Moving Back Home:
Insurance Against Labor Market Risk[1]

Greg Kaplan
New York University
gregkaplan@nyu.edu

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Abstract
This paper uses an estimated structural model to argue that the option to move in and out of the parental home is an important insurance channel against labor market risk for low-skilled youths. Using data from the NLSY97, I construct a new monthly panel of parent-youth coresidence outcomes and use it to document an empirical relationship between these movements and individual labor market events. The data is then used to estimate the parameters of a dynamic game between youths and their altruistic parents, featuring coresidence, labor supply and savings decisions. Parents can provide both monetary support through explicit financial transfers, and non-monetary support in the form of shared residence. To account for the data, two types of exogenous shocks are needed. Preference shocks are found to explain most of the cross-section of living arrangements, while labor market shocks account for individual movements in and out of the parental home. I use the model to show that coresidence is an important form of insurance, particularly for youths from poorer families. The option to live at home also helps to explain features of aggregate data for low-skilled young workers: their high elasticity of labor supply and their relatively small consumption responses to labor market shocks. An important implication is that movements in and out of home can reduce the consumption smoothing benefits of social insurance programs.

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1 Introduction

For many young people, the passage out of the parental home is a prolonged, transitional phase, in which they alternate between periods of living at home and living independently.[2] Throughout this phase, young workers face substantial risk in the labor market, yet make minimal use of traditional insurance mechanisms. Low-skilled youths have very little personal wealth, poor access to credit markets, receive only small amounts of direct financial assistance from family members and are often not eligible for benefits from social insurance programs. This paper uses an estimated structural model to account for observed coresidence dynamics and to argue that the option to move in and out of home is a valuable mechanism for insuring against labor market risk, substituting for more traditional insurance channels for young workers.

The use of coresidence as insurance turns out to have important implications. On the positive side, it helps explain otherwise puzzling aspects of youths' economic behavior: their relatively small consumption responses to labor market shocks and their high elasticity of labor supply. On the normative side, the option to live at home can reduce the consumption smoothing benefits of social insurance programs for youths, suggesting that parental coresidence should be considered when assessing the welfare gains of interventions targeted at young workers.

I start by constructing a new monthly panel dataset of parent-youth coresidence outcomes from the National Longitudinal Survey of Youth 1997 (NLSY97), and use it to document several new facts about the living arrangements of 16 to 23 year-old youths who do not go to college. Over this age range, the fraction of youths living independently from their parents increases sharply. However, it is also common for youths to move back home - over 40% of youths who lived away from home, were also observed to move back home by age 23. Moreover, there is a direct link between these coresidence movements and labor market events. In Kaplan (2008*a*) I use the same panel dataset to estimate a series of duration models for movements in and out of home and show that the hazard of moving back home is significantly increased for youths who have recently stopped working.[3]

In light of this evidence, this paper asks three questions (i) To what extent do labor market shocks account for observed patterns of parental coresidence? (ii) What is the insurance value of the option to move in and out of home and what is its impact on the value of social insurance programs? and (iii) How does coresidence affect young people's labor market behavior?

[2] A substantial body of anecdotal evidence and reports in the popular press suggest a recent trend in the USA for young people to move back home with their parents after a period of living away from home. This has led to the coining of the term "Boomerang Kids" to describe this group. See Section 2 and Kaplan (2008*a*) for empirical evidence on the extent of these movements in and out of home for low-skilled youth.

[3] For male youths who do not go to college, the monthly hazard of moving back home is increased by 46% if a youth is currently not working, and by 42% if a youth has stopped working in the preceeding 3 months. There is also evidence to support a link between parent-youth living arrangements and labor-market outcomes at the aggregate level. In Kaplan (2008*b*) I use data from the Current Population Survey (CPS) to show that over the last 30 years, the fraction of 16 to 30 year-olds who live with their parents decreases substantially during booms and increases during recessions.

