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PUBLIC HOUSING AND LABOR SUPPLY

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Abstract

Approximately 20 percent of female headed households with children receive government-subsidized housing. For those who receive housing subsidies, the subsidies are often worth more than all other welfare benefits combined. Despite its value and prevalence, there is comparatively little empirical evidence on how public housing in the United States affects economic behavior.

This study uses data from the SIPP and CPS to explore how public housing rules affect the work behavior of female headed households. The public housing rules create a great deal of variation in the program generosity, through three different dimensions. First, the program generosity varies by metropolitan area. Second, it varies over time, through year-to-year changes in the subsidy and income eligibility limit. Third, unlike other welfare programs, the benefits vary based on the sex composition of the children. For example, a family with one boy and one girl gets a three-bedroom apartment or voucher, while a family with two boys or two girls gets a two-bedroom apartment or voucher. By combining these different sources of variation, this study is better able to control for fixed geographic differences (such as the degree of rationing by the public housing authority), a limitation in several previous studies.

The results indicate that the public housing rules induce labor supply distortions in both data sets, though the evidence on other outcomes such as AFDC participation is less conclusive in the annual CPS data than in the monthly SIPP data. Among female headed households, a one-standard deviation increase in the subsidy reduces labor force participation by 3.6-4.2 percentage points from a baseline participation rate of 70-75 percent.

JEL Classification: H53, I38, J22, R21

I. Introduction

Nearly 20 percent of all female headed households with children receive government-subsidized housing or vouchers, and more than 40 percent of female heads who receive cash welfare also receive housing assistance. The participation rate for public housing is not much lower than that for AFDC, 27 percent. For those who receive housing subsidies, the subsidies are often worth more than all other welfare benefits combined. The federal government spent more than $19 billion on subsidized housing programs for the poor in Fiscal Year 1992 (U.S. House of Representatives, 1994). Of this amount, two-thirds was spent on Section 8 housing vouchers and one-third on public housing projects. The spending on public housing is nearly equal to the expenditure from the former Aid to Families with Dependent Children (AFDC) program, Supplemental Security Income program, or Food Stamp program.[1] The rules for the public housing program were only trivially affected by the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA), and the public housing rules present a unique set of work disincentives that typically go much higher up the income distribution than other transfer programs.[2]

Despite the fact that housing assistance is expensive to the government and taxpayers, valuable to its recipients,[3] and not uncommon among female heads, there is little empirical evidence on how housing

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[1] The term "public housing" will be used throughout this paper to refer to three programs – Section 8 vouchers, Section 8 certificates, and public housing projects. Section 8 certificates constrain households into choosing apartments that rent for less than the subsidy amount, while Section 8 vouchers act like a lump sum payment. The data used in this paper do not separately distinguish these programs. Thus, both will simply be called "vouchers." When a distinction is to be made between the first two programs and the later, they will be called "vouchers" and "projects," respectively. The cash welfare program is now called Temporary Aid to Needy Families (TANF), but it was called AFDC during the time this study's data spans. Thus, it will be referred to as "AFDC."

[2] PRWORA made several changes to public housing eligibility and benefits that affected aliens who were not already living in public housing, homeless who were receiving transitional housing assistance, welfare recipients who lost benefits because of fraud, and public housing recipients who engage in certain criminal acts. These changes affected only a small fraction of female headed households with children; thus the results from this study should continue to be relevant after welfare reform.

[3] Olsen and Barton (1983) find that the public housing program typically results in a large improvement in the housing of its participants and a significant increase in their consumption of other goods. The mean benefit of the program to these families is considerable relative to their mean income,

programs affect work behavior. Most research on the work-incentive effects of the U.S. welfare system focuses on the high implicit tax rates on recipients under the former AFDC program. This research finds modest effects of AFDC program rules on earnings – for each dollar transferred to a recipient, 37 cents are lost in earnings.[4] Cash benefits are only one of several programs provided to the poor, however. For some welfare recipients, cash benefits amount to less than one-third of the total benefit package. In-kind transfers, such as food stamps, Medicaid, and public housing, may also distort labor supply decisions. Moreover, the structure of these in-kind programs often creates marginal tax rates that exceed 100 percent, implying a potentially large change in behavior. In recent years a good deal of attention has been given to the effects of the Medicaid program, a smaller amount to food stamps, and virtually none to public housing.[5]

To my knowledge, only three studies explore the effects of public housing rules on labor supply in the United States.[6] The lack of research on public housing is surprising in light of the potentially large distortions public housing may create, and the variation in the program which reduces the challenges to evaluating the public housing program. Murray (1980) relies on coefficient estimates from other studies, and his "back-of-the-envelope" calculations conclude that public housing induces tenants to reduce their labor earnings by about 4 percent. Keane and Moffitt (1998) use cross-sectional data from the Survey of Income

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but small relative to the cost to taxpayers.

[4] See Moffitt (1992) for a summary of this work.

[5] For evidence on Medicaid, see Blank (1989), Winkler (1991), Moffitt and Wolfe (1992), Wolfe and Hill (1995), and Yelowitz (1995). For evidence on Food Stamps, see Fraker and Moffitt (1988), Blank and Ruggles (1996), Hagstrom (1996), and Yelowitz (1996). See Gruber (2000) and Currie (2000) for overviews of Medicaid and Food Stamps, respectively.

[6] There is a related literature in the United States that examines the "Moving To Opportunity" (MTO) program. MTO selects public housing recipients, assigns them to more advantaged neighborhoods, and subsidizes their rents with housing vouchers. The intent of the program, however, is to examine the effects of neighborhoods rather than the effects of the budget constraint. See Goering, et. al. (1999) for a detailed description of MTO, and Katz, Kling, Leibman (2000) and Duncan, Ludwig, and Pinkston (2000) for recent evaluations of MTO. There are several studies that explore the "housing benefit" in the United Kingdom. Blundell, Fry, and Walker (1988) and Dorsett and Heady (1991) examine take-up of the "housing benefit", and Giles, Johnson, and McCrae (1997) examine the returns to working.

and Program Participation (SIPP), and include public housing in their structural model of multiple program participation. They find that fair market rents have no significant effect on labor supply or participation in housing programs. They argue that lack of an effect represents the extensive rationing in the allocation of subsidized housing units, for which they are unable to control. Painter (2000) examines data from the SIPP and asks how rationing of public housing affects work behavior. Using a measure of rationing that varies across Metropolitan Statistical Area (MSA), he finds that housing programs raise the disincentives of the welfare package by an additional 21 percent compared with when housing programs are excluded. He also finds that the "discounted housing benefit" has a negative effect on labor force participation in some specifications.

My study explores how public housing rules affect the work behavior of female headed households, and makes three new contributions to the literature. The most important contribution is that the source of variation in the public housing rules is transparent. The rules create a great deal of variation in the program generosity through three different dimensions. First, the program generosity varies by region or metropolitan area. Second, it varies over time, through annual updates in the subsidy, known as the fair market rent (FMR). The FMR is the housing subsidy that a household with zero income would get from public housing. Finally, generosity varies based on the sex composition in the family. As Currie and Yelowitz (2000) first noted, a family with an even number of children but an odd number of boys and girls receives a larger subsidy from the program because they are offered a larger apartment or a larger voucher than an observationally equivalent family with an even number of boys and girls. For example, a family with one boy and one girl gets a three-bedroom apartment, while a family with two boys or two girls gets a two-bedroom apartment. The variation based on the sex composition of children allows the empirical work to include MSA fixed effects, while at the same time obtain precise estimates of the impact of the subsidy.

The second contribution is using two data sets, each with larger sample sizes than previous work and covering more recent years. Both data sets cover the calendar years 1990 to 1995 – the 1990 to 1993 panels

of the SIPP and 1991 to 1996 Current Population Survey (CPS). The labor supply results are broadly consistent across both data sets, and the longitudinal structure of the SIPP allows the estimates to account for unobserved individual heterogeneity.

Third, this study uses several measures of the public housing rules. In addition to examining the FMR – the focus of Keane and Moffitt (1998) and Painter (2000) – I also construct a measure of the public housing notch. That is, I examine whether the loss of housing benefits distorts work behavior when income goes beyond the eligibility level. The public housing notch arises because the FMR and the income eligibility limit are determined from two separate sources, and the well-known "breakeven level" formula does not apply. In welfare programs like AFDC, the income eligibility limit is mechanically related to the tax rate (t) and the guarantee (G) – ignoring deductions, the income eligibility limit is equal to G/t. In contrast, the housing subsidy is often positive at the income eligibility limit for public housing.

The results indicate that the public housing rules induce labor supply distortions in both data sets, though the evidence on other outcomes in the annual CPS data is less conclusive than in the monthly SIPP data. Among female headed households, an increase of $180 in the monthly subsidy (one standard deviation) reduces labor force participation by 3.6-4.2 percentage points from a baseline participation rate of 70 to 75 percent. A similar policy change also results in a small increase in AFDC participation. Exploring the labor supply results further, it appears that households respond to the public housing notch by reducing full-time work, and to a lesser extent, part-time work. The implication of these findings is that policy changes which lower marginal tax rates (and therefore reduce the notch) could increase work effort and earnings, reduce welfare dependency, and possibly provide more positive "role models" in the projects.

The remainder of this paper is arranged into four sections. Section II goes into detail about the public housing rules, illustrating the sizable subsidies from the FMR and illustrating the public housing "notch." It also discusses the theoretical effects of changes in the budget constraint on work effort and welfare participation. Section III reviews the identification strategy for isolating the effect of public housing from

other features of the tax code, welfare system, and economy. This section also discusses the SIPP and CPS extracts used in the study, and the Housing and Urban Development (HUD) data that is linked to it. Section IV presents the main results and some specification checks, and Section V concludes.

II. Background and Theory of the Work Incentives Created by Government-Subsidized Housing

A. Institutional Background[7]

Government-subsidized housing is delivered in two basic forms: public housing projects, where the household is offered a specific apartment, and Section 8 vouchers/certificates, where the household can choose any apartment in a given area that meets a set of quality and rent standards specified by HUD. Approximately 1.3 million households live in 13,000 projects administered by 3,300 distinct public housing authorities. Households with children occupy half of these units, and the elderly and disabled occupy the remainder. Another 1.3 million households use the voucher program. Compared with project residents, voucher recipients are younger, less likely to be from minority groups, and more likely to be single parents. Working-age, female-headed households with children (both in and out of subsidized housing) will be the focus of this paper.

