rental housing than they need. Lerman and Reeder (1987) suggest a "quality-based" measure of housing affordability. This measure calibrates the cost of housing just meeting adequacy standards over the conventional rent-to-income criterion. Based on Annual Housing Survey data, these authors found that the conventional measure overestimated the extent of affordability problems among renters compared to a quality-based affordability. They estimated that 35 percent of rental households identified as having affordability problems using the conventional measure did not have affordability problems using the quality-based measure. This suggests that a significant portion of the renter households who suffer from a housing cost burden do so because they choose to consume more housing than Lerman and Reeder estimate is necessary to just meet standards of adequacy. Thus, the conventional measure is over-inclusive. It can also be under-inclusive, as 19 to 23 percent of rental households found to have an affordability problem by the quality-based measure were not so classified using the conventional measure.

Implication: Any model explaining variation in the presence of WCN should control for the quality and condition of housing. This means not only the presence of rental housing in poor condition but the presence of housing serving very low-income households that goes beyond normally accepted standards of adequacy.

- **Local regulations**

Theory: Local regulations often inhibit the development of assisted or low-cost housing. Restraints on the provision of such housing can restrict choice, forcing more very low-income households into WCN.

Research finds a negative relationship between the supply of housing and the degree of land use regulation (Elliott, 1981; Green, Malpezzi, & Mayo, 2005; A. C. Nelson, Pendall, Dawkins, & Knaap, 2004). Mayer and Somerville (2000) found that regulations that lengthen the development process can lower the supply elasticity resulting in fewer housing starts. They pointed out that not all regulation has this effect. Regulations that impose impact fees without delays in the development process seem to have little effect on supply. Quigley and Raphael (2004) expanded on the impact of regulations, explaining that many low-income households are well served by the filtering process, but filtering depends upon the introduction of new units at all price levels. Planning and development controls that inhibit the introduction of new units into the market can result in price increases of up to 20 percent for the bottom quartile of the rental market compared to areas with unrestrictive land use regulations. This can be especially difficult for the households with the lowest income as it can price them out of the market or compel them to suffer a heavy housing cost burden (Cervero, 1989). Because minorities are disproportionately found in the very low-income category, the exclusionary effect of these restrictive land use regulations can also have a racial component, forcing Black and Hispanic residents out of the market (Pendall, 2000).

Not all regulation is harmful to the low-priced segment of the market. Strongly exclusionary practices are designed to enhance value and keep supply scarce, but growth management regulations that provide for inclusionary housing can be helpful (A. C. Nelson et al., 2004).

Implication: Variation in the incidence of WCN may be associated with the presence of land use controls that are exclusionary or create delays. Controlling for the level and type of regulation may be needed at the level of the jurisdiction imposing the controls as these controls are often imposed by municipalities.

Demand conditions

Housing affordability is not just a function of the supply conditions of the housing market. The scale and composition of the demand for housing, especially in the low-priced segment of the market, influence the extent to which affordability problems persist in a housing market.

- **Income levels and poverty**

A housing affordability problem can be the result of an insufficient supply of housing, especially in the lower price range. However, a housing affordability problem may result from the level of income found in the market. Independent of the price levels of housing, some households have too little income to enter into the housing market successfully. A significant body of research addresses the relationships between housing affordability problems and the demand side of rental markets.

Theory: Where there is a concentration of very low-income households, the incidence of WCN increases.

HUD's report on WCN finds that a majority of WCN households live in neighborhoods with low levels of poverty. However, a disproportionately high percentage of WCN households live in high-poverty neighborhoods compared with all U.S. households (Hardiman et al., 2010). In 2007 nearly one-third of the households with worst case housing needs were living in high-poverty neighborhoods, compared with less than one-fourth of all renters and less than 15 percent of all households living in such neighborhoods. Thus, where poverty is concentrated, the incidence of WCN can be expected to be high and, perhaps, more resistant to remedy through the provision of assisted housing.

The prospects are not good for the market to correct the housing problems resulting from the concentration of poverty. The incomes of renters are not keeping up with inflation, making renters prone to ever greater affordability problems (Kaufman, 1997). But the general trend masks a great deal of variation across markets. Longitudinal examination of the fortunes of the poorest U.S. metropolitan neighborhoods, those with poverty rates of 20 percent or more, found that the increases or decreases in poverty vary widely (G. C. Galster, Quercia, Cortes, & Malega, 2003). Regional economic cycles and population growth performance are the strongest determinants of neighborhood poverty change. The authors concluded that continued poverty is not the only, or even most likely, fate of poor neighborhoods; their fortunes depend on both local and regional context.

The relationship between income levels and affordability problems becomes even more puzzling. Matlack and Vigdor (2008) estimate models suggesting that income increases among the households at the upper end of the income spectrum can raise the housing prices paid by households at the lower end. The authors admit that this relationship is not robust; it does not work in models where the rich and poor consume distinctly different products. However, the evidence shows that, in tight housing markets, the poor do worse when the rich get richer.

Implication: A model explaining variation in the incidence of WCN should control for the level of income in the market, the incidence of poverty, and the degree of separation between the markets for households of different income levels.

- **Unemployment and the labor supply**

Theory: High unemployment, especially among low-skill entry level workers, may increase worst case housing needs, but housing assistance may decrease incentives to find work.

Sard and Lubell offer three ways in which housing subsidies can help households to gain and retain employment (2000). These include:

1.   By making housing more affordable, housing subsidies may help to stabilize the lives of low-income families and thereby improve their ability to secure and retain jobs.
2.   By reducing housing costs, housing subsidies can free up funds within the budgets of low-income families for work-related expenses, such as child care, work clothes, and transportation.
3.   Housing subsidies can help families move to areas with greater job opportunities.

Very low-income households may have spells of time in and out of housing assistance programs. The capacity of households to move into assistance is limited, as most forms of assistance require applicants to be placed on a long waiting list. It is not easy to rise to the top of this list, and this long wait probably discourages households from giving up on this assistance once it is obtained. Some of these assisted households are able to use the housing assistance to reduce the burden of housing on income and with the additional discretionary income, may invest in greater education. This could pay off in the form of moving out of very low-income status.   Sadly some of the assisted households will leave the program but fail to move up and out of the very low-income category. To the extent that households simply cycle on and off of housing assistance but remain in the very low-income category, there will be no permanent reduction in the count of worst case needs.

The relationship between unemployment and WCN is not well defined   Supply and demand conditions remain the primary determinants of the extent to which a metropolitan area suffers from housing affordability problems. However, unemployment remains a predictor of housing affordability problems (Bunting, Walks, & Filion, 2004). Susin (2007) found that those very low-income households who experience a severe housing cost burden over an extended period of time also suffered from long periods of unemployment and greater dependence upon Supplemental Security Income.

The relationship between unemployment and housing assistance is also poorly understood. Shroder (2002a) argues that housing assistance should be modeled as a reduction in the price of a normal good, in this case, housing, rather than as an income supplement. Housing assistance is commonly thought to reduce incentives to work. However, if housing assistance is more of a commodity supplement than an income supplement, the effect of housing assistance on labor supply becomes ambiguous. The reduced price of housing could cause a family to work more in an effort to consume more housing.