To answer these questions, the paper proceeds by estimating the structural parameters of a dynamic model of labor supply, savings, coresidence and transfer decisions. The structure of the model is a dynamic game between youths and parents. Parents, who are altruistic, can provide both monetary support through explicit financial transfers, and non-pecuniary support, in the form of shared residence. The benefits of shared residence accrue from a reduction in per-capita direct housing costs and the availability of public goods inside the parental home. Youths make labor supply and savings decisions, in addition to a choice about whether or not to live with their parents. In the benchmark model I assume that allocations are given by the unique Markov-perfect equilibrium of this game.[4]

To simultaneously account for the cross-section and panel dimension of coresidence and labor market outcomes, the model requires two types of idiosyncratic uncertainty. The first are preference shocks, which reflect non-labor market events that affect youths' desire to live away from their parents, such as finding a partner. The stochastic structure of these shocks is flexible enough so that in principle, all coresidence movements could be generated by preference shocks alone. The second are labor-market shocks, that come in the form of job offers, job losses, promotions and changes in productivity. These shocks generate an additional motive for moving in and out of home, since the housing decision and the labor market are tied together through a budget constraint. The strength of this link depends on the extent to which parents are willing and able to provide direct financial support to youths. In addition, coresidence can be used to insure against the impact of adverse labor market events.

Importantly, the model is stylized enough to render structural estimation feasible, with all key parameters pinned down by the available data. The estimated model is able to account for all the salient dimensions of the data. In particular, I am able to identify the unobserved process for preference shocks, which is estimated to be very persistent but with a large amount of cross-sectional heterogeneity. This implies that the extent to which labor-market shocks account for coresidence patterns depends on whether one looks at the *cross-section* of living arrangements or the *within-individual time-series* of living arrangements. Whereas only around 15% of cross-sectional differences are accounted for by labor market outcomes, around 63% of *movements out of* and 40% *of movements into the parental home* are driven by events in the labor market. This is an important distinction - it implies that the importance of parental coresidence as an insurance channel would be overlooked if one were to restrict attention to cross-sectional regressions or a static structural model.

I then use the model to measure the value of different insurance channels. To do this, I compare the welfare cost of a job loss, expressed in terms of a compensating asset transfer, with the corresponding welfare cost when a particular insurance channel is removed. Measured this way, I find that the option to move in and out of home is valuable for all youths, but

[4]In Section 6, I compare the resulting allocations with allocations that are Pareto-efficient between youths and parents.

particularly so for youths from poor families. This is because parents from the lower part of the income distribution find it more costly to substitute financial transfers for coresidence, when the option to move back home is removed. For an average 21 year-old youth from the bottom quartile of the parental income distribution, removal of the option to move back home increases the cost of a job loss by 137%, compared with less than 1% for the removal of financial transfers and 37% for the removal of a simple unemployment insurance system. Conversely, for a youth from the top quartile of the parental distribution these values are 43% for the option to move back home, 117% for financial transfers and 30% for unemployment insurance.[5]

Identifying the quantitatively important insurance channels for different subgroups of the population is an important economic goal for at least two reasons. First, the welfare implications of redistributive policy interventions depend crucially on the extent to which policies crowd out private transfers that take place within the family. This paper shows that a key component of these private transfers is coresidence, particularly for low-skilled youths from poor backgrounds. Hence ignoring youths' option to live with their parents can potentially lead to a mistaken assessment of the value of social-insurance programs for young workers. I provide an example of the potential for such effects in Section 7, where I compare the estimated consumption-smoothing benefits of unemployment insurance in an environment where coresidence is ignored, with the estimated benefits when it is modelled. I find that the average drop in consumption due to the loss of a job is increased by 22 percentage points when unemployment insurance is removed and there is no option to live at home. However, when there is an option to live at home, the removal of unemployment insurance increases this average consumption drop by only 5 percentage points.

Second, studying the way that people smooth shocks sheds light on other aspects of their behavior. For young males, I find this to be especially important with respect to labor supply. A number of recent papers have noted that labor market fluctuations at business-cycle frequencies are larger for younger workers than for older workers, and larger than the predictions of standard real-business-cycle models.[6] Recognizing that for many young people, the outside option when making their labor-market decisions includes the opportunity to live with their parents, leads them to raise their reservation wages to a point whereby overall job acceptance rates are more sensitive to changes in the overall distribution of wage offers than if youths were precluded from living at home. Coresidence can thus provide a plausible mechanism for explaining the high aggregate labor elasticity of young workers.[7] Note that a key contribution of the paper is to

[5] These numbers are reported for a 21 year old youth with median assets and earnings, in the model with full economies of scale in the parental home. When economies of scale are reduced the quantitative magnitudes are changed but the relative values of insurance channels across the parental income distribution are unchanged. These relative values are also robust across the distribution of assets and earnings. See Section 7 for details.

[6] See Rios-Rull (1996), Gomme et al. (2004) and Jaimovich and Siu (2006).