Eligibility to live in the projects or to receive vouchers is determined by the local public housing authority (HA). Eligibility is based on a family's total annual gross income and family size, and is limited to U.S. citizens and specified categories of non-citizens. In general, to initially qualify the family's income may not exceed 50 percent of the median income for the county where the family chooses to live. This rule is known as the "very-low" income limit. In certain cases, a family may be admitted with income under the 80

[7] The description presented in this section draws upon Burke (1993, 1995) and Congressional Research Service (1991, 1993, 1994). It also draws on conversations with HUD economists, who clarified some issues concerning the public housing notch.

percent of the median income for the county, known as the "low" income limit.[8]

The HA collects information on the income, assets, and composition of applicant families, verifies this information with other local agencies, employers, and banks, and then determines program eligibility and the amount of the rental assistance payment. If the HA is unable to assist eligible families immediately, it places them on a waiting list. Since the demand for housing assistance often exceeds the supply, waiting periods between one and two years are common. In fact, a housing authority may close its waiting list when it has more families on the list than can be assisted in the immediate future. In selecting a family from its waiting list, a HA may give preference to a family who is homeless or living in substandard housing, paying more than 50 percent of its income for rent, or involuntarily displaced. Families who qualify for these preferences will move ahead of other families on the list who do not qualify for any preference. Each HA has the discretion to establish other additional preferences to reflect other needs of its particular community. Income eligibility must be maintained while a household is on the waiting list. Typically, a HA checks a household's income every six months from the time the application is first submitted until the subsidy is granted (Painter, 2000). When the family gets to the top of the project waiting list, they are usually offered only one choice for an apartment. If they turn it down, they are normally taken off the waiting list or moved to the bottom.[9] In essence, the household is given a take-it or leave-it offer (Olsen, 2000). When a family moves to the top of the voucher waiting list, they then have three months to find a suitable apartment that meets HUD's quality standards and has a landlord willing to participate in the program. If they do not find such an apartment, the family loses the voucher. Several studies suggest that a non-trivial fraction of

[8] Since 1999, there has been a third distinction for income below 30 percent of the median income -- sometimes called the "extremely-low" income limit.

[9] The one exception is that a household may refuse a unit for "good cause." Good cause to reject a unit offer exists when an applicant's acceptance of a unit offer would result in undue hardship such as making employment, health care, or other support services inaccessible. When public transportation is available, rejections based on inaccessibility are not considered good cause.

households do not end up using the voucher.[10]

In subsidized housing, a family pays a share of rent equal to either 30 percent of its monthly adjusted gross income (which includes deductions for each dependent under the age of eighteen, and deductions for child care expenses related to work), 10 percent of its monthly gross income, or its welfare rent payment, whichever is greater. As long as a working family's annual earnings exceed the deductions for dependent children and child care expenses, the marginal tax rate on earnings will be 30 percent.

The family's share of the rent is calculated by the HA, but the family pays that amount to the landlord in the case of vouchers. The HA pays the remainder of the rent directly to the landlord. In the case of projects, the family's share is paid directly to the HA. The family's rent share changes when its income or family circumstances change.

The family receives a project apartment or a voucher that is based on its size and composition. HUD's Handbook 4350.03, "Occupancy Requirements of Subsidized Multifamily Housing Programs," offers the following guidelines (HUD, 1996, pages 2-29 and 2-30):

- Children of the same sex may share a bedroom,
- No more than two persons would be required to occupy a bedroom,
- Unrelated adults and persons of the opposite sex (other than spouses) would not be required to share a bedroom.[11]

The result of these rules is that families with an even number of children but an odd number of boys and girls get larger apartments than equally sized families with even numbers of boys and girls. In the simplest case, a family with one boy and one girl receives a three-bedroom apartment, while a family with two boys or two

[10] One case study of 56 single mothers in eastern Massachusetts found that after waiting an average of two years to receive a certificate, 24 women returned them unused because they were unable to find housing that met program requirements within the allotted time (Mulroy, 1988). Another study found that 39 percent of voucher recipients were unable to find a unit that met HUD's standards within the allotted time (Leger and Kennedy, 1990).

[11] The guidelines allow very young children to share a bedroom, even if they are not the same sex.

girls only receives a two-bedroom apartment. Thus, the subsidy from the program varies not only by family size, but by the sex mix of the children.

B. Illustrations of the Effects of the HUD Rules

The "very-low" income limit varies considerably and is usually higher than eligibility for most other welfare programs. For example, in 1993 the "very-low" income limit established by HUD for a four-person family in the 48 contiguous States ranged from $12,100 (in some rural areas of Mississippi) to $36,700 (in a metropolitan area of Connecticut). In the median county, the "very-low" income limit was $16,550. The poverty line for this family was $14,350 (Federal Register, 1993) and more than 80 percent of the counties in the U.S. had public housing income limits greater than the poverty line. In contrast, most states had income limits for AFDC that were less than the poverty line (U.S. House of Representatives, 1994, pages 379-381).

Table 1, which substantially expands on a similar table in U.S. House of Representatives (1996), calculates total income for a family of three in Philadelphia, Pennsylvania as its earnings increases. The table shows the interaction of the EITC, AFDC, Food Stamps, Social Security, federal and state taxes, and work expenses. The two main changes to this table are that Medicaid and public housing are included in "total income," and additional computations are carried out for $22,000, $23,000, and $25,000 in earnings. These earnings levels are important because the "very-low" income limit to initially qualify for public housing in Philadelphia is $22,200, after which a family is ineligible. The “very-low” income limit is significantly higher than those for most welfare benefits – it covers the same income range as EITC phase out.

The effect of incorporating public housing (and Medicaid) into the budget constraint is remarkable: "total income" at $0 of earnings is $19,217, while "total income" at $30,000 is $19,837.[12] This translates into

[12] Medicaid is valued at its average expenditure of $3,307, though in general in-kind benefits are valued at less than the cash equivalent. Smeeding (1982) estimates that Medicaid is valued at 36.8 percent of its costs. The same issue arises with public housing, which in this case is valued at $8,136, but most researchers agree it is valued closer to the actual cost. Table 1 assumes that the household takes up the housing subsidy – it ignores the possibility of rationing.

a tax rate of 98 percent for the first $30,000 of earnings. Moreover, there are certain portions of the budget constraint where marginal tax rates are greater than 100 percent. By moving from $22,000 to $23,000 of earnings, total income falls by $2,592 because the household loses the remaining housing subsidy.

This drop in housing benefits is not unique to Philadelphia; Table 2 illustrates the income limits, subsidies, and notches for seven metropolitan areas. Depending on the area and family composition, the notch varies between $1,656 for two bedroom apartments in Baltimore and $8,892 for three bedroom apartments in San Francisco. Given these steep drops in benefits and the waiting period to requalify, it is plausible that households will alter their earnings decisions either to qualify for, or remain in, public housing.

C. Notches

Although it is difficult to find good documentation on the specific rules for letting households in public housing, and especially for removing them from public housing, discussions with HUD economists highlight three points about the enforcement of the housing rules:

- For those neither in the projects nor receiving vouchers, the "very-low" income limit applies, and the notches represented in Tables 1 and 2 are accurate.

- For those receiving Section 8 vouchers/certificates, the "low" income limit applies, and the notches represented in Tables 1 and 2 are too large. The notches would be smaller, but in many cases would not disappear completely. In a sense, it is easier to keep a voucher than to get a voucher.

- For those in public housing projects, it is impossible to be removed for having too much income – thus, there is no notch. It is possible for a millionaire to live in the projects, but she would have to pay 30 percent of her income toward rent. The tax rate and rent payment associated with it, rather than the income limit, is the reason why wealthy households do not live in the projects.

Curiously, this final generalization about projects is not totally consistent with HUD's explanation of the program on their web site (see http://www.hud.gov/phprog.html):

> "You may stay in public housing as long as you comply with the lease. If, at reexamination your family's income is sufficient to obtain housing on the private market, the HA may determine whether your family should stay in public housing. You will not be required to move unless there is affordable housing available for you on the private market."

With 3,300 different housing authorities and no centralized source for each housing authority's

admission rules, it is not possible to verify that these guidelines are enforced universally (especially for the projects). In the empirical specifications that employ the "notch" as the policy variable, I will experiment with several specifications that use different assumptions about enforcement of the rules. In one specification, I will avoid the sample selection bias that arises from the endogeneity of housing status by using the "very-low" income limit for all individuals in constructing the notch. This assumption – that the "very-low" income limit is binding for all individuals – is close to the truth because subsidized housing take-up among income-ineligibles is trivial – tabulations of the SIPP and CPS show that less than 4 percent of female heads deemed ineligible report receiving any housing subsidy. In another specification, I estimate instrumental variables models where the notch varies based on actual housing status. This specification explicitly incorporates the idea that it is harder to get into subsidized housing than to stay in.

D. Theoretical Effects of the Public Housing Program

The fact that welfare programs may distort labor supply is well known, and the particular quirks of public housing are also well recognized theoretically.[13] Assume that the consumer maximizes utility, U=u(Leisure, Consumption). She faces a constant pretax wage, W^0. The welfare and tax systems create nonlinearities in the budget set. Figure 1 illustrates the resulting static budget constraint for a female-headed household, abstracting for a moment from the possibility of rationing of public housing. At zero hours of market work, the mother receives a certain level of AFDC benefits, known as the "guarantee," in addition to public housing. The value of the housing subsidy at zero earnings is the FMR. As she begins to work, her

[13] Murray (1980) explores the differential incentives of in-kind and cash benefits on labor supply, and uses public housing as an example. Blinder and Rosen (1985) discuss the efficiency effects of notches. They argue that a standard tax or subsidy alters the price everyone faces, and hence distorts everyone's behavior. A notch, on the other hand, leaves the effective price unchanged – except at the notch point itself, where the price is undefined. A standard tax imposes small excess burdens on everyone, while a notch imposes large excess burdens on a small number of people. Mulligan (1998) examines 100 percent tax rates (and implicitly notches as well), and argues that the primary intent of policy may be to discourage taxable income.

AFDC and public housing benefits are taxed away, so her after-tax wage is $W^1=(1-t_1)W^0$, where t_1 is the cumulative marginal tax rate for earning income while on AFDC and public housing (which varies from 67 to 100 percent for AFDC, and 30 percent for public housing). Once she works more than H^1, the hours of work where the entire AFDC benefit is taxed away, she loses her AFDC eligibility. In many cases, she still receives public housing because the eligibility limits for public housing are somewhat higher than those for AFDC. She now faces a higher market wage, $W^2=(1-t_2)W^0$, where t_2 is the equal to the 30 percent tax rate. At the hours point H^2, her eligibility for public housing ends, and her family loses the remaining subsidy in its entirety because she has earned too much income. This discrete drop in benefits creates a marginal tax rate in excess of 100 percent for earning additional income, and is called the public housing notch.[14] In principle, this loss of housing benefits results in a portion of the budget constraint that utility-maximizing households would not choose. To determine this precise portion of the budget constraint, however, one needs to know the household's valuation of the benefits.

Both changing the income eligibility limit and changing the subsidy will have effects on labor supply. Figure 2 illustrates the effects of changing the income eligibility limit, holding the subsidy constant, while Figure 3 shows the effects of changing the subsidy, holding the income limit constant. Even without imposing a particular utility function, several predictions can be made through revealed preference arguments. Increasing the income limit unambiguously increases labor force participation, but has an ambiguous effect on earnings and hours of work. Labor force participation increases because all of the new {Leisure,

[14] Yelowitz (1995) reviews similar disincentives with health insurance created by the "Medicaid notch." The public housing notch differs from the Medicaid notch in two respects, both of which create larger labor supply distortions. First, public housing is not an entitlement. If the household earns too much and loses its project apartment or voucher, it may have to wait several months or years to receive it again. During the time the family is on the waiting list, its income may not go above the "very-low" limit. Medicaid, in contrast, is an entitlement. If a family becomes eligible, it can usually collect Medicaid within 45 days of application. Second, the alternative to not living in subsidized housing is to pay for a unsubsidized apartment or perhaps live with an extended family, both costly alternatives (in terms of dollars or utility). The alternative to not receiving Medicaid is usually less severe: families can use emergency rooms or charity care if they become sick, and if they are healthy the value of Medicaid is probably quite low.

