Subsidized Housing and Household Structure

by

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One of the explicit goals of US welfare policy has been to keep families together and discourage non-marital childbearing (Berrick 2006). While participation in AFDC has had a modest effect on divorce and separation and almost no effect on unmarried fertility, the program's most pronounced influence may have been on the living arrangements of unmarried mothers by encouraging their independent residence away from kin (Ruggles 1997). This paper will examine a related but often overlooked part of the relationship between government subsidies and household composition, namely how the availability and receipt of subsidized housing affects household composition.

Housing subsidies defray the largest expense facing families and may provide residents with options away from unsatisfactory relationships and crowded conditions (Freeman 2005). On the other hand, the strict rules regarding who may reside in the subsidized apartment and stepped-up enforcement of "one strike, you're out" rules as they pertain to people with drug abuse histories and criminal records may limit the pool of potential partners available to subsidized residents and keep unions from forming in subsidized housing (Mincy 2009). Moreover, the act of entering and exiting the program as opposed to the length of stay in subsidized housing may by themselves influence household composition decisions, as a mother may choose to live apart from the father of her child if that means she is eligible for the subsidy or choose to move out if the rules in subsidized housing make certain unions or living

arrangements impossible. Therefore, I analyze not only the dynamics of household composition during tenure in subsidized housing but also before families take up the subsidy and after they give it up.

Housing assistance and household structure

Housing assistance might affect household composition in several ways. First, by reducing the cost of housing, rent subsidies may also reduce the economic incentive to share a home and thus reduce household size. This prediction is supported by empirical evidence showing that households receiving rent assistance have fewer adults (Ellen and O'Flaherty 2002, Abt Associates 2006, Freeman 2005). For example, subsidized single adults are less likely to get married over time (Freeman 2005). Moreover, cohabitation before the birth of a child is less likely if the mother lives in subsidized housing rather than other types of rental housing (Turner 2003). In fact, in-depth interviews with recipients of Welfare-to-Work housing vouchers in a demonstration program for single mothers on welfare show that vouchers enabled them to stop living with partners in abusive circumstances (Abt Associates 2006). Therefore, by providing single adults and especially single women with children with a feasible alternatives to staying in unsatisfactory relationships, housing subsidies may allow families to establish independent households away from partners and other family members (Turner 2003, Freeman 2005, Abt Associates 2006).

Nevertheless, the stringent rules of who may live under the same lease in a subsidized apartment may also cause unwanted family break-ups. For example, Welfare-to-Work voucher recipients reported amongst the reasons of not living with other relatives the mistaken belief that even related adult males (e.g. husbands, adult sons) could not live in the same household as the

voucher holder. Therefore, even though housing assistance does not appear to affect the dissolution of partnerships once families enter the program (Freeman 2005), it may reduce the number of adults in a household by forcing subsidized individuals to choose between taking up the subsidy or living together with other family members.

Second, by decreasing rent burdens and freeing up family resources, housing assistance might make having an additional child more feasible, thus, increasing the number of children in the household (Freeman 2005). Nevertheless, while recipients of housing assistance do have more children on average than their private-market counterparts, they are less likely to have an additional child while in public housing (Freeman 2005). Therefore, the program itself does not appear to have a positive effect on the number of minors in the household.

Third, because of their access to stable and decent housing, subsidized families may take in extended family members in hard times. There is some limited cross-sectional evidence though that subsidized residents do not appear to be doubled up with other adults. For example, housing assisted leavers of TANF are much less likely than non-assisted leavers to live in extended family or multifamily households (Mancuso et al. 2003). Moreover, Welfare-to-Work voucher recipients reported satisfaction with being able to leave doubled-up housing arrangements (Abt Associates 2006). Voucher recipients considered forming their own household an improvement that gave them a sense of increased stability and independence (Abt Associates 2006). In fact, they could still rely on support from their kin even though they did not live in the same housing unit (Abt Associates 2006).

Nevertheless, the initial decrease of the number of family members living with the subsidized individual could still be offset over time by the stability and quality of subsidized housing arrangements. For example, family members who find themselves without housing

options or with poor housing alternatives may seek help first from individuals in subsidized housing, thus, bringing up the number of persons in the subsidized unit over time. Therefore, while initially housing subsidies may allow recipients living in extended households to move out and form their own households, over the long run they can also make recipients more attractive to pleas for help with housing from friends and extended family members.

Research Model

As the decision to enter and exit subsidized housing is related to the household composition of tenants who choose to take advantage of the subsidy, I examine the household structure of subsidized tenants not only during their stays in subsidized apartments but also before they take up the subsidy and after they leave the program. While there is some evidence that being in subsidized housing reduces the number of adults in the household compared to income-eligible households (Ellen and O'Flaherty 2002, Abt Associates 2006, Freeman 2005), it is not clear whether this reduction comes about because of lower propensity of subsidized tenants to marry, lower propensity to cohabit or lower propensity to live with other kin. Therefore, my study builds upon previous findings regarding the number of adults in subsidized households by using the complete household roster of subsidized units and tracking over time exactly who moves in or who moves out of the household.

Moreover, it is not established whether the event of entering the program or exiting the program rather than the stay in a subsidized apartment has a greater salience for the marital, cohabitation, and doubling-up decisions of subsidized individuals. We know that over time subsidized individuals have lower probabilities to get married and, once partnered, lower probabilities to get divorced (Freeman 2005). We also know that subsidized pregnant women are

less likely to cohabit with the father of the child compared to similar non-subsidized women (Turner 2003). However, these findings do not speak to how household composition changes in conjunction with the event of entering or exiting subsidized housing. Moreover, the first set of results are only based on subsidized households in New York City who did not move between 1996 and 1999 (Freeman 2005), while the second set of findings come from cross-sectional data (Turner 2003). Therefore, I build upon these previous studies of the marital and cohabitation decisions of subsidized households by using a nationally representative dataset of both subsidized and non-subsidized individuals that tracks household composition decisions and subsidized housing receipt on a monthly basis for the period 1990-2008. I not only explore if a move into subsidized housing is associated with leaving overcrowded conditions or doubled-up living arrangements. I also ascertain how households change over time by tracking the movement of specific individuals across household arrangements in conjunction with changes in subsidized housing receipt.

I answer the following questions. Is a move into subsidized housing associated with a decrease in the number of household members and, if so, is that decrease due to a move away from a spouse, cohabitor, or other kin? Is the negative effect on marriage for individuals in the program due to the income eligibility rules of subsidized housing or is it due to the unfavorable set of marital prospects that people in subsidized housing face? Are exits from subsidized housing associated with changes in household composition such as marriage or are they due to other circumstances related to increases in employment stability and earnings? How would household arrangements both for the subsidized and unsubsidized population change if the rates of entry into and rates of exit from subsidized housing change or if the number of people that the subsidized housing program can accommodate changes?

I answer these questions using a multi-state life table that allows me to incorporate within the same analysis the sequence of decisions that individuals make regarding whether or not to receive a housing subsidy and in what type of household arrangements to live. It is methodologically challenging to establish a causal relationship between stays in subsidized housing and the timing of union formation, childbearing, and doubling-up with family members and roommates. It may be the case that households with certain living arrangements choose to apply for subsidized housing in order to establish a less stressful environment for their children. It could also be true, however, that the rules associated with living in subsidized apartments discourage certain household arrangements from happening, so that the beneficiary does not lose the subsidy. Therefore, my study builds upon the findings of previous research regarding the decrease in the number of adults in subsidized housing and the decrease in the marital prospects of subsidized adults by examining the complete sequence of household decisions that individuals make in conjunction with entries into and exits from subsidized housing. Because I do not impose a particular causal order to household formation and subsidized housing decisions, I am able to see what particular circumstances lead to the realized household arrangements in subsidized housing, how households evolve while in subsidized housing, and how they change once their members leave subsidized housing.

Methods

The multi-state life table, also known as an increment-decrement life table, characterizes population movement over time between finite and mutually exclusive states (Schoen 1975, 1988). The transitions from one state to another occur as a Markov process, meaning that the

distribution of the population across all states at time t depends only on the distribution of the population across all states at time t-1. Multi-state life tables are useful in the analysis of life cycle processes that involve multiple and recurrent transitions between at least two transient states. The direction of movement across states is flexible.

In this paper, I specifically analyze the transitions of individuals between different types of household arrangements crossed with subsidized housing status. I categorize household arrangements as follows: 1) single person household; 2) married couple family household; 3) single householder with at least one child under 18; 4) married couple family household with at least one child under 18; 5) single householder with a cohabitor[1], or non-primary family members, or roommates[2]; 6) single householder with at least one child under 18 and a cohabitor, or non-primary family members, or roommates; 7) married couple household with non-primary relatives, or roommates; 8) married couple household with at least one child under 18 and non-primary relatives, or roommates. These household arrangements can occur both within and outside subsidized housing, yielding a sixteen state space. Figure 1 is a schematic representation of all household arrangements crossed with subsidized housing status.[3] I examine transitions between

[1] The SIPP only started collecting data on cohabitation with the 1996 panel. Before the 1996 panel, any cohabitor would be classified as a "non-relative" member of the household. Therefore, I choose to classify cohabitors in the "non-primary relative/roommate" category, so that I use consistent household categories over time. In future research, I will explore the possibility of coding cohabitors for panels prior to the 1996 one, using the householder's age, sex and marital status to construct implied cohabitation status.

[2] Non-primary family members are the following: parent of the householder, grandchild of the householder, brother/sister of the householder, foster child of the householder, other relative of the householder.

[3] Note that for neatness not all transitions have been marked with an arrow. However, I examine transitions between all states in the figure.

all states in the figure. All transitions are reversible and there are no absorbing states. Transitions can occur on a monthly basis. The clock in the analysis is age measured in months.

