The Effects of Housing Assistance on Labor Supply: Evidence from a Voucher Lottery

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Web Appendix

Appendix A:
Program Rules for Housing Vouchers, TANF and Food Stamps

Housing vouchers

Eligibility for the housing voucher program is related to the local median household income. Specifically, for a family of four, eligibility is limited to 50 percent of the local median income for all families. (By way of comparison, the federal poverty line is usually around 30 percent of the local median). Some families with incomes up to 80 percent of the local median income may be eligible, including those who are in Section 8 project-based units when the private-market landlord opts out of the government program, as well as those who are displaced as a result of HUD's Hope VI public housing demolition program. The eligibility limits for families of different sizes equal the following percentages of the four-person limit (taken from Olsen, 2003, p. 379):

Table A1: Housing voucher eligibility by family size (relative to four-person limit)

Family Size	Percentage Adjustment
1	70%
2	80%
3	90%
4	100%
5	108%
6	116%
7	124%
8	132%

The maximum subsidy available to families is governed by the "payment standard," which for the old Section 8 housing certificate program (which was still in operation at the time what we are calling the CHAC "voucher lottery" occurred) was equal to the Fair Market Rent. The FMR was equal to the 45th percentile of the local rent distribution for a unit of a given size up through 1995. It was then lowered to the 40th percentile in 1995, and beginning in 2001 specific metropolitan areas, including Chicago, were allowed to set the FMR equal to the 50th percentile. In Chicago, the FMR is the same for the entire Metropolitan Statistical Area (MSA). For the old Section 8 voucher program that was in operation at the time of the CHAC lottery, the payment standard could not exceed the FMR, but housing agencies had the option of setting the payment standard below the FMR. The new housing voucher program that was phased in towards the end of our study period enabled families to lease units with rents above the FMR, but the payment standard was capped at the FMR, and housing consumption is capped by limiting the family's contribution towards rent to be no more than 40 percent of adjusted income (see Olsen, 2003, pp. 376-86, 401-4 for details). The FMR also varies according to the number of bedrooms to which a family is entitled as a function of the family's size and gender composition (for example, male and female children are not asked to share a bedroom). In our calculations we use publicly-available HUD data on FMR by housing unit size.[1]

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1 See http://www.huduser.org/portal/datasets/fmr.html.

For simplicity, we describe just the rule for the Section 8 voucher program for a jurisdiction that sets the payment standard equal to FMR. Families receiving a voucher have a maximum subsidy value equal to:

Maximum Subsidy = [FMR – S]

S = Family's monthly rent payment
= $\max\{.3 \times Y_{ah}, .1 \times Y_{gh}\}$

Y_{ah} = Adjusted Income under housing program rules
= Earnings + TANF – ($480×Children) – ($400×Disabled) – Child Care Expenses – [Unreimbursed Medical Care Expenses Over 3% of Annual Income] – [Unreimbursed Attendant Care or Auxiliary Apparatus Expenses to Disabled Family Members That Support Work by Other Family Members, Over 3% of Annual Income]

Y_{gh} = Gross household income
= Earnings + TANF

Note that TANF benefits are counted as part of income for the purposes of calculating program eligibility and the family's rent contribution, while the value of both Food Stamp and Medicaid benefits is not. Income from the EITC is also not counted towards income under the voucher program rules, nor is any earnings by children under age 18 or payments received for the care of foster children.

Note also that families offered housing vouchers have a limited time to lease up a unit from when they are offered the voucher (usually 3 to 6 months; while they may request an extension, there is still ultimately a finite search period). Families can also only use vouchers in private-market units that meet HUD's minimum quality standards. Landlords may prefer tenants paying with cash over those with vouchers because of these quality standards and other HUD paperwork involved with the program. The combination of these three factors helps explain why many families who are already living in private-market housing fail to use a voucher when it is offered to them – they fail within the specified time period to successfully find and lease up a new unit that has a landlord willing to rent to them and meets the quality standard.

Unlike other social programs, once an individual qualifies for a housing voucher, the person is not removed from the program if his or her income exceeds the eligibility limit. However, since voucher recipients are required to pay 30 percent of their income toward their rent, the actual amount of their subsidy will decrease. Essentially, this means that there is no "notch" in the budget constraint with housing vouchers – there is simply a smooth phase-out. Since the average earnings of families in our CHAC applicant sample is so low – $14,000 at baseline – and the phase-out range is $43,000, most families probably expect to receive some sort of subsidy for a very extended period of time (perhaps permanently) if they are offered a housing voucher.

Temporary Assistance for Needy Families (TANF)

The TANF program in Illinois replaced AFDC on July 1, 1997, at almost exactly the same time as the CHAC housing voucher program. Thus all of the post-lottery data analyzed in this paper were generated in a social policy environment governed by TANF rules.

TANF provides cash assistance to: (1) families with children but without any employed members, and with assets low enough to be eligible; (2) families with children and at least one employed member, but with incomes and assets low enough to be eligible; and (3) children whose parents have incomes and assets low enough to be eligible for TANF, but are not because they are not U.S. citizens or eligible non-citizens, or receive some other form of cash assistance such as SSI or SSA disability. Asset limits under the TANF program are equal to $2,000 for one-person TANF filing units, $3,000 for 2-person filing units, and increase by $50 for each additional person in the filing unit. The TANF benefit per month is essentially equal to:

TANF benefit = P - .33×Y_{at}

Y_{at} = Adjusted income under TANF program rules
= Earnings – Workers Deduction ($90) – Child Care[2]

Note that the maximum payment, P, varies by family size, type of TANF case, and year.[3] Under the TANF program in Illinois, income in these formulas does not include benefits from housing vouchers, Food Stamps, the EITC, or government programs such as VISTA or the Job Corps, nor does it include earnings through college work-study or those earned by dependent children. If families reduce their work without prior permission from the Illinois Department of Human Services or they failed to report their earnings (and then those earnings are discovered), they are taxed at a 100 percent rate.

Food Stamps (FS)

Currie (2003) notes that FS benefits are reduced by 30 cents for each dollar of either earned or unearned income (including income from cash transfer programs).

Y_g = Gross Income
= Earnings + TANF

Y_n = Net Income
= Y_g – Standard Deduction– .2×Earnings – Child Care[4] - min{$250, R}

R = Rent – .5×[Y_g – Standard Deduction– .2×Earnings – Child Care]

Food Stamp benefit = max{P-.3*Y_n, Minimum Allotment}

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2 Where applicable, subject to a maximum deduction in eligible cases. See IDHS Program Manual, 08-01-02-d, http://www.dhs.state.il.us/page.aspx?item=15234

3 The data for P come from this website prior to 2003: http://www.dhs.state.il.us/page.aspx?item=19811. After 2003, we obtain benefit levels from the 2004 Green Book for households of size 1-6. We don't have data on larger households, and so we apply the same increment increases for larger households as existed pre-2003.

4 Currie (2003), p. 207 reports that the dependent care expenses for those in work activities or training equal up to $175 per month per child (or $200 for children under age 2).

Note that gross income under the Food Stamp program includes the household's total cash income, including earnings and TANF benefits, minus some excluded sources (such as earnings from dependent children and payments from the EITC). Also, note that P, the standard deduction (in some years), and the minimum allotment vary by family size. [5]

5 The time-varying data for P and the standard deduction come from the following websites: http://www.dhs.state.il.us/page.aspx?item=21871#a_toc3 and http://www.dhs.state.il.us/page.aspx?item=21863.

Appendix B:
Data Appendix

Baseline information on the 82,607 adults and nearly 8,700 spouses that applied to CHAC for a housing voucher in 1997 comes from the lottery application forms. These files include information on address, lottery number and household demographics such as the number and gender of other children and adults in the household, as well as identifying information (names, date of birth, and social security number) for the household heads and spouses.

B1. Rules for Cleaning and Processing Data

We impute certain demographic variables that are either incomplete or not included on the application forms using information from the Illinois Department of Human Services (IDHS) Client Data Base (CDB). Table B1 below shows the fraction of observations that are imputed and missing (despite efforts at imputation) for the full sample of HHH as well as our primary analysis sample – i.e., able-bodied, working-age individuals living in private housing at baseline. Note that we have non-missing data for virtually all observations, and that we only impute demographic data for a small fraction of our sample. Moreover, it is important to realize that the imputation we do generally involves prioritizing one data set over another.

Gender - Household head gender is not included on the CHAC application form, so we use gender from the CDB. For household heads who do not appear in the CDB, we impute gender by comparing their first name with lists of names of known gender using four data sources: Census data, Social Security Administration data, two websites with lists of names; and finally using a gender-assigning algorithm. For spouses with missing gender, we assign them the opposite gender of the household head.

Race - We start with the CDB race variable and then impute missing values using the less complete lottery application information. For those observations that are missing, we check to see whether the "multiple races" box is checked on the CHAC application. To determine the coding of these multiple races, we create an empirical link by looking at those individuals with multiple races on the CHAC application forms *and* who also have race information in the CDB. For each combination of multiple races we choose the modal race that is indicated by the CDB. For example, if those who are listed as both white and Hispanic on the CHAC forms are listed most often as Hispanic in the CDB, then we assume that all people marked both white and Hispanic in the CHAC forms are Hispanic.

Age - We use information from both the CHAC application forms and the Illinois Department of Human Services client database (CDB). The age variables we create indicate age during 1997 when the CHAC lottery application takes place. For the household heads, if the CHAC age is missing but we have CDB age, then we use CDB age. If he or she indicates age less than 16 on the application form and we have no CDB information, then we set age equal to missing. If the CHAC age is less than 18 or greater than 70, and the difference between that age and the CDB age is greater than one, then we use the CDB age. For spouse age, we use date of birth information if available and when missing we use CDB age as long as it is a reasonable

value (ie, not less than 16). For children and other household members we first check for members age 0 to 18 that are a household head or spouse somewhere else in the sample (e.g., a 17 year who applied as a head and is also the child of a parent who applied separately as a head). For those that we find, we make sure their age is consistently reported across observations. There are a small number of observations that have age greater than 100; we set these to missing.

Household Composition - There are several outliers in the CHAC information with implausibly high values for household size. We take the following steps to clean this information: for number of male children and female children we set values ranging from 20 to 29 equal to 2, and values from 10 to 19 equal to 1. Similarly for number of adult females and adult males, we set values of 10, 11 and one instance of 81, all equal to 1. We set negative values equal to 0. When there are zero adults listed, we impute one adult, male or female based on household head gender. We then create total household, total adult, and total child categories by summing the cleaned household composition variables. We have confirmed that these cleanings have no impact on our randomization checks or any other results.