Consumption} bundles in Figure 2 involve the head of the household giving up leisure – some households who were initially enrolled in public housing and not working may now receive higher utility from these points on the budget constraint. For those who were initially participating in public housing, hours worked and earnings also increase – all the new bundles are at higher levels than before. For those initially off public housing, however, increasing the income limit may have both "mechanical" and "behavioral" effects. Some households, located on the segment *ab*, now become eligible for public housing, and assuming they participate, the income effect of the subsidy reduces hours and earnings. They will not reduce their hours below H^2, however, since they could have done that before an increase in the eligibility limit. Other households, located on segment *bcd*, are not mechanically eligible after the limit increases, but may reduce their earnings to become eligible.

The effects of increasing the subsidy are more straightforward as shown in Figure 3 (again, compared to Figure 1). The increase in the subsidy provides an income effect which should reduce hours of work, earnings, and labor force participation for households initially participating. For those initially in unsubsidized housing, this increase may cause them to join the program, and locate somewhere along the segment *efg*. All of these bundles involve lower earnings and hours-of-work than before, so the net effect on these outcomes is negative. Some initial nonparticipants may also withdraw from the labor force completely, so the net effect on participation is negative. Finally, AFDC participation could conceivably increase because of this reduction in earnings.

Although changing the income limit and overall subsidy leads to some predictions on labor supply, the most stunning feature of the budget constraint is the public housing notch. Holding the subsidy constant and lowering the income limit makes the notch bigger, and raising the subsidy and holding the income limit constant has a similar effect. In Figure 2, consider lowering the income limit from W^0H^3 to W^0H^2 (and making the public housing notch bigger). For most sets of preferences, those initially in public housing and working between H^2 and H^3 will reduce their work effort. It is possible, however, for some recipients to leave

public housing entirely. In Figure 3, the predictions for making the public housing notch bigger are the same as those for raising the subsidy. By combining these two policy choices, the income limit and the subsidy, into one measure for the public housing notch, the labor supply distortions are likely to be larger.

It is also important to point out that public housing is rationed. Rationing may affect the labor supply of households who are in and out of public housing. For those out of public housing, it takes longer to get into the program with more rationing, so some households on the margin (presumably with better labor market opportunities) will give up their chance to be in subsidized housing and ignore the restrictive rules on earnings. On the other hand, longer waiting lists increase the incentive to try to qualify for "special preferences" in admissions – for example, by having a high rent-to-income ratio. One way to qualify for this preference is to decrease earnings. Thus, the effect of rationing on earnings for those initially out of public housing is ambiguous. For those in public housing, increased rationing makes it less tempting to leave the program, since it is more difficult to requalify. In most cases, however, the effect of greater rationing on labor supply should be small. Unless there is uncertainty about the income limit, enforcement of the rules by the housing authority, or the level of the household's earnings (such as an unexpected bonus), then as long as the household obeys the parameters of the program, they will not be removed.[15]

Although the two data sets in this study do not permit an examination of changes in the degree of rationing within an MSA over time, the empirical estimates control for variation in rationing across MSAs through MSA fixed-effects, and it is unlikely that the degree of rationing changed appreciably during the six year period that this study explores.

III. Empirical Methods and Data Description

[15] It is possible for greater rationing to reduce earnings for those planning to leave public housing. Suppose that a household could earn $25,000 at a temporary job, but the household would lose public housing eligibility as a consequence. If the household could quickly requalify and reenter public housing after the job ended, it would be more likely to accept the higher paying job.

A. Methods

To assess the predictions explained in the preceding section, the analysis will focus initially on the effects of the FMR and the "very-low" income limit, and then on the notch. The estimates may be viewed as the "reduced form," in the sense that the analysis examines the overall effects of the policy variables on labor supply, rather than imposing a particular utility function and estimating this function's underlying parameters.

The most transparent specification estimates an equation that takes the form:

$$(1) \quad OUTCOME = \$_0 + \$_1 FMR + \$_2 VERY\_LOW + \$_3 X + *_M + *_Y + *_B + *_K + *_F + *_{BK} + *_{BY} + *_{KY} + *_{FY} + *_{FBK} + *_{BKY} + ,$$

where OUTCOME is a measure of the female head's work effort (for example, labor force participation, full or part time work, or welfare participation); FMR represents the subsidy at zero earnings received by the household from the government housing programs (e.g., in Table 1, it would be $8,136 per year); VERY_LOW is the very-low income limit defined by HUD rules (e.g., in Table 1, it would be $22,200); X is a set of demographic and family structure variables for the head including age, race/ethnicity, marital status, and education; $*_M$, $*_Y$, $*_B$, $*_K$, and $*_F$ are full sets of dummy variables indicating the MSA (denoted as the subscript "M"), YEAR (denoted as "Y"), number of BOYS (denoted as "B"), number of KIDS (denoted as "K"), and number of family members present (denoted as "F"), respectively; $*_{BK}$, $*_{BY}$, $*_{KY}$, $*_{FY}$, $*_{FBK}$, and $*_{BKY}$ represent interactions of the dummy variables – the subscript "BK" represents the interaction of boys and kids, for example.[16]

Including these main effects ($*_M$, $*_Y$, $*_B$, $*_K$, and $*_F$) represents a contribution that previous studies were unable to make -- Keane and Moffitt (1998) estimate their model on cross-sectional data and include only region-specific effects rather than MSA effects, while Painter (2000) estimates models with county and time variation but does not include the full set of main effects. Including these effects is important to eliminate other confounding factors that might falsely attribute changes in labor supply to either the FMR or

[16] Some of the main effects are subsumed by the interaction terms in the empirical analysis.

the "very-low" income limit. For example, metropolitan areas with high income eligibility limits are likely to have high wages, which could bias the labor supply regressions. Or, perhaps, metropolitan areas with larger housing subsidies have longer waiting lists or fewer local preferences. The analysis eliminates concerns about higher wage areas and greater rationing by including MSA fixed effects. The fixed effects for YEAR would control for secular trends in the labor force participation of single mothers, which was rising in the late 1980s and early 1990s. The YEAR fixed effects also control for changes in the federal minimum wage. Some important interactions between these dimensions are also included in the model. The analysis controls for the sex composition by including the interaction of BOYS and KIDS; Angrist and Evans (1998) find that the sex composition of the first two children affects the likelihood of having a third child (though the fertility effect is much stronger for married mothers than for single mothers who are the focus of this study). The interaction of KIDS and YEAR controls for changes in the EITC, which was dramatically expanded after 1993, especially for families with two or more children and has had some impact on labor force participation (Eissa and Leibman, 1996; Meyer and Rosenbaum, 1999; Neumark and Wascher, 2000).

By including the main effects for these five variables, and some of the important interactions, the coefficients on the FMR and income limit are identified only through *interactions* of these dimensions. Identification of FMR comes from: the interaction of M*Y*B*K, the interaction of M*Y*B and M*Y*K, and the interaction of M*Y, M*B, and M*K. Identification of the income limit comes from the interaction of M*Y*F and the interaction of M*Y and M*F.

In constructing the second measure, NOTCH, I combine information on HUD's rules with additional family-specific information and whether the household is in unsubsidized housing, receiving Section 8 vouchers, or in the projects. For a family in unsubsidized housing, the rent that would be paid at the public housing notch is equal to:

(2) $RENT_i = 0.3*ADJUSTED_i$

where ADJUSTED is the household's annual income after some adjustments.[17] Adjusted income is related to the maximum income limit as follows:

(3) $ADJUSTED_i = VERY\_LOW_i - 480*KIDS_i - CHILDCARE_i*¼(KIDS_i<13)$,

where KIDS is defined above and multiplied by an annual deduction of $480 per child, CHILDCARE represents the annual child care expenses associated with working, and ¼(KIDS<13) is an indicator variable for whether the children are under the age of thirteen. I maintain the assumption from Table 1 that per-child childcare costs equal 10 percent of earnings, up to an annual maximum of $2,100 per child (U.S. House of Representatives, 1996). In following the HUD rules (HUD, 1996), child care costs are deducted only for children ages zero to twelve, inclusive.[18]

Finally, for the family in unsubsidized housing, NOTCH is defined as:

(4) $NOTCH_i = FMR_i - RENT_i$.

For a family receiving Section 8 vouchers, NOTCH is calculated in a similar way except that equation (3) substitutes the "low" income limit for the "very-low" limit. Finally, for families in the projects, NOTCH equals zero -- according to the interpretation of economists at HUD, wealthy families are not automatically removed from the projects.

Returning to Table 2, the NOTCH measure is illustrated for families in unsubsidized housing. Consider a family with two young boys who live in Baltimore in 1996. The income limit is $23,600, while the subsidy is $7,188. The exemptions for the children are $960, and child care expenses are $4,200. The

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[17] Forty states use the maximum of thirty percent of adjusted income or ten percent of gross income in determining the rent payment. In the remaining ten states, they also consider the welfare shelter deduction (Keane and Moffitt, 1998). Adjusted income, rather than gross income or the welfare shelter deduction, is used because the earnings levels at the notch point are sufficiently high that the net income requirement will bind rather than the gross income requirement or welfare shelter deduction.

[18] Keane and Moffitt (1998, page 566) incorporate child-care and work-related expenses into their analysis. In some specifications (not presented), I have varied child-care expenses by assuming the cost is 5 percent of income per child, up to a maximum of $1050. This modification does not change the conclusions.

notch of $1,656 is equal to $7,188 minus 0.3*(23,600 - 960 - 4,200).

There is one difficulty with the NOTCH measure defined in equation (4). The value depends on the household's actual housing choice, which is endogenous. NOTCH is equal to zero for households in the projects, is larger for those receiving vouchers, and is largest for those in unsubsidized housing. Thus, families in unsubsidized housing face bigger notches to get into subsidized housing than those already in it. They are also likely to be better off in certain respects, some aspects observable and others unobservable. In particular, these families are likely to have a greater attachment to the workforce and higher earnings potential. Thus, an ordinary least squares regression will likely lead to the counterintuitive result that making the notch bigger increases earnings and encourages labor force participation. However such a conclusion is very misleading, because it does not account for the endogeneity of housing choice.