Shroder reviewed the research on the issue of whether or not housing assistance perversely reduces incentives to work (2002a). In his 2002 study, he found mixed results. For example, Fischer (2000) found federal rental subsidies create disincentives for work through marginal taxes on earnings, income effects, and requirements that non-recipients on waiting lists maintain low incomes in order to remain eligible. Yet, Nagle (2003) found housing-assisted households leaving the welfare program were somewhat more likely to be employed than the unassisted, but the housing-assisted welfare leavers commanded a lower average hourly wage. Finally, Van Ryzin (2003) found no effect of housing assistance on employment. Shroder identified many flaws in the various studies and concluded that housing assistance is not persuasively associated with any effect on employment. In his later study, Shroder (2010) summarized more recent studies that did find that housing assistance produces a disincentive for additional work. The disincentive is in the range 10 to 20 percent of the amount of the housing assistance. If an assisted household has a disincentive to work, it may extend the duration of time that the household remains on housing assistance. To the extent that job opportunities are scarce, the assisted household will have less access to gainful employment and still further disincentive to leave housing assistance. Reduced willingness and ability to transition out of housing assistance can exacerbate WCN by slowing the pace at which housing assistance can reach needy households.

Implication: A model explaining variation in housing affordability should control for wage levels and the level of employment, especially positions appropriate for the skill levels of very low-income persons.

- **Educational attainment**

Theory: A low level of educational attainment in a marketplace may increase the incidence of worst case housing needs. Low human capital accumulation can reduce earnings as well as the capacity to compete for employment. In housing markets with low levels of educational attainment, the resulting reduced income could thrust a greater proportion of households into worst case housing needs.

In the context of welfare reform, Rosenbaum and DeLuca (2000) suggested that neighborhoods exert a strong influence on the capacity of poor families to find gainful employment. They found that efforts to provide job training or work incentives for poor households may be frustrated by the negative influence of neighborhoods with high concentrations of poorly educated residents. They argue that residential mobility away from neighborhoods with poor educational resources should be a part of any effort to reform the provision of welfare and housing assistance.

Shroder (2002a) suggested that housing assistance can offer a poor family an environment more conducive to greater human capital formation. The effect of housing assistance on labor supply may also substantially depend upon other factors, including an individual family's characteristics and circumstances.

Implication: A model explaining variation in housing affordability should control for the level of educational achievement within the housing submarket.

- **High concentrations of minorities and immigrants**

Theory: Concentrations of minorities and immigrants increase the incidence of worst case housing needs.

The spatial separation of households by race, ethnicity and national origin continues to define metropolitan housing markets in the United States. America's cities and suburbs remain highly segregated, and this affects the housing options available to all families, especially those of low-income and minority families (Mark Shroder & Martin, 1996). Unfortunately, housing assistance often compounds the problem with public housing developments creating many inner-city concentrations of minorities. Even the Housing Choice Voucher program tends to concentrate the poor minorities, as few use the voucher to move from areas with high concentrations of poor or minority families to well-integrated areas (Khadduri, Burnett, & Rodda, 2003).

The extent to which the spatial separation of minorities and immigrants is a function of discrimination has been the subject of heated debate. Clarke (1986) argued that discrimination was not as strong an influence in the spatial segregation of American cities as it had been in the

past. He acknowledged that individual cases of discrimination occur, but they do not appear to be the manifestation of a collusion to deny housing opportunities to minorities. Rather, he contends that there are multiple causes for the spatial separation of minorities. Galster (1988) countered that discrimination continues to be a major force in the nation's housing markets, reinforcing the spatial segregation of minority households.

Implications: A model explaining variation in housing affordability should control for the incidence of racial, ethnic, and immigrant minorities in the market. The modeling process may become more difficult because submarkets may exist as a function of race, ethnicity, and immigrant status. The introduction of housing assistance into one racially defined housing submarket within a metropolitan area may have the desired effect of reducing the incidence of WCN in that submarket. However, this reduction could be masked by growth of WCN in submarkets serving different populations within the same metropolitan area. To the extent possible, the modeling of the WCN population should reflect the existence of submarkets which may operate more or less independently of each other as they serve different racial, ethnic, or immigrant groups.

- **Household type**

Theory: Some households composed of the disabled, the elderly, or single-parent female-headed households may have trouble navigating the housing market, making it harder for them to find affordable housing and increasing the incidence of WCN.

The report to Congress on the status of worst case housing needs in 2007 examined the variation in these needs across different types of families. The report stated that worst case needs are found across all types of families (Hardiman et al., 2010). Disabled households were found to have the highest likelihood of having WCN among the four main family types (families with children, elderly, disabled, and "other" households).

Implication: A model explaining variation in housing affordability should control for the incidence of disabled households, single-parent female-headed families, and households that are elderly.

- **Gentrification**

Theory: The influx of high-income households into a neighborhood previously occupied by low-income households can bid up prices in the housing market and displace very low-income households who are unable to compete. As the influx bids up the rents, increasing numbers of very low-income households can be forced into WCN.

Gentrification generally refers to the process where households with higher incomes, educational attainment, and occupational achievement enter into a neighborhood occupied by households with lower levels of these three measures (McClure, 2008). The households entering the neighborhood may occupy previously unoccupied housing, generating little or no displacement. However, they may outbid prior residents causing direct displacement. Less

directly, the in-movers may cause a general price rise, which can generate economic displacement of the poorer residents.

While this is the theory, and there seems to be a great deal of anecdotal evidence of these forms of direct and indirect displacement, it is not clear that the process is occurring at scale or that the displaced households were forced to move to housing offering a lower quality of housing service than was being experience before the gentrification. Freeman and Braconi (2004) examined the process in New York City. They found that rapid displacement of low-income households was rare. Gentrification was more commonly associated with slower residential turnover among these households. Normal succession appears to be responsible for changes in gentrifying neighborhoods. Wyly and Hammel (1998) indicate that gentrification can displace lower income households, but it can also bring new development to unproductive unutilized space. They indicated that the process affects very few urban neighborhoods, thus it is not a large scale problem except in a very few cities.

Implication: A model explaining variation in housing affordability should control for the level of in-movement of higher income households creating price increases pressuring very low-income households. Ideally these controls capture the extent to which households are actually displaced by the process and whether or not the households suffer a lower standard of living due to the displacement process.

Absorption of assisted housing

Beyond the supply and demand conditions of the rental housing market, the extent of housing affordability problems is influenced by the design and implementation of the various housing assistance programs. These programs can directly and indirectly affect the incidence of WCN in a market as the assistance becomes absorbed into the market.

- ### Displacement of unsubsidized units by subsidized units

Theory: To the extent that the level of housing assistance in a marketplace is high, it should reduce the incidence of WCN. This is especially true for project-based housing designed to serve very low-income households. These project-based units should augment the supply of housing for these targeted households, and perhaps, the stock of housing as a whole.

It is not at all clear that the provision of assisted project-based units actually adds proportionately to the stock of housing. Additional project-based assistance may displace private production, thus the gain to the supply may be less than the count of assisted units added. The additional assisted housing units could bring more units into a rent level serving, or close to serving, very low-income renters. However, adding units in the lower price range could cause unassisted units at the same or nearly the same price points not to be developed. Displacing unassisted housing that would have been produced in the absence of assisted production could make some unassisted households unable to find units at a rent level affordable to them. As these unassisted households search for units in the diminished unassisted stock, they could compete with the low-income unassisted households. This competition could result in more households suffering from

high housing cost burden than might otherwise have been the case, offsetting some of the gains from the additional housing assistance.

Sinai and Waldfogel (2005) addressed this issue. They found that adding government-financed units increased the total number of units in a market. However, they found that with each subsidized unit added to a market there is a net growth in the stock of only one-third to one-half of a unit.

Baum-Snow and Marion (2009) examined the impact of new Low-Income Housing Tax Credit developments awarded a bonus for entering Qualified Census Tracts, which are tracts with a high incidence of low-income households. They find that these LIHTC units crowd out nearby new rental construction in gentrifying areas, but they do not displace new construction in stable or declining areas.

Implications: A model explaining variation in housing affordability should control for the incidence of assisted housing, especially the incidence of project-based units, as well as the net growth in the housing stock.