Voucher Utilization - Data on voucher utilization comes from HUD 50058 records, which families must complete at least once a year to verify eligibility and also when they exit or enter housing programs or when household composition or income changes. These HUD 50058 forms provide complete longitudinal information on housing assistance administered by CHAC (i.e., all tenant-based rental assistance such as Section 8 vouchers and certificates, but excluding public housing), including when the household started and stopped receiving assistance and the different addresses where the household lived while on a Section 8 voucher. We merge the application data to CHAC files on voucher utilization using CHAC tenant identification numbers coupled with name, social security number and date of birth. We use a probabilistic match that is robust to misspellings, typos and other minor inconsistencies across data sets. These files also provide information on the type of apartment leased, and the number of members in the household.

Residential Location - To track residential locations for both the treatment and control groups, we rely on passive tracking sources such as the National Change of Address (NCOA) registry and national credit bureau checks. Because of resource constraints, we tracked a random ten percent sub-sample of all CHAC applicants. We have confirmed that this subset matches the overall applicant pool on a variety of baseline characteristics, and that the impact estimates on labor supply for this 10 percent sub-sample are virtually identical to the impact estimates for the full sample. We are also able to (at least partially) verify the accuracy of the passive tracking techniques using the subset of families that received housing vouchers. In the vast majority of these cases, the location information obtained through passive tracking matches the information found in the administrative 50058 records. Using these addresses along with 2000 census data, we can characterize each household's residential neighborhood down to the block group level.

Neighborhood Characteristics – Census tract level poverty rate and percent black come from the 2000 census. Census tract level social capital and collective efficacy scores come from the 1995 Project on Human Development in Chicago Neighborhoods (PHCDN) Community Survey. Although PHCDN used 1990 census tract boundaries, we assign the scores based on 2000 census tract boundaries because there were extremely few Chicago tracts that changed

boundaries between 1990 and 2000. Tract level property and violent crime rates come from city of Chicago beat-level crime information. We scale these beat level rates to the census tract level using the fact that beats are approximate aggregations of census blocks. If anyone has a missing value for census tract then all of the above neighborhood characteristics will be missing. If any of the neighborhood characteristics are missing because of missing census, PHCDN or crime data, then we set all of the neighborhood characteristics to missing and count the person as having a missing census tract.

Baseline Housing Status - We determine whether a family was living in public housing or a project-based Section 8 housing at the time of the lottery by merging baseline addresses from the CHAC application files to lists of subsidized units maintained by the Chicago Housing Authority and HUD. We use baseline housing status because housing arrangements may be influenced by the outcome of the voucher lottery. This means the group identified as living in a housing project at baseline may include some families who are in private-market housing by the time they are actually offered a housing voucher by CHAC. This occurs in part because of the natural transition of families out of project-based housing units over time, and in part because the city of Chicago was demolishing thousands of units of public housing during the course of the 1990's (see Jacob 2004).

Baseline Rent – See discussion in Appendix D.2.

Labor Market Outcomes - To measure labor market participation and earnings, we have obtained quarterly earnings data from the Illinois unemployment insurance (UI) program, maintained by the Illinois Department of Employment Security (IDES). If an individual works for more than one employer in a given calendar quarter, we aggregate up earnings from all employers. People in our sample are counted as working in a given quarter if they report having any earnings at all in the UI data in a quarter. Household-level employment is defined as having anyone in the CHAC baseline household with positive earnings in a given quarter. We set to missing those person-quarter observations where quarterly earnings are reported to be less than $5 in nominal terms. We set equal to the 99th percentile of the distribution those outlier observations greater than the 99th percentile. Earnings figures are then converted into constant 2007 dollars.

Social Program Participation - We obtain our welfare information from the IDHS administrative databases. They provide us with start and end dates of AFDC/TANF, Food Stamp and Medicaid spells for every household member of those households that we match to the CDB. From these start and end dates we then create, for each of the welfare programs, a variable indicating the number of days during the current quarter a person was receiving assistance and separate binary indicators for whether the person received assistance during the current quarter, the first quarter of 1997, and second quarter of 1997. We also create binary indicators for whether the household head received assistance of any type during the current quarter, the first quarter of 1997, and the second quarter of 1997.

Criminal behavior: We have obtained data from the Illinois State Police (ISP) that capture all arrests made in the state of Illinois between 1990 and 2005. These arrest histories include information on the date and criminal charges associated with each arrest event. In

principle these ISP arrest histories should capture juvenile as well as adult arrests, although inspection of the age / arrest gradient around the age of majority by calendar year suggests the ISP data become somewhat more complete in their juvenile arrest coverage over time. We use these ISP arrest histories to create indicators for the number of pre-randomization arrests that CHAC applicants have experienced for different offense types (violent, property, drug, other).

B2. Covariates included in baseline regression specifications

Unless otherwise noted, the baseline covariates in all of our models include the following variables: binary indicators for black, Hispanic, white, other race, male, disabled, spouse present; a quartic in age interacted with the male indicator; continuous measures of the number of adults in the household, the number of children in the household, and the number of days after the opening of the waiting list that the family submitted an application; binary indicators based on self-reported information from the CHAC application form of whether the household head was willing to accept a certificate as well as voucher, currently receiving any earned income, currently receiving any SSI benefits, currently receiving AFDC/TANF; a series of measures drawn from Illinois administrative databases describing the household head's public assistance receipt and employment in the first and second quarter of 1997, including binary indicators for whether the household head worked, received TANF, received any public assistance (Medicaid, Food Stamps or TANF), and total earnings in the quarter; a series of 12 binary indicators of total prior arrests for different crimes (1,2,3+ prior arrests for a violent crime, property crime, drug crime or other crime); measures of the applicant's baseline neighborhood, all measured at the tract level, which include percent minority, percent black, poverty rate, collective efficacy, social capital, violent crime rate, property crime rate; the average earnings, employment and public assistance receipt of all household members in the second quarter of 1997; the average prior criminal history of all household members (i.e., 12 variables which are merely the household averages of the 12 binary prior crime variables above); the household's imputed fair market rent and baseline rent.

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Table B1. Data Sources

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Data Item	Source of Data	Full Sample of HHH (n=82,607)		Analysis Sample of HHH (n = 42,358)	
		Fraction Imputed	**Fraction Missing**	**Fraction Imputed**	**Fraction Missing**
HHH gender	CHAC housing voucher application forms	0.088	0.008	0.095	0.010
HHH race	Same as above	0.001	0.002	0.001	0.002
HHH age (as of July 1, 1997)	Same as above	0.011	0.002	0.011	0.000
Spouse present	Same as above	0.000	0.000	0.000	0.000
Number of adults in HH	Same as above	0.071	0.000	0.065	0.000
Number of kids 0-18 in HH	Same as above	0.000	0.000	0.000	0.000
Indicated interest in the certificate program as well as the voucher program	Same as above	0.000	0.043	0.000	0.040
Reported receiving Supplemental Security Income (SSI) benefits	Same as above	0.000	0.000	0.000	0.000
Time (in days) of application since applications opened	Same as above	0.000	0.025	0.000	0.024
TANF, Medicaid and Foodstamp receipt	Illinois Dept. of Human Services administrative data	0.000	0.000	0.000	0.000
Criminal arrests	Illinois State Police arrest histories	0.000	0.000	0.000	0.000
Labor Market Outcomes (employment and earnings)	Illinois Dept. of Employment Security administrative data	0.000	0.000	0.000	0.000
Baseline census tract race and poverty measures	CHAC application forms (baseline addresses) and 2000 Census (tract characteristics)	0.000	0.073	0.000	0.084
Baseline census tract crime rates	Chicago Police Department	0.000	0.073	0.000	0.084

	administrative records				
Baseline census tract collective efficacy and social capital measures	1995 Project on Human Development in Chicago Neighborhoods (PHCDN) Community Survey	0.000	0.073	0.000	0.084

Notes: Analysis sample restricted to working-age, able-bodied individuals living in private housing at baseline with lottery numbers 1-18,110 or 35,000-82,607.

Appendix C:
Procedure for Identifying Other CHAC Household Members

The CHAC application forms ask household heads for information on the total number of male and female adults, and male and female children, living within the home, but only ask for individual identifying information (name, date of birth, and social security) for the head and his or her spouse (if applicable). Only when families with sufficiently good lottery numbers were offered housing vouchers by CHAC did the organization ask household heads to provide individual identifying information on *all* household members.

In order to preserve the strength of our research design – random assignment of households to the voucher waiting list – we must identify household members for all families across the entire CHAC waiting list using the same method. To do this, we subcontracted with Chapin Hall at the University of Chicago to match the individual identifying information available for all CHAC applicants and their spouses to administrative data on social program participation from the Illinois Department of Human Services (IDHS). The essence of our approach is to identify any other individuals who were listed as a member of the CHAC applicant's household (based on the IDHS data) during the pre-CHAC lottery period. As noted in the text, the imputation strategy we follow means that our estimates involving other household members will be representative of the subset of CHAC applicants who appear on the IDHS files prior to July 1997, because they themselves or someone in their household was receiving AFDC/TANF, food stamps or Medicaid during this period. However, because approximately 94 percent of the 82,607 CHAC applicants appear on the IDHS files prior to the lottery, our estimates reflect the vast majority of housing applicants. Roughly 93 percent of the main sample for the analysis presented in this paper (i.e., working-age, able-bodied adults living in private housing at baseline) appear in the IDHS files prior to the voucher lottery.

This appendix summarizes the procedures we use to impute the identity of other members of the households that applied to CHAC for vouchers, and then discusses how well these procedures appear to work.

C1. Household Member Imputation Procedure

Chapin Hall was able to match around 94 percent of CHAC applicant households to the IDHS client data base (CDB) using probabilistic matching techniques that use a combination of name (converted to Soundex), dates of birth, and Social Security numbers. For each CHAC applicant (or spouse) who matched to the IDHS CDB, Chapin Hall identified their spell of social program participation that was closest in time prior to the date of the CHAC lottery (7/1/97), which we call the "target case." We then identified the other members of the CHAC applicant household through the following multiple-step process:

1. Identify everyone who was in the CHAC applicant's (or spouse's) target case.
2. Then determine the target case for everyone identified in step (1). Note that some members of the CHAC applicant's target case could have a different target case if, for example, the daughter of a welfare recipient left her mother's household before the time

of the CHAC lottery and started her own household and then also received welfare benefits on her own for this new household.

3. For individuals whose target case is the same as that of the CHAC applicant, we count these people as members of the CHAC applicant's household.

4. For individuals whose target case is different from that of the CHAC applicant, we count these people as members of the CHAC applicant's household (as well as anyone else listed as part of the household in this target case) *only if* the address of this other household member's target case is equal to the address of the CHAC applicant's target case. This scenario could occur if, for example, the daughter of a CHAC applicant has started her own welfare spell but continues to live with her mother.

Note that our procedure counts everyone who we believe was living in the CHAC applicant's household at the time of the voucher lottery as being part of the study sample. It is possible that some people living in these baseline households might start their own households during the post-lottery period, particularly if the CHAC applicant receives a voucher. Under our definition everyone in the baseline household at the time of the voucher application is counted as "treated," even household members who do not move, since they still experience some "treatment" from a reduction in crowding within the housing unit.