The analysis takes two approaches to this endogeneity problem. The first approach computes equation (4) for each household using the "very-low" income limit; thus, it ignores actual housing status. This assumption -- that the "very-low" income limit is binding for all individuals -- is close to the truth because subsidized housing take-up among income-ineligibles is trivial. The second approach uses an instrumental variables strategy where the instrument does not rely on the household's actual choice. As an instrument for the household's actual NOTCH level, I take a weighted average of the NOTCH in unsubsidized housing, the NOTCH in the voucher program, and the NOTCH in the projects (which is always equal to zero). The weights correspond to the fraction of households in the MSA that reside in unsubsidized housing, have vouchers, or in projects. These weights were computed from HUD administrative data.[19] The instrumental variable is equal to:

(5) $\quad INSTNOTCH = NOTCH_{VOUCH}*P_{VOUCH} + NOTCH_{UNSUB}*(1-P_{PROJ}-P_{VOUCH})$

where the subscript under NOTCH stands for the notch from that housing choice ($NOTCH_{PROJ}$ is omitted

[19] On average, approximately 1 percent of the households in the MSAs live in projects, and 1.3 percent have vouchers. The fractions for each usually vary between 0 and 4 percent, and the total between 0 and 5.5 percent. These numbers are constructed for all households, not just female heads.

because it is always equal to zero), and P_{PROJ} and P_{VOUCH} stand for the fraction of households in the MSA that live in the projects or use vouchers. Unlike the original NOTCH variable, INSTNOTCH does not incorporate the household's actual housing choice.

The regression specification using the notch becomes:

(6) $$OUTCOME = \$_0 + \$_1 NOTCH + \$_2 X + *_M + *_Y + *_B + *_K + *_F + *_{BK} + *_{BY} + *_{KY} + *_{FY} + *_{FBK} + *_{BKY} + ,$$

The one modification is that the vector X now includes indicator variables for any children under age six, and any children under age thirteen. These are now included because the NOTCH measure incorporates child care deductions for these younger children.

B. Data extraction

For the empirical analysis, I use SIPP and CPS. Each household in the SIPP is interviewed at 4-month intervals (known as "waves") for approximately 32 months (36 months for the 1992 and 1993 panels). The SIPP is a panel survey in which a new panel is introduced each year. For the basic analysis, I use all interviews from the 1990, 1991, 1992, and 1993 SIPP panels. The 1990 through 1993 panels interviewed approximately 14,300, 14,000, 19,600, and 19,890 households, respectively. The panels cover the calendar years 1990 to 1995. The SIPP provides information on the economic, demographic, and social situations of the household members. While, in principle, the SIPP asks about income and public housing participation in every month, it is well known that some respondents tend to give the same answer for every month within a 4-month interval.[20] I extract every person-month observation contained in the SIPP, and control with dummy variables for each month within the four-month interval.

The March CPS is a nationally representative data set that surveys approximately 50,000 households each year. In addition to demographic characteristics, the March Annual Demographic File provides

[20] See Blank and Ruggles (1996) for a discussion of this seam bias.

retrospective information on income, labor force participation, and welfare participation. The 1991 to 1996 surveys provide information on the calendar years 1990 to 1995.

Both data sets have advantages and disadvantages. While both are nationally representative, the CPS has a more detailed set of geographic identifiers – it identifies all of the states and more than twice as many MSAs. The key labor market outcomes are defined with respect to the previous year in the CPS, and the previous month in the SIPP. It is likely that the retrospective information in the CPS is prone to more recall bias. Finally, the longitudinal structure of the SIPP can be used to estimate models with individual fixed effects.

I focus on non-elderly female-headed households because the public housing rules treat income and assets of elderly members (which HUD defines as age 62 rather than the more traditional age of 65) differently than others, and because labor supply issues are largely irrelevant for the elderly. Thus, the analysis focuses on households where the female head was between the ages of 18 and 61. I am forced to restrict the sample to households who live in uniquely identified metropolitan areas in the SIPP, because identification of non-metropolitan areas contains substantial measurement error.[21] To ensure comparability, I apply the same screen to the CPS data. In the SIPP panel, I also exclude individuals with inconsistent demographic information across months (e.g., the respondent's race changed).

Finally, the sample is restricted to households eligible for either a two- or three-bedroom apartment. They have between one and three children, and two to five total family members. The screen ensures that I can impute FMRs and income limits to each household, and that the availability of project apartments and vouchers is fairly uniform within an MSA.

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[21] According to the SIPP users guide, the SIPP identifies residences located in metropolitan areas and can be used to produce national estimates of the metropolitan population. However, the SIPP cannot be used to produce estimates of the non-metropolitan population. In order to protect respondent confidentiality, a random sample of metropolitan households were recoded and identified in the public use files as living in a non-metropolitan area. The procedure contaminates the non-metropolitan sample and estimates of non-metropolitan characteristics based on that sample will be biased. The data identifies 93 separate MSAs and CMSAs (Consolidated Metropolitan Statistical Areas).

Appendix Tables 1 and 2 go through the precise screens for the SIPP and CPS, and the number of observations that are lost, in making the final extract. Overall, the sample consists of 74,383 observations on 4,053 female heads in the SIPP, and 15,443 female heads in the CPS. On average, each female head is observed 18.4 times during the panel.

There are several differences between my sample and those used in previous work. Unlike previous studies that exclude households with high asset levels or homeowners, the sample in this study includes both renters and homeowners, as well as those with high and low income or asset levels. Other studies also control for nonlabor/nontransfer income (such as interest income, earnings of other members, and child support payments). Asset ownership, housing status, and nonlabor/nontransfer income could conceivably be outcomes of the transfer system, and hence are inappropriate to take as exogenous.[22]

IV. Results

A. Results on rationing

Before exploring the labor supply results with the SIPP and CPS, I investigate some issues related to the rationing and location of projects.[23] Since the families in my sample qualify for a two- or three-bedroom apartment, one would like to know whether it is more difficult to get the larger apartments. If waiting lists were substantially longer for three-bedroom units, then the extra bedroom might be perceived as a cost rather than a benefit.

Even if the extra bedroom was still perceived as a benefit, there are stories related to administrative selection that could cause concern. If larger public housing units are in even scarcer supply than small units and public housing authorities have some latitude in deciding which applications to accept, then housing

[22] For example, see Hubbard, Skinner, and Zeldes (1995) for a model on savings behavior that incorporates means-tested and asset-tested transfer programs. See Powers (1998), Neumark and Powers (1998), and Gruber and Yelowitz (1999) for some recent empirical examples.

[23] Similar issues arise with vouchers, but no data exists with which to test these hypotheses.

authorities may apply lower standards for two-child families of the same gender than for two-child families with different genders. This form of administrative selection would likely lead to downward biased estimates of the effect on the public housing rules on labor supply – those that qualify for and receive more generous public housing might be positively selected and have a greater attachment to the labor force. The measured effects on labor supply, therefore, may not be related to the FMR or the notch, but rather to unmeasured individual heterogeneity. On the other hand, if larger apartments are systematically located in worse neighborhoods (to compensate for the increased cost of building them), then the effects of the FMR or notch may be upward biased.

National tabulations from HUD's Multifamily Tenant Characteristics System for August 2000 show that 25 percent of project units are two-bedroom and 21 percent are three-bedroom.[24] Thus, the difference in availability by bedrooms appears to be modest.

It is not possible to get the admission criteria for all 3,300 public housing authorities. Fortunately, however, administrative data from HUD for the year 1996, called "A Picture of Subsidized Households," allows researchers to explore the extent of rationing in project developments (though not at the apartment-level).[25] The first three columns of Table 3, taken from unpublished work of Currie and Yelowitz (2000), explore whether two- and three-bedroom project apartments are equally available. To do this, development-level data about the average stay in the development, the average waiting time, and the fraction of movers in the previous year was regressed on characteristics of the housing complex, including the fraction of one-, two-, and three-plus bedroom units, as well as MSA fixed effects. The characteristics of the housing complex include the age distribution of the residents, income distribution, race composition, and family structure

[24] These numbers come from http://www.hud.gov/mtcs/. The fraction of vouchers that go to two-bedroom apartments is 39 percent, while the fraction of vouchers that go to three-bedroom apartments is 30 percent.

[25] For a detailed description of this data, see http://www.huduser.org/datasets/assthsg/statedata96/index.htm .

composition. Each of these could have effects on turnover and waiting times that are independent of the size of the unit – for example, many elderly residents will stay in their units for the rest of their lives, whereas younger residents are more likely to leave. The key coefficients to focus on in Table 3 are those on the fraction of one-, two-, and three-plus bedroom apartments (with the omitted category being efficiency or zero-bedroom units). As the p-values at the bottom of the table indicate, one cannot reject the hypothesis that the fraction of two-bedroom units has the same effect on turnover as the fraction of three-bedroom units. This suggests that projects with three-bedroom units are as likely to have vacancies as those with two-bedroom units. It is not the case, for example, that relative scarcity of three-bedroom apartments would result in differential selection rules being applied to mixed sex versus same sex child families.

The final column of Table 3 explores whether three-bedroom apartments are located in worse neighborhoods than two-bedroom apartments. I examine one of the measures of neighborhood quality that Katz, Kling, and Liebman (2000) used in their evaluation of MTO: the poverty rate in the census tract. On average, the developments were located in Census tracts that had a poverty rate of nearly 30 percent. The coefficient estimates indicate that developments with two-bedroom apartments were located in census tracts with somewhat lower poverty rates, but again, one cannot reject the hypothesis that the coefficient is equal to that for three-plus bedroom apartments.

In summary, the distribution of project units at the national level as well as regression results on resident turnover and neighborhood quality at the development level do not indicate that larger units are substantially more scarce than smaller units. These findings mitigate concern about sample selection bias based on administrative selection.

B. Summary statistics

Table 4 compares SIPP and CPS summary statistics for the entire sample, as well as for those in and out of subsidized housing. Columns (1) and (4) examine the whole SIPP and CPS sample, respectively.

Taken as a whole, it is clear that the labor market variables and demographic variables are very similar in the two data sets. The labor market variables for the SIPP are presented both at the monthly level in the first six rows, and then at the annual level in the next six rows to maintain comparability to the annual CPS. In any given year, 19 percent of the sample participates in subsidized housing, and the take-up rate among those who are income-eligible is 28 to 29 percent.[26] More than three-quarters of the sample works in the labor force, and approximately one-quarter of the sample reports AFDC participation. It is interesting to note that despite rationing of public housing, the participation rate for public housing is not much smaller than that for AFDC. Although not shown, of those on AFDC, about 40 percent participate in public housing.[27]

The table also illustrates three other labor market outcomes – an indicator variable having income below the "very-low" income limit (denoted in the table and subsequent regressions as "below income threshold"), an indicator variable for full-time work (defined as 36 or more hours of work per week), and an indicator variable for part-time work (defined as 1 to 35 hours of work).[28] The SIPP gives higher participation rates for full- and part-time work when it is aggregated to the annual level, but very similar numbers when it is taken at the monthly level. This is not surprising, because the March CPS supplement asks about the number of hours that the respondent usually worked – it therefore does not allow variation in hours over the course of the year.

Moving to the columns that show the summary statistics for public housing recipients, several patterns emerge. First, although labor force participation is lower than for the entire sample, it is not true that participating in public housing and participating in the labor force are mutually exclusive decisions. Over the course of a year, approximately one-half of public housing recipients work, and more than one-third work in any given month. It is also incorrect to assume that participating in public housing implies participation in

[26] The participation rate is very similar to that in Keane and Moffitt (1998, Table 1). They show that 18 percent of sample participates in some form of subsidized housing.