- **Location of the assisted housing**

Theory: The location of assisted housing may or may not be beneficial for the successful reduction in WCN. If the housing assistance is poorly located relative to the need for that housing assistance, then its impact on the reduction of WCN may be diminished.

Some variation in the number of units administered may result from the procedures used to allocate housing assistance resources across the various markets. Kingsley (1992) found that states and cities vary widely in the degree to which the HUD assistance they receive matches their share of the nation's low-income households. These jurisdictions also vary significantly in the mix of the three programmatic forms of HUD assistance they receive. For example, some states have disproportionately more public housing, others have more non-public housing developments, while still others have more vouchers. Kingsley and Tatian (1999) concluded that the spatial distribution of housing assistance is influenced by institutional forces at the metropolitan level. They suggested that local officials and developers in some metropolitan areas have taken advantage of housing assistance programs, creating an uneven distribution of housing assistance.

A manifestation of the uneven distribution of housing assistance may be that assistance is not located where it is needed. The nation's largest production program, the LIHTC program, may be adding units to markets where there is already a surplus of units serving the price range. Over one-half of the stock of LIHTC units were built in census tracts with a surplus of 100 or more units serving this price (Mark Shroder & Martin, 1996). If housing assistance is locating where there is already a surplus of comparably priced housing, those with housing affordability problems may not benefit from the assistance.

Implication: A model explaining variation in housing affordability should control for the scale of housing assistance relative to the need for such housing in the marketplace.

- **Voucher success rates in low-income markets**

Theory: The success with which a household is able to lease a unit when given a voucher varies from market to market. This variation in voucher success rates may affect the capacity of housing assistance to reduce the incidence of WCN.

Finkel and Buron (2001) found that 69 percent of the households who received vouchers from large metropolitan Public Housing Authorities (PHAs) succeeded in using them to lease units in 2000. This success rate was lower than found in 1993. The lower rate may result from tighter markets and lower Fair Market Rents (FMRs). However, there remains considerable variation across metropolitan areas in terms of success rates. Tight housing markets tend to have success rates that are about 10 percentage points lower, and soft markets are about 10 percentage points higher.

Implication: A model explaining variation in housing affordability should control for the success rate at which voucher households are able to lease units.

- **Vouchers may increase the cost of housing through price effects**

Theory: Vouchers may increase the cost of housing in the surrounding marketplace, increasing the prices confronted by very low-income households who are not assisted. This can increase the incidence of worst-case needs households.

The use of vouchers can increase the cost of housing in the affordable segment of the market resulting in a net loss to low-income households (Khadduri, Burnett, et al., 2003). The cost increase resulting from vouchers seems to be related to the strength of the supply response in the market. Understandably, where the supply response to changes in demand is weak, the price increase is greater. Susin (2002) investigated whether the addition of vouchers into a market raises rents for unsubsidized poor households. He found, as many analysts predicted, that low-income households in metropolitan areas with more vouchers experienced faster rent increases than those where vouchers were less abundant. These rent increases can increase the incidence of WCN.

Implication: A model explaining variation in the incidence of worst case needs should control for the incidence of vouchers in the marketplace as well as the trends in rents at the affordable segment of the rental market.

- **Fragmented administration of housing assistance**

Theory: The policies and procedures adopted by local housing assistance administrators influence the success that assisted households will experience as they navigate the housing market.

The more fragmented the administration of assisted housing within a housing market, the more difficulty assisted households may experience in being absorbed into the market due to reduced

information on alternative jurisdictions. The current administration of the HCV program undermines the potential of the program to promote mixed-income housing and the deconcentration of poverty (Katz & Turner, 2001). If the voucher program could be administered regionally rather than locally, then greater success may be experienced.

The success of voucher households in leasing units is dependent, in part, upon the outreach extended by PHAs to landlords. Success rates were compared across several PHA practices and procedures that could play a role in determining these success rates, including policies for extending the permitted search time, policies for screening households, and PHA outreach to landlords. The quality of the landlord outreach by PHAs was found to be significantly associated with successful voucher usage (Finkel & Buron, 2001).

The success of voucher households in leasing units is also dependent upon the quality of the counseling services provided (Mark Shroder, 2003). The analysis suggests that a slight rise in service intensity could raise the lease-up success rate several percentage points.

Implication: A model explaining variation in housing affordability should control for the any administrative procedures that may affect the implementation of the assisted units.

Unit of Analysis: Submarkets within a Metropolitan Area

One final issue that must be addressed when modeling housing affordability involves the unit of analysis. Should the analysis be performed at the level of the metropolitan area or at some other level?

Theory: The primary purpose of the model is to understand the behavior of those submarkets serving worst case needs households. If the analysis assumes that a metropolitan area describes a housing market, then this implies that adding assisted housing to the metropolitan market reduces the count of WCN households within the metropolitan area. But a metropolitan area may contain many submarkets. These submarkets may operate relatively independently of each other; housing assistance added to one may have little impact on other submarkets. Measuring the incidence of WCN at the metropolitan level simply sums the WCN across a set of submarkets. Introducing housing assistance into one submarket may reduce WCN in that submarket, but the change in the submarket may not be discernable at the metropolitan level as it is washed out by changes found in other submarkets each of which contribute to the metropolitan count of WCN.

Galster and Rothenberg (1991) described urban housing markets as a collection of submarkets segmented by the quality of the housing. Each submarket has the latitude for independent adjustments of supply and demand. Adjustments in one market send price signals to other submarkets. These signals lead to systematic but non-uniform responses from the other submarkets. Consumers and suppliers in one submarket will respond, or not, to the signals depending upon the degree of substitutability of housing between the individual submarkets involved. For example, additional housing assistance provided in one submarket may free up units offering the potential to reduce WCN. However, the potential could be lost if the freed up units serve a market segment that is not a close substitute for other submarkets, by virtue of price level, location, or racial differences. These submarkets are not necessarily defined by

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geography. Rather, they may be defined by the quality of the housing services provided as indicated by prices but influenced by the racial and economic choices afforded to the households (G. Galster, 1997; Rothenberg, Galster, Butler, & Pitkin, 1991).

Implication: The unit of analysis may need to identify submarkets serving very low-income renter households. While this may work at the metropolitan level, the data may need to be disaggregated to the level of individual submarkets.

Chapter 3. RESEARCH METHODOLGY

Building a Model

In an ideal setting, a model that relates the incidence of WCN to the incidence of assisted housing would examine all submarkets serving very low-income renter households. Each submarket would be the segment of the metropolitan area housing market serving this population. These submarkets should also reflect the extent to which VLI renter households are constrained to live in submarkets serving a single racially or ethnically defined minority.

The model or models may have one or more forms of the dependent variable, test variable, and various control variables.

- **Dependent variables: Incidence of WCN**

The model may employ different versions of the dependent variable, depending on the availability of data. These include:

- The count of WCN households in the submarket at various points in time, permitting analysis of either the absolute count at one point in time or the change in the count over two points in time.
- The percent of VLI renter households in the submarket who have WCN, also at various points in time.

- **Test variables: Incidence of housing assistance**

The independent variable assessing the incidence of housing assistance may take various forms as well. These include:

- The count of assisted households in the submarket at various points in time permitting analysis of either the count of assisted households at one point in time or the change in the count over two points in time, corresponding to the form of the dependent variable.
- The percent of renter households receiving housing assistance in the submarket at various points in time.
- Separate counts for each of the forms of housing assistance across the tenant-based Housing Choice Voucher program and the various project-based programs.

- **Control variables**

The control variables need to contain measures of supply conditions, demand conditions, and the measures of the capacity of the submarkets to absorb assisted housing.