[7] See Section 8 for more details. In Kaplan (2008*b*), I investigate the quantitiative size of this effect using a calibrated model of the business cycle. This pursuit heeds the call of Gomme et al. (2004) who state (p6): "*In looking for alternative theories to better account for aggregate labor market fluctuations, attention should be directed toward features that specifically affect individuals during the first half of their life.*"

highlight the fact that the *option* to move back home can have important behavioral implications for youths living at home or away, even if they never actually experience such a move. Simply knowing that this opportunity exists, causes youths to modify their labor supply decisions.

Because it focuses explicitly on the experiences of young people, this paper is less general than other studies of insurance mechanisms.[8] However by focusing on a particular group of individuals, the paper makes a point that is overlooked by much of the existing literature on risk-sharing: even if the overall insurability of shocks is the same for different parts of the population, the particular mechanisms that implement this level of consumption smoothing may differ markedly across sub-groups. Moreover, the recent findings in Kaplan and Violante (2008) suggest that young households with low wealth are exactly the group whose insurance mechanisms are least understood. Kaplan and Violante (2008) compute the amount of consumption insurance implicit in a calibrated incomplete-markets lifecycle economy where self-insurance through borrowing and savings is the only private insurance channel. When compared with corresponding estimates from US data in Blundell et al. (2008), it is found to be young households for whom the hypothesis of self-insurance alone is most at odds with the data. This paper argues that parental coresidence is an important component of this additional consumption smoothing.

Connections to Existing Literature The idea that families have an important role to play in smoothing the impact of economic shocks dates back at least as far as the seminal work of Becker (1974) and has been investigated empirically by Hayashi et al. (1996). More recently, a growing body of work has recognized that an important component of intra-family support comes in the form of coresidence.[9] However, this literature has largely restricted attention to the provision of support after retirement and into old-age. For example, Bethencourt and Rios-Rull (2007) and Pezzin et al. (2007) examine various modes of interaction that determine living arrangements of elderly parents and Costa (1999) studies the interaction between public-assistance programs and these living arrangements.

The existing literature on coresidence at the beginning, rather than the end, of the working life - between young adults and their parents - is largely empirical in nature. It has focussed on comparing the family and individual characteristics of youths living at home versus youths living away from home. In the economics literature, prominent examples are McElroy (1985), Rosenzweig and Wolpin (1993), Rosenzweig and Wolpin (1994), Ermisch and Di Salvo (1997), Ermisch (1999) and Manacorda and Moretti (2005). In the sociology literature examples include Goldscheider and Goldscheider (1999) and Buck and Scott (1993).

[8] In fact, the estimation restricts attention to youths who do not go to college - around one half of the relevant population. However, this is partly due to limited data availability on coresidence for youths who go to college. Moreover, almost all of the anecdotal evidence in the popular press about movements back home refer to college graduates. Hence the importance of these movements in the current study is likely a lower bound on the importance of allowing for these movements in the entire youth population.

[9] For an excellent review of work on the various forms of intergenerational ties in economics, sociology and psychology see Bianchi et al. (2006).

By studying the insurance value of parental coresidence, this paper advances a research agenda initiated in part by the findings in Rosenzweig and Wolpin (1993) and Rosenzweig and Wolpin (1994). Their results indicate that coresidence is indeed a common form of assistance provided by parents, and suggest that it should be explicitly considered together with financial transfers when analyzing the nature of parent-youth interactions. Although some of these papers interpret their results within the context of structural models of behavior, none of them estimate structural parameters.[10] One recent paper that does estimate a structural model of coresidence is Sakudo (2007), who investigates the decision to move out of home and get married for young females in Japan.

The work in this paper has strong links to a number of other branches of existing literature. First it is related to the purely theoretical analyses of youth coresidence in Fogli (2004) and Fernandes et al. (2007), that allow for expectations about future outcomes to affect current coresidence decisions. Second, the model builds on a class of models that have incorporated a savings decision into a labor market search setting, pioneered by Danforth (1979), Lentz and Tranaes (2005), Lise (2006) and Low et al. (2007). Third, the paper contributes to a line of literature originally advocated by Deaton and Paxson (1994) that attempts to quantify the extent to which idiosyncratic shocks are insurable.[11] This paper take a structural approach by explicitly incorporating an as-yet unstudied channel of insurance that is particularly relevant around the time of entry to the labor market.[12] Finally, it adds to a growing body of evidence that non-labor market shocks are important for understanding economic outcomes at both an individual and aggregate level.[13]