[27] This is similar to the 42 percent participation rate reported in Moffitt (1992, Table 2)

[28] These definitions of full- and part-time work follow Keane and Moffitt (1998).

AFDC. Fully one-third of those in public housing do not report cash assistance. As one might expect, public housing recipients are more likely to be nonwhite than other female heads (approximately 80 percent versus 50 percent), where nonwhite includes Hispanic ethnicity. Public housing recipients are twice as likely to be never-married or be a high school dropout, and have slightly larger families, on average. Perhaps more surprising, however, is that public housing recipients report at least as much part-time work than those out of public housing.

Finally, the table shows the means of the three policy variables. Each of these is expressed in monthly terms, divided by 1000, and inflated to 1995 constant dollars. The FMR averages about $700 per month in the SIPP and CPS, with a standard deviation of approximately $180. The "very-low" income limit is considerably higher, around $1460 per month in the SIPP, and nearly $1700 per month in the CPS. These differences across data sets likely reflect the different geographic coverage: the CPS covers more MSAs with finer detail than the SIPP. Finally, the notch (computed in the same fashion as it was in Table 2), averages $265 per month in the SIPP and $342 per month in the CPS. The notch has a standard deviation of $150 in both data sets.

C. Results on labor supply

The remaining tables estimate the effects of public housing policy on labor supply. The results are presented as linear probability models; the estimates may therefore be interpreted as percentage point changes. The SIPP results are presented in two ways: results that include random effects and results that include individual fixed effects. Although the coefficients in the two specifications look quite similar, Hausman tests rejected the random effect specification.

Tables 5, 6, and 7 examine labor force participation and AFDC participation. Table 5 presents coefficients using the FMR and "very-low" income limit. The first row shows that raising the FMR generally has a significant, negative impact on work effort and a significant, positive impact on welfare participation.

Columns (1), (3), and (5) show very consistent evidence in the CPS, the SIPP random effects, and SIPP fixed effects specification for the impact of the FMR. In each case, a one-standard deviation increase in the FMR reduces labor force participation by 3.6 to 4.2 percentage points, from a baseline rate of 70 to 75 percent. The standard errors are fairly small, especially in the SIPP. The FMR and very-low income limit are still identified with the inclusion of individual fixed effects, because these rules are updated each year (and do not necessarily increase uniformly across MSAs). The table also presents some of the other demographic variables included in the regression. The results on the demographics are largely intuitive. Labor force participation increases with age, but at a decreasing rate. Minorities, never-married, and less-educated women are less likely to work. The results also show much less of an impact of the "very-low" income limit itself: in none of the three columns is it significant. It is possible that changes in the income limit work along the earnings or hours-of-work margin, rather than the participation margin.

The results on AFDC participation are less consistent: the FMR has no impact in the CPS data, but it has a small positive impact on AFDC participation in the SIPP data. The largest estimate of a one-standard deviation increase in the FMR is a 1.4 percentage point increase AFDC participation. Increases in the "very-low" income decrease AFDC participation in the SIPP. This is to be expected, because the budget constraint in Figure 1 helped illustrate the income limit for public housing was often greater than AFDC – any increases in that limit would therefore create {Leisure, Consumption} bundles that consisted of higher earnings and no AFDC participation.

Table 6 combines the information on FMRs and very-low income limits into the NOTCH variable expressed in equation (4). Except for replacing these policy variables and adding indicator variables for any children under age 6 or under age 13 (to account for the child care costs), the specifications are identical to those in Table 5. Combining these measures makes a difference to the precision of the estimates: the results in the CPS are much stronger and the SIPP results remain strong as they were in Table 5. A one-standard deviation increase in the notch (approximately $150 per month) reduced labor force participation by 3.8 to

6.2 percentage points, and increases AFDC participation by 1.8 to 2.4 percentage points. A concern about the estimates in Table 6 is that the NOTCH variable constructed from the "very-low" income limit is measured with error: those in the projects or with vouchers may be able to earn substantially more than that limit and still keep their subsidies. Table 7 substitutes a notch measure that is a function of actual housing status, and instruments for that notch with INSTNOTCH, defined previously. This instrument is highly correlated with the actual notch. The first-stage fit is excellent: regressing NOTCH on INSTNOTCH (and the other covariates) gives a coefficient estimate of 0.88 with a standard error of 0.01. The coefficients are still precisely measured in Table 7, though they are about 10 to 20 percent larger than the estimates in Table 6.

Table 8 explores three additional labor market outcomes: whether the family has income below the "very-low" income limit, whether the head works full time, and whether the head works part time. The three rows represent the same specifications found in Tables 5, 6, and 7. The budget constraint analysis in Figure 1 suggests that the bigger the notch, the greater the incentive for a family to reduce earnings below the income threshold. This conjecture is confirmed in the SIPP data (but not the CPS data) – increasing the notch substantially increases the likelihood of being below the threshold. One reason for the difference between the SIPP and CPS may be because of increased measurement error in annual income compared to monthly income. This table also shows that significant reductions in both full- and part-time work effort, using both the notch measures and the FMR.

Finally, Table 9 explores two specification checks – the first panel of the table reestimates the results from Table 5 but excludes families that had an infant in the previous year (for the CPS), or during the panel (for the SIPP). Having an infant would increase the FMR and "very-low" income limit (each policy variable would be affected through a larger family size, and the FMR might be affected through the sex composition). Yet this variation in the policy variable is unlikely to reflect the effects of the rules on labor supply – rather, having a baby is often associated with a withdrawal from the labor force. The results of this first panel show that although the labor force participation regressions lead to the similar conclusions, the AFDC regressions

do not. The increase in AFDC participation appears to originate, in part, from changes in family structure.

The second panel of this table explores attrition in the SIPP. A female head may leave the panel for a variety of reasons – aging out (e.g., reaching age 62), getting married, having an only-child leave the household, moving to a non-metropolitan area, or simply refusing to participate in the sample. The sample in Table 9 examines 776 female heads who report information for all 32 months (36 months in the 1992 and 1993 panels). The coefficient estimates for both the labor force participation and AFDC participation specifications are stronger than before: this is consistent with the idea that the female heads who leave the sample are less dependent on and less responsive to the public welfare system. This would occur, for example, if many of the exits were due to marriage.

V. Conclusions and Additional Directions for Research

This paper has evaluated the effects of the public housing program on labor supply. The rules of public housing create non-linearities in the budget constraint, and for families in the Section 8 voucher program or families on waiting to enter public housing, the notches in the program can be substantial. By linking information about fair market rents and income limits to micro data, I construct a measure of the subsidy that would be lost at the "notch point" for public housing. After taking account of the endogeneity of housing choice, the notch has the expected effects on labor supply and welfare participation: making the notch bigger creates strong disincentives to work and strong incentives to collect other transfer income.

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Table 1: Earnings and benefits after four months on job for a mother with two children with day care expenses 1996 -- Philadelphia, Pennsylvania.

Earnings	EITC	AFDC	Food Stamps	Medicaid $3307	Eligible for public housing	Housing subsidy, 2 bedrooms	Social Security Tax	Federal Income Tax	State Income Tax	Work Expenses	Total Income
0	0	5052	2722	Yes	Yes	8136	(0)	(0)	(0)	(0)	19217
2000	800	4892	2410	Yes	Yes	7936	(153)	(0)	(0)	(600)	20592
4000	1600	3292	2530	Yes	Yes	7464	(306)	(0)	(0)	(1200)	20687
5000	2000	2492	2590	Yes	Yes	7224	(383)	(0)	(0)	(1500)	20730
6000	2400	1692	2650	Yes	Yes	6984	(459)	(0)	(0)	(1800)	20774
7000	2800	892	2710	Yes	Yes	6744	(536)	(0)	(0)	(2100)	20817
8000	3200	0	2798	Yes	Yes	6484	(612)	(0)	(0)	(2400)	20776
9000	3556	0	2618	Yes	Yes	6264	(689)	(0)	(0)	(2700)	21356
10000	3556	0	2438	No	Yes	6024	(765)	(0)	(0)	(3000)	18253
15000	2842	0	1538	No	Yes	4824	(1148)	(0)	(420)	(4200)	18436
20000	1789	0	0	No	Yes	3624	(1530)	(0)	(560)	(5200)	18123
22000	1368	0	0	No	Yes	3084	(1683)	(260)	(616)	(5400)	18493
23000	1157	0	0	No	No	0	(1760)	(452)	(644)	(5400)	15901
25000	736	0	0	No	No	0	(1913)	(794)	(700)	(5400)	16929
30000	0	0	0	No	No	0	(2295)	(1628)	(840)	(5400)	19837
50000	0	0	0	No	No	0	(3825)	(5187)	(1400)	(5400)	34188

Notes: In adding the numbers across each row to get total income, negative values are in parentheses. See the next page for the assumptions used in this table.

Notes for Table 1:

1. Sources: U.S. House of Representatives, 1996 (http://aspe.os.dhhs.gov/96gb/08tanf.txt), HUD Fair Market Rent and Income Eligibility data 1996 (http://www.huduser.org/data/asthse/fmrdata/hud96pa.txt), and Pennsylvania Income Tax Form PA-40, 1996 (http://www.revenue.state.pa.us/forms/pit/1996/index.htm)

2. The annual income eligibility limit (very low limit) in Philadelphia was $22200, and the annual fair market rent was $10176 for a three bedroom apartment, and $8136 for a two bedroom apartment. The actual rent paid by the public housing recipient is the max{0.3*Adjusted Income, 0.1*Gross Income, welfare shelter deduction}. Adjusted income has deductions of $480 per child per year and child care costs. This table assumes the family receives a two-bedroom apartment.

3. Medicaid is valued at its annual average expenditure in Pennsylvania for an AFDC family with one adult and two children: $919 per child, and $1469 per adult. The total is therefore $3307 for this family.

4. AFDC benefits assume these deductions: $1440 annual ($120 monthly) standard allowance, which would drop to $1080 annual ($90 monthly) after one year on the job and child care costs equal to 20 percent of earnings, up to maximum of $4200 per year ($350 per month) for two children. The EITC, food stamps, Medicaid, public housing, and taxes are not counted in the AFDC calculation. Because of these deductions, AFDC benefits fall by 8 percent for the first $2000 of earnings, and by 80 percent thereafter. The statutory tax rate is 100 percent.

5. The food stamp program assumes these deductions: 20 percent of earnings, $1608 annual ($134 monthly) standard deduction, and child care costs equal to 20 percent of wages, up to a maximum of $3840 per year ($320 per month) for two children. The maximum food stamp payment for a family with zero income is $3756 per year ($313 per month). Both earnings and AFDC are counted in the food stamp calculation. The statutory tax rate is 30 percent.