My analysis proceeds in three steps. First, I calculate the observed transition rates between distinct states in my multi-state life table (${}_nM^{ij}_x$). Second, using these observed rates, I estimate the following multi-state life table quantities for a synthetic cohort of 10,000 people: 1) the number of people in state *i* at age *x* ($l^i(x)$); 2) the number of transitions from state *i* to state *j* between ages *x* and x+1 (${}_nd^{ij}_x$); 3) the probability of leaving state *i* between age *x* and age *x+1* (q^i_x); and 4) the number of person-months lived in state *i* between ages *x* and *x+1* (${}_nL^i_x$). The mathematical relationships between these measures are as follows:

$$l^i(x+n) = l^i(x) + \Sigma\, {}_nd^{ji}_x - \Sigma\, {}_nd^{ij}_x \qquad (1)$$

$${}_nd^{ij}_x = {}_nM^{ij}_x * {}_nL^i_x \qquad (2)$$

$${}_nL^i_x = .5 * [\, l^i(x) + l^i(x+n)] \qquad (3)$$

$$q^i_x = 1 - (l^i(x) - l^i(x+n)) \,/\, l^i(x) \qquad (4)$$

(Palloni 2001: 263)

Third, after I construct my multi-state life table using the observed transition rates between each state, I conduct a number of simulations that show what would happen to the household arrangements of the subsidized and the non-subsidized population under different policy regimes that would affect either the rates of entry into and exit from subsidized housing or the number of people in subsidized housing. Specifically, I manipulate the rate of entry into subsidized housing and the rate of exit from subsidized housing to be zero, half, twice or four times its current rate at any age. Second, I manipulate the number of people in subsidized housing at age 0 or age 18 to be zero, half, twice or four times the current number. These

simulations show how changing who gets in or gets out of subsidized housing would change the household composition of the non-subsidized and the subsidized population.

Data

I implement the multi-state life table analysis using data from the 1990, 1991, 1992, 1993, 1996, 2001 and 2004 panels of Survey of Income and Program Participation (SIPP) covering the period between 1990 and 2008. The SIPP is a nationally representative, longitudinal survey of the U.S. civilian non-institutionalized population. It was designed to measure the effectiveness of federal, state, and local programs and to collect measures of economic wellbeing. Each SIPP panel lasts between 3 and 4 years. Interviews are conducted every four months with information available for each of the preceding four months. The SIPP has a detailed household roster, which allows me to create different categories of household composition. In addition, the SIPP has been asking householders whether they live in public housing or whether they receive any other help from federal, state or local sources in paying their rent in every wave of each panel. The "other" category of subsidized housing includes both privately managed building-based subsidized housing (such as properties built using Low Income Housing Tax Credits) and housing vouchers that subsidized individuals can use on the private market.

Descriptive statistics (Table 1) indicate that the distribution of person-months spent in different types of household arrangements is similar across the two types of housing subsidies. For example, 19 percent of person-months in public housing are spent in a single-person household, while the corresponding number for other types of subsidized housing is 15 percent. Twenty-five percent of person-months in public housing are spent in a household with a married

couple with at least one child versus 23 percent in other types of subsidized housing. The biggest difference between the two housing subsidy types is in the category of single parent with child where 41 percent of person-months in public housing occur. The corresponding number for other types of subsidized housing is 51 percent. Despite this last difference, for simplicity, I combine both categories of subsidized housing into a single one.

Results

My analysis uses the monthly longitudinal housing and household composition histories of all individuals in all SIPP panels from 1990 through 2008. I use information on more than 17 million person-months, clustered within 604,052 individuals. About 5 percent of these individuals (N=31,860) have ever been in subsidized housing. I observe a total of 7,181 transitions into subsidized housing and a total of 9,018 transitions out of subsidized housing (Table 2). As Table 2 shows, States 1 through 6 experience a fair amount of both outflow and inflow, while States 7 and 8 experience very few transitions into and out of them. States 15 and 16 also send very few individuals into subsidized housing. While I keep these states in my analysis for completeness, in all subsequent discussions I focus my attention on describing the states where individuals spend the most time (i.e. States 1, 3 and 4, see Table 2) and the transitions between states that are most frequent (i.e. transitions into and out of States 1, 2, 3, 4 and 5, see Table 2).

Unconditional and Conditional Durations

Table 3 shows the expected number of years spent in each of the 16 states of my multi-state life table overall and disaggregated by age period. The total duration shows that over an

entire life course, an individual is expected to spend about 4 years (1.18+0.31+1.41+0.74+ 0.13+0.12+0.01+0.02 = 3.92) in subsidized housing with the rest of the time – outside of subsidized housing[4]. The longest expected duration overall is for State 12 – a married couple family with at least one child outside of subsidized housing (36 years). Within subsidized housing, the longest expected durations are for State 3 – single householder with at least one child (1.4 years), followed by State 1 – single person household (1.2 years).

States 3 and 1 correspond to the most frequent household arrangements within subsidized programs targeted, respectively, at families and at the elderly. There is a strong life course component to the ages at which subsidized individuals live in these particular household arrangements. For example, 73% (0.86/1.18*100) of the expected duration in subsidized housing as a single person household occurs after age 65, while 58% (0.82/1.41*100) of the expected duration in subsidized housing in a single parent household occurs before age 18. In contrast, outside of subsidized housing only 56% of the expected duration in a single person household occurs after age 65 and only 30% of the expected duration in a single parent household occurs before age 18.

Because of the strong age patterns of household arrangements in subsidized housing, next I ask the question of what happens to individuals once they are in a certain household arrangement at a certain age (Tables 4 and 5). The first line in Tables 4 and 5 represents the unconditional duration in each state, or the average duration spent in each state regardless of the state of origin at either age 0 or age 18. The unconditional durations in Table 4 match the ones from Table 3 as I compute them over the entire life course. The unconditional duration in Table 5

[4] The SIPP dataset includes individuals as young as 1 month old and as old as 89 years old. Therefore, the expected durations in the table are computed off of the observed transitions in the dataset given the age span of respondents.

cover the period of life after age 18 and sum up only to 71.4 years. The rest of the rows in Tables 4 and 5 show conditional durations in each state. These durations depend on the state in which each individual was at either age 0 or age 18[5].

Similarly to the unconditional durations, the conditional durations show that the longest lasting states in subsidized housing are a single person household (State 1) and a single-headed householder with at least one child (State 3). In particular, depending on the state in which an individual is at birth, that individual is expected to spend between 1.45 and 2.78 years in a single parent household in subsidized housing[6]. The longest duration in that state is for children who are born to a single parent outside of subsidized housing. These children are expected to spend a total of 6 years over their entire life course (1.19+0.31+2.78+1.20+ 0.15+0.34+0.01+0.06 = 6.04) in subsidized housing with a majority of that time (2.78 years) in a single-parent household. The total duration in subsidized housing for children who start out life in single-parent families (State 12) is about 2 years longer than any of the other durations in subsidized housing conditional on being born into a particular household arrangement.

After age 18, the unconditional expected duration in subsidized housing is about 3 years (Table 5). Compared to this unconditional duration of 3 years, individuals who started out in a single-parent household outside of subsidized housing (State 12) at age 18 are expected to spend about 4 years in subsidized housing. Taken together Tables 4 and 5 show that it is individuals who start off in single-parent households outside of subsidized housing who end up staying the

[5] Since no one can be in a single person household or a married couple household without a child at age 0, in Table 4 I do not present conditional durations for states 1, 2, 9, and 10.

[6] Please note that the years spent in a particular state are calculated over an entire life course. Therefore, an individual could be in subsidized housing in a single parent household either as the child to a single parent or the single parent to a child. Table 4 does not show distinctions between what role in the household each individual holds as it sums across all instances of life spent across different household arrangements over an entire lifespan.

longest in subsidized housing.

Transitions across States: A Graphical Approach

Next, I present in graph form the annual transition probabilities between different household states over time[7]. Figures 2 through 7 graph the probabilities of transition from household states in subsidized housing, while figures 8 through 19 graph the probabilities of transition from household states outside of subsidized housing. The clock in all figures is age. I present transition probabilities that are based on at least 50 total transitions[8]. Dashed lines graph transitions into different types of household arrangements in subsidized housing, while solid lines graph transitions into different household arrangements on the private housing market. For all transitions out of subsidized housing (out of States 1 though 9) and into subsidized housing (into States 1 through 9), I also plot on the same graph the total number of transitions between distinct states off of which I compute the transition probabilities. I plot the number of transitions with a dot. Each dot represents the total number of transitions in the ten-year period around the dot. For example, the first dot from the left on each graph shows the total number of transitions between ages 0 and 10, the second dot – the total number of transitions between ages 11 and 20, the third dot – the total number of transitions between ages 21 and 30, etc.

First, Figure 2 shows the probability of transitioning from a single-person household in

[7] The graphed annual transition probabilities are smoothed using the –lowess– command in STATA 10, a running-mean smoothing method with a bandwidth of 1 (Cox 2005). I also experimented with smoothing the transition probabilities using a regression of the transition probabilities on a third-order polynomial of age. The graphs across the two methods are similar in terms of the resulting shape and order of the lines.

[8] As discussed above, there are very few transitions between certain states (see Table 2). Therefore, I choose to present only the lines that are based on more than 50 transitions between two states.

subsidized housing to any other type of household.[9] That single person has the highest probability of transitioning to either a single-parent household with child in subsidized housing (State 1 to State 3) or to living in a single-person household outside of subsidized housing (State 1 to State 9). Second, Figure 3 shows the transition probabilities for a married couple living in subsidized housing. A similar pattern to Figure 2 emerges in that households have high probabilities of transitioning outside of subsidized housing in the same household arrangement (State 2 to State 10) and high probabilities of welcoming a child to the family (State 2 to State 4) especially before age 40. In addition married couple households have a growing probability over time of transitioning into a single-person household (State 2 to State 1), which could be attributable to divorce earlier in life and mortality later in life.