C2. How Well Does This Imputation Procedure Work?

Our process for identifying household members is necessarily imperfect and will introduce some measurement error into our measures of household composition. To explore the extent of measurement error, we examine the subset of CHAC applicant households who matched to the IDHS files pre-lottery. Starting with this set of 77,666 households, we drop roughly 2,400 households with missing data on gender for any household member and 84 households that report more than 10 household members on the CHAC application forms (which we believe is most likely due to a data entry errors). Our final sample thus includes 75,145 households. Note that including cases with missing gender or large number of household members yields nearly identical results to those reported below.

Our imputation procedure and the CHAC baseline applications identify the exact same number of total household members in 47.4 percent of cases (the CHAC applications reported more in 38.7 percent of cases); the same number of adult females in 70.8 percent of cases (the CHAC applications reported more in 6.9 percent of cases); the same number of male adults in 71.9 percent of cases (the CHAC applications reported more adult males in 19.4 percent of cases); and the same number of children for over half (56.5 percent) of applications (the CHAC forms reported more children in 36.7 percent of cases). Table C1 presents a more thorough breakdown of whether our IDHS estimation procedure and the CHAC applications are identifying the same number of household members.

Table C1: To what extent does the IDHS estimation procedure over or underestimate household size? (N=75,145)

	CHAC and IDHS equal	Fraction of the cases in which:			
		CHAC greater than IDHS by:		IDHS greater than CHAC by:	
		One	More than one	One	More than one
Number of Female Adults	0.71	0.06	0.01	0.20	0.03
Number of Male Adults	0.72	0.17	0.02	0.08	0.01
Number of Female Children	0.71	0.16	0.06	0.05	0.02
Number of Male Children	0.67	0.19	0.08	0.04	0.01
Number of Total Adults	0.70	0.10	0.03	0.13	0.04
Number of Total Children	0.57	0.21	0.15	0.04	0.03
Total Household Size	0.48	0.21	0.17	0.08	0.06

Table C2 presents comparisons for the average household size and compositions implied by the CHAC applications and our imputation procedure.

Table C2: Comparisons of average household size as reported on CHAC application forms versus the IDHS estimation procedure (N=75,145)

	CHAC Applications	IDHS Estimates
Number of Female Adults	0.86	1.04
Number of Male Adults	0.45	0.33
Number of Female Children	0.79	0.59
Number of Male Children	0.92	0.60
Number of Total Adults	1.31	1.37
Number of Total Children	1.72	1.19
Total Household Size	3.03	2.56

One reason the IDHS data may understate household size is that some welfare target cases may end before 7/1/97, and so we might miss household members who enter between the end of that target spell and the time of the CHAC voucher lottery. To test this hypothesis, we replicated the above tables using only those households where the household head's target case

was active at the time of the CHAC voucher application period (that is, the household head's most recent social program spell prior to 7/1/97 was still active on that date), and find results similar to those from the full sample – that is, entry into the household by members between the last welfare spell and the time of the CHAC application period does not seem to be an important explanation for why the IDHS data understate household size. It is possible that some households might overstate on the CHAC application form the number of children living in the household in order to receive a larger unit, although we have no way to directly test this hypothesis.

The key question for identification in our study is whether any error in the identification of household members is systematically related to a family's position in the CHAC housing-voucher lottery. Given the procedure we used to impute household members (namely the fact that it relies entirely on pre-lottery information), there should be no such relationship. To address this question empirically, we create the following variables to characterize disagreements between the CHAC applications and our IDHS estimation procedure for each household in our analytic sample: a dummy variable equal to 1 if the CHAC application reports more people in the household than does our IDHS estimation procedure, and equal to 0 otherwise; a dummy variable equal to 1 if the IDHS data report more people in the household than does the CHAC data, and equal to 0 otherwise; a variable equal to the difference between the total number of household members reported on the CHAC application and the total number of household members suggested by our IDHS estimates; and similar variables for specific sub-groups of household members (female adults, male adults, total adults, female children, male children and total children).

First, we regress each of these outcome measures against each household's actual lottery number. Out of the 21 total regressions that we estimate, only one yields a coefficient on the household lottery variable that is statistically significant at the 5 percent level, about what we would expect by chance alone. (The one significant coefficient suggests that households with higher lottery numbers are somewhat more likely to have more male adults reported by our IDHS estimation procedure than on the CHAC baseline application, with p=.047, although the measure for the actual difference in the number of male adults between the two datasets, as opposed to a dummy variable indicating that there is a discrepancy, is not significant). Of course these 21 regression coefficients for comparing measures from the IDHS and CHAC applications are not truly independent; if we focus on the four independent measures of household size (actual difference between the two data sources for female adults, male adults, female children, male children), none of these are statistically significant.

The regressions reported above look for some linear relationship between voucher wait list position and measurement error in our IDHS household identification procedure. But in principle there could be some non-linear relationship between wait list position and this measurement error, if for example families who are offered vouchers immediately are more likely to be captured by the IDHS records for some reason. To explore this possibility, we create a set of indicator variables that divide families up into groups of 5,000 based on each household's CHAC lottery number, and regress each of the outcome measures described above against these lottery number indicators. Of the 315 total regression coefficients that we generate, only five are statistically significant at the 5 percent level, about what we would expect based on chance alone. If we focus only on the raw difference in household members between the two

data sources for the four independent groups (female adults, male adults, female children, male children), only one of these sixty regression coefficients is statistically significant.

C3. Who gets missed by our household member identification procedure?

While it is reassuring that there is no systematic relationship between CHAC lottery numbers and measurement error in household composition, the question of who gets missed by our IDHS estimation approach to household composition is still of some interest to our study.

We cannot directly determine who is included in the household count on the CHAC application forms because the former includes total counts of other household members but not individual identifying information. We instead take advantage of the fact that households who lease up with a voucher are required to fill out what are called HUD 50058 forms, which capture individual identifying information for everyone in the household that is leasing up. So we can try to learn more about who is missed by our IDHS household identification procedure by comparing the results of our IDHS procedure with who is listed on the HUD 50058 forms, at least for those households who lease up.

There are several limitations to this approach. First, those families who lease-up are different in some observable and likely unobservable ways from those families who were offered a voucher but do not lease up (see Table II of the paper). Second, household composition could change between the time when a family applies to CHAC and when they are actually offered a voucher and lease up (members could in principle be either lost or added in the interim). For this reason, we focus this analysis on those households who were offered a voucher by the end of 1998 (within the first 16 months following the start of the program) and who lease up. Tables C3 and C4 indicate that the patterns documented in Tables C1 and C2 are also apparent in this subsample.[6]

Table C3: To what extent does the IDHS estimation procedure over or underestimate household size for those households who were offered a voucher by 1998 and leased up?
(N=2,164)

	CHAC and IDHS equal	CHAC greater than IDHS by:		IDHS greater than CHAC by:	
		One	More than one	One	More than one
Number of Female Adults	0.70	0.06	0.01	0.20	0.02
Number of Male Adults	0.72	0.18	0.02	0.07	0.01
Number of Female Children	0.71	0.16	0.05	0.05	0.02
Number of Male Children	0.67	0.19	0.08	0.04	0.02
Number of Total	0.73	0.10	0.02	0.12	0.03

6 Note that the sample of 2,164 households included in this analysis meet the following sample criteria: (1) the household head (or spouse) appeared in the IDHS files prior to the voucher lottery; (1) the household was offered a voucher by 1998; (3) the household utilized the voucher and leased an apartment; (4) the household reported at most 10 total household members on the voucher application form.

Adults					
Number of Total Children	0.57	0.21	0.15	0.04	0.03
Total Household Size	0.49	0.21	0.17	0.07	0.05

Table C4: Comparisons of average household size as reported on CHAC application forms versus IDHS estimation procedure for those households who were offered a voucher by 1998 and leased up? (N=2,164)

	CHAC Applications	IDHS Estimates
Number of Female Adults	0.86	1.03
Number of Male Adults	0.42	0.27
Number of Female Children	0.81	0.64
Number of Male Children	0.98	0.66
Number of Total Adults	1.28	1.30
Number of Total Children	1.79	1.30
Total Household Size	3.06	2.60

Our next step is to try to figure out who exactly is in the 50058 data but not identified by our IDHS procedure, and who is identified by our IDHS procedure but does not show up in the HUD 50058 forms. We do this by attempting to match specific individuals through some combination of name, DOB and SSN. We restrict this sample to non-household heads because the goal of this analysis is to compare who shows up in the 50058 data to who is identified using our IDHS procedure, and all household heads will show up in the 50058 data by definition. As above, we limit this analysis to the set of 2,164 households who were offered vouchers in 1997 or 1998 and who utilized these vouchers to lease up.

Comparing the 50058 records to either the IDHS or CHAC application records for this set of households, we find the 50058 records contain a larger number of people. Specifically, the average number of children (non-head adults) in the 50058 records is 2.15 (0.29) compared with 1.79 (0.28) in the CHAC application files and 1.30 (0.30) in the IDHS records. This suggests that individuals may have "joined" successful CHAC applicants in starting a new household, which is consistent with evidence that voucher receipt is often accompanied by changes in household composition (see, for example, Gubits et al., 2006). It may also be the case that families have a greater incentive to accurately and fully account for all household members on 50058 forms. Individuals had no incentive to accurately report household size or composition on the CHAC application form. And we know that the IDHS records may not contain information on

individuals who do count toward the benefits calculation for the family, as in the case of other adults and AFDC/TANF benefits.

Table C5 shows that roughly 77 percent of the 3,417 non-household heads who appear in our IDHS sample show up in the 50058 data. However, the match rates for young children in our IDHS sample are much higher – approximately 90 percent for those children under the age of 11. Among children age 11-15 that we identify in our IDHS sample, 83 percent also appear in the 50058 records, while the match rate for 16-17 year olds are noticeably lower (i.e., 70 percent). Interestingly, very few of the adult family members we identify in the IDHS files appear in the 50058 data. This pattern is consistent with a situation in which young children are very likely to accompany their parent or guardian to a new residence, but that the receipt of a housing voucher allows adults who had previously been living together to form their own households.

Table C5: The fraction of non-household heads who appear in IDHS records (n=3,417) that also matched to 50058 records, separately by age

Age as of 7/1/97	Fraction of the total sample of 3,417 individuals (1)	Fraction of individuals that match to the 50058 records (2)
All ages	1.00	0.77
0-3	0.20	0.91
4-6	0.19	0.88
7-10	0.21	0.90
11-15	0.18	0.83
16-17	0.05	0.71
18-25	0.07	0.30
25-45	0.07	0.20
45-65	0.03	0.32
65 or older	0.01	0.35

C4. Summary

Because the CHAC application forms list the total number of adults and children in the home but do not provide individual identifying information about household members other than the household head and his or her spouse (if applicable), we use IDHS data on pre-CHAC-lottery social program spells to identify other household members using the procedure described above. Our IDHS procedure suggests household sizes that are about one-half child smaller than what is suggested by the CHAC application files. However, a comparison of the individuals who appear in our IDHS data and those who later appear on official HUD 50058 forms among those families who utilized a housing voucher suggests our IDHS imputation procedure correctly identifies nearly all of the young children (below the age of 15) in a household and a fairly high (70 percent) fraction of older children. On the other hand, it appears that our IDHS estimation may not reliably identify other adults associated with the household. Finally, and quite importantly, the analysis reported here confirms that the measurement error in identifying household members is unrelated to the randomly assigned CHAC voucher wait list position.