6. Federal and state taxes assume head of household tax rates in effect for 1996. The dependent care tax credit reduces tax liability at earnings of $13,550 and above. Exemptions were $2,550 per person in 1996, the standard deduction was $5,900, the 15 percent bracket ended at $32150 of taxable income, and the 28 percent bracket ended at $83050 of taxable income. Eligible employment-related expenses are limited to $4800 if there are two or more qualifying dependents. The 30 percent dependent care credit rate is reduced, but not below 20 percent, by one percentage point for each $2000 (or fraction thereof) of adjusted gross income (AGI) above $10000. The marginal tax rate in Pennsylvania was 2.8 percent.

7. Work expenses assumed to equal 10 percent of earnings up to maximum of $1200 annually, plus child care costs equal to 20 percent of earnings up to a maximum of $4200 annually for two children. for earnings of $21000 and over.

8. Family would qualify for Medicaid at $8000 of earnings because the mother, by law, would be deemed still an AFDC recipient, even though no AFDC would be paid; her calculated benefit would be below the minimum amount ($10 monthly) payable.

9. Family would qualify for Medicaid for 12 months after leaving AFDC with $9000 in earnings under the 1988 Family Support Act. State must offer Medicaid to all children up to age six whose family income is not above 133 percent of the Federal poverty guideline (ceiling of $17290 for a family of three in 1996) and to children over age six born after September 30, 1983 (up to age ten years and four months in January 1996), whose family income is below the poverty guideline ($12600 for a family of three).

10. None of the value of public or subsidized housing is counted as income of an Aid to Families with Dependent Children (AFDC) applicant or recipient in Pennsylvania (Urban Institute).

11. The credit rate for the EITC was 40 percent for families with two or more children until $8890, and the phase-out rate was 21.06 percent for earnings between $11610 and $28495.

12. The incidence of the social security payroll tax is assumed to be equally shared between the worker and the employer.

Table 2: Very-low income limits, fair market rents, and public housing notches for several metropolitan areas, 1996

	Very Low Income Limit for female head with two children	Two bedroom apartment (two boys or two girls)		Three bedroom apartment (one boy and one girl)	
		Subsidy at $0 earnings	Public housing notch	Subsidy at $0 earnings	Public housing notch
Baltimore	$23600	7188	1656	9504	3972
Boston	25400	9696	3624	12120	6048
Chicago	24350	8448	2691	10572	4815
Los Angeles	23100	10260	4878	13848	8446
New York	22050	9804	4737	12264	7197
Philadelphia	22200	8136	3024	10176	5064
San Francisco	27600	11400	4668	15624	8892

Note: The computations for the public housing notch assume $4200 in annual child care expenses and $960 in deductions.

Table 3: Are two- and three-bedroom project apartments equally available?

	(1) Average stay length in development (in years)	(2) Average wait time for program participants (in months)	(3) Fraction of movers into development in prior year	(4) Fraction of households in Census tract below the poverty line
% 1 bedroom	.007	.001	-.087	-.002
	(.002)	(.016)	(.020)	(.014)
% 2 bedrooms	.042	.075	-.129	-.055
	(.003)	(.027)	(.028)	(.020)
% 3 bedrooms	.044	.077	-.138	-.037
	(.004)	(.031)	(.031)	(.022)
% Head 25-44	-.004	.012	.198	-.091
	(.006)	(.050)	(.050)	(.034)
% Head 45-61	.086	.013	-.023	.122
	(.006)	(.053)	(.052)	(.036)
% Head 62 +	.060	.009	.007	-.072
	(.006)	(.045)	(.047)	(.032)
% Income < $5000	-.023	-.157	.335	.309
	(.005)	(.049)	(.044)	(.031)
% Income $5,000-$10,000	-.027	-.219	.174	.132
	(.004)	(.048)	(.038)	(.027)
% Income >$20,000	.040	.258	.033	-.140
	(.008)	(.166)	(.076)	(.050)
% Asian	.001	.004	.189	.302
	(.006)	(.053)	(.055)	(.037)
% Black	.026	.021	.065	.297
	(.002)	(.014)	(.016)	(.012)
% Hispanic	.012	.044	.035	.260
	(.003)	(.028)	(.029)	(.021)
% Indian	-.003	-.094	.012	.081
	(.020)	(.213)	(.168)	(.124)
% Single head with children under 18	-.011	-.080	-.060	-.024
	(.004)	(.033)	(.031)	(.019)
% Married head with children under 18	-.047	-.170	.101	.021
	(.006)	(.069)	(.055)	(.037)
Sample	HUD PSH data	HUD PSH data	HUD PSH data	HUD PSH data
P-value on % 1 bedroom= % 2 bedroom	0.000	0.005	0.107	0.003
P-value on % 3 bedroom =% 2 bedroom	0.587	0.931	0.685	0.225
Mean of dependent variable [range]	5.97 years [0,25]	9.99 months [1,99]	17.33% [0,98]	29.56% [1,93]
Number of observations	4,666	1,542	4,557	3,832
Adjusted R^2	.561	.516	.323	.480

Notes: The results from columns (1)-(3) come from unpublished work of Currie and Yelowitz (2000). The unit of observation is a public housing project that has information reported on the number of two- and three-bedroom units. Omitted categories include % 0 bedroom, % Head under age 25, % Income $10,000-$20,000, % White, and % Heads without children under 18. The number of observations differs across columns because of missing values for the outcome variable. All regressions include MSA fixed effects.

Table 4: Means (standard deviations) of female headed households with children, 1990-1995

	Survey of Income and Program Participation			Current Population Survey		
	(1) Full sample	(2) In PH	(3) Not in PH	(4) Full sample	(5) In PH	(6) Not in PH
Part. in PH (monthly)	.17	1	0	n/a	n/a	n/a
LFP (monthly)	.70	.37	.76	n/a	n/a	n/a
AFDC part. (monthly)	.24	.61	.16	n/a	n/a	n/a
Below income threshold (monthly)	.52	.89	.45	n/a	n/a	n/a
Full time work [36+] (monthly)	.54	.22	.61	n/a	n/a	n/a
Part time work [1,35] (monthly)	.16	.17	.16	n/a	n/a	n/a
Part. in PH (annual)	.19	1	.02	.19	1	0
LFP (annual)	.77	.49	.82	.75	.51	.80
AFDC part. (annual)	.27	.66	.19	.28	.61	.20
Below income threshold (annual)	.65	.94	.59	.63	.93	.56
Full time work [36+] (annual)	.63	.30	.69	.56	.28	.62
Part time work [1,35] (annual)	.25	.25	.25	.19	.23	.18
PH take-up rate	.29	1	0	.28	1	0
Fair Market Rent	.708 (.179)	.739 (.192)	.702 (.176)	.695 (.185)	.713 (.188)	.690 (.184)
Very-Low Income Limit	1.460 (.255)	1.494 (.257)	1.453 (.254)	1.692 (.314)	1.710 (.333)	1.688 (.310)
Public housing notch	.265 (.149)	.294 (.145)	.258 (.149)	.342 (.152)	.379 (.161)	.335 (.149)
Age (range [18,61])	36.3 (8.8)	33.1 (8.8)	37.0 (8.6)	35.1 (8.5)	31.7 (8.1)	35.9 (8.4)
Nonwhite	.56	.83	.50	.56	.77	.51
Never Married	.31	.54	.26	.34	.54	.29
High school dropout	.21	.34	.18	.21	.31	.19
Number of boys (range [0,3])	.85 (.73)	.91 (.76)	.84 (.73)	.83 (.75)	.92 (.76)	.81 (.74)
Number of kids (range [1,3])	1.65 (.72)	1.86 (.78)	1.61 (.70)	1.65 (.73)	1.83 (.76)	1.61 (.72)
Family size (range [2,5])	2.95 (.86)	3.01 (.82)	2.93 (.87)	2.87 (.82)	2.96 (.83)	2.85 (.82)
Number of observations	74,383	12,495	61,888	15,443	2,933	12,510

Notes: Unless otherwise stated, all dollar figures are in 1995 constant dollars, expressed on a monthly basis, and divided by 1,000. All labor market and welfare outcomes are measured for the head of household; the demographic variables are also measured for the head.

Table 5: Labor Supply Results using the Fair Market Rent and Income Limit

	CPS		SIPP Random effects specification		SIPP Fixed effects specification	
	(1) Labor force participation	(2) AFDC participation	(3) Labor force participation	(4) AFDC participation	(5) Labor force participation	(6) AFDC participation
Fair Market Rent	-.199	.006	-.233	.079	-.222	.074
	(.087)	(.087)	(.036)	(.024)	(.036)	(.025)
Very-Low Income Limit	.003	-.005	-.029	-.072	-.020	-.080
	(.062)	(.062)	(.036)	(.025)	(.037)	(.025)
Head Age	.036	-.047	.033	-.020	.034	-.017
	(.003)	(.003)	(.003)	(.003)	(.005)	(.003)
Head $Age^2/100$	-.044	.051	-.037	.019	-.043	.023
	(.004)	(.004)	(.004)	(.003)	(.006)	(.004)
Head Black	-.029	.082	-.042	.095	---	---
	(.008)	(.008)	(.014)	(.013)		
Head Hispanic	-.063	.073	-.064	.053	---	---
	(.010)	(.010)	(.017)	(.016)		
Head Other race	-.022	.006	-.049	.071	---	---
	(.017)	(.017)	(.031)	(.029)		
Head Divorced	.112	-.123	.137	-.153	---	---
	(.009)	(.009)	(.016)	(.015)		
Head Separated	.056	-.086	.071	-.125	---	---
	(.010)	(.010)	(.017)	(.016)		
Head Widowed	.005	-.200	.019	-.200	---	---
	(.016)	(.016)	(.026)	(.024)		
Head Educ#8	-.281	.232	-.358	.323	---	---
	(.017)	(.017)	(.028)	(.026)		
9#Head Educ#11	-.261	.265	-.347	.316	---	---
	(.013)	(.013)	(.023)	(.021)		
Head Educ=12	-.100	.115	-.138	.124	---	---
	(.011)	(.011)	(.019)	(.017)		
13#Head Educ#15	-.049	.076	-.066	.049	---	---
	(.011)	(.011)	(.020)	(.019)		
Mean of dependent variable	0.746	0.279	0.696	0.238	0.696	0.238

Notes: There are 15,443 households in each CPS regression, and 74,383 observations (4,053 female head of households) in each SIPP regression. In addition to the variables reported in the table, the regressions contained fixed effects for MSA (280/93 categories in CPS/SIPP), YEAR (6 categories), BOYS(4 categories), KIDS (3 categories), FSIZE (4 categories), BOYS*KIDS (9 categories), BOYS*YEAR (24 categories), KIDS*YEAR (18 categories), FSIZE*YEAR (24 categories), BOYS*KIDS*FSIZE (25 categories), BOYS*KIDS*YEAR (54 categories), REFMTH (4 categories in SIPP), and a constant term. All dollar figures are in 1995 constant dollars, expressed on a monthly basis, and divided by 1,000. All labor-market, welfare, and demographic variables are measured for the head of household. Omitted categories are head white, head never married, and head's education greater than 15 years.