Control variables describing supply condition should include measures of:

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- Scarcity such as the vacancy rate in each submarket or the availability of units, calibrated as the count of units either occupied by VLI renters or vacant and affordable, eliminating those units that are occupied by households with higher income levels.
- Rent levels to indicate the submarket's affordability in terms of rent to income measures.
- Physical condition of the housing.
- Housing market regulation, whether inhibiting or promoting housing for VLI households.

Demand conditions control variables should include measures of:

- Income of the renter households and the incidence of poverty in the submarket.
- Employment and jobs readily available to workers in the submarket.
- Educational attainment in the submarket.
- Minority presence in the submarket.
- Household composition, describing the presence of female-headed family households, disabled households, and elderly households.
- Gentrification pressure from changes in the population by income, educational attainment, plus measures of the turnover in the housing stock.

The control variables should also include measures of the submarket's capacity to absorb assisted housing. These measures would include:

- Displacement of the stock of unsubsidized housing resulting from additions to the stock of assisted housing.
- Success rates experienced by voucher households when seeking an apartment.
- Trends in rents and the impact of these trends on administrative procedures such as setting FMRs and payment standards.
- Fragmentation of the administration of housing assistance within a market.

Specification issues

With any model building exercise, it is difficult to select the appropriate variables for inclusion in the model. These variables often suffer from problems of multicollinearity, rendering the estimated partial regression coefficients unreliable. In addition, these variables often suffer from calibration problems as well. Either their measurement is inaccurate or they are only proxies for larger processes that are only imperfectly captured through the variables. These problems necessitate careful, incremental selection of the control variables, checking at each step for the sensitivity of the model's accuracy to adjustments in its specification.
Several of the theoretical issues involved in this research are not easily tested given the limitations of readily available data. For example, it is possible that the elasticity measures sought from this research differ between submarkets for non-Hispanic white households and households composed of various racial and ethnic minorities who may be limited in their housing choices. To the extent that there is a very low level of movement from one racially defined submarket to another, these submarkets should be analyzed separately. To the extent that there is a high level of movement from one racially defined submarket to another, these submarkets can be analyzed as a group controlling for the racial or ethnic composition of the submarkets.

Functional form

Any effort to model the complex forces that operate in housing markets must also confront the problem with the selection of a functional form for each model. The behavior of the underlying forces in the marketplace may follow a linear form with constant change or they follow some other pattern of change with growth in the test variable. This necessitates some testing of alternative functional forms to determine the best possible estimate of the elasticity of the WCN population with respect to changes in housing assistance controlling for various other market factors.

Residual analysis

For this analysis to be instructive, the model or models should provide a clean and simple estimate of the impact of marginal change in the amount of housing assistance on the number of WCN households. However, models of this type do not work well in all cases. Individual examination of the housing markets where the models work well and where the models perform poorly is beneficial. Analysis of the residuals from the various models is often helpful both in understanding the limits of the various models as well as in guiding further development of the models. Some markets demonstrate high levels of reduction in WCN with increases in assisted housing. These are examined to identify any special characteristics that seem to influence their successful outcome. Similarly, those markets where the outcomes are particularly unsuccessful are examined to identify any special characteristics contributing to the poor performance.

Data requirements

The data needed to build models of this type are difficult, and in some cases impossible, to find.

- **Data for the dependent variables: Incidence of WCN**

WCN are defined using rent burden and housing condition criteria. The counts of WCN are estimated from American Housing Survey (AHS) data because this survey obtains information on both criteria.
Unfortunately, these AHS data are only available at the metropolitan level. This is a problem to the extent that housing submarkets operate at a smaller spatial level than a metropolitan area. Using AHS data, it may be possible to identify the counts of rental units serving VLI households in each racial or ethnic group within each metropolitan area. These counts could represent the submarkets operating there. This approach assumes that when households examine housing alternatives, they search across the entire metropolitan area in which they live. In small metropolitan areas, this may be true. In larger metropolitan areas, this may not be true given the greater distances involved.

Beyond the spatial level, there is a problem with AHS data in terms of the number of areas surveyed. The AHS data are only available for a few metropolitan areas. This becomes a problem in that the search for the elasticity of WCN with respect to change in housing assistance seeks an estimate that is applicable across the nation. AHS data leave out many metropolitan areas and all non-metropolitan areas. These omissions result in an insufficient number of cases

to permit building a model with more than a few control variables, certainly not with all the variables that prior research suggests are necessary.

The AHS data are only available for a few years, and this creates an additional problem. Each metropolitan area included in the AHS was surveyed during specific years, but not all were surveyed in the same years. Thus, if AHS data are to be used in the modeling, the amount of assisted housing needs to be calculated for each of the years during which the AHS was conducted. Matching these various years with some of the control variables also proves to be difficult. Specifically, this means that some of the control variables will measure housing market conditions a year or two before or after the AHS was taken. This difference is assumed to not affect the validity of the results.

- **Data for the test variables: Incidence of housing assistance**

Pleasantly, HUD provides housing assistance data at any level of geography because these data are now coded by longitude and latitude. This means that they can be identified within a block group, a census tract, a city, a county, or a metropolitan area. In addition, the racial and ethnic composition of each assisted household is known, although with varying degrees of accuracy. For example, the race and ethnicity of each household in the HCV program is known along with their location. This permits very finely tuned analysis of which submarket is being served by this program. The same quality of reporting is not found with the public housing data. Many public housing developments report the racial composition of the residents, but many do not report fully.

- **Data for the control variables**

The control variables come from a variety of sources, and these sources present their own challenges in terms of making the control variables compatible with the WCN and assisted housing data. The control variables are drawn from AHS, decennial census, or American Community Survey data, and include such measures as vacancy rates, rent levels, income and poverty levels, and minority presence.
Among the problems plaguing assisted housing research is the inability to calibrate three issues that are known to be important to a VLI household's housing search: the quality of schools; the availability of skill-appropriate employment opportunities; and the level of crime. None of these issues are directly addressed by census data. Various researchers have engaged in neighborhood indicator research in these issues, but there remains no readily available source for data on these issues. Proxies are used. Educational attainment may proxy school quality. Unemployment rates may proxy job availability. Poverty may correlate well with crime levels. But these proxies introduce additional layers of uncertainty into any modeling exercise.

Similar issues are found with measuring the level of local regulation. This issue has been studied for various states and metropolitan areas, but there does not appear to be a generally accepted nationwide index assessing the level of local regulation in housing markets.

Research Approach

Given the limited number of metropolitan areas available with the AHS, these data permit only the most rudimentary models to be estimated. With only a small number of cases, the models permit the introduction of very few of the needed control variables to improve the estimated elasticity of WCN beyond the research that has already been generated.

In an attempt to improve upon this AHS-based estimate, the research also estimates models using cities across the county drawing upon decennial census and ACS data. This approach permits more disaggregation of the housing markets by location. The possible problem with this approach is that the estimated level of WCN is compromised by the absence of data on severely inadequate housing conditions at the city level.

This study is to determine the impact of incremental changes in the count of HUD-assisted housing on the number of very low-income renter households that have worst case housing needs within a housing market. Specifically, if the number of assisted households is increased in a housing market, will there be a commensurate decrease in the number of renter households with worst case needs?

This is performed twice using two different geographic units of analysis. The first is an examination of a set of metropolitan areas, and the second is a set of cities. The study of metropolitan areas proved relatively successful and is described in the next chapter. However, the analysis at the city level did not prove to be successful. That analysis is found in an appendix to this report.