Appendix D:
Calculation of Baseline Income, Rent and Implied Voucher Benefits

At several points in the analysis, we rely on estimates of income, rent and taxes in our sample. Because this information is not reported directly or fully in any single data set, we must estimate these values for families in our sample using data from a variety of different administrative data sources. Using our estimates of baseline income and rent, we are able to estimate the value of the housing voucher for each family.

D1. Estimating Fair Market Rents for CHAC Applicants

In order to calculate the housing benefit available to each family that is offered a voucher, we must first determine the maximum value of the apartment for which the voucher can be used. This value is known as the Fair Market Rent (FMR). The FMR is a function of the number and gender composition of the adults and children in the household, the metropolitan area the family is living in, and the calendar year. CHAC applicants are required to report all the relevant information for household size and gender composition, and HUD publishes the FMR for different-sized housing units in each local metro area for each year at www.huduser.org/datasets/fmr.html. We estimate the FMR for each CHAC family for 1997 using the baseline information on household composition that they report to CHAC on their voucher application to identify the largest apartment the family is entitled to, and then assign them the FMR for that size unit using the FMR reported by HUD. The average 1997 FMR for CHAC applicant households headed by a working age, able-bodied adult in our dataset was around $1,000 per month, or $12,000 per year.[7]

D2. Estimating Baseline Rent for CHAC Applicants

For our calculations we require a way of determining each CHAC applicant's baseline rent that we can apply consistently for all families across the entire voucher wait list. Unfortunately direct data on baseline rents are only available for families in our treatment group who were offered vouchers by CHAC, and then use their voucher to lease up in their same baseline apartment. The HUD 50058 forms that these families will be required to fill out as a condition of their voucher receipt will include complete information on their unit's rent.

To estimate baseline rents for our entire sample of CHAC applicants (treatment and control families), we use data from a special tabulation conducted for us by the Census Bureau using 2000 Census data for Chicago. We basically assign each CHAC applicant the average rent

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7 This FMR calculation uses the household size and gender composition that we estimate using the Illinois Department of Human Services (IDHS) data and estimation procedure described in Appendix B for households that ever show up in the IDHS data system; for those who do not show up in the IDHS system, we use the household composition and gender composition reported directly on the CHAC application forms. If we look at just the household composition among those who show up in the IDHS data, the FMR is equal to $12,010, while if we use just the CHAC application data we have available for everyone (whether they show up in the IDHS data system or not), the FMR is equal to $12,600. We prioritize the estimates for household composition obtained from the IDHS data using our Appendix C procedure because we can only calculate earnings and total income for people we can specifically identify through that IDHS procedure, and so the FMR calculation will be conceptually consistent with the income figures we estimate for each families.

paid by households with similar basic demographic characteristics living in the CHAC applicant's same baseline census tract. We define household "types" or categories on the basis of the census tract of residence, race of the household head, number of adults in the home, and number of children in the home. The Census Bureau suppresses rent figures in cases where there are too few households of a given type in a given census tract. In these cases, we assign CHAC applicants the average rent for households with the same number of adults and children in the same census tract (regardless of race). In cases where the relevant rent figures for a given household type in a tract are also suppressed by Census confidentiality requirements, we assign the average rent from households in the same tract with the same number of children (ignoring race and number of adults).[8]

A final complication in estimating baseline rents for CHAC applicants from the Census 2000 special tabulation is that we are interested in rents paid by families living in private-market housing, yet the 2000 Census questionnaire does not ask families whether they are living in public- or private-market housing. It is not clear what a family living in public housing would actually answer to a Census question about unit rent; would they, or should they, report their own out-of-pocket rent contribution, equal to 30 percent of adjusted income just as in the housing voucher program? Or would a family in public housing instead report some guess about the true market-equivalent "rent" for their public housing unit? (How a family would even begin to make such an assessment if they tried is not clear). We try to deal with this problem by estimating baseline rents under three different procedures: (a) using the mean rent reported by families in the 2000 Census, with no adjustments; (b) using median rent; (c) using an adjusted mean rent, where the adjustment assumes a truncated normal distribution for rents and truncates the rent distribution at the minimum rent cutoff used by HUD in their own calculations of the FMR (to weed out what HUD believes are likely to believe either public housing rents reported in the Census, or sub-standard private-market units).[9] The results under each of these approaches are quite similar. We have also asked the Census Research Data Center at the University of Michigan to do some tabulations with restricted-use individual-level Census data excluding households with rents below the cutoff HUD uses; those mean rent figures across family types and tracts are generally similar to what the Census has estimated for us without any adjustment for low rents. The average baseline rent in our sample is estimated to be on the order of $680 per month, or $8,160 per year.

To give some sense for how much measurement error there might be in our estimates, we make the following calculations. Within our tract-household-type cells, on average the median is only about $50 lower than the mean rent, suggesting some (but not dramatic) skew to the rent distribution. In terms of the amount of dispersion, we asked the Census Bureau to provide us with the 10th and 90th percentiles of the rent distribution within each tract-and-household-type

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8 Around 20 percent of our CHAC sample are assigned baseline rents for families of the same race, number of adults, and number of children in the same tract; around 75 percent of the CHAC sample are assigned rents based on households in the Census with the same number of adults and children in the same tract (pooling all races together); and the remaining 5 percent or so of CHAC applicants are assigned baseline rents of households with the same number of children in the same tract.

9 For the truncated mean adjustment we try this once using a common standard deviation calculated for households of all sizes citywide, and once trying to calculate tract-specific standard deviations for the rent distribution Here the data become quite limited given Census bureau data suppression at the tract level. In any case, both procedures yield similar results.

cell, but these are masked in case where there are too few households of a given type within a given census tract. For the 511 tract-household-type cells for which we have these data, the average 10th percentile of the tract-household-type rent distribution is $441 while the average 90th percentile rent value is $787.

D3. Estimating Baseline Income for CHAC Applicants

In reality, families in our sample may receive income from a variety of different sources. Due to data limitations, we only consider earned income that appears on UI records, income received (owed) due to legislated tax refunds (liabilities), TANF, and the monetary value of food stamps benefits received.

Earned Income: We sum all quarterly UI earnings reported for all household members for the four quarters prior to the CHAC application period (from 1996:Q3 through 1997:Q2).

Legislated federal, state, and FICA tax refund or liability levels (including EITC): These were obtained using TAXSIM. [10] We do not have data on who actually filed a tax return. Our baseline specification assumes that all individuals with positive earnings file a tax return. [11] Note that this assumes that individuals automatically receive all EITC benefits for which they qualify based on their earned income and household characteristics. Individuals with zero earnings are assigned zero tax liability. While we know whether an individual claims a "spouse" on their CHAC application form, we do not know whether the CHAC household head and listed "spouse" are married or merely cohabiting, and even if the couple is legally married, whether the household head filed jointly with his or her spouse. The baseline specification assumes that all household heads with listed "spouses" are married and file jointly. [12] Lastly, to accurately calculate tax refund (liability) levels, we need a measure for dependents. For the purpose of calculating baseline income, we use the information on dependents listed on the CHAC application form and the administrative records of the Illinois Department of Human Services. [13]

TANF benefit levels: In our data, we know who was on TANF in each quarter, but not the level of benefits they were receiving. As noted in Appendix A, benefit levels are a function of earned income, household size, and child care. We do not have data on child care used, so this does not enter into our calculations. In our baseline specification, earned income includes

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10 An overview of TAXSIM can be found in Feenberg and Coutts (1993). The calculations were done using the STATA program taxsim9. These tax rates include state and federal EITC programs. We assume that individuals file for the child tax credit if eligible. FICA tax rates include the employee portion only.

11 We are aware that not all low-income individuals file. For example, Scholz (1994) estimates that 80-86 percent of EITC eligible families file their taxes. As he points out, this could be either for legal or illegal reasons. Legally, individuals below a certain gross income threshold are not required to file. In 2005, the thresholds were $8,200 for single filers, $16,400 for married filers filing jointly, and $10,500 for head of household filers. At the same time, Scholz (1994) shows that 32.3 percent of individuals claiming the EITC were in fact ineligible in 1988. This is roughly 4-5 times larger than noncompliance rates for other social programs such as TANF and food stamps. We also consider an alternative, which assumes that all individuals who were not legally required to file in a given year choose to not file.

12 We also construct an alternative in which all individuals with "spouses" are cohabiting (or file separately). In this alternative specification, all dependents are assigned to the household head.

13 Our baseline specification takes the number of dependents as given. We estimate an alternative specification that caps the number of dependents at six.

income of all individuals in the household age 18 and older.[14] We also consider an alternative specification, in which earned income includes income of all individuals in the household. If we conclude that an individual receives no benefit given our measures of earned income and household size, the tax rate and benefit levels are set to zero.[15]

Food stamp benefit levels: In our data, we know whether or not an individual was on food stamps, but not the benefit level. As noted in Appendix A, benefit levels are a function of earned income, household size, child care, and rent.[16] We do not have data on child care or rent, so these values do not enter into our calculations. The appropriate household unit for food stamps is vaguely defined. We assume that the household unit consists of all household members at baseline regardless of age. If we conclude that an individual receives no benefit given our measures of earned income and household size, the tax rate is set to zero and the benefit level is set to the minimum (we assume this is $10 per month for all individuals). [17]

Summary Statistics on Baseline Income: This table shows the mean, median, and standard deviation of baseline income for the whole sample and our main analysis sample, which includes all able-bodied working-age adult CHAC applicants.

	Mean	Median	Std. Dev.
Whole Sample	12,403.21	10,271.38	10,946.16
Main Analysis Sample	14,366.88	12,171.99	11,166.03

D4. Housing Voucher Benefits

After calculating total family baseline income, we then tabulate the adjusted income value that is used under housing voucher program rules to determine the family's rent contribution. We first subtract from total household income those sources that are not counted as income by the voucher program, namely tax refunds (liabilities), food stamp receipt, and earnings by household members under the age of 18. We then also subtract allowable deductions that we can identify with the data available to us, namely the $480 per child deduction under voucher program rules. Mean *adjusted* income for our sample of able-bodied, working-age CHAC adult applicants is $12,584.

As discussed in Appendix A, the maximum value of a family's housing voucher or certificate subsidy is equal to the payment standard minus the family's obligated rent payment.

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14 Technically, the appropriate definition of earned income should be income of parents and siblings. Because we do not know which children in the household are siblings and which adults are parents of the qualifying children, we simply include earned income for all individuals age 18 or older.