Third, Figure 4 shows the transition probabilities for a single householder with child in subsidized housing. The probability of transitioning outside of subsidized housing in the same household arrangement stays about the same through age 20 and drops off after that (State 3 to State 11), while the probability of staying in subsidized housing as a single person household picks up after age 20 (State 3 to State 1). The first pattern is consistent with parents leaving subsidized housing with their minor children. The second pattern is consistent with children leaving the nest as they and their parents age. In addition, Figure 4 shows small probabilities of transitioning to a married couple household with child (State 3 to State 4) or a single householder with cohabitor/roommates (State 3 to State 5). This pattern implies that single parents in subsidized housing do marry but the probability of marriage is much lower than the probability of leaving subsidized housing altogether (State 4 vs. State 11). Moreover, it suggests that as

[9] As mentioned above, no one lives in a single-person household or a married couple household before the age of 16. Therefore, the transition probabilities into and out of States 1, 2, 9, and 10 start at age 16.

children age they may stay with their parents in subsidized housing as an adult roommate (State 5).

Figure 5 reveals similar patterns to Figure 4 in that individuals transition outside of subsidized housing in the same household arrangement as they were in subsidized housing, in this case – a married couple household with at least one child (State 4 to State 12). It also shows that starting with age 35, the probability of transitioning to a married couple household without any children picks up which is consistent with children leaving the nest. Figure 5 also shows that the probability of transitioning from a married couple family to a single parent family (State 4 to State 3) decreases up to age 50 and increases after that. This pattern reveals that there is some probability of married couples in subsidized housing splitting up over time.

Finally, in terms of the transitions from household states in subsidized housing, Figures 6 and 7 show that there is not one distinct pattern of transition probabilities for households with cohabitors and/or roommates (State 5 or State 6). While these households do have relatively high probabilities of transitioning outside of subsidized housing in the same household arrangement (State 5 to State 13 or State 6 to State 14), there are also high probabilities of transitioning to a single parent household (States 3 and 11) and somewhat lower probabilities of transitioning to a married couple household with child (State 4).

Overall, the figures showing the transitions from household arrangements in subsidized housing (transitions from States 1 through 8) suggest that when individuals living in subsidized housing transition to a different household arrangement, that transition happens to a household arrangement in subsidized housing. When they leave subsidized housing, they have the highest probabilities of transitioning in the same household arrangement. The figures also imply that the probability of marriage for single parents in subsidized housing is much lower than the

probability of leaving subsidized housing altogether. The figures also show that the probability of a split for married parents with children is much lower than leaving subsidized housing altogether.

Next, Figures 8 through 13 plot the transition probabilities from household arrangements not in subsidized housing to all other types of household arrangements (transitions from States 9 through 16). Individuals living across all types of household arrangements outside of subsidized housing have probabilities of transitioning into subsidized housing very close to 0. The only exceptions to this pattern are individuals living in single-parent households (State 11, Figure 10), cohabitor/roommate households (State 13, Figure 12), and single-parent households with a cohabitor/relatives/roommates (State 14, Figure 13), where the probability of entering subsidized housing as single-parent household is modest especially before the age of 40 (States 11, 13, or 14 to State 3).

Because of the very low probabilities of transitioning into subsidized housing compared to transitioning to different types of household arrangement outside of subsidized housing, I plot separately all transitions into subsidized housing from different types of household arrangements outside of subsidized housing (Figures 14 through 19). First, single individuals outside of subsidized housing have the highest probability of transitioning into subsidized housing as a single individual compared to any other household arrangement (State 9 to State 1, Figure 14). Before age 50, they also have a declining probability of transitioning into subsidized housing that is associated with the birth of a child (State 9 to State 3, Figure 14).

Second, individuals living in a married couple household outside of subsidized housing have a fairly low and steady probability of entering subsidized housing as a single individual (State 10 to State 1, Figure 15), while individuals living in single parent households outside of

subsidized housing overwhelmingly enter the program again as a single parent household (State 11 to State 3, Figure 16).

Third, individuals who are already married with children have the highest probability of entering subsidized housing as a married couple with child (State 12 to State 4, Figure 17), while individuals who live in the same household with a cohabitor, relatives and/or roommates up until age 30 have a high probability of transitioning into subsidized housing as a single householder with a child (State 13 to 3, Figure 18) and a modest probability thereafter of transitioning into subsidized housing either as a single householder or a single householder with cohabitor/roommates (State 13 to States 1 and 5, Figure 18). Finally, individuals who live in a household with a child and cohabitor/relatives/roommates have high probabilities of transitioning into subsidized housing as a single parent with child (State 14 to State 3, Figure 19) and modest ones of transitioning either as a cohabitating couple with child (State 14 to State 6, Figure 19) or as a married couple with child (State 14 to State 4, Figure 19).

Overall, these results suggest that the entry into subsidized housing could reduce household size by the movement of individuals away from cohabitors, relatives or roommates. Nevertheless, married couples with children who enter subsidized housing have higher probabilities of making the transition in the same household arrangement as opposed to as a single-parent household. Moreover, while households with cohabitors/roommates have a high probability of transitioning into subsidized housing as a single-parent household they also have modest probabilities of bringing the cohabitor/roommate along with them. Therefore, subsidized households have lower numbers of adults because the program ends up admitting individuals who already live in single-parent households and because individuals living with cohabitors or roommates move away from them. However, the program does not seem to break up marriages

that are already in existence.

Looking back at Table 2, this is not a surprising result. For example, 86 percent of the transitions of single parent households into subsidized housing involve entering subsidized housing as a single parent household (State 11 to State 3), while 72 percent of the transitions of married couple households with children involve entering subsidized housing again as a married couple with children (State 12 to State 4). Moreover, 40 percent of the transitions into subsidized housing of households with a cohabitor/roommate involve bringing the cohabitor/roommate along (State 13 to State 5). On the other hand, when households with children and cohabitors/relatives/roommates enter subsidized housing about half of those transitions involve leaving the cohabitor/relatives/roommates behind (State 14 to State 3). Therefore, Table 2 and the graphs of transitions into subsidized housing indicate that the entry into subsidized housing is associated with moving away from a cohabitor/relatives/roommates for single parents with children; however, it is rarely associated with the break-up of an actual marriage.

Simulations

As a final step in my analysis of the relationship between subsidized housing and household composition, I conduct a series of simulations that show what would happen to the household arrangements of the subsidized and the non-subsidized population should either the rates of entry into and exit from subsidized housing change or the number of people in subsidized housing change. Specifically, I first manipulate the rates of entry into subsidized housing and the rates of exit from subsidized housing for all individuals in my multi-state life table (Table 6). This simulation multiplies the transition rates by the same amount across all ages of the individuals in my analysis. Second, I manipulate the number of individuals in subsidized

housing at age 0 (Table 7) and age 18 (Table 8). This manipulation involves changing the number of individuals across different household states only for ages 0 and 18.

Table 6 shows the results of my first simulation. The columns in this table represent the proportion of person-months lived over the course of a lifetime, given the observed rates of entry into and exit from subsidized housing and given the simulated rates of entry into and rates of exit from subsidized housing. I start with a simulation that assumes rates equal to 0 and proceed with rates that are half the current observed rate, twice the current observed rate, and four times the current observed rate.

First, using the observed rates of entry into and exits from subsidized housing, I show that individuals are expected to spend about 5 percent of their lives in subsidized housing across any of the eight household arrangements (States 1 through 8). In terms of calendar time spent in subsidized housing, individuals are expected to spend about 4 years in subsidized housing. When the rate of entry into subsidized housing drops to 0 and all rates of exit stay at their current levels, the corresponding percent of life lived in subsidized housing drops to 1 percent, or about 1 year. When the rate is halved, the corresponding percent drops to 3, or about 3 years. When the rate is doubled, the corresponding percent increases to 8, or about 7 years. Finally, when the rate of entry is quadrupled, the corresponding percent increases to 15, or about 13 years.

It is interesting to point out that increasing the rates of entry into subsidized housing does not have the same multiplicative effect across different types of household arrangements. For example, when the rate of entry into subsidized housing is quadrupled, the time spent in either a single-parent household (State 3) or a married couple household with child (State 4) only doubles, while the time spent in a single-person household quadruples (State 1). Given the age distribution across these household arrangements, this simulation implies that if the rates of entry

into subsidized housing increased by the same factor across all ages, individuals would spend more of their lives in subsidized housing as single-person elderly households as opposed to younger single-parent or married couple households.

If no one exits subsidized housing (rate of exit = 0) but the corresponding rates of entry are kept at their current levels, the percent of life lived in subsidized housing across all household states would be very similar to the observed percent of life lived in subsidized housing, or about 5 percent. Even if the rate of exit is halved, doubled, or quadrupled, individuals would still spend about 5 percent of their lives in subsidized housing. Therefore, the expected percent of life lived in subsidized housing would stay about the same even if no one exited subsidized housing or if the current rates quadruple.

Taken together the above simulations that manipulate the rates of entry into and rates of exit out of subsidized housing show that changing how fast people enter subsidized housing as opposed to changing how fast they exit subsidized housing would have a greater effect on the amount of time spent in subsidized housing. Moreover, increasing the rates of entry into subsidized housing does not have the same multiplicative effect across different types of household arrangements. If the rates of entry into subsidized housing increased by the same factor across all ages, the program would house single-person elderly households for longer periods of time compared to younger single parent or married couple households.

Tables 7 and 8 show the results of my second simulation that manipulates the number of individuals in subsidized housing at either age 0 or age 18. Since I only simulate the number of individuals in subsidized housing at these two ages, my simulations amount to asking either what would happen to individuals if a different number of them are born into subsidized housing or what would happen to individuals if a different number of them start their adult lives in

subsidized housing.