Table 6: Labor Supply Results using the public housing notch

	CPS		SIPP Random effects specification		SIPP Fixed effects specification	
	(1) Labor force participation	(2) AFDC participation	(3) Labor force participation	(4) AFDC participation	(5) Labor force participation	(6) AFDC participation
Public housing notch (constructed from the very-low income limit)	-.415 (.076)	.157 (.076)	-.292 (.033)	.145 (.023)	-.256 (.034)	.125 (.023)
Head Age	.026 (.003)	-.040 (.003)	.033 (.003)	-.020 (.003)	.035 (.005)	-.018 (.003)
Head Age^2/100	-.035 (.004)	.044 (.004)	-.037 (.004)	.019 (.003)	-.044 (.006)	.024 (.004)
Head Black	-.030 (.008)	.082 (.008)	-.042 (.014)	.095 (.013)	---	---
Head Hispanic	-.063 (.010)	.074 (.010)	-.064 (.017)	.053 (.016)	---	---
Head Other race	-.023 (.017)	.006 (.017)	-.048 (.031)	.071 (.029)	---	---
Head Divorced	.103 (.009)	-.117 (.009)	.137 (.016)	-.153 (.015)	---	---
Head Separated	.054 (.010)	-.084 (.010)	.071 (.017)	-.125 (.016)	---	---
Head Widowed	-.002 (.016)	-.195 (.016)	.020 (.026)	-.200 (.024)	---	---
Head Educ#8	-.284 (.017)	.234 (.017)	-.358 (.028)	.323 (.026)	---	---
9#Head Educ#11	-.268 (.013)	.272 (.013)	-.347 (.023)	.315 (.021)	---	---
Head Educ=12	-.106 (.011)	.119 (.011)	-.137 (.019)	.124 (.017)	---	---
13#Head Educ#15	-.053 (.011)	.079 (.011)	-.066 (.020)	.049 (.019)	---	---
Mean of dependent variable	0.746	0.279	0.696	0.238	0.696	0.238

Notes: The sample sizes and covariates are the same as Table 5, except that indicator variables for any children under age 6 and under age 13 are also included.

Table 7: Instrumental variables results

	CPS		SIPP Random effects specification		SIPP Fixed effects specification	
	(1) Labor force participation	(2) AFDC participation	(3) Labor force participation	(4) AFDC participation	(5) Labor force participation	(6) AFDC participation
Public housing notch (using actual housing status)	-.501 (.101)	.185 (.099)	-.346 (.040)	.170 (.028)	-.300 (.041)	.146 (.028)
Head Age	.029 (.003)	-.041 (.003)	.034 (.003)	-.021 (.003)	.036 (.005)	-.018 (.003)
Head Age^2/100	-.037 (.004)	.046 (.004)	-.038 (.004)	.020 (.003)	-.045 (.006)	.025 (.004)
Head Black	-.050 (.010)	.089 (.010)	-.061 (.014)	.104 (.013)	---	---
Head Hispanic	-.070 (.011)	.077 (.010)	-.072 (.017)	.057 (.016)	---	---
Head Other race	-.025 (.017)	.007 (.017)	-.055 (.031)	.074 (.029)	---	---
Head Divorced	.115 (.010)	-.120 (.009)	.145 (.016)	-.157 (.015)	---	---
Head Separated	.065 (.010)	-.088 (.010)	.079 (.017)	-.129 (.016)	---	---
Head Widowed	.015 (.017)	-.202 (.016)	.031 (.026)	-.206 (.024)	---	---
Head Educ#8	-.300 (.018)	.240 (.017)	-.368 (.028)	.328 (.026)	---	---
9#Head Educ#11	-.288 (.014)	.278 (.014)	-.365 (.023)	.324 (.021)	---	---
Head Educ=12	-.118 (.012)	.124 (.011)	-.147 (.019)	.129 (.017)	---	---
13#Head Educ#15	-.063 (.012)	.083 (.012)	-.072 (.020)	.052 (.019)	---	---
Mean of dependent variable	0.746	0.279	0.696	0.238	0.696	0.238

Notes: The sample sizes and covariates are the same as Table 5, except that indicator variables for any children under age 6 and under age 13 are also included.

Table 8: Additional labor market outcomes

	CPS			SIPP Random effects specification			SIPP Fixed effects specification		
	(1) Below threshold	(2) Full time work	(3) Part time work	(4) Below threshold	(5) Full time work	(6) Part time work	(7) Below threshold	(8) Full time work	(9) Part time work
1. Results in the fair market rent and very-low income limit									
Fair Market Rent	-.057	-.042	-.157	.052	-.203	-.109	.048	-.202	-.100
	(.091)	(.102)	(.088)	(.042)	(.039)	(.038)	(.043)	(.040)	(.039)
Very-Low Income Limit	.208	-.016	.019	.173	.030	-.072	.159	.038	-.074
	(.064)	(.073)	(.063)	(.042)	(.039)	(.038)	(.044)	(.040)	(.039)
2. Results using the public housing notch									
Public housing notch (constructed from very-low income limit)	.024	-.168	-.248	.230	-.209	-.135	.181	-.178	-.132
	(.079)	(.089)	(.077)	(.039)	(.037)	(.035)	(.041)	(.037)	(.037)
3. Instrumental variables estimates using the public housing notch									
Public housing notch (using actual housing status)	.043	-.205	-.295	.277	-.247	-.161	.217	-.208	-.157
	(.101)	(.115)	(.099)	(.047)	(.044)	(.043)	(.049)	(.045)	(.044)

Notes: Results in these tables included the same covariates as Tables 5, 6, and 7.

Table 9: Specification checks

	CPS		SIPP Random effects specification		SIPP Fixed effects specification	
	(1) Labor force participation	(2) AFDC participation	(3) Labor force participation	(4) AFDC participation	(5) Labor force participation	(6) AFDC participation
1. Exclude women who had baby at any time during CPS year/SIPP panel						
Fair Market Rent	-.166	.013	-.202	.006	-.196	.002
	(.089)	(.089)	(.039)	(.025)	(.040)	(.026)
Very-Low Income Limit	.001	.011	-.008	-.039	-.001	-.040
	(.063)	(.063)	(.040)	(.026)	(.040)	(.026)
2. Exclude female heads who were not in the SIPP for entire panel						
Fair Market Rent	n/a	n/a	-.335	.138	-.322	.136
			(.047)	(.032)	(.047)	(.032)
Very-Low Income Limit	n/a	n/a	.040	-.110	.031	-.112
			(.055)	(.037)	(.055)	(.037)

Notes: In the first panel of this table, there are 14,435 households in each CPS regression, and 60,494 observations (3,315 female head of households) in each SIPP regression. In the second panel, there are 26,836 observations on 776 female heads in the SIPP.

Appendix Table 1: Sample screens for Survey of Income and Program Participation, 1990-1995

	(1) 1990 Panel Waves 1-8	(2) 1991 Panel Waves 1-8	(3) 1992 Panel Waves 1-9	(4) 1993 Panel Waves 1-9
1. Original sample (all persons, all waves, all months)	1,769,133	1,133,515	1,748,849	1,750,970
2. HMSA>0	1,121,821	662,041	1,056,316	1,061,325
3. FKIND=3	273,687	147,880	248,839	242,753
4. FNKIDS>0	141,695	72,715	126,867	124,208
5. Ref. person aged 18-61 and unmarried	121,631	61,770	104,183	106,571
6. RRP=1	37,134	18,701	31,895	32,313
7. Merged FMR and very low income limit	35,096	18,596	31,697	32,158
8. DISAB¥1	30,999	16,360	27,537	28,207
9. 1-3 children and 2-5 family size	28,270	14,643	24,740	25,564
10. Variables about head's race, age, ethnicity, and education consistent across waves	22,485	11,694	19,687	20,517
Unique individuals	1,309	679	1,018	1,047

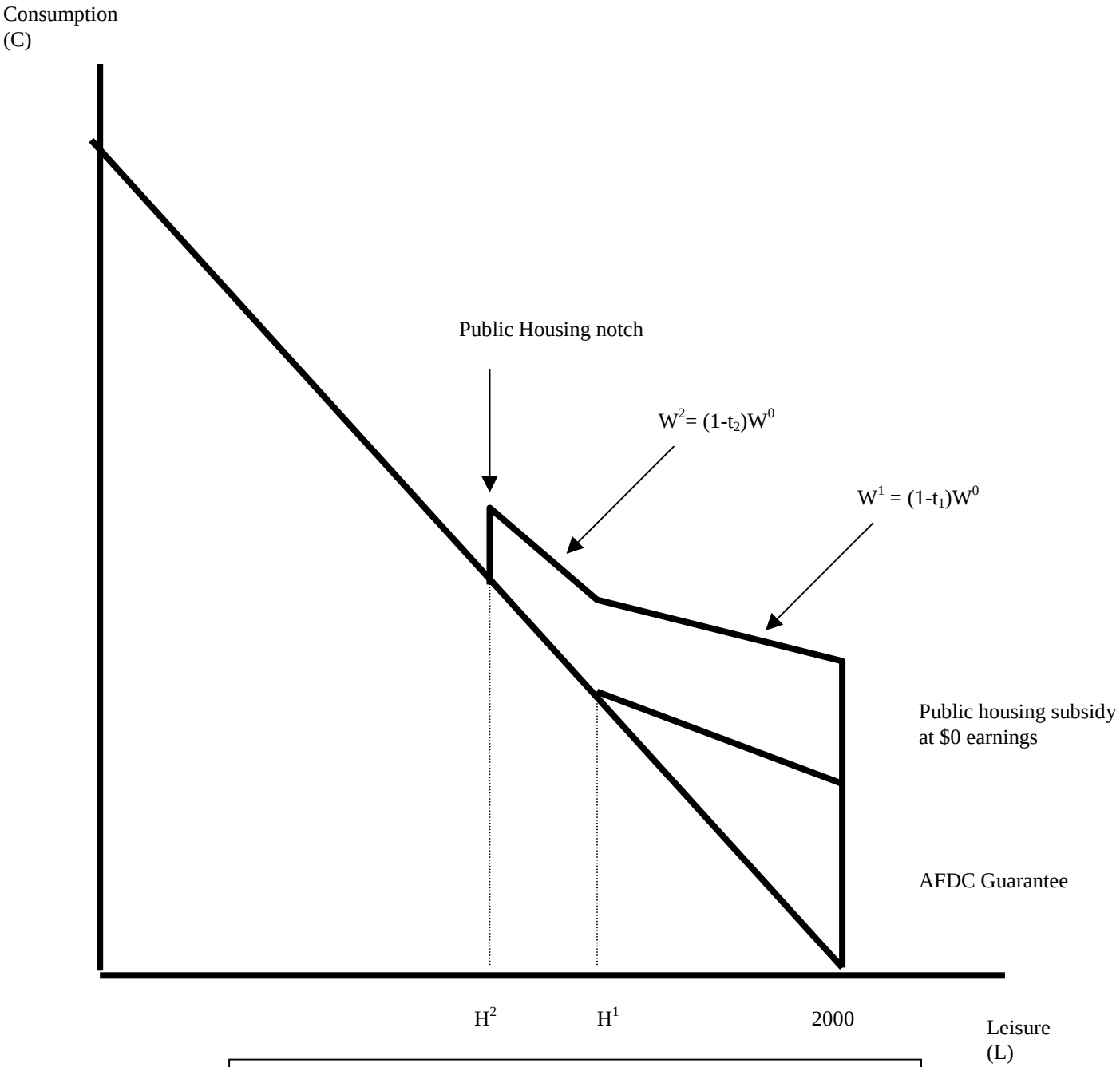
There are a total of 4,053 female heads (74,383 observations) in the sample for the calendar years 1990-1995. The screens in lines 1., 2., 3., 4., 6., and 8. come directly from the SIPP. In line 5., the variables AGE, RRP, and MS were used to determine which families had a female head, and the variables PANEL, SUID, ADDID, and FID were used to keep only individuals in families with a female head. In line 7., the fair market rent and income limit were merged using HMSA, YEAR, and FSIZE. In lines 7. and 9., FSIZE was created within the data set, where a family member is defined in relation to the head. Those counted include: Reference person, natural/adopted child, stepchild, grandchild, parent, brother/sister, and other relative. KIDS was created with a similar screen: AGE<18, and relation to head classified as natural/adopted child, stepchild, grandchild, brother/sister, and other relative. The number of BOYS additionally has SEX=1.