Chapter 4. ANALYSIS WITH METROPOLITAN LEVEL DATA

This research was initiated in 2003 by Khadduri, Shroder and Steffen. Exhibit 2 is taken from their work. They examined this issue graphically displaying 44 metropolitan areas in terms of the percent of extremely low-income families with children with WCN against the count of assisted housing as a percent of extremely low-income families with children. Given the data limitations, not all metropolitan areas were measured at the same point in time. Rather, they were measured from 1989 through 1996 depending upon the availability of data from the American Housing Survey (AHS).

Exhibit 2.   **Percent of Extremely Low-Income Families with Children with Worst Case Housing Needs and Percent of Extremely Low-Income Families with Children Receiving Housing Assistance for Metropolitan Areas 1989 to 1996**
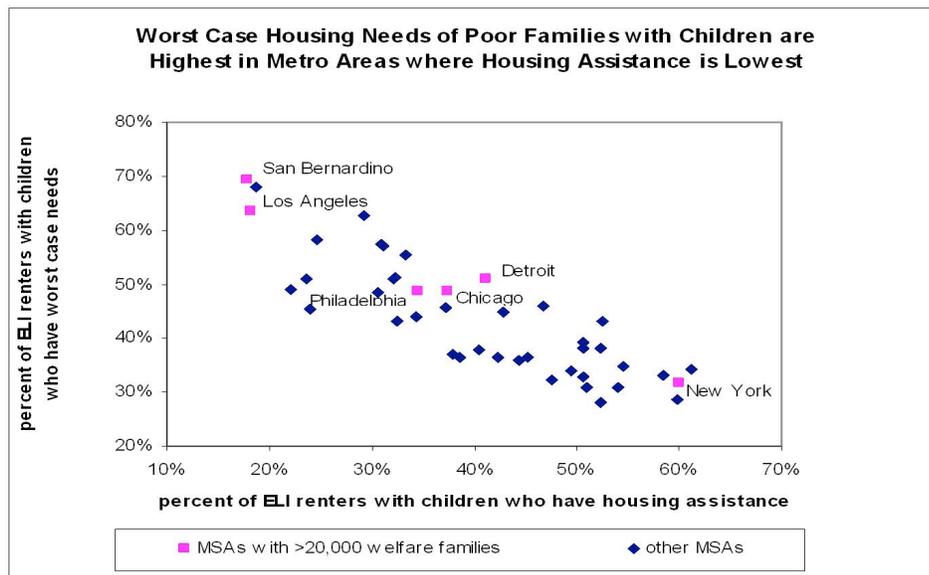
Source: Jill Khadduri, Mark Shroder and Barry Steffen. 2003. Can housing assistance support welfare reform? In Barbara B. Sard, Amy S. Bogdon (Eds.), *A Place to Live, a Means to Work: How Housing Assistance Can Strengthen Welfare Policy* (pp. 23-62). Washington, D.C.: Fannie Mae Foundation.

Khadduri, Shroder and Steffen did not estimate the elasticity of WCN with respect to assisted housing. However, using their data, an estimate can be generated. Exhibit 3 provides that estimate. The model finds a regression coefficient of -.76 between WCN as as a percent of extremely low-income families with children and assisted housing as a percent of the same group. The coefficiant is, as expected, negative and significant. (See Exhibit 3.)

Their work suggests that a 1 percent rise in assisted housing in a metropolitan market results in about a 0.83 percent fall in the incidence of WCN. This elasticity can be used against the housing market conditions described in the Worst Case Needs 2007 report to estimate the

changes in the count of WCN with the addition of assisted housing to a market. In 2007, the estimated stock of assisted housing was 5.06 million units. A 1 percent rise in assisted housing would mean the addition of 50,600 units or vouchers. In 2007, the estimated number of WCN households is 5.91 million. Given a coefficient of -0.76, this 1 percent rise in assisted housing would result in a decline of WCN by about 38,500 households.

This is less than a one-for-one reduction in the number of WCN households. In round numbers, for each 100 additional units of housing assistance, this elasticity suggests that the count of WCN would be reduced by about 75 households.

Exhibit 3. **Estimated Elasticity of Worst Case Housing Needs with Respect to Assisted Housing Metropolitan AHS Data from 1989 to 1996**

Regression Statistics	Amount
Estimated Coefficient	-0.760
R Square	0.726
Number of Observations	44
Mean Percent Worst Case Needs	40.18
Mean Percent Assisted Housing	43.93
Estimated Elasticity at the Mean	-0.83

Source: Author's calculations using data from Khadduri, Shroder and Steffen, 2003.

The work of Khadduri, Shroder and Steffen was done in the context of research on welfare reform. As such, they used extremely low-income families with children as their basis. Extremely low-income is defined as income below 30 percent of Area Median Income (AMI), a level that approximately corresponds to the poverty level. However, the incidence of WCN is based upon all households, with or without children, with very low-income (0 to 50 percent of AMI). This population is used as the basis for the research reported here.

Given this context, the work of Khadduri, Shroder and Steffen is replicated using more current data and setting all very low-income renter households as the basis for analysis.

Exhibits 4 and 5 re-estimate the elasticity of WCN with respect to assisted housing using more recent data. Exhibit 4 illustrates the same negative relationship found the Khadduri, Shroder and Steffen.

Exhibit 4. **Relationship of Worst Case Needs and Assisted Housing for Very Low-Income Households in Metropolitan Areas from 2002 to 2007**
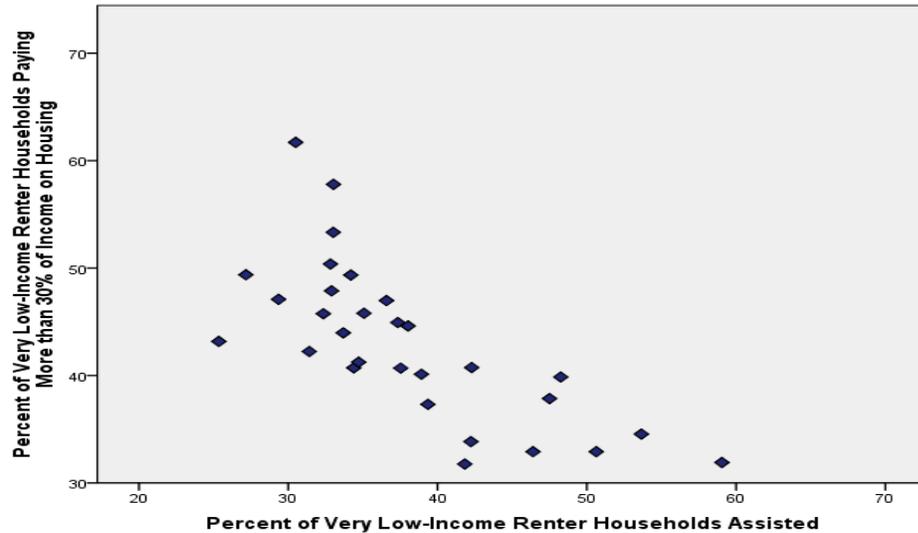
Source: American Housing Survey Metropolitan Data 2002, 2004, 2007.

Exhibit 5 estimates the elasticity using bivariate lease squares regression. The coefficient estimated is -0.68 which suggests that the elasticity at the mean is about -0.60. This is a figure lower than found in the earlier study.

This figure suggests that a 100 unit increase in assisted housing would result in about a 70 household decrease in WCN.

The literature on WCN and assisted housing indicates that several factors may influence variation in the incidence of WCN. These factors may work from the supply side by influencing the pricing and availability of housing affordable to unassisted very low-income households. These factors may work from the demand side by influencing the levels of income available for housing consumption.