I first start with a simulation that assumes that no one is born into subsidized housing. Then, I assume that half of the observed number of people are born into subsidized housing, twice the observed number of people are born into subsidized housing, and four times the observed number of people are born into subsidized housing. [10] As the first column in Table 7 shows, over the course of an entire lifetime given the current observed distribution of births across different household arrangements, an individual is expected to spend about 5 percent (or about 4 years) of his/her life in subsidized housing. If no one is born into subsidized housing, about 4 percent of person-months (or about 3 years) would be spent in subsidized housing. If only half of the current number of people is born into subsidized housing, about 5 percent of person-months (or about 4 years) would be spent in subsidized housing. When I double and quadruple the numbers at age 0, the corresponding percent of person-months are 6 percent (or about 5 years) and 8 percent (or about 7 years).

Simulating the number of people in different household states at age 0 has the most impact on the percent months individuals spend in either single-parent households (State 3) or married couple households with children (State 4). For example, doubling the number of children

[10] For all of these analyses, I use a synthetic cohort of 10,000 people and weigh the number of people in each state according to their proportion across all household states in the SIPP. This analysis amounts to assuming that there are a total of 10,000 newborns across different household arrangements both inside and outside of subsidized housing or that there are a total of 10,000 eighteen-year olds across all types of household arrangements. In order to maintain a starting cohort of 10,000 people, I either add or subtract the number of people who otherwise would have been in subsidized housing to the non-subsidized population. For example, if we assume that 500 of these 10,000 people are born in subsidized housing, it follows that 9,500 children are born to households outside of subsidized housing. In the simulation where half the number of children is born in subsidized housing, I assume that only 250 children are born in subsidized housing and that 9,750 children are born outside of subsidized housing. In the simulation where twice the number of children is born in subsidized housing, I assume that 1,000 children are born in subsidized housing and 9,000 children are born outside of subsidized housing.

at age 0 in subsidized housing increases the percent months spent in States 3 or 4 by about 40%, while quadrupling the number of children at age 0 in subsidized housing doubles the percent months spent in States 3 or 4. It is interesting to point out that this simulation has the same multiplicative effect on the percent months spent in both State 3 and State 4. Therefore, this simulation implies that if the relative proportions of children at age 0 across household states stays the same, multiplying the absolute numbers by the same amount would not change the relative amounts of time spent across these household states in subsidized housing. In other words, the proportion of life spent in single parent or two-parent households in subsidized housing would not change if the relative rates of birth into these types of families also do not change.

Table 8 shows the results of similar simulations to the ones in Table 7. In Table 8, I start with a cohort of 18-year olds instead with a cohort of newborns. The first column in Table 8 shows that given the current distribution of people in subsidized housing, an 18-year old is expected to spend about 4 percent of his/her life in subsidized housing (or about 3 years). Even if no one starts out in subsidized housing at age 18, the percent of life spent in subsidized housing would again be about 4. If half of the current number of people starts out in subsidized housing at age 18, the percent would again stay at about 4. When I double or quadruple the number of individuals in subsidized housing at age 18, the corresponding percent of person-months goes up to about 5, representing an expected duration in subsidized housing after age 18 of about 4 years.

The simulations in Tables 7 and 8 suggest that the biggest changes in the expected duration in subsidized housing occur when I manipulate how many people get into subsidized housing at birth as opposed to how many people are in subsidized housing at age 18. Unlike the simulations in Table 6, the ones in Table 7 and 8 also indicate that multiplying the number of

people across household states at age 0 or 18 by the same number does not change the relative proportion of time spent in subsidized housing across different household arrangements.

Discussion

This paper examines an understudied aspect of the relationship between government subsidies and household structure, namely how entering subsidized housing, staying in subsidized housing and exiting into the private housing market interacts with the choices that subsidy recipients make regarding the kind of households they live in. Housing subsidies may provide families a way out of crowded and stressful living arrangements. At the same time, the income and behavioral rules associated with keeping the subsidy may make adding extra members to the household, especially adult members, a tough choice if that means losing the housing benefit.

My multi-state life table results show that there is a distinct life course pattern to the entry into subsidized housing with younger individuals transitioning into subsidized housing as single parents with children and older individuals transitioning as single householders. In fact, a majority of years that subsidized individuals spend in a single parent household occur before age 18, while a majority of years that subsidized individuals spend in single person households occur after age 65. Moreover, it is children who are born into single parent households outside of subsidized housing as opposed to those who are born to single parent households in subsidized housing who spend the most time in the program. Since single parent households and single person households are a majority of subsidized housing participants, the program seems to be serving the most vulnerable members of society - children in single parent household and the elderly - for the longest amounts of time.

My results also show that the entry into subsidized housing is accompanied by changes in household composition that reduce the number of adults. Specifically, single parents living with cohabitors, roommates and other kin in a majority of cases move into subsidized housing leaving the cohabitors, roommates, and relatives behind. Nevertheless, the entry of married couple families into subsidized housing happens without any corresponding changes in household composition. Therefore, while entries into subsidized housing may break up living arrangements with cohabitors, roommates, and relatives, they do not seem to break up marriages.

I also find no strong evidence that marriages break up once individuals are in subsidized housing, but I do find that single mothers with children have low probabilities of marriage while in subsidized housing. Households in subsidized housing do not seem to take in cohabitors or extended family members while receiving the subsidy. Moreover, individuals tend to exit subsidized housing in the same household arrangement as they were in subsidized housing, indicating that these moves may be associated with other changing circumstances such as greater economic stability rather than changes in household composition.

Finally, the simulations in my paper suggest that the biggest changes in the expected number of years that individuals spend in subsidized housing occur with changes in the rates of entry into subsidized housing or changes in how many people are born into subsidized housing. In fact, the expected percent of life lived in subsidized housing would stay about the same even if the current rates of exit quadrupled. These results indicate that a policy aimed at speeding the transitions of individuals out of subsidized housing would not change the amount of time that individuals spend in subsidized housing without any corresponding changes in the rates of entry into subsidized housing. Moreover, increasing the rates of entry into subsidized housing does not have the same multiplicative effect across different types of household arrangements. In fact, a

policy that allows individuals across all ages to transition more frequently into subsidized housing would shift the program towards housing single-person elderly households for longer periods of time compared to younger single parent or married couple households.

While my multi-state life table results extend our knowledge of the sequence of household transitions that happen along with entries into, stays in, and exits from subsidized housing, as mentioned above, they do not imply a particular causal order to the decision with whom to live and the decision whether to use the subsidy. Therefore, my results cannot speak to what would have happened to households had they not received the subsidy, nor can they indicate if households engage in particular types of behaviors because they expect to receive the subsidy or because they are trying to keep the subsidy. Therefore, while I find descriptively that single parents in subsidized housing do not get married and that subsidized households do not take in additional adult members, it could be the case that the rules associated with who could be on the lease or what the maximum amount of household income should be might prevent some marriages from happening or might change with whom subsidized individuals choose to live. Nevertheless, I do not know if these single parents would have had better marriage prospects had they not been in subsidized housing nor do I know if households would have taken in additional members had they not been in subsidized housing. Therefore, a next step in this line of research would establish whether the associations I find in my paper are a function of the rules of the program or would have occurred even without the presence of the program.

Table 1. Percent Months Lived in Different Types of Household Structure by Subsidized Housing Status, SIPP 1990-2008

	Public Housing		Other Types of Subsidized Housing		Not in Subsidized Housing	
Household Structure	Percent	N	Percent	N	Percent	N
Single	18.6	131,834	14.8	37,922	11.2	1,818,846
Married	6.3	44,694	3.4	8,807	17.2	2,800,370
Single with child	40.9	289,945	50.5	129,641	13.1	2,137,077
Married with child	24.5	173,604	23.1	59,409	48.2	7,859,592
Single with cohabitor/relatives/roommates	3.9	27,662	3.8	9,777	5.1	823,071
Single with child and cohabitor/relatives/roommates	4.5	31,939	3.8	9,809	2.7	439,571
Married with relatives/roommates	0.3	1,836	0.1	247	0.7	106,754
Married with child and relatives/roommates	1.0	7,138	0.4	1,081	1.9	310,285
Total	100%	708,652	100%	256,693	100%	16,295,566

Table 2. Total number of transitions between states (17,260,911 person-months clustered within 604,052 individuals; 31,860 individuals ever in subsidized housing)

Inflow state	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
	In subsidized housing								Not in subsidized housing								
Outflow state	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	
1		120	294	38	125	12	3	4	570	33	55	41	107	12	36	26	1,476
2	145		5	329	25	1	1	1	12	222	3	18	3	3	1	9	778
3	325	6		743	153	187	1	3	117	20	3,176	339	105	399	9	131	5,714
4	36	179	868		70	32	2	26	86	24	114	2,086	47	62	4	68	3,704
5	227	59	151	131		66	16	2	91	7	64	46	233	13	7	6	1,119
6	10	4	248	68	92		0	35	19	1	140	36	20	254	2	13	942
7	4	2	2	3	15	0		13	7	2	1	2	2	2	9	0	64
8	2	2	18	17	1	39	9		4	0	13	16	6	10	1	53	191
9	639	19	53	34	79	14	4	4		5,487	4,979	2,804	4,745	252	410	280	19,803
10	19	247	10	20	4	4	0	0	4,997		403	14,401	785	143	87	218	21,338
11	93	11	2,295	102	41	123	3	15	6,167	712		10,159	2,408	2,693	190	861	25,873
12	101	29	269	1,339	58	29	5	20	5,736	12,227	14,062		2,318	1,647	296	1,692	39,828
13	113	14	75	25	176	14	5	7	7,280	3,050	2,180	2,823		1,363	599	232	17,956
14	23	10	324	79	21	197	0	15	409	245	3,527	2,857	1,700		49	765	10,221
15	13	1	8	2	9	0	6	0	537	143	140	281	542	53		472	2,207
16	34	13	216	47	4	24	0	23	427	363	1,171	1,960	221	1,030	497		6,030
Total	1,784	716	4,836	2,977	873	742	55	168	26,459	22,536	30,028	37,869	13,242	7,936	2,197	4,826	157,244