15 In roughly 3 percent of household-quarter observations during 1996Q3-1997Q2 in which our records indicate that the household head was receiving some TANF benefits, we estimate zero benefit levels.

16 We assume household size is one plus the number of other members under the age of 18.

17 In roughly 3 percent of household-quarter observations during 1996Q3-1997Q2 in which our records indicate that the household head was receiving some food stamp benefits, we estimate that the household receives the minimum benefit allocation or no benefit at all.

We assume the payment standard is the Fair Market Rent (FMR)[18] and the obligated rent payment as .3 times net income.[19]

One can think of the total value of the housing voucher as the sum of two components: (1) the increase in housing consumption that the individual receives by moving into a more expensive apartment and (2) the increase in disposable income the family receives as a result of devoting a smaller fraction of its income to rent.

Most families in our sample will have baseline rents that are far below the FMR, and will be spending far more on rent than 30 percent of their adjusted income. (Recall from Appendix A that adjusted income is less than total income because the housing voucher program rules exclude certain sources of income, and allow families deductions for dependents and other reasons). For these families, the amount of the voucher subsidy that they can take as cash is equal to the difference between their baseline rent and 30 percent of their adjusted income. The increase in housing consumption for a family that leases a unit with rent equal to the FMR is equal to the difference between the FMR and the family's baseline rent.[20]

Our estimation procedure will unavoidably add some error to our measures of baseline rent and income values. But since our estimation procedure for baseline rent and income relies entirely on pre-baseline administrative records, this measurement error should be orthogonal to each family's randomly assigned position on the CHAC voucher wait list.

Given our estimates for able-bodied, working-age adult CHAC applicants of average baseline total household income of $14,367, adjusted income (under housing program rules) of $12,584, baseline rent of $8,160 per year, and average FMR of $12,000, then the average maximum voucher subsidy value (cost to the government) will equal $8,383. Since Reeder (1985) estimates the ratio of benefit to the recipient to cost to the government for vouchers to be around .83, this implies an average equivalent variation for a voucher on the order of $6,957. Our calculations imply that on average, the extra cash a family can take out of a voucher will be around ($8,160 - $3,775) = $4,385 per year, while the family will increase their housing consumption ($12,000 - $8,160) = $3,840. Put differently, the fact that families spend such a large amount of their baseline income on rent, and can then substantially reduce their spending on housing upon receipt of a voucher, means that the typical CHAC applicant is able to take more than half of the dollar value of the housing voucher subsidy in the form of cash.

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18 The payment standard differs for the old Section 8 certificate program, the old voucher program, and the new voucher program, but that we will assume is equal to the FMR for simplicity.

19 In some cases, the rent payment is defined as .1 times gross income (or the welfare rent payment – that is, the minimum amount of a family's welfare contribution towards rent). For the purposes of the calculations described above, we only use .3 x net income as the obligated rent payment.

20 Leger and Kennedy (1990) provide some evidence suggesting that most families will choose units with rents equal to the relevant FMR. To simplify things our discussion abstracts from the differences in program rules for the old Section 8 certificate program, the old Section 8 voucher program, and the new voucher program (all of which were in operation during our study period) that impact how the housing voucher influences consumption patterns among families. For example the old Section 8 certificate program prevented families from leasing units with rents above FMR, which means that a family with baseline rent above the FMR would receive no change in consumption of either housing or other goods without moving to a new unit with rent at or below the FMR.

Appendix E
Calibration of Labor Supply Model

To determine what income and substitution elasticities are consistent with our data, we write down a simple labor supply model and calibrate it using data from our analysis sample.

E1. Estimation of person-quarter measures of hours worked (H), post-tax wage rate (w) and non-wage or virtual income (V)

We first estimate hours worked, post-tax wages, and non-wage income for each person-quarter observation in our data set.

Hours Worked: The UI data we use has information on quarterly earnings, but does not have specific information on hours worked or wage rate. Based on 2000 Census data for African-American single female household heads with children in Chicago, we estimate that that the hourly wage rate for our sample is roughly $8/hour. Using this figure, we calculate the weekly hours worked for individual i in quarter q as $h_{iq} = \dfrac{E_{iq}}{13 * 8}$ where E_{iq} is the quarterly earnings reported for this individual in UI records. Note that here we use only data on earnings for the household head, not all individuals in the household.

Post-Tax Wage Rate: We calculate the marginal tax rate of individual i in quarter q as a function of legislated federal, state, and FICA tax rates and credits, as well as TANF, food stamps and housing vouchers (see below for more details). The post-tax wage rate is then calculated assuming a pre-tax wage of $8/hour: $w_{iq} = 8 * (1 - \tau_{iq})$.

Non-Wage (Virtual) Income: We assume that the individuals in our sample have no savings and the only non-wage income they have comes from the following social program benefits – TANF, food stamps, housing vouchers and EITC. As described below, for each person-quarter, we estimate the social program benefits they are receiving along with the marginal tax rate that they face. We then define their virtual income as the benefits they would receive at zero hours of work assuming the marginal tax rate, as shown in the figure below.

Since the wage rate is assumed constant for everyone, the diagram with hours on the vertical axis looks like:
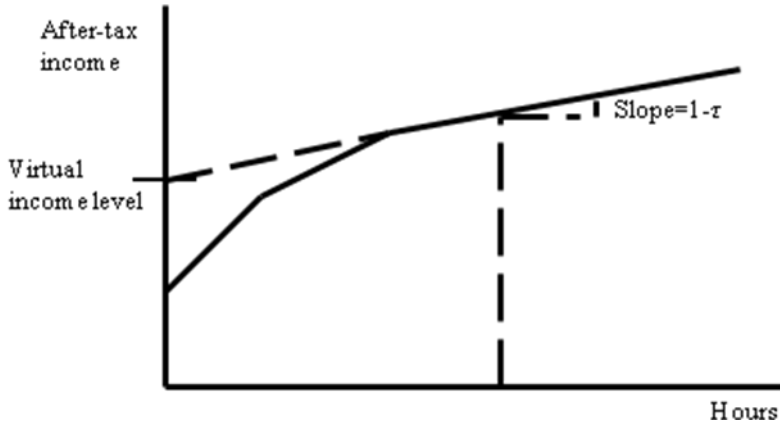
Alternatively, one can consider a graph with after-tax income on the vertical axis and before-tax income on the horizontal axis, as shown below.
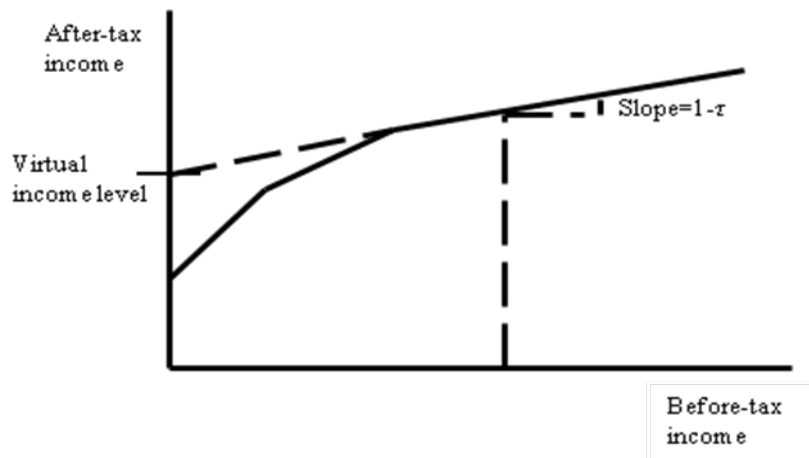
All we need to know is an individual's before- and after-tax income levels and their marginal net-of-tax rate $1-\tau$ to obtain virtual income. The formula can be written as follows: $VI = ATI - (1-\tau)BTI$ where VI, ATI and BTI are virtual income, before-tax and after-tax income levels, respectively. Note that ATI=BTI – T where T is the tax liability (or tax benefit) incurred. T is positive (negative) if there is a liability (benefit).

If the HHH is the only income-earning individual in the household, then it is clear that virtual income should simply be a function of the HHH's income. However, suppose there is a spouse who also earns income. Now, if virtual income is calculated solely as a function of the HHH's income level, this implies that the HHH and spouse make independent labor supply decisions. And, if virtual income includes both HHH and spouse, then this implies a joint labor supply decision model. Our baseline specification assumes virtual income is a function of HHH and spouse income. However, we also consider the alternative specification in which virtual income is a function of HHH income only. In any case the vast majority of households in our study sample are unmarried females.

E2. Details on how tax rates and benefit levels are estimated across programs

In each of the programs below, various sources of income other than earned income and that from social programs considered in our analysis (TANF, food stamps and housing vouchers) are included when calculating benefit levels. However, we have no data on such income sources, and therefore set the value of these income sources to zero.

For the purpose of our calculations, we exclude all individuals who were not receiving some form of public assistance (AFDC, food stamps or Medicaid) in Illinois prior to the voucher lottery. As described in Appendix C, we use the public assistance records collected by the Illinois Department of Human Services (IDHS) to identify other household members. It is critical that we have information on the number and ages of dependents for the calculation of program benefits and tax rates so we exclude the 7 percent of household for whom we cannot calculate this information. Our baseline specification leaves the number of dependents for each of the tax rate calculations uncapped. We also try an alternative, where we cap the number of dependents at 6.

Legislated federal, state, and FICA tax refund or liability levels (including EITC): These were obtained using TAXSIM.[21] We do not have data on who actually filed a tax return. Our baseline specification assumes that all individuals with positive earnings file a tax return.[22] Note that this assumes that individuals automatically receive all EITC benefits for which they qualify based on their earned income and household characteristics. Individuals with zero earnings are assigned zero tax liability. While we know whether an individual claims a "spouse" on their CHAC application form, we do not know whether the CHAC household head and listed "spouse" are married or merely cohabiting, and even if the couple is legally married, whether the household head filed jointly with his or her spouse. The baseline specification assumes that all household heads with listed "spouses" are married and file jointly.[23] Lastly, to accurately calculate tax refund (liability) levels, we need a measure for dependents. We determine the number and ages of all children associated with the household at the time of the voucher lottery (July 1997) using the procedure described in Appendix C.[24] We assume that no individuals went to college, so they can no longer be claimed as dependents once they turn 19.[25] Additionally,

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21 An overview of TAXSIM can be found in Feenberg and Coutts (1993). The calculations were done using the STATA program taxsim9. These tax rates include state and federal EITC programs. We assume that individuals file for the child tax credit if eligible. FICA tax rates include the employee portion only.

22 We are aware that not all low-income individuals file. For example, Scholz (1994) estimates that 80-86 percent of EITC eligible families file their taxes. As he points out, this could be either for legal or illegal reasons. Legally, individuals below a certain gross income threshold are not required to file. In 2005, the thresholds were $8,200 for single filers, $16,400 for married filers filing jointly, and $10,500 for head of household filers. At the same time, Scholz (1994) shows that 32.3 percent of individuals claiming the EITC were in fact ineligible in 1988. This is roughly 4-5 times larger than noncompliance rates for other social programs such as TANF and food stamps. We also consider an alternative, which assumes that all individuals who were not legally required to file in a given year choose to not file.