Appendix Table 2: Sample screens for Current Population Survey, 1990-1995

	(1) March 1991	(2) March 1992	(3) March 1993	(4) March 1994	(5) March 1995	(6) March 1996
1. Original sample	158,477	155,796	155,197	150,943	149,642	130,476
2. HG_MSAC>0	109,102	107,659	106,516	104,068	101,701	95,444
3. FKIND=3	25,138	25,452	24,998	24,933	23,985	22,637
4. FRELU18>0	12,583	13,024	12,882	12,990	12,534	11,778
5. Ref. person aged 18-61 and unmarried	9,655	10,004	9,905	9,949	9,647	9,132
6. A_EXPRRP=1	3,213	3,318	3,331	3,313	3,194	3,058
7. Merged FMR and very low income limit	3,204	3,312	3,328	3,307	3,103	3,051
8. DIS_HP¥1	2,939	3,045	3,030	2,999	2,842	2,766
9. 1-3 children and 2-5 family size	2,599	2,659	2,640	2,608	2,506	2,431

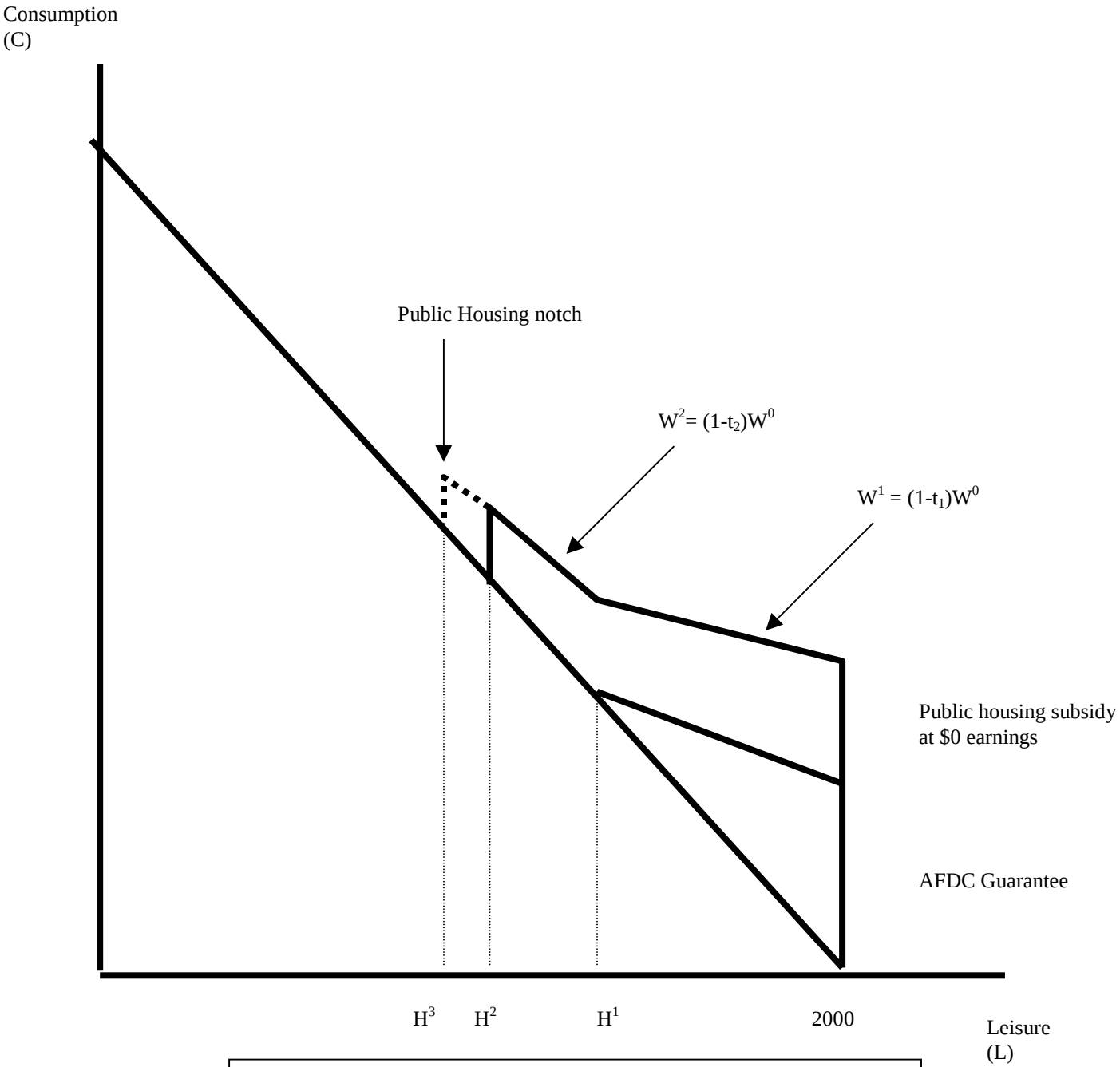
There are a total of 15,443 female headed households in the sample for the calendar years 1990-1995. The screens in lines 1., 2., 3., 4., 6., and 8. come directly from the CPS. In line 5., the variables A_AGE, A_EXPRRP, and A_MARITL were used to determine which families had a female head, and the variables H_YEAR, H_SEQ, and FFPOS were used to keep only individuals in families with a female head. In line 7., the fair market rent and income limit were merged using HG_MSAC, H_YEAR, and FSIZE. In lines 7. and 9., FSIZE was created within the data set, where a family member is defined in relation to the head. Those counted include: Reference person, natural/adopted child, stepchild, grandchild, parent, brother/sister, and other relative. KIDS was created with a similar screen: A_AGE<18, and relation to head classified as natural/adopted child, stepchild, grandchild, brother/sister, and other relative. The number of BOYS additionally has A_SEX=1.

Figure 1
Budget constraint with public housing



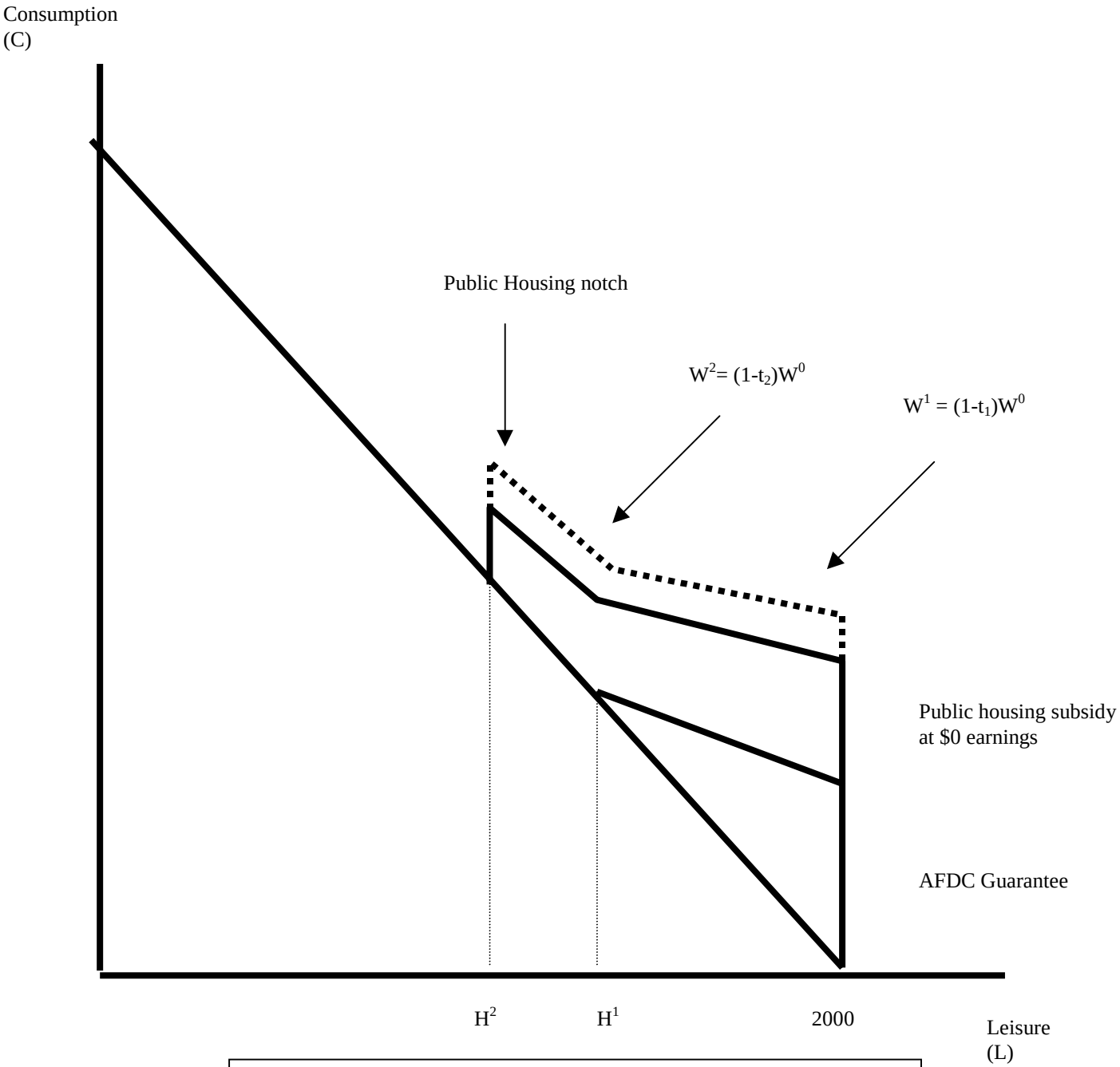
The public housing is taxed away at 30%, until earnings of W^0H^2, at which the remaining subsidy is taken away.

Figure 2
Increasing the "very-low" income limit



The notch point is now at H^3. The notch becomes smaller if the FMR is held constant and the income limit increases.

Figure 3
Increasing the FMR



The notch gets bigger when the FMR increases while the income limit is held constant.