Table 3. Expected duration in years by state and age

Age	Expected number of years to be lived in state j =																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
	In subsidized housing								Not in subsidized housing								
	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	
Ages 0-18	0.00	0.00	0.82	0.37	0.01	0.12	0.00	0.02	0.00	0.00	3.36	12.60	0.06	0.90	0.05	0.68	19.0
Ages 19-35	0.05	0.01	0.48	0.23	0.04	0.02	0.00	0.01	1.84	1.20	2.97	8.54	0.92	0.34	0.12	0.22	17.0
Ages 36-64	0.25	0.08	0.34	0.25	0.04	0.02	0.00	0.00	3.94	6.00	3.29	13.24	1.08	0.25	0.07	0.15	29.0
Ages 65+	0.86	0.21	0.08	0.04	0.05	0.01	0.00	0.00	7.70	10.14	1.55	1.75	1.15	0.18	0.30	0.36	24.4
Total	1.18	0.31	1.41	0.74	0.13	0.12	0.01	0.02	13.68	17.80	11.15	35.99	3.26	1.66	0.55	1.41	89.4

Table 4. Expected duration in years by state and state of origin

State of origin (at birth)	Expected number of years to be lived in state j =																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
	In subsidized housing								Not in subsidized housing								
	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	
All	1.18	0.31	1.41	0.74	0.13	0.12	0.01	0.02	13.68	17.80	11.15	35.99	3.26	1.66	0.55	1.41	89.4
1																	
2																	
3	1.18	0.31	1.45	0.86	0.14	0.16	0.01	0.03	13.68	17.80	10.99	35.98	3.26	1.63	0.55	1.40	89.4
4	1.18	0.31	1.64	0.77	0.14	0.16	0.01	0.03	13.68	17.80	11.08	35.77	3.26	1.64	0.55	1.40	89.4
5	1.18	0.31	1.68	0.88	0.14	0.17	0.01	0.03	13.68	17.80	11.06	35.66	3.26	1.63	0.55	1.40	89.4
6	1.18	0.31	1.65	0.88	0.14	0.12	0.01	0.03	13.68	17.80	11.04	35.75	3.26	1.62	0.55	1.40	89.4
7	1.18	0.31	1.68	0.88	0.14	0.17	0.01	0.03	13.68	17.80	11.06	35.66	3.26	1.63	0.55	1.40	89.4
8	1.18	0.31	1.67	0.88	0.14	0.16	0.01	0.03	13.68	17.80	11.06	35.67	3.26	1.63	0.55	1.39	89.4
9																	
10																	
11	1.18	0.31	1.62	0.89	0.14	0.16	0.01	0.03	13.68	17.80	10.55	36.23	3.25	1.61	0.55	1.40	89.4
12	1.19	0.31	2.78	1.20	0.15	0.34	0.01	0.06	13.72	17.78	13.15	30.11	3.33	2.59	0.60	2.09	89.4
13	1.18	0.31	1.68	0.88	0.14	0.17	0.01	0.03	13.68	17.80	11.06	35.67	3.25	1.63	0.55	1.40	89.4
14	1.18	0.31	1.65	0.88	0.14	0.16	0.01	0.03	13.68	17.80	10.94	36.10	3.25	1.36	0.55	1.39	89.4
15	1.18	0.31	1.68	0.88	0.14	0.17	0.01	0.03	13.68	17.80	11.06	35.67	3.26	1.63	0.53	1.40	89.4
16	1.18	0.31	1.66	0.89	0.14	0.16	0.01	0.03	13.68	17.80	11.01	36.01	3.26	1.60	0.54	1.14	89.4

Table 5. Expected duration in years by state and state of origin

State of origin (at age=18)	Expected number of years to be lived in state j =																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
	In subsidized housing								Not in subsidized housing								
	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	Single person	Married couple	Single householder with at least one child under 18	Married couple with at least one child under 18	Single householder with a cohabitor, or non-primary relatives, or roommates	Single householder with child and a cohabitor, or non-primary relatives, or roommates	Married couple with non-primary relatives, or roommates	Married couple with at least one child under 18 and non-primary relatives, or roommates	
All	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.68	17.79	7.86	23.60	3.23	0.80	0.51	0.76	71.4
1	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.68	17.79	7.86	23.60	3.23	0.80	0.51	0.76	71.4
2	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.68	17.79	7.86	23.60	3.23	0.80	0.51	0.76	71.4
3	1.17	0.31	0.73	0.54	0.13	0.05	0.01	0.01	13.68	17.81	7.84	23.83	3.24	0.80	0.51	0.76	71.4
4	1.18	0.31	0.91	0.48	0.13	0.05	0.01	0.01	13.69	17.80	7.88	23.65	3.24	0.81	0.51	0.76	71.4
5	1.18	0.31	0.93	0.55	0.13	0.05	0.01	0.01	13.68	17.79	7.86	23.61	3.23	0.80	0.51	0.76	71.4
6	1.18	0.31	0.92	0.55	0.13	0.05	0.01	0.01	13.68	17.79	7.86	23.63	3.23	0.80	0.51	0.76	71.4
7	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.68	17.79	7.86	23.60	3.23	0.80	0.51	0.76	71.4
8	1.18	0.31	0.93	0.55	0.13	0.05	0.01	0.01	13.68	17.79	7.86	23.60	3.23	0.80	0.51	0.76	71.4
9	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.67	17.79	7.86	23.61	3.23	0.80	0.51	0.76	71.4
10	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.68	17.78	7.87	23.60	3.24	0.80	0.51	0.76	71.4
11	1.17	0.31	0.92	0.58	0.13	0.06	0.01	0.01	13.60	17.81	6.81	24.70	3.20	0.80	0.52	0.77	71.4
12	1.23	0.32	1.44	0.73	0.16	0.08	0.01	0.02	13.92	17.74	9.81	19.91	3.55	1.03	0.59	0.86	71.4
13	1.18	0.31	0.93	0.56	0.13	0.06	0.01	0.01	13.67	17.78	7.87	23.65	3.20	0.80	0.51	0.76	71.4
14	1.18	0.31	0.93	0.56	0.13	0.05	0.01	0.01	13.66	17.78	7.88	23.77	3.17	0.72	0.51	0.76	71.4
15	1.18	0.31	0.93	0.55	0.13	0.06	0.01	0.01	13.67	17.78	7.87	23.63	3.23	0.80	0.49	0.75	71.4
16	1.18	0.31	0.93	0.56	0.13	0.06	0.01	0.01	13.67	17.78	7.88	23.67	3.23	0.80	0.49	0.71	71.4

Table 6. Proportion of person-months lived between ages 0 and 89, observed and simulated rates

State	Observed rate	Rate of entry = 0	Rate of entry = 1/2	Rate of entry = x2	Rate of entry = x4	Rate of exit = 0	Rate of exit = 1/2	Rate of exit = x2	Rate of exit = x4
1	0.013	0.000	0.006	0.028	0.058	0.012	0.012	0.012	0.013
2	0.003	0.000	0.002	0.007	0.014	0.003	0.003	0.003	0.003
3	0.019	0.004	0.012	0.030	0.045	0.021	0.021	0.022	0.022
4	0.010	0.002	0.006	0.016	0.023	0.011	0.011	0.011	0.010
5	0.002	0.000	0.001	0.003	0.006	0.001	0.002	0.002	0.002
6	0.002	0.001	0.001	0.003	0.004	0.002	0.002	0.002	0.002
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000
9	0.153	0.144	0.149	0.161	0.172	0.137	0.138	0.144	0.151
10	0.199	0.194	0.197	0.202	0.204	0.184	0.185	0.190	0.197
11	0.124	0.128	0.126	0.120	0.111	0.120	0.121	0.125	0.130
12	0.399	0.449	0.423	0.356	0.289	0.434	0.428	0.408	0.382
13	0.036	0.035	0.036	0.037	0.039	0.033	0.034	0.036	0.039
14	0.018	0.020	0.019	0.017	0.014	0.019	0.019	0.020	0.021
15	0.006	0.006	0.006	0.006	0.007	0.006	0.006	0.006	0.007
16	0.016	0.017	0.016	0.015	0.013	0.016	0.017	0.018	0.019
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