Exhibit 5. **Estimated Elasticity of Worst Case Housing Needs with Respect to Assisted Housing Metropolitan AHS Data from 2002 to 2007**

Regression Statistics	Amount
Estimated Coefficient	-0.678
R Square	0.525
Number of Observations	30
Mean Percent Worst Case Needs	43.03
Mean Percent Assisted Housing	37.98
Estimated Elasticity at the Mean	-0.60

Source: American Housing Survey 2002, 2004, and 2007.

Exhibit 6 expands the modeling of WCN as a function of assisted housing by introducing control variables that could explain variation in WCN. With introduction of these control variables, it may be possible to better estimate the relationship between WCN and the introduction of assisted housing at the metropolitan level. The model reported in Exhibit 6 is deemed to be the best from among many tested. The number of potential control variables tested was large, too large for a dataset with only 30 cases. The level of correlation between various pairs of these control variables rendered many combinations of variables unreliable. As a result, a variety of models were tested, and the model reported provides the greatest explanatory power while minimizing the problems with correlations among the control variables. Of necessity, this means that many of the topics raised in the literature review could not be included in the model. However, the estimate of the relationship between assisted housing and worst case needs seems to be sturdy and does not vary significantly with alternative specifications.

The introduction of the control variables provides some improvements to the model. The explanatory power of the model increases to .78, suggesting that the model is reliable. However, among the available control variables, only the estimated coefficient for the median income of renter households and percent of the population living in poverty prove to be statistically significant. This corresponds to the research suggesting that the underlying fundamental of any housing market is the income of the households residing there. The control variable for median income suggests that as median incomes of renters rise, so too does the incidence of WCN. This probably results from increased demand for rental housing pulling prices up. As the incidence of middle- and upper-income renters increases in a market, it may influence the distribution of units by price, raising the proportion of higher-priced units and lowering the proportion of lower-priced units. This upward shift in the price distribution of units could increase the incidence of WCN as very low-income renter households are compelled to pay higher prices causing more households to suffer from high housing cost burden.

The control variable for the incidence of poverty is negative. This sign is opposite the bivariate relationship found between poverty and WCN. This unexpected result is probably a byproduct of attempting to stretch a very small dataset too much.

Exhibit 6. **Estimated Elasticity of Worst Case Housing Needs with Respect to Assisted Housing Controlling for Market Conditions Using AHS Data from 2002 to 2007**

Regression Statistics	Amount
Variable:	Coefficient:
Percent of Very Low-Income Renters Assisted	-0.87 ***
Median household income	1.66 ***
Percent of population with income below poverty	-1.33 **
Percent of housing stock severly inadequate	-1.90
Percent of adults who did not complete high school	0.45
Percent of population minority	-0.07
R Square	0.78
Number of Observations	30
Mean Percent Worst Case Needs	43.03
Mean Percent Assisted Housing	37.98
Estimated Elasticity at the Mean	-0.77

Source: American Housing Survey 2002, 2004, 2007.
Significance: *=.10; ** = .05; *** = .01

The elasticity of WCN with respect to assisted housing from this model with control variables is estimated to be -.77, and the model's coefficient for percent of VLI assisted renters is -.87. With a little rounding, this coefficient suggests that for every 100 units of additional assisted housing added to a metropolitan area, after controlling for income levels, the count of WCN households falls by about 85 households. In one respect, this is the expected result. The Worst Case Needs 2007 report found that 85 percent of assisted households were drawn from the VLI population. It then seems likely that nearly all of these would be households who, except for the housing assistance, would have been among the WCN population. But the estimated drop in WCN households is 85 out of 100, not the full 100. This indicates that at least some of the households admitted to assisted housing are not drawn from the WCN population and it is probable that

some of the households admitted may experience income increases without exiting the housing assistance program.

The Influence of Income and Rent Levels

The influence of income on the incidence of WCN is not a surprise. It would be expected that as incomes rise, the increased demand for housing pulls up prices and increases the problems of WCN. What is not clear is the impact of this process on the capacity of assisted housing to reduce WCN. Exhibit 7 addresses this issue.

Exhibit 7 describes three alternative estimates of the relationship between assisted housing and WCN. The first is the estimate from all metropolitan areas discussed earlier. This model suggests that for each 100 additional assisted housing units, WCN falls by 87 households. The second is an estimate based on those metropolitan areas with above average incomes. The impact is greater in well-off areas, estimated to be 128 households. The third is an estimate looking only at metropolitan areas with below average median renter household income levels. With this smaller sample of less well-off metropolitan areas the coefficient falls to -.58. This is not a particularly reliable estimate as it is significant at only the .06 level. However, the combined results clearly suggest that incremental housing assistance has a lesser impact in poorer metropolitan areas and a greater impact in richer communities.

Closely related to income is the influence of rent levels. Higher income is associated with higher rents, and this shows in the coefficients. The coefficient in high rent areas is -1.35 and only -.52 in areas with low rents. The coefficient for the low rent areas is significant at only the .09 level.

This analysis suggests that housing hardship is more severe among the VLI in high-income and high-rent metropolitan areas, and incremental housing assistance has a correspondingly greater impact on the incidence of WCN in those areas.

Exhibit 7. **Sensitivity of Coefficient between Assisted Housing and WCN to Variation in the Median Income of Metropolitan Area**

Regression Statistics			Amount		
Data used in model:	*Coefficient:*		*Elasticity:*	*R Square:*	*N of cases:*
All Metropolitan areas	-0.87 ***		-0.77	0.78	30
Only metropolitan areas with above average median income	-1.28 ***		-1.14	0.90	14
Only metropolitan areas with below average median income	-0.58 *		-0.51	0.66	16
Only metropolitan areas with above average median gross rents	-1.35 ***		-1.25	0.95	14
Only metropolitan areas with below average median gross rents	-0.52 *		-0.44	0.55	16

Source: American Housing Survey 2002, 2004, 2007.

Significance: *=.10; ** = .05; *** = .01

The Influence of the Functional Form of the Models

Alternative models were estimated testing the sensitivity of the estimates to the functional form of the models. The linear models tested thus far all assume that the relationship between WCN and assisted housing follows a straight line with equal levels of decline in WCN across all levels of assisted housing. This assumption may be faulty, and testing alternative functional forms of the model evaluates the validity of this assumption.

Exhibit 8 lists the estimated coefficients derived from various alternative forms of the model. The exhibit lists the usual alternative forms. These are: Linear-Log (conversion of the independent variables to their logarithmic form); Log-Linear (conversion of the dependent variable to its logarithmic form), and Log-Log (conversion of all variables to their logarithmic form). The specification of variables in these models continues to be the same as with the multivariate model tested previously. All three of the alternative functional forms performed comparably to the linear model, suggesting that there are no gains with the alternative function

forms. These alternative models suggest that with the introduction of 100 assisted housing at the mean, the count of WCN will be reduced 86 to 92 households.

Exhibit 8. **Sensitivity of Coefficient between Assisted Housing and WCN to Variation in the Functional Form of the Model and to Case Weighting**

Regression Statistics		Amount		
Functional form of the model:	*Coefficient:*	*Reduced WCN Households with 100 Added Assisted Units*	*R Square:*	*N of cases:*
Linear model	-0.87 ***	87	0.78	30
Linear-Log model	-34.33 ***	92	0.77	30
Log-Linear model	-0.02 ***	86	0.79	30
Log-Log model	-0.80 ***	90	0.77	30
Weighted lease squares with count of renters as weight	-0.94 ***	94	0.83	30

Source: American Housing Survey 2002, 2004, 2007.
Significance: *=.10; ** = .05; *** = .01

Exhibit 8 also examines one last alternative form of the model. The linear models used treated all metropolitan areas equally, independent of their size. An alternative is to weight the cases as a function of the number of renters in the metropolitan areas, giving greater weight to those areas with more renters. The weighted least squares version of the model performs similarly to the ordinary least squares versions. With the weighted least squares model there is a modest increase in explanatory power and a slight increase in the responsiveness of WCN to changes in assisted housing.