The remainder of the paper proceeds as follows. In section 2, I describe the data that is used for estimation and highlight key features of the economic environment for unskilled male youths. Section 3 introduces the model and Section 4 describes the structure of a non-cooperative repeated game between youths and parents. In Section 5, I outline the estimation strategy, discuss identification of the structural parameters, analyze the fit of the model and evaluate the relative contribution of labor market and preference shocks to coresidence dynamics. Section 6 discusses the Pareto-efficiency properties of the estimated game. In Section 7, I quantify the

[10] Despite the wealth of anecdotal evidence on young people moving back home, this existing empirical literature has largely restricted attention to cross-sectional patterns of coresidence at a point in time, or the first movement out of the parental home. There are very few empirical analyses of movements back home. Two exceptions from the sociology literature are DaVanzo and Goldscheider (1990) who use the 1972 National Longitudinal surveys and Goldscheider and Goldscheider (1999) who use the National Survey of Families and Households. The only study of movements back home at a greater frequency than annual, and that links such movements to contemporaneous events in the labor market is the companion paper Kaplan (2008*a*).

[11] Other examples include Attanasio and Davis (1996), Hayashi et al. (1996), Storesletten et al. (2004), Krueger and Perri (2006), Blundell et al. (2008) and Kaplan and Violante (2008).

[12] Other examples of papers that study the effect of 'real-world' channels on consumption insurance include Fernández-Villaverde and Krueger (2007) (durable consumption goods), Low (2005), Kaplan (2007) (variable labor supply) and Chatterjee et al. (2007) (bankruptcy protection).

[13] See for example Cubeddu and Rios-Rull (2003).

value of coresidence as an insurance channel and in Section 8, I illustrate the interaction of coresidence with labor supply behavior. Section 9 concludes.

2 Facts About Coresidence and the Labor Market

In this section I introduce the data that will be used for estimation, and highlight several facts about the economic environment of young males who do not go to college in the USA.[14]

Data Source The data comes from the National Longitudinal Survey of Youth 1997 (NLSY97) and is described in more detail in Appendix A. The NSLY97 is a longitudinal survey of 8,984 individuals from the cohort born between 1980 and 1984. They have been sampled approximately annually since 1997. The survey contains extensive information on their labor market behavior and educational outcomes, together with detailed information about the youth's family and community background. The questions that make the NLSY97 an ideal data set to study the dynamics of parent-youth living arrangements are a set of retrospective questions about monthly coresidence that were asked in rounds 2-6 (1998-2002). At each interview, these questions asked respondents to list each period of one month or more in which they lived separately from each of their parents.[15] From these questions, it is possible to reconstruct a monthly panel of parental coresidence outcomes for each respondent, which was then merged with data on educational, labor market and marital histories.

Sample Selection A number of important selection criteria were imposed on the sample. The most important is that I drop all individuals who are ever observed to have attended college. This is because the college participation decision is almost certainly endogenous with respect to the decision to leave or return to the parental home. Focusing on a sample of youths for whom we can condition on a decision to not attend college allows the focus to be clearly placed on the interaction between residential movements and labor market events. It thus seems a natural starting point for understanding the economic implications of coresidence movements and avoids the complications that arise from the interaction with college choice. Moreover, the monthly coresidence questions in the NLSY97 were discontinued in 2002. This restricts the ages at which it is possible to observe contemporaneous labor market and coresidence outcomes.[16]

[14] In a companion paper, Kaplan (2008*a*), I describe the construction of the data set in further detail and provide a more comprehensive empirical analysis. That paper also reports the full results from the estimation of various duration models of the hazard of leaving and returning home, and includes and analysis of females.

[15] A parent is defined in the NLSY97 as a biological, step, adoptive or foster parent. Youths were explicitly asked to ignore periods of temporary separation from their parents due to summer camp. The wording of the question on coresidence changed slightly across interview rounds. A typical question was worded as follows:

Since [date of last interview], has there been a continuous period of one month or more when you and your [mother (figure)/father (figure)] lived in different places? If you were temporarily away at summer camp, but lived with your [mother (figure)/father (figure)] before and after that time, please include those months as months you were living with [him/her].