23 We also construct an alternative in which all individuals with "spouses" are cohabiting (or file separately). In this alternative specification, all dependents are assigned to the household head.

24 Our baseline specification takes the number of dependents listed on the application form as given. We estimate an alternative specification that caps the number of dependents at six.

25 If a child went to college, it is possible to claim them as a dependent until they are 24 years old.

note that we do not know if there were any additional children born after baseline, so over time so our estimation will do a progressively worse job of estimating the correct number of dependents (though there should be no difference in the accuracy of our estimates between treatment and control households).

TANF benefit levels: In our data, we know who was on TANF in each quarter, but not the level of benefits they were receiving. As noted in Appendix A, benefit levels are a function of earned income, household size, and child care. We do not have data on child care, so this does not enter into our calculations. In our baseline specification, earned income includes income of all individuals in the household age 18 and older.[26] We also consider an alternative specification, in which earned income includes income of all individuals in the household. If we conclude that an individual receives no benefit given our measures of earned income and household size, the tax rate and benefit levels are set to zero.[27]

Food stamp benefit levels: In our data, we know whether or not an individual was on food stamps, but not the benefit level. As noted in Appendix A, benefit levels are a function of earned income, household size, child care, and rent.[28] We do not have data on child care or rent, so these values do not enter into our calculations. The appropriate household unit for food stamps is vaguely defined. We assume that the household unit consists of all household members at baseline regardless of age. If we conclude that an individual receives no benefit given our measures of earned income and household size, the tax rate is set to zero and the benefit level is set to the minimum (we assume this is $10 per month for all individuals). [29]

Housing voucher effective tax rate and benefit levels: As shown in Appendix A, the effective tax rate associated with housing vouchers is 0.3. Additionally, if the household is on both TANF and food stamps, the combined tax rate is 0.53 due to interactions between the two programs (the implied TANF benefit level is also decreased). Just as for the other social programs, we know whether or not an individual received a housing voucher, but not the level of their subsidy. Earned income is again assumed to include income of all individuals in the household at baseline who are age 18 or older. And, we again assume that the household unit consists of all household members at baseline. Given our measures of earned income and household size, if we conclude that an individual receives no benefit, the tax rate and benefit levels are set to zero.[30]

E3. Calculation of treatment and control means for H, w and V

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26 Technically, the appropriate definition of earned income should be income of parents and siblings. Because we do not know which children in the household are siblings and which adults are parents of the qualifying children, we simply include earned income for all individuals age 18 or older.

27 In roughly 14 percent of household-quarter observations in which our records indicate that the household head was receiving some TANF benefits, we estimate zero benefit levels. This is likely due to the errors in measuring household composition.

28 We assume household size is one plus the number of other members under the age of 18.

29 In roughly 14 percent of household-quarter observations in which our records indicate that the household head was receiving some food stamp benefits, we estimate that the household receives the minimum benefit allocation or no benefit at all. The latter is likely due to the errors in measuring household composition.

30 In roughly 37 percent of household-quarter observations in which our records indicate that the household head was receiving a housing voucher, we estimate zero benefit levels. This is likely due to the errors in measuring household composition.

For the control group, we calculate H, w and V as the simple average of all person-quarter observations over our entire sample period. In order to estimate the difference between the treatment and control groups, we estimate three Intent-to-Treat model where the outcomes are H, w and V respectively. Specifically, we estimate equation (1) from the main text. The coefficient β_1 measures the treatment-control difference. We obtain the treatment group means by adding these differences to the control means.

	Control Group	Treatment Group
Assumed pre-tax wage	8	8
Quarterly earnings	3115.574	2995.8576
Weekly earnings	239.6595385	230.4505846
Weekly hours (h)	29.95744231	28.80632308
VI per quarter	1251.135	2006.3399
VI per week (V)	96.24115385	154.3338385
Marginal tax rate	0.1832188	0.2470425
Post-tax wage (w)	6.5342496	6.02366

E4. Calibration of Labor Supply Model

Consider an individual with a CES utility function as in (E1), where c is consumption, h is weekly hours worked, and T is total available time, so that T-h reflects weekly hours of leisure.

(E1) $u(c,h) = \left[(1-\alpha)c^{-\mu} + \alpha(T-h)^{-\mu} \right]^{-\frac{1}{\mu}}$

Individuals choose hours to maximize utility given the constraint:

(E2) $c = wh + V$

where w is the post-tax wage and V is non-wage (virtual) income. This setup yields the following labor supply equation (assuming $\alpha > 0, \mu > -1$):

(E3)
$$h = \frac{Tkw^e - V}{w + kw^e}$$
$$k = \left(\frac{1-\alpha}{\alpha} \right)^e, e = \frac{1}{1+\mu}$$

We calibrate equation (7) using the separate treatment and control group means of h, V

and w in our data, which gives us two equations and two unknowns and implies parameter values

equal to $\mu = .7285$ and $\dfrac{1-\alpha}{\alpha} = 54.945$.

The derivatives of labor supply with respect to wages and income equal (Stern 1976)[31]:

(E4)
$$\frac{\partial h}{\partial V} = -\frac{1}{w + wk^e} = -\frac{(T - h)}{V + wh}$$
$$\frac{\partial h}{\partial w} = \frac{(V - \mu wh)(T - h)}{w(\mu + 1)(V + wT)}$$

We then use the Slutsky equation to find the compensated wage effect

(E5)
$$\frac{\partial h^{comp}}{\partial w} = \frac{\partial h}{\partial w} - h\frac{\partial h}{\partial V}$$

Our simple calibration exercise suggests an income elasticity of -0.09 and a compensated

wage elasticity of 0.15.

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[31] Note that $kw^e = \dfrac{wh + V}{T - h}$.

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Appendix Table I: Effects Of Housing Vouchers On All Household Members

	CM	ITT	IV	CCM	Number of Households
At least one member of HH employed	0.665	-0.011**	-0.029**	0.680	42,358
		(0.003)	(0.008)		
At least one member of HH on public assistance	0.558	0.024**	0.058**	0.666	42,358
		(0.004)	(0.009)		
At least one member of HH on TANF	0.182	0.005**	0.014**	0.149	42,358
		(0.002)	(0.005)		
Fraction of people in HH employed	0.396	-0.008**	-0.020**	0.379	42,358
		(0.003)	(0.006)		
Fraction of people in HH on public assistance	0.464	0.023**	0.056**	0.553	42,358
		(0.003)	(0.008)		
Fraction of people in HH on TANF	0.143	0.005**	0.012**	0.111	42,358
		(0.002)	(0.004)		
Total HH earnings	4,390.22	-107.01**	-275.72**	4,137.01	42,358
		(41.260)	(100.176)		
Total HH earnings per capita	2,178.73	-87.18**	-219.64**	1,918.61	42,358
		(21.086)	(51.319)		
Total HH earnings conditional on at least one working	6,599.27	-71.60	-185.87*	6,116.74	40,021
		(47.210)	(111.504)		
Log total HH earnings conditional on at least one working	8.407	-0.027**	-0.067**	8.359	40,021
		(0.008)	(0.019)		

Notes: The unit of observation is person-year-quarter. The sample includes all working-age, able-bodied CHAC applicants who were living in private housing at baseline. CM = Control Mean. ITT = Intent-to-Treat. IV = Instrumental Variables. CCM = Control Complier Mean. See text for discussion of these estimates. Robust standard errors clustered at household level. ** = significant at 5% level, * = significant at 10% level. All earnings are measured in 2007 dollars.

Appendix Table II: Baseline ITT Estimates, with and without Person Fixed Effects

	Number of Households (1)	Baseline OLS (2)	OLS with Individual Fixed Effects (3)	Difference (4)
HHH employed	42,282	-0.014** (0.004)	-0.012** (0.003)	-0.002 (0.003)
HHH earnings	42,282	-128.18** (30.638)	-98.65** (25.895)	-29.53 (24.819)
HHH earnings > $3,500 (FT@$8/hr)	42,282	-0.018** (0.004)	-0.013** (0.003)	-0.005 (0.003)
HHH earnings conditional on working	38,558	-90.36** (34.132)	-95.12** (28.389)	4.76 (26.256)
HHH log earnings conditional on working	38,558	-0.029** (0.008)	-0.030** (0.007)	0.001 (0.008)
HHH received public assistance	42,282	0.027** (0.004)	0.016** (0.004)	0.011** (0.003)
HHH received TANF	42,282	0.006** (0.002)	0.009** (0.003)	-0.003 (0.003)
HHH received Medicaid	42,282	0.024** (0.004)	0.015** (0.004)	0.009** (0.004)
HHH received Food Stamps	42,282	0.030** (0.003)	0.028** (0.003)	0.002 (0.004)

Notes: The sample exludes the 76 households headed by a HHH appearing in multiple HHs. All covariates in column (3) are dropped except for the time dummies. Column (4) gives the difference between columns (2) and (3). The standard errors reported in column (4) are calculated by taking the mean difference between columns (2) and (3) across 100 samples blocked at the person level, and then using the standard deviation of that mean difference. For columns (2) and (3), robust standard errors clustered at household level. ** = significant at 5% level, * = significant at 10% level. All earnings are measured in 2007 dollars.

Appendix Table III: Alternative Specifications for ITT Estimates

	Employment (CM = 0.592)	Public Assistance Receipt (CM=0.460)
Baseline OLS	-0.014**	0.027**
	(0.004)	(0.004)
Logit		
coefficient	-0.071**	0.154**
	(0.018)	(0.020)
average marginal effect	-0.014**	0.027**
	(0.004)	(0.004)
Probit		
coefficient	-0.043**	0.091**
	(0.011)	(0.012)
average marginal effect	-0.014**	0.027**
	(0.004)	(0.003)
OLS with person fixed effects	-0.012**	0.016**
	(0.003)	(0.004)
Conditional Logit		
coefficient	-0.097**	0.166**
	(0.028)	(0.035)
average marginal effect	-0.023**	0.026**
	(0.007)	(0.006)

Notes: The sample exludes the 76 households headed by a HHH appearing in multiple HHs. For the fixed effects and conditional logit regressions, all covariates are dropped except for the time dummies. Robust standard errors clustered at household level. ** = significant at 5% level, * = significant at 10% level.