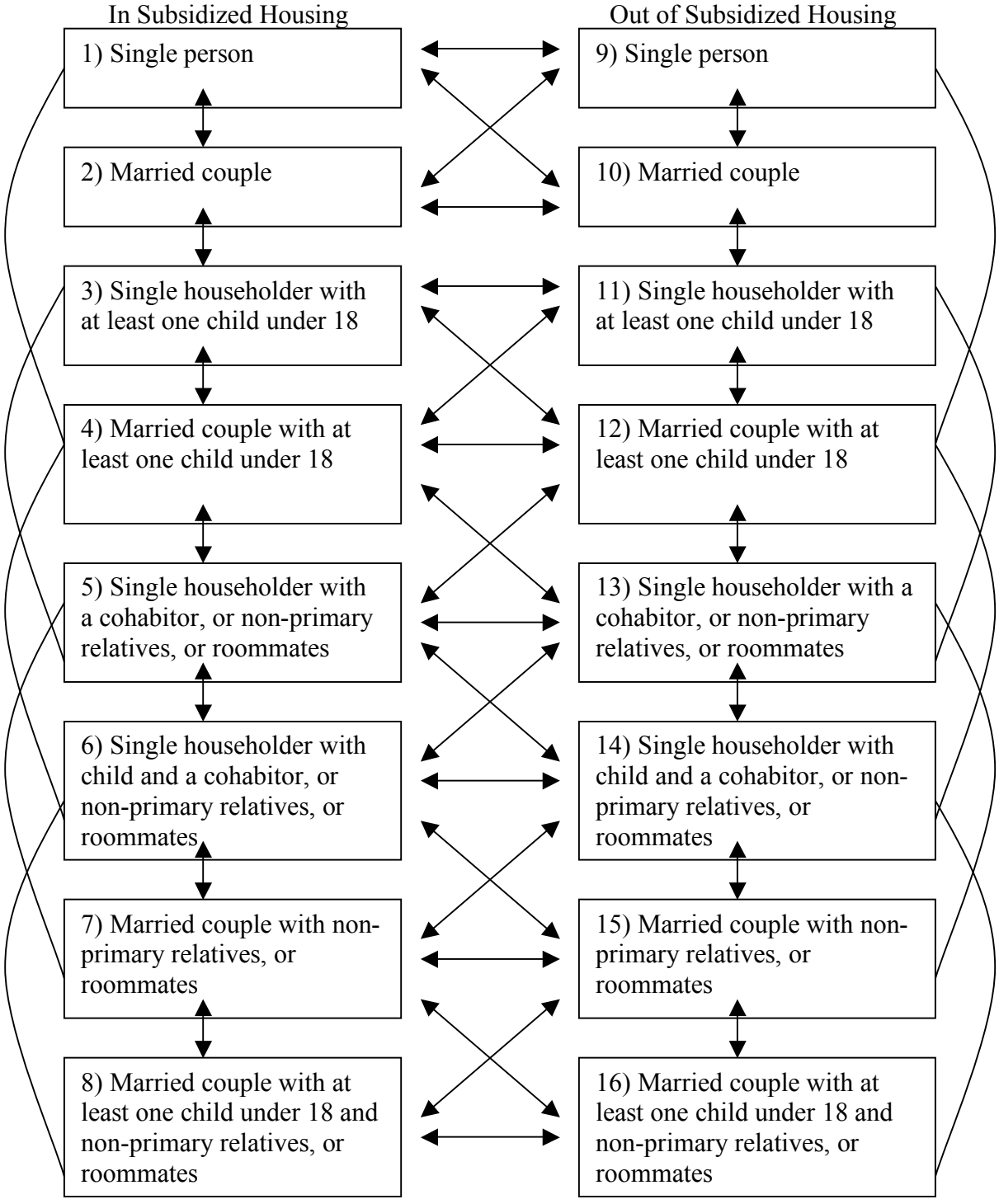
Table 7. Proportion of person-months lived between ages 0 and 89, observed and simulated number of people

State	Observed number of people at age 0	Number of people at age 0 = 0	Number of people at age 0 = 1/2	Number of people at age 0 = x2	Number of people at age 0 = x4
1	0.013	0.013	0.013	0.013	0.013
2	0.003	0.003	0.003	0.003	0.003
3	0.019	0.016	0.019	0.027	0.038
4	0.010	0.008	0.010	0.014	0.020
5	0.002	0.001	0.002	0.002	0.002
6	0.002	0.001	0.002	0.003	0.005
7	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.001	0.001
9	0.153	0.153	0.153	0.153	0.153
10	0.199	0.199	0.199	0.199	0.199
11	0.124	0.125	0.124	0.121	0.117
12	0.399	0.403	0.399	0.388	0.374
13	0.036	0.036	0.036	0.036	0.037
14	0.018	0.019	0.018	0.017	0.016
15	0.006	0.006	0.006	0.006	0.006
16	0.016	0.016	0.016	0.015	0.015
Total	1.000	1.000	1.000	1.000	1.000

Table 8. Proportion of person-months lived between ages 18 and 89, observed and simulated number of people

State	Observed number of people at age 18	Number of people at age 18 = 0	Number of people at age 18 = 1/2	Number of people at age 18 = x2	Number of people at age 18 = x4
1	0.017	0.016	0.016	0.017	0.017
2	0.004	0.004	0.004	0.004	0.004
3	0.013	0.010	0.011	0.013	0.016
4	0.008	0.006	0.007	0.008	0.009
5	0.002	0.002	0.002	0.002	0.002
6	0.001	0.001	0.001	0.001	0.001
7	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000
9	0.192	0.192	0.192	0.192	0.191
10	0.249	0.250	0.249	0.249	0.249
11	0.110	0.112	0.111	0.110	0.108
12	0.330	0.333	0.332	0.330	0.328
13	0.045	0.046	0.045	0.045	0.045
14	0.011	0.011	0.011	0.011	0.011
15	0.007	0.007	0.007	0.007	0.007
16	0.011	0.011	0.011	0.011	0.011
Total	1.000	1.000	1.000	1.000	1.000

Figure 1. Multi-state representation of household structure by housing status



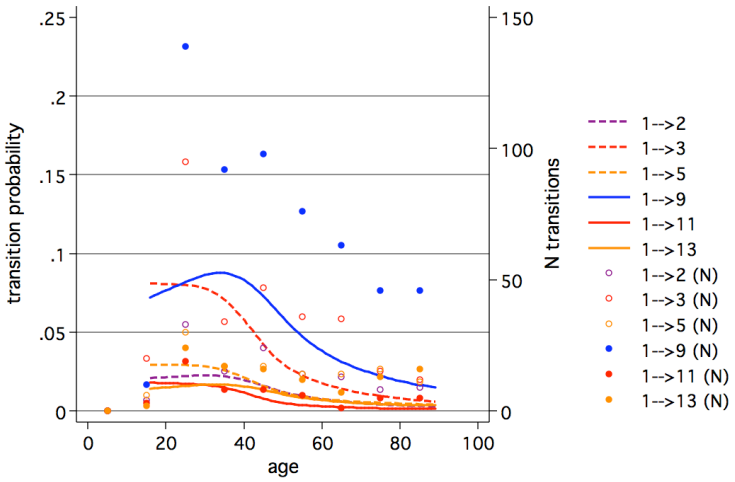


Figure 2. Transition probabilities from State 1
(Single individual, In subsidized housing)

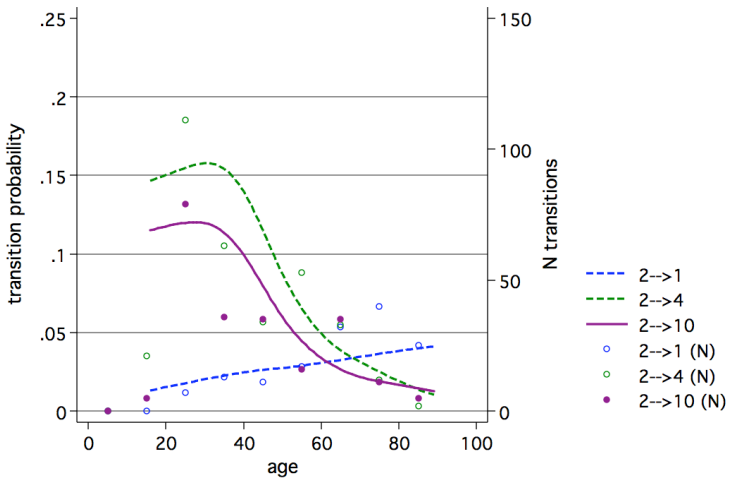


Figure 3. Transition probabilities from State 2
(Married couple, In subsidized housing)

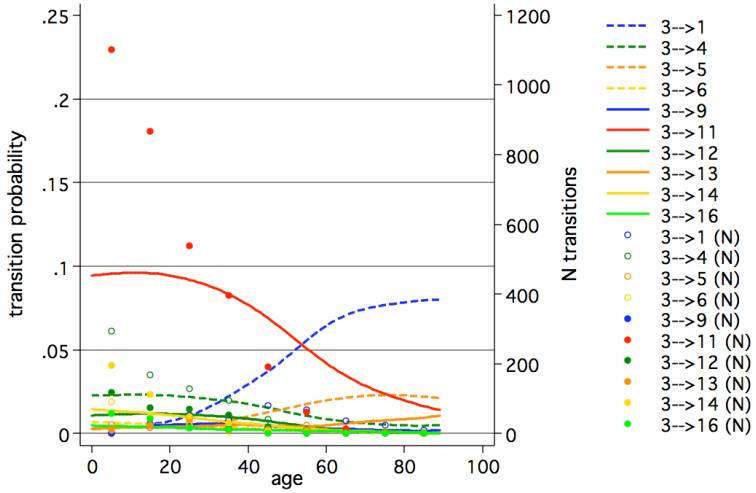


Figure 4. Transition probabilities from State 3
(Single householder with child, In subsidized housing)

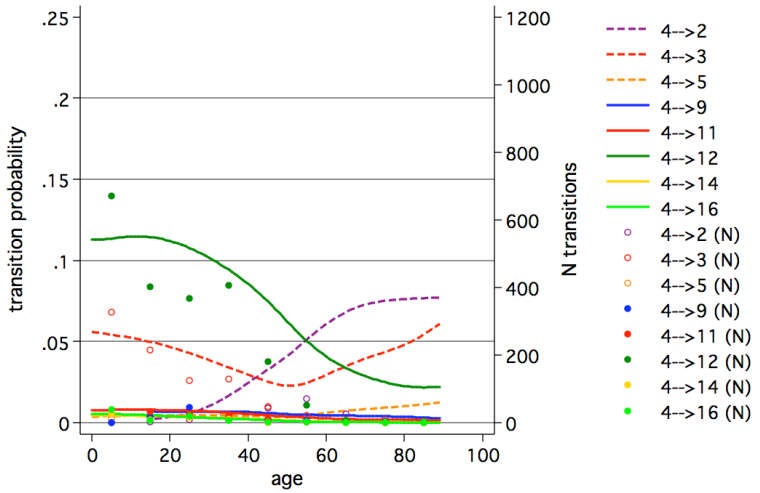


Figure 5. Transition probabilities from State 4
(Married couple with child, In subsidized housing)