[16] After 2002 (round 6), the retrospective coresidence questions were replaced with two questions that ask about

The other important selection criteria are as follows. Females are dropped, as are males who ever go to the military or have all parents dead. A youth is included in the final panel from the first month after he stops attending high school or after he turns 16, whichever is later. Only youths who have non-missing residence data are included in the final sample. The final sample consists of $25,526$ month-youth observations, for 976 male youths ranging in age from 16 to 23. These generate 251 spells back home, where a spell is defined as one that is not left censored. Since the NLSY97 has an oversampling of black and hispanic youths, sample weights are used in all calculations. Table 2 reports the number of respondents lost at each stage of the selection process. Weighted summary statistics for the final sample are shown in Table 3.

Parental Coresidence Panel (A) in Figure 1 plots the increase in the fraction of the sample living away from home between ages 16.5 and 22.5. Over these 6 years, this fraction increases roughly linearly from 16% to 52%, and will presumably continue to increase as the cohort ages.[17] However, it may take some time to reach 100%. Evidence from the Consumer Expenditure Survey and the Current Population Survey suggests that for older cohorts, the fraction of males not living with their parents plateaus at 90% at around age 40. The fact that even by age 23 nearly half of the subjects are living with their parents, suggests that a substantial fraction of the sample may not move out at all during the sample period. This is correct: Table 3 reports that 47% of the sample are observed to live at home throughout the whole sample period.

Moving In and Out of Home The main premise of this paper is that for many youths, moving out of home is not a one-way transition. Evidence for this can be found in panel (B) of Figure 1. The solid blue line shows the fraction of youths of each age who have *ever* lived away from home and the dashed red lines shows the corresponding fraction that has *ever moved back* home. 37% of all 22.5 year-olds in the sample have moved back home at some point. Of course to move back home, one has to first live away from home, and this number represents 54% of the corresponding fraction of youths who have ever lived away. Again, the right-censoring of the coresidence panel prevents us from observing how big this fraction becomes as the cohort ages, but a lower bound on the fraction of youths who ever move back home of 37% is considerably high, and should be taken as evidence that movements back to the parental home are a common occurrence for youths who do not go to college in the USA.[18]

the month and year that a youth first lived away from their parents, and the month and year when they first returned home for a period of at least 3 months. As the cohort ages, it is possible that these questions could be used to study movements back home for college graduates.

[17] It may appear surprising that the fraction living away from home is positive at age 16.5. This is because the selection critera impose that only youths who have already completed their education are included in the sample. Because the decision to stop school is closely related to the decision to move out of home, a selection effect is introduced, whereby those youths in the sample at ages 16 and 17 are more likely to be living away than other males of that age. These are youths that had already finished school and were living away from home when they entered the sample.

[18] These statistics constitute empirical eveidence to support the numerous informal anec-

The fact that the NLSY97 allows for *monthly* coresidence data to be constructed means that it is possible to examine the nature of movements in and out of the parental home in more detail than has been studied in the past.[19] The average monthly probability of moving back home amongst youths living away from home is 3.0%. The corresponding average monthly probability of moving out of home is 2.9%. These high movement rates further support the notion that there is a strong dynamic component to parent-youth coresidence.

Panel (C) of Figure 1 reports the Kaplan-Meier estimate of the empirical survival function for spells back home. Overall, spells are fairly long, with a median duration of 11 months back home. However, the survival function also reveals considerable heterogeneity in the duration of spells back home. Some spells are fairly short: 27% are 6 months or less in duration; yet some spells are very long: 16% are 2 years or more. Recall that due to the nature of the survey question, a spell is only included if it is longer than 1 month. It is thus likely (although difficult to confirm) that there are numerous extremely short spells back home, of less than one month duration that are ignored altogether. In addition, a large fraction of spells (56%) are right censored, which suggests that durations may be even longer than those reported here.

An alternative way of summarizing the dynamics of moving in and out of home is to look at the hazard of leaving home again, as a function of the time since moving back home. This is shown in panel (D) of Figure 1. The hazard of moving out of home again increases for the first year back home and then decreases gradually. The decrease in the hazard after the first year back suggests that heterogeneity may play an important role in understanding longer duration spells back home. However the increasing hazard in the first year is consistent with a story that emphasizes the role of fixed costs of moving, and the time needed for assets and earnings to accumulate before moving out again.