This analysis of alternative function forms and weighting finds that the estimated relationship between assisted housing and WCN is relatively robust. It does not vary significantly with the form of the model. The weighted least squares model does provide a higher estimate of the

coefficient for assisted housing and boosts the R Squared statistics slightly, suggesting that this may be a better answer, at least for larger cities.

Analysis of Residuals

Weaknesses in models can also be identified by examination of the residuals, that is, the differences between the actual level of WCN in a metropolitan area and the level predicted by the model. If the cases with large errors show some similarities, it can help to identify a weakness in the model, such as a controlling variable left out.

Looking at the residuals for the linear model does not provide too many clues. Some metropolitan areas fit the model well with small differences between the predicted and the actual levels of WCN. Some metropolitan areas have higher levels of WCN than the model predicts. These include:

o   Columbus
o   Portland, Oregon
o   San Antonio
o   Tampa-St. Petersburg

Some metropolitan areas have lower levels of WCN that the model predicts. These include:

o   Atlanta
o   Buffalo
o   Dallas
o   Kansas City
o   St. Louis

With inspection of these two lists of metropolitan areas, it is not clear what separates them from the areas that conformed to the model's predictions. They are not especially soft or tight markets. They are not especially high- or low-priced markets. They are not concentrated in any particular region of the country.

Here again, this suggests that the model is relatively robust as the errors are random and do not suggest a particular weakness in the model.

Chapter 5. CONCLUSION

The relationship between WCN and assisted housing may never be known with certainty. However, the various estimates provided in this report probably define a range within which the true relationship exists.

The most basic models suggest that 70, 75, 85 or 95 WCN households are benefited with each increase in assisted housing by 100 units. This is quite a range of estimates, a range so wide as to be confusing. (See Exhibit 9.) However, several points are worth noting when looking at this array of estimates and attempting to find the one best answer.

Exhibit 9. **Summary of Estimated Elasticity of Worst Case Housing Needs with Respect to Assisted Housing Controlling for Market Conditions**

Regression Statistics	Amount	
Model:	Coefficient:	R Square:
Bivariate model from Khaddurri et al 2003	-0.76 ***	0.73
Bivariate model updated	-0.68 ***	0.53
Mulivariate model with controls unweighted	-0.87 ***	0.78
Mulivariate model with controls weighted	-0.94 ***	0.83

Source: American Housing Survey 2002, 2004, 2007.
Significance: *=.10; ** = .05; *** = .01

First, Hardiman et all (2010) find that about 85 percent of the households benefiting from HUD housing assistance are of very low-income. This suggests an upper limit on the estimated coefficient between assisted housing and WCN. The admission requirements for the various HUD funded housing assistance programs vary. Each program serves people of low-income, but not exclusively very low-income. Some households admitted to the various assistance programs will have incomes above 50 percent of AMI. In addition, even though the vast majority of households given housing assistance will come from VLI population, not all will come from housing with severely inadequate condition or costing more than 50 percent of household income. The 2007 WCN report finds that 51 percent of all unassisted VLI renters have WCN. It is doubtful that households admitted to housing assistance programs would be drawn disproportionately from those without high housing cost burden. Thus, the 50 percent figure probably sets a lower boundary and the 85 percent figure sets a reasonable upper boundary of

expectations. The Public Housing Authorities administering the public housing and Housing Choice Vouchers programs, the two dominant forms of housing assistance, have some discretion, but they generally admit new participating households from waiting lists based in part on the housing cost burden of the household. Given this process, it seems likely that as housing assistance becomes available, it would draw heavily from the unassisted VLI renter population with a high housing cost burden. This makes it reasonable to expect the reduction in WCN to be closer to the upper boundary of 85 per 100 new units of housing assistance.

Second, a variety of models have been estimated. These models range from very simple bivariate models to more complex multivariate models. The explanatory power of the ordinary least squares multivariate model tends to be higher than the bivariate models, making the estimated coefficients more reliable. The estimated coefficient for WCN and assisted housing predicts a reduction of 87 households with WCN for each additional 100 units of assisted housing.

Third, the model using weighted least squares suggests a still greater reduction of WCN, at 94 households per 100 additional assisted units. It is unclear whether the answer derived from the weighted model is necessarily better than from the unweighted model. The weighting technique gives greater weight to those metropolitan areas with larger counts of renter households. It is possible that the reduction in WCN is greater in larger markets, but the nation's housing markets are a combination of large, medium and small markets. Thus, this is not necessarily a better model for the nation as a whole. Rather, it may provide a better model for large metropolitan areas.

Taken together, the available estimates suggest that for each 100 additional units of housing assistance, the count of WCN households is reduced by 80 to 90 households. The reduction appears to be a little greater in larger markets, as well as in markets with higher incomes and higher rents.

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END NOTES

[1]   The elasticity at the mean is calculated using the formula:

Elasticity = coefficient * (mean of independent variable / mean of dependent variable)

Using the coefficient and means reported in (Khadduri, Shroder, et al., 2003) yields:

Elasticity = -.756 * (43.9318 / 40.1818)
            = -.826

APPENDIX: ANALYSIS WITH CITY LEVEL DATA

As an alternative approach to calibrating the relationship between WCN and assisted housing, analysis was performed on data at the city level, rather than the metropolitan level. The concern with the metropolitan level was that each metropolitan area may behave more as collections of housing markets rather than as a single housing market. Assisted housing could be added to one submarket within a metropolitan area, causing a reduction in WCN in that submarket. However, this submarket, defined by its racial or ethnic households or by its intrinsic location or housing type, may be only one of multiple submarkets in the metropolitan area. WCN may fall in one individual submarket while increasing in other submarkets within the metropolitan area. This could make the research unreliable if based on data at the metropolitan level.

A second analysis was performed using data aggregated at the city level. It was hoped that the smaller spatial area covered by each case and the greater number of cases would offer a different, and potentially improved, estimate of the relationship between assisted housing and households suffering from housing hardship. Unfortunately, this effort did not prove to provide better answers than the analysis at the metropolitan level. In fact, the city level data performed poorly, producing only very weak models with unreliable estimates of the relationship between WCN and assisted housing. This weak performance may be the result of inter-city movement of households as they relocate to a different city to reside in assisted units or to lease a unit with a voucher. It may also result from the calibration problems inherent in using city data.

The decennial census and the American Community Survey (ACS) data provide data at the city level. Using these data, it is possible to obtain information on rental housing markets across the nation over time. Unfortunately, it is not possible to obtain counts of WCN. The census and ACS data provide counts on the housing cost burden of renter households by income level, but housing condition data are not directly included in the decennial census or the ACS survey. In addition, it is not possible to isolate just those VLI renter households who do not receive housing assistance.

The absence of housing condition data means that analysis at the city level must be performed with estimates of WCN based upon high housing cost burden among all renters of VLI. The downside of this approach is that, in the absence of housing condition data, the WCN estimates must be based wholly on income and housing cost burden criteria. It is possible to identify VLI renter households who pay more than 30 percent of their income on housing. This approach creates under-counts of WCN in the various rental housing submarkets examined because it ignores the incidence of severely inadequate housing. These undercounts should be small as housing cost burden is known to be the primary reason for a VLI household to suffer from WCN. This approach creates offsetting over-counts, as it includes moderate cost burdens above 30 percent of income in addition to severe burdens above 50 percent of income.

The absence of housing assistance data within the census also means some level of over-counts. It is possible for a VLI renter household to suffer from a high housing cost burden even though the household is receiving housing assistance.