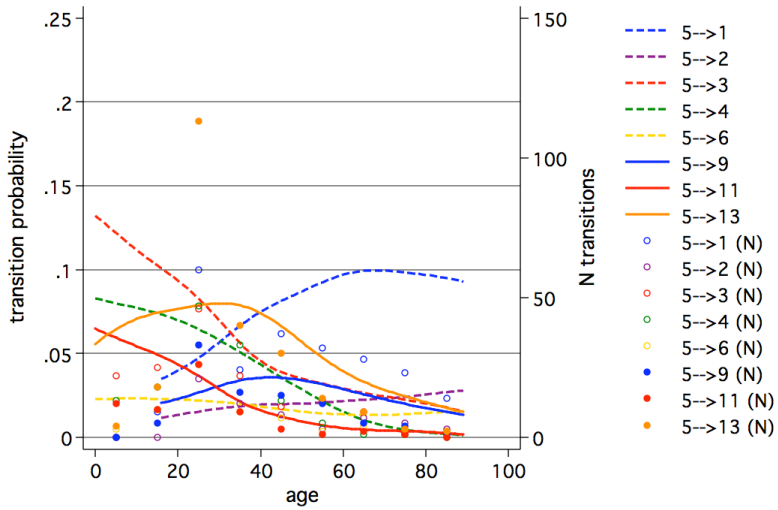


Figure 6. Transition probabilities from State 5
(Single with cohabitor/roommates, In subsidized housing)

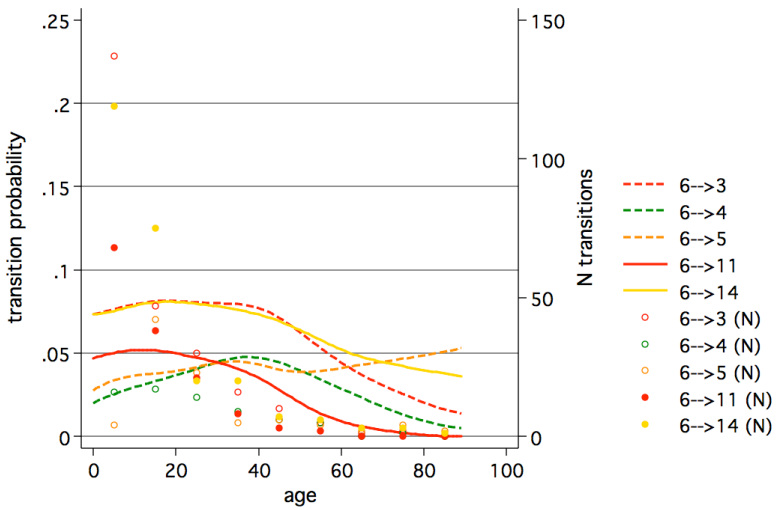


Figure 7. Transition probabilities from State 6
(Single with child, cohabitor/roommates, In subsidized housing)

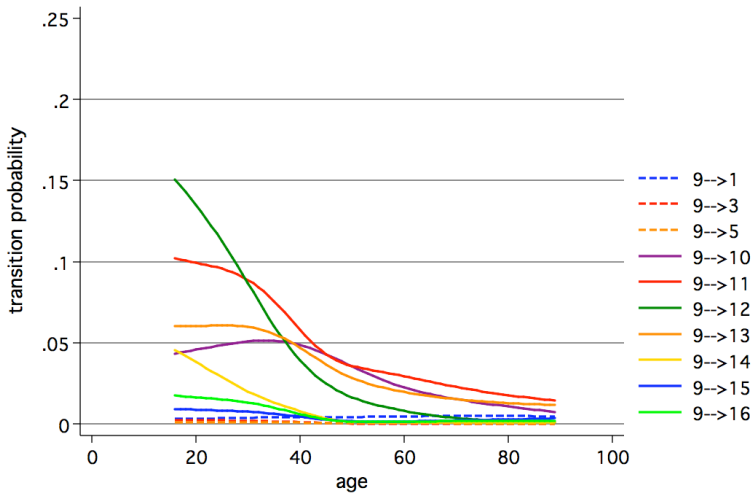


Figure 8. Transition probabilities from State 9
(Single person, Not in subsidized housing)

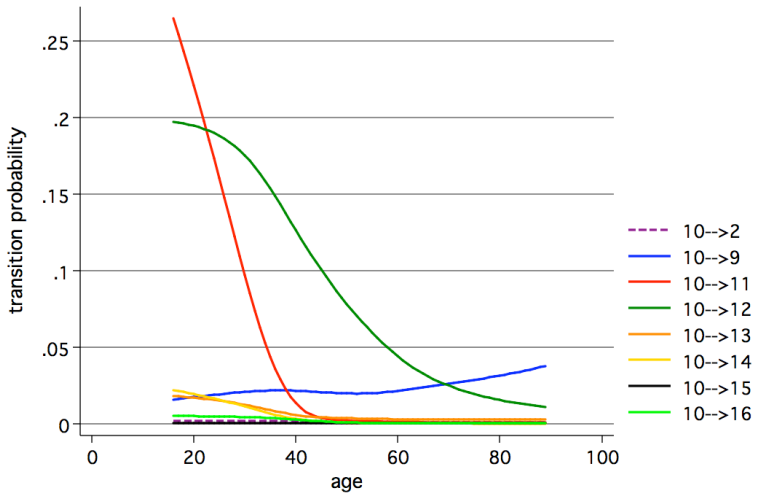


Figure 9. Transition probabilities from State 10
(Married couple, Not in subsidized housing)

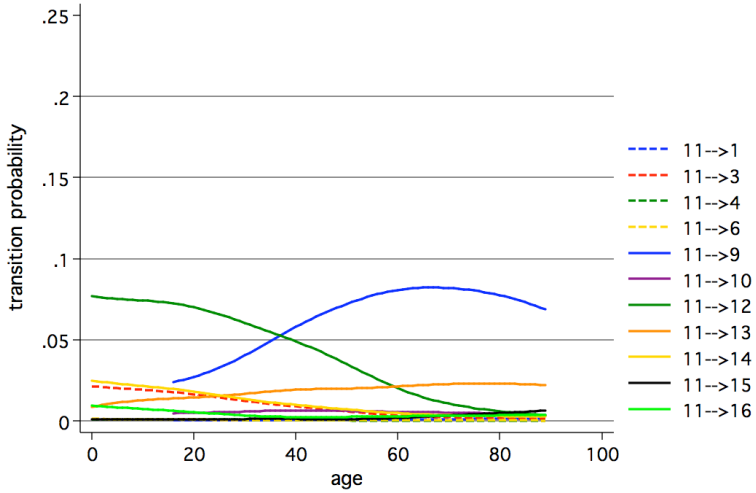


Figure 10. Transition probabilities from State 11
(Single householder with child, Not in subsidized housing)

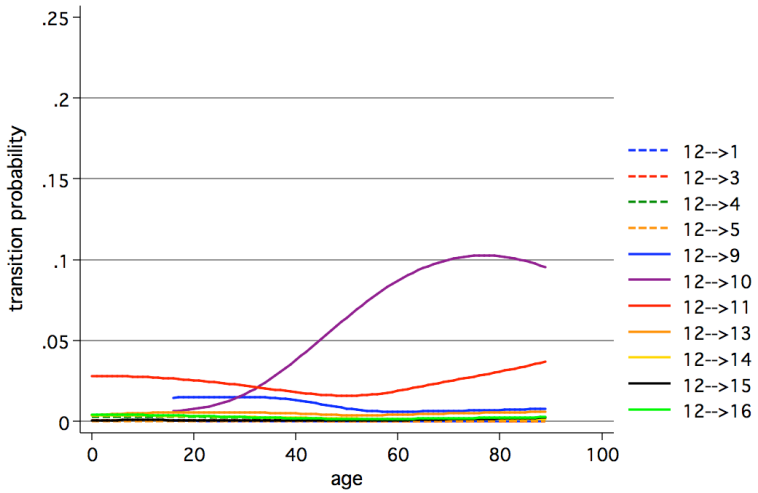


Figure 11. Transition probabilities from State 12
(Married couple with child, Not in subsidized housing)

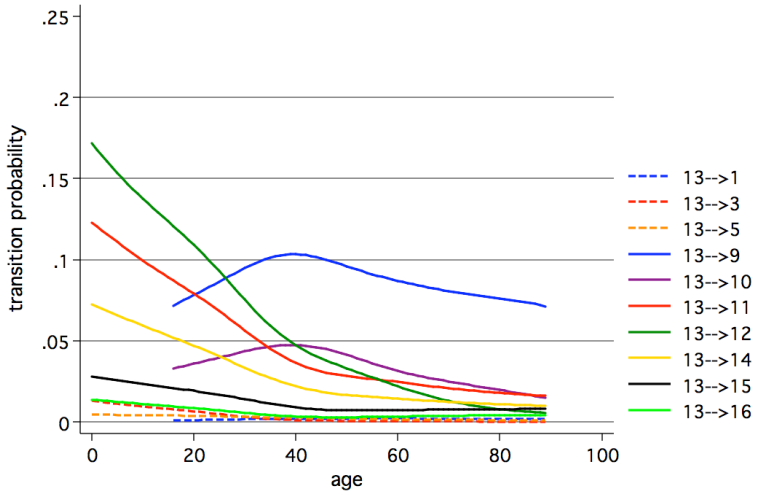


Figure 12. Transition probabilities from State 13
(Single with cohabitor/roommates, Not in subsidized housing)