Appendix Table IV: Effects Of Housing Vouchers On Household Heads 60 and Younger

	CM	ITT	IV	CCM	Number of Households
HHH employed	0.596	-0.015** (0.004)	-0.037** (0.009)	0.609	41,908
HHH earnings	3,316.04	-131.67** (30.859)	-334.97** (74.937)	3,136.25	41,908
HHH earnings > $3,500 (FT@$8/hr)	0.407	-0.018** (0.004)	-0.046** (0.009)	0.406	41,908
HHH earnings conditional on working	5,561.17	-90.82** (34.170)	-226.21** (80.272)	5,129.60	38,410
HHH log earnings conditional on working	8.280	-0.029** (0.008)	-0.073** (0.018)	8.221	38,410
HHH received public assistance	0.462	0.027** (0.004)	0.068** (0.009)	0.552	41,908
HHH received TANF	0.148	0.006** (0.002)	0.017** (0.004)	0.111	41,908
HHH received Medicaid	0.401	0.024** (0.004)	0.058** (0.009)	0.484	41,908
HHH received Food Stamps	0.376	0.030** (0.003)	0.076** (0.008)	0.450	41,908

Notes: The unit of observation is person-year-quarter. The sample includes all working-age, able-bodied CHAC applicants who were living in private housing at baseline. CM = Control Mean. ITT = Intent-to-Treat. IV = Instrumental Variables. CCM = Control Complier Mean. See text for discussion of these estimates. Robust standard errors clustered at household level. ** = significant at 5% level, * = significant at 10% level. All earnings are measured in 2007 dollars.

Appendix Table V: Alternative TOT Estimates

		Number of Households	Employed		Receiving TANF, Food Stamps, or Medicaid	
			IV	CCM	IV	CCM
	Baseline	42,358	-0.036**	0.605	0.067**	0.552
			(0.009)		(0.009)	
(1)	Include households with lottery numbers 18,103-35,000	53,135	-0.037**	0.606	0.069**	0.550
			(0.009)		(0.008)	
(2)	Scale by receipt of voucher through the 1997 lottery (rather than simply receiving a voucher through any program)	42,358	-0.034**	0.607	0.062**	0.555
			(0.008)		(0.008)	
(3)	Scale by actual voucher usage in each quarter (rather than defining voucher usage as all quarters post initial lease-up)	42,358	-0.044**	0.622	0.081**	0.590
			(0.011)		(0.010)	
(4)	Scale by actual usage of 1997 voucher (combination of changes in both rows 2 and 3)	42,358	-0.042**	0.625	0.076**	0.589
			(0.010)		(0.010)	

Notes: The unit of observation is person-year-quarter. The sample includes all working-age, able-bodied CHAC applicants who were living in private housing at baseline. CM = Control Mean. ITT = Intent-to-Treat. IV = Instrumental Variables. CCM = Control Complier Mean. See text for discussion of these estimates. Robust standard errors clustered at household level. ** = significant at 5% level, * = significant at 10% level.

Appendix Figure I: Control Group Outcomes Over Time
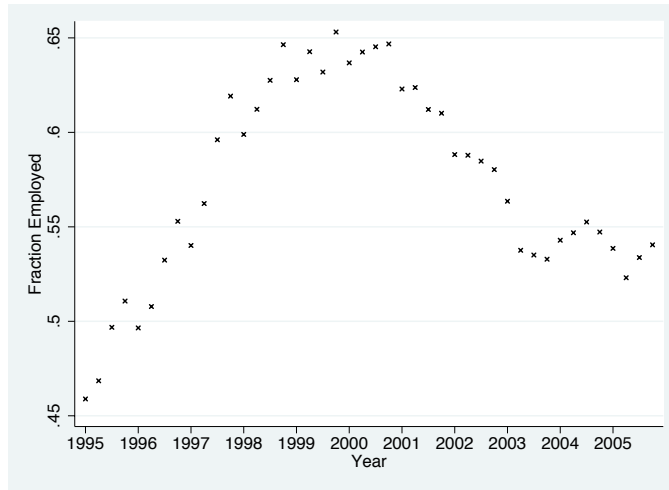
(a) HHH Employed
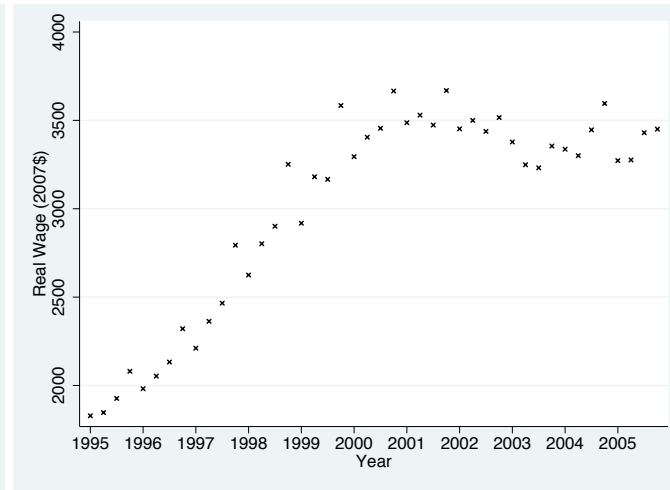
(b) HHH Real Earnings (2007$)
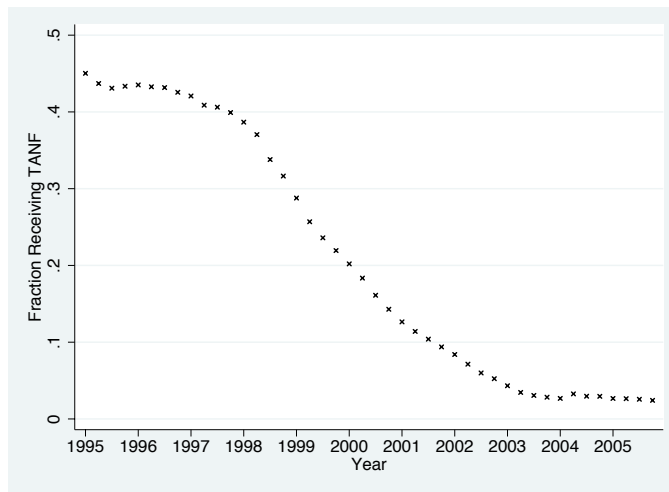
(c) HHH Receiving Cash Assistance
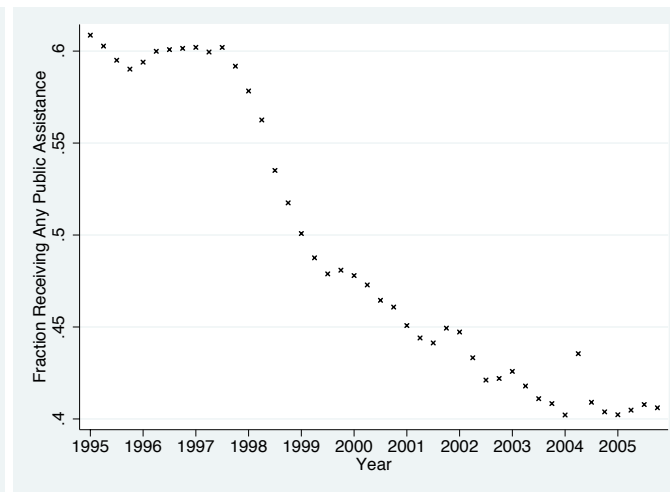
(d) HHH Receiving Any Public Assistance

Notes: Control group defined as CHAC applicants with lottery number greater than 35,000. Sample includes all working-age, able-bodied CHAC applicants who were living in private housing at baseline.

Appendix Figure II: Chicago Metropolitan Area Vacancy And Unemployment Rates 1995-2005

Appendix Figure III: Offer And Lease Up Rates Over Time
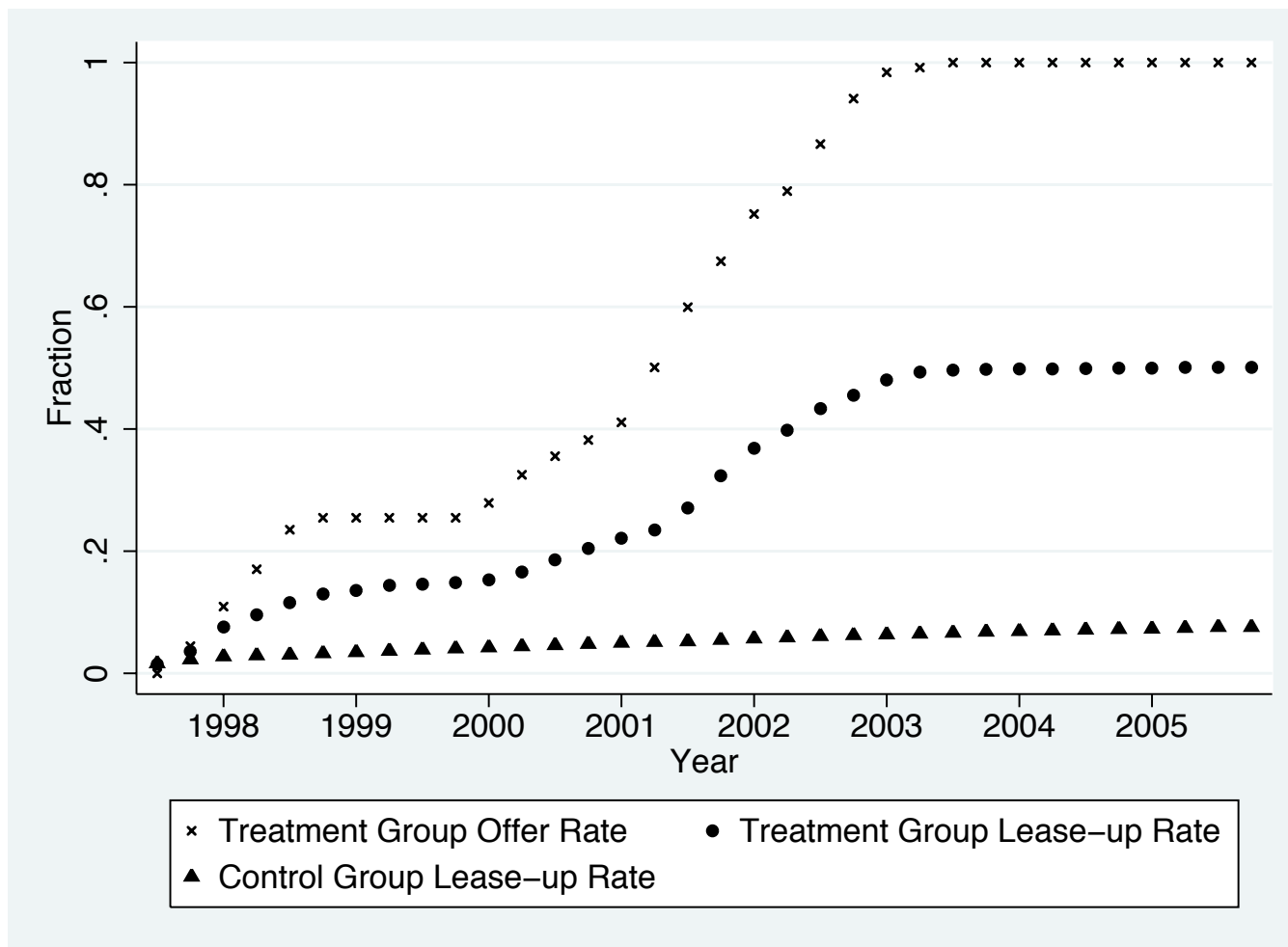
Notes: Treatment group defined as CHAC appicants with lottery number less than or equal to 18,100. Control group defined as CHAC applicants with lottery number greater than 35,000. Sample includes all working-age, able-bodied CHAC applicants who were living in private housing at baseline.