The great advantage of using cities as the unit of analysis is that cities are smaller, which may reflect housing submarkets better than metropolitan areas. In addition, there are simply more of them. Rather than analysis with the 30 metropolitan areas with data from the AHS, it is possible to perform the analysis with nearly 1,000 cities for which decennial census and ACS data are available.

Exhibit A-1 illustrates the relationship between VLI renters with a high housing hardship as a percent of all VLI renters and assisted housing as a percent of VLI renters for cities across the nation. The same negative relationship is seen at the city level that was seen at the metropolitan level. However, unlike the metropolitan areas, the relationship is less pronounced with a great deal of variation as the assisted housing variable increases.

Exhibit A1.   Percent of Very Low-Income Renter Households Paying More than 30% of Income on Housing and Percent of Very Low-Income Renter Households Receiving Housing Assistance for Cities 2008
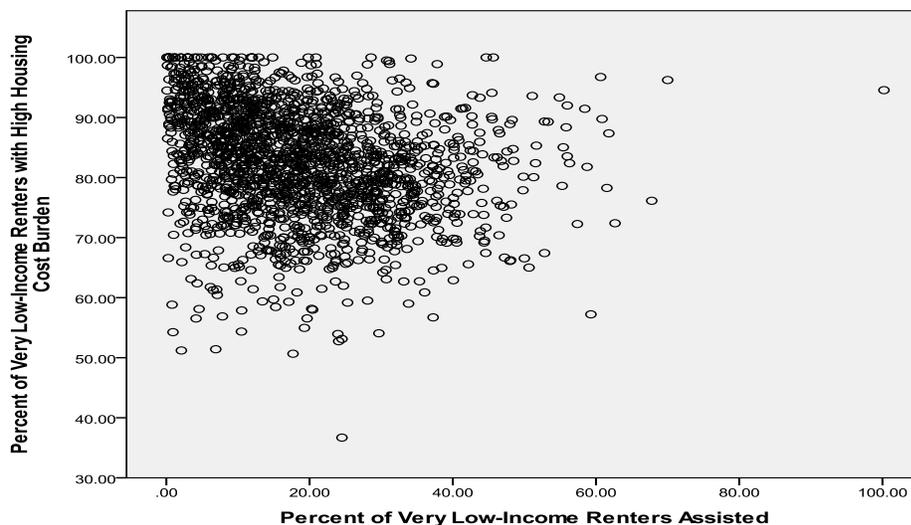
Source: American Community Survey, 2008, 3-Year estimates..

Many different models were estimated using the city level data. The most successful of the models are described in Exhibit A-2 and A-3.

Exhibit A2- **Estimated Elasticity of VLI Renters with High Housing Hardship**
as a Percent of VLI Renters with Respect to Assisted Housing
as a Percent of VLI Renters for Cities 2008 - Ordinary Least Squares Models

Variable	Ordinary Least Squares Models			
	Model 1	Model 2	Model 3	Model 4
Assisted Housing as a Percent of VLI Renters	*-0.180* ***	*-0.125* ***	*-0.123* ***	*-0.134* ***
Control variables: Supply				
Percent of rental units affordable to VLI households		-0.293 ***	-0.288 ***	-0.297 ***
Percent of rental units built before 1970		-0.045 ***	-0.040 ***	-0.028 **
Percent of rental housing with two or more conditions				0.187 **
Control variables: Demand				
Percent of population moved with last 4 years		-1.031 ***	-0.919 ***	-0.796 ***
Percent of population elderly		-0.228 ***	-0.226 ***	-0.200 ***
Percent of workers using public transit		-0.106 ***	-0.116 ***	-0.096 ***
Percent of adults below poverty		0.393 ***	0.336 ***	0.260 ***
Median area income		0.00001 ***	0.00009 ***	0.00007 ***
Percent of population minority		0.042 ***	0.040 ***	
Percent of female headed households				0.772 ***
R Square	0.06	0.65	0.67	0.73
Number of Observations	1,923	872	708	466
Mean Percent	82.709	80.847	81.809	82.688
Mean Percent Assisted Housing	18.677	20.295	20.413	20.770
Estimated Elasticity at the Mean	*-0.041*	*-0.031*	*-0.031*	*-0.034*

Source: Author's calculations using data from Khadduri, Shroder and Steffen, 2003.

Significance: *=.10; ** = .05; *** = .01

Exhibit A-1 examines a bivariate model and three multivariate models using ordinary least squares analysis. The results are unimpressive. The bivariate model, though statistically significant, is prohibitively weak to guide policy. The R Squared statistics is less than .1. The test variable has an elasticity of only -.04. The multivariate models perform better and are worth review. The primary difference between them is in the count of cases resulting from the availability of different control variables. Through these models the weakness of the dependent variable becomes apparent.

The dependent variable contains too many sources of error. It does not measure WCN; it measures high housing cost burden. It does not measure severe cost burden above 50 percent of income; the census tables only indicate cost burden above 30 percent of income. It does not distinguish unassisted renters from assisted renters; it combines all renters, both assisted and unassisted. It does not measure severely inadequate housing conditions; these variables are not present in the ACS data.

Exhibit A3. **Estimated Elasticity of VLI Renters with High Housing Hardship**
as a Percent of VLI Renters with Respect to Assisted Housing
as a Percent of VLI Renters for Cities 2008 - Weighted Least Squares Models

Variable	Weighted Least Squares Models: Weighted by VLI Renters			
	Model 1	Model 2	Model 3	Model 4
Assisted Housing as a Percent of VLI Renters	***-0.105*** ***	***-0.131*** ***	***-0.127*** ***	***-0.142*** ***
Control variables: Supply				
Percent of rental units affordable to VLI households		-0.299 ***	-0.293 ***	-0.316 ***
Percent of rental units built before 1970		-0.032 ***	-0.023 **	
Percent of units built 2005 or later		-0.178 **		-0.189 **
Percent of units with more than 1.0 occupants per room			0.085 ***	
Control variables: Demand				
Percent of population elderly		-0.357 ***	-0.304 ***	-0.274 ***
Percent of workers using public transit		-0.021 *	-0.027 **	-0.039 ***
Percent of adults below poverty		0.174 ***	0.168 ***	0.124 ***
Percent of adults unemloyed		0.299 ***	0.275 ***	0.256 ***
Percent of population moved with last 4 years		-0.662 ***	-0.558 ***	
Percent of population Hispanic		0.020 **		
R Square	0.026	0.732	0.750	0.780
Number of Observations	1,923	872	708	466
Mean Percent	81.804	81.438	81.709	81.891
Mean Percent Assisted Housing	20.877	21.341	21.442	21.660
Estimated Elasticity at the Mean	***-0.027***	***-0.034***	***-0.033***	***-0.038***

Source: Author's calculations using data from Khadduri, Shroder and Steffen, 2003.

Significance: *=.10; ** = .05; *** = .01

The models do a respectable job of explaining the variation in the dependent variable. The R Squared statistics in the multivariate models range from .65 to .73. However, the test variable, assisted housing as a percent of VLI renter households, does not do a very good job of contributing to that explanatory power. The estimates of the elasticity of this variable are very low, ranging from only -.03 to -.04. Given the strong relationship found in the models built using metropolitan data, these results suggest that the dependent variable for city level data does a very poor job of approximating the WCN that is measured well in the metropolitan models using AHS data.

Exhibit A-2 repeats the city level analysis using weighted least squares. As before, the weighting is based upon the count of renters in the market. These models perform similarly to the unweighted models.

One last effort to examine the change in housing hardship across cities from 2000 to 2008 was not productive. The models performed poorly. Further analysis of the city level data does not appear to be promising.