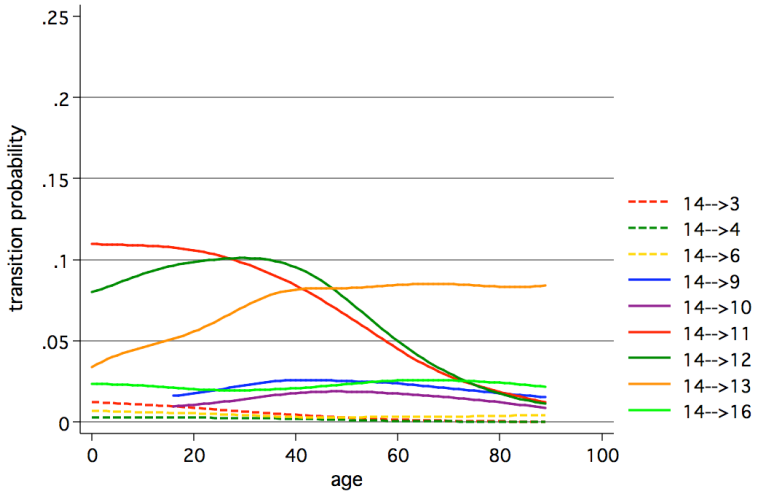


Figure 13. Transition probabilities from State 14
(Single w/ child, cohabitor/roommates, Not in subsidized housing)

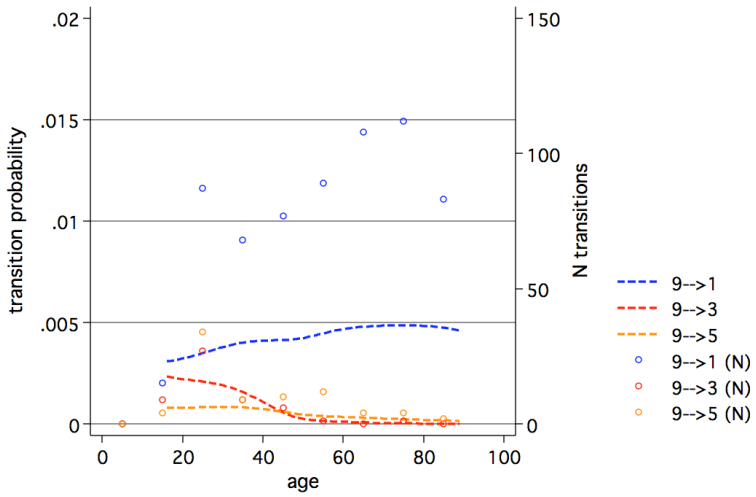


Figure 14. Transition probabilities from State 9
(Single person, Not in subsidized housing)

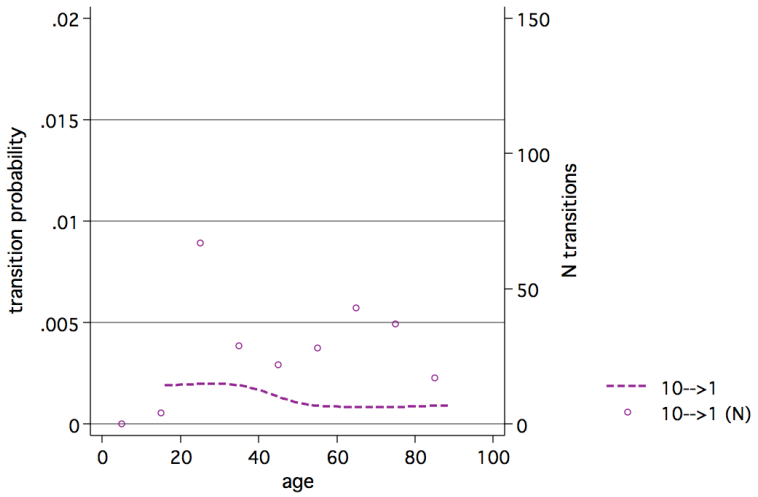


Figure 15. Transition probabilities from State 10
(Married couple, Not in subsidized housing)

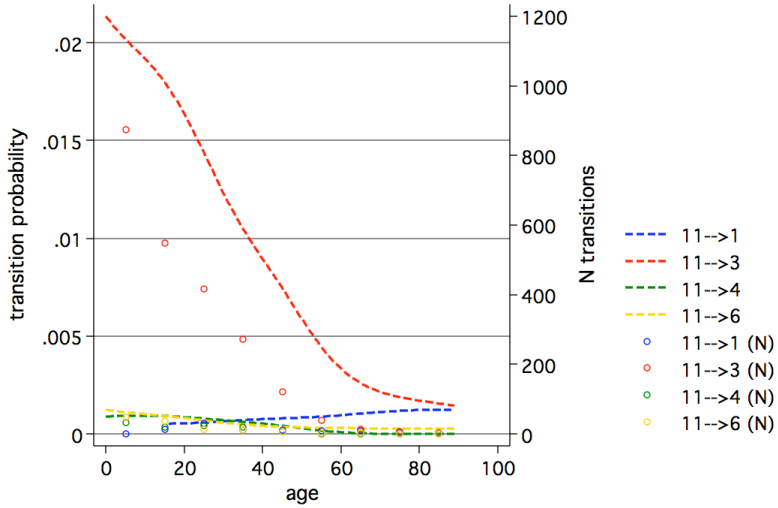


Figure 16. Transition probabilities from State 11
(Single householder with child, Not in subsidized housing)

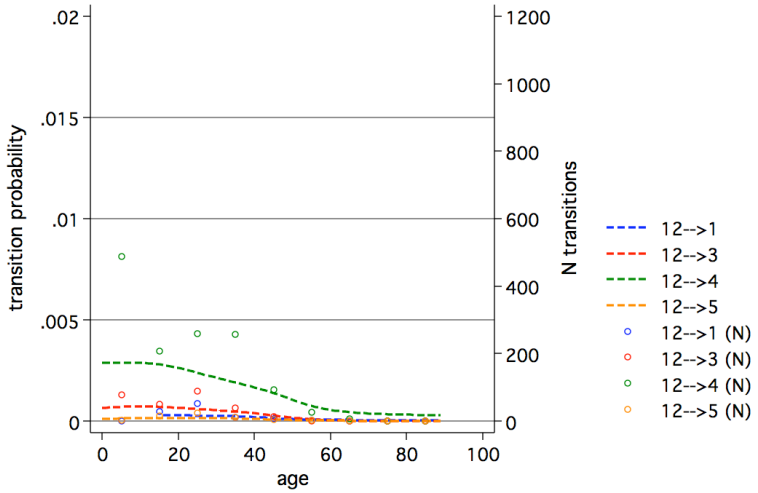


Figure 17. Transition probabilities from State 12
(Married couple with child, Not in subsidized housing)

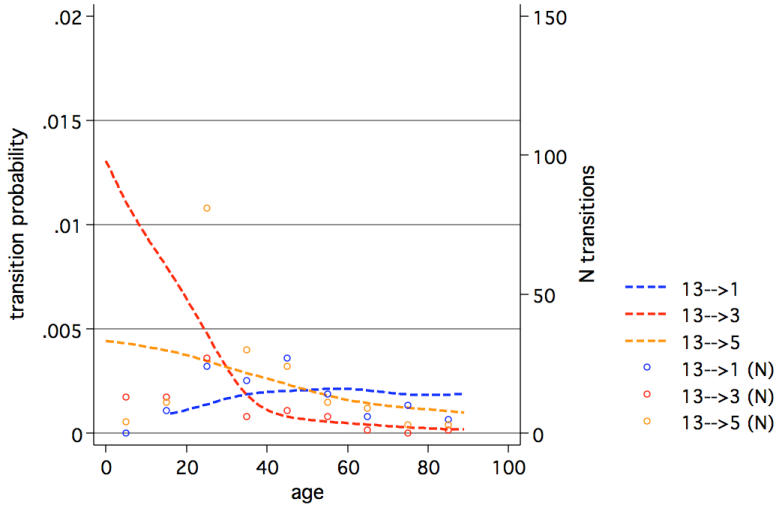


Figure 18. Transition probabilities from State 13
(Single with cohabitor/roommates, Not in subsidized housing)

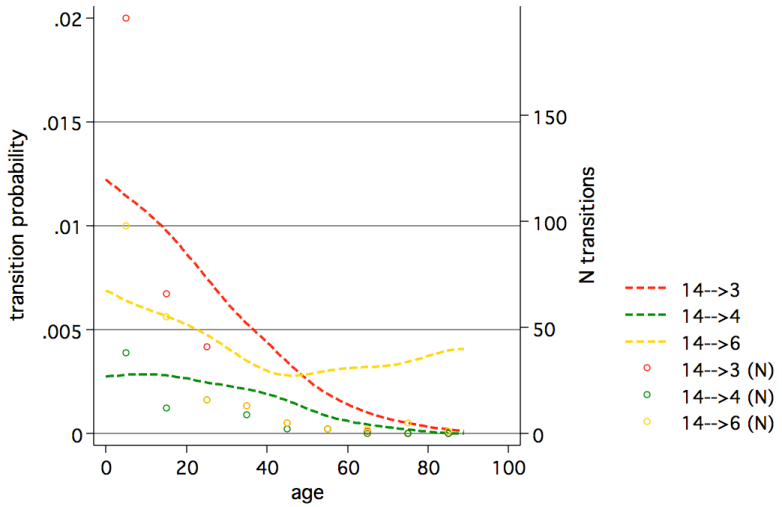


Figure 19. Transition probabilities from State 14
(Single w/ child, cohabitor/roommates, Not in subsidized housing)

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