Appendix Figure IV: ITT Effect Of Vouchers Over Time On Employment, Earnings And Receipt Of Public Assistance, By Baseline TANF Receipt
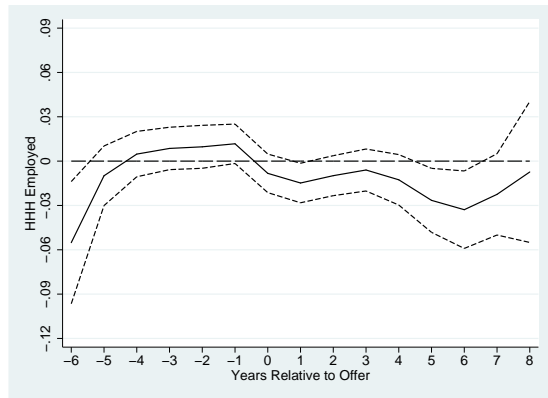
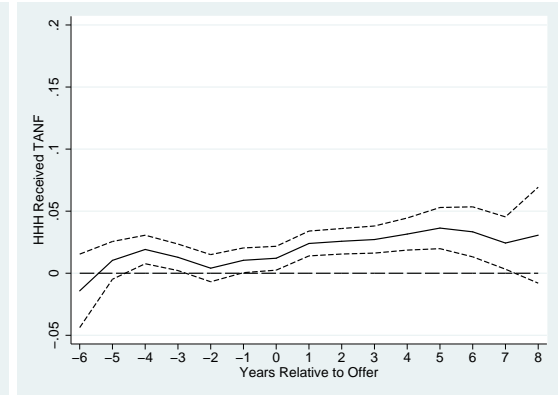(a) Employment, TANF in 1997 Q2
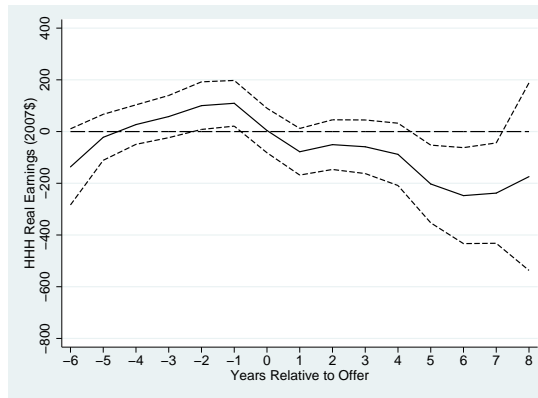
(b) Earnings, TANF in 1997 Q2
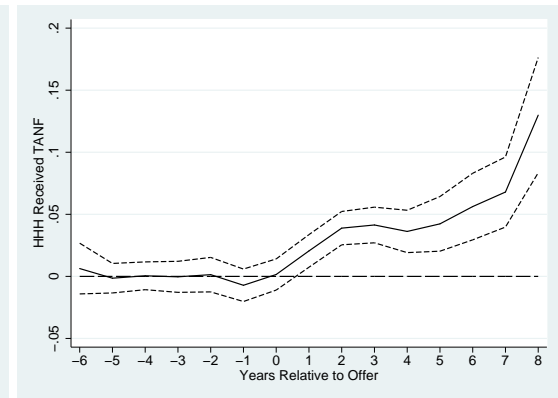
(c) Public Assistance, TANF in 1997 Q2
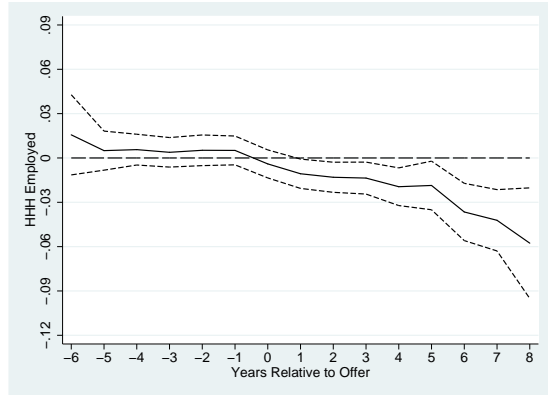
(d) Employment, No TANF in 1997 Q2
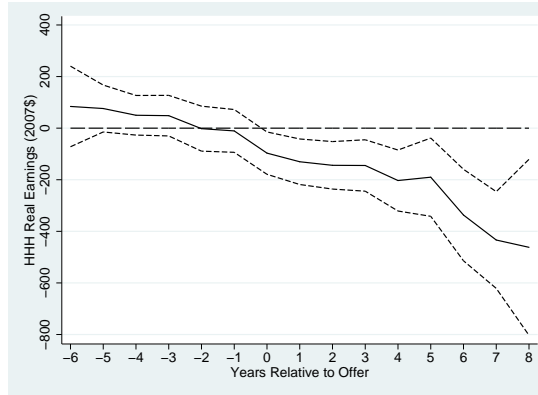
(e) Earnings, No TANF in 1997 Q2

(f) Public Assistance, No TANF in 1997 Q2

Notes: Dotted lines represent the 95 percent confidence interval. Solid lines represent the point estimate. Estimates come from equation (4) in the text. Year zero is defined as the first full year after an offer, measured at the quarter level, and including the quarter of the offer. The sample for panels (a), (b) and (c) includes all working-age, able-bodied CHAC applicants who were living in private housing and receiving TANF at baseline. The sample for panels (d), (e) and (f) includes all working-age, able-bodied CHAC applicants who were living in private housing and not receiving TANF at baseline.

Appendix Figure V: Control and Treatment Group Outcomes Over Time, With Treatment Group Split By Offer Cohort
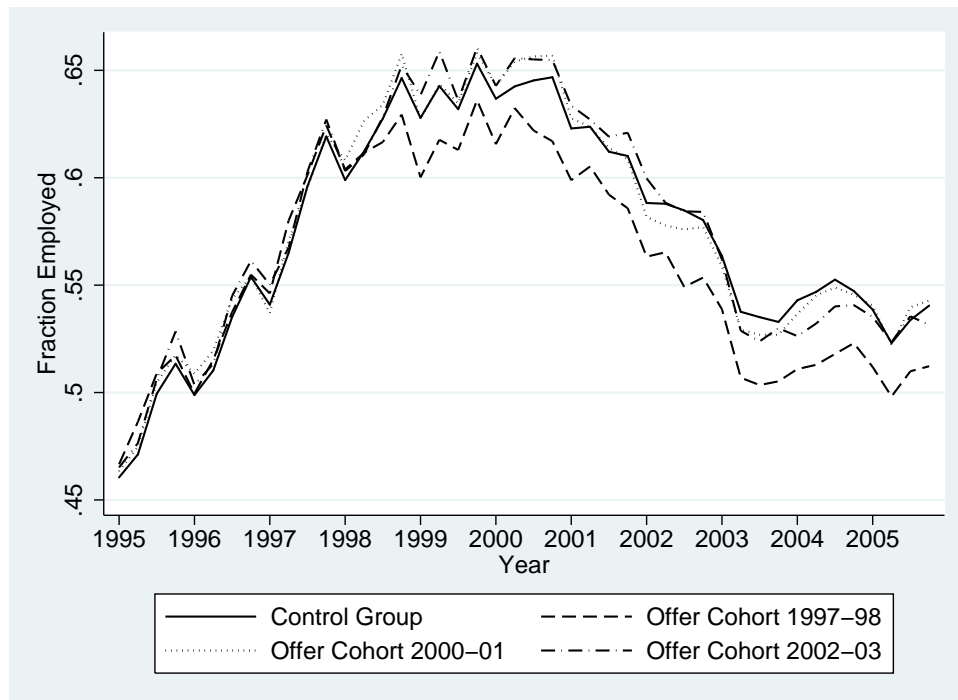
(a) HHH Employed
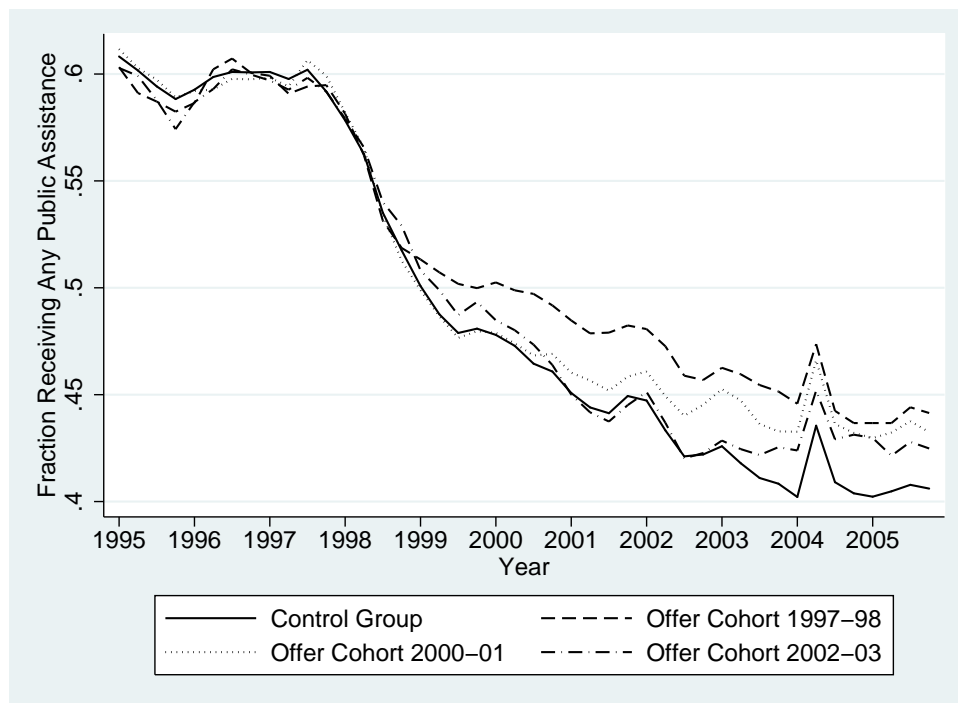
(b) HHH Receiving Any Public Assistance

Notes: Control group defined as CHAC applicants with lottery number greater than 35,000. Offer cohort 1997-98 consists of those CHAC applicants who were offered a CHAC housing voucher in 1997 or 1998. Offer cohorts 2000-01 and 2002-03 defined similarly. No CHAC vouchers were offered in 1999. Sample includes all working-age, able-bodied CHAC applicants who were living in private housing at baseline.