Entering the Labor Market Panels (A) and (B) of Figure 2 shows that there is a large amount of non-stationarity in the earnings and employment for young males who do not go to college over this age range. The fraction of youths that are working in a given month increases from around 30% to over 80%. Average monthly earnings, conditional on working in a given month, approximately doubles, from around $\$1,500$ to around $\$3,000$.[20]

Unstable Labor Market Young males who do not go to college face considerable instability in the labor market. Panels (C) and (D) of Figure 2 show the monthly separation rate and

dotes in the popular press about youths moving back home. Examples can be found at http://en.wikipedia.org/wiki/Boomerang_Generation.

[19] Having access to monthly data makes it possible to address questions about the length of spells back home, how the hazard of leaving home again changes with the duration of the spell back home and how the hazards of moving in and out of home are affected by recent events in the labor market. This is in contrast with existing empirical studies, which have utilized either annual data or data on single spells away from home. Such studies include (DaVanzo and Goldscheider, 1990), (Goldscheider and Goldscheider, 1999), (Ermisch and Di Salvo, 1997), (Ermisch, 1999), (McElroy, 1985), (Rosenzweig and Wolpin, 1993) and (Rosenzweig and Wolpin, 1994).

[20] All currency units reported in the paper are in terms of Jaunary 2007 dollars.

survival function for spells out of work. Panel (C) suggests that jobs are particularly fragile for this group: the monthly separation rate is around 3%, which translates to an annual rate of over 30%. Youths also face substantial earnings fluctuations when employed. Conditional on working, the monthly probability of an earnings change - either through a job change, a wage change on the job or a change in hours worked - is around 23%. Of these, around 57% are positive and 43% are negative. In addition, Panel (D) reports that spells out of work tend to be fairly long. The median duration out of work is 4 months, with a long right tail. Both a gradual process of attachment to the labor market and high job mobility for young workers are facts that are consistent with evidence from an earlier cohort, documented by Topel and Ward (1992).

Coresidence and the Labor Market Panels (E) and (F) of Figure 2 provide a view of how earnings differ between youths living at home and youths living away. Panel (E) plots the average log monthly earnings of youths away (solid blue line) and youths at home (dashed red line) against age. There are three things to note. First, the increase in average earnings over this age range occurs in both residence states. Second, the difference between earnings at home and away, conditional on age, is very small. Conditioning on age is important when making this comparison, since the fact that both earnings and the probability of living away from home increase with age induces a spurious difference in the average earnings of those at home and those away. Third, earnings of youths at home are initially above that of youths away from home, but this gradually reverses as the group ages. This point can be seen more clearly in the panel (F), which plots the away-home difference in average log earnings. One can see that this difference increases with age.

It is important to note that the fact that the earnings of youths at home is very similar to those away from home does not necessarily imply that the labor market is not a driving force behind coresidence outcomes. The facts in Figure 2 are cross-sectional, whereas in Section 5.3 I will use the estimated model to argue that it is primarily coresidence *movements* that are related to labor market outcomes. To provide some direct evidence for this hypothesis, Table 4 reports the average monthly probabilities of moving in and out of home by labor market status. The monthly probability of moving back home is 54% higher for youths who are not working than for youths who are. Similarly, the probability of leaving home is 15% higher for working youths than non-working youths. In Kaplan (2008*a*) I estimate a series of duration models and show that the relationship between labor market events and the probability of moving back home is strong and significant even once other characteristics are controlled for. I find that the monthly hazard of moving back home is 32% lower when a youth is working and 42% higher if the youth stopped work in the previous 3 months.

Assets I focus on two measures of wealth: net financial assets and net financial assets plus net value of cars. These measures can be constructed using annual data for a subset of youths from ages 17 to 20.[21] Figure 3 shows that youths in the sample hold very little wealth. Panel (A) shows that a large proportion of youths actually hold no assets at all. For financial assets, this fraction decreases from 65% to 43% between ages 17 and 20. When cars are included these fractions drop to 46% and 27%. Nonetheless, for those youths with non-zero wealth, average assets increase modestly between the ages of 17 and 20 - from \$600 to \$2,000 for financial assets, and from \$1,800 to \$5,400 when cars are included.

Financial Transfers from Parents Panels (C) and (D) of Figure 3 report statistics on the extent of annual financial transfers from parents to youths.[22] Although around one third of subjects reported receiving financial support from their parents in a given year, the reported amounts are low. Conditional on receiving a positive transfer, the overall mean and median amounts are approximately \$1,000 and \$350 respectively. However, it is important to view the data on transfer amounts with caution for two reasons. First, recall bias may lead to substantial under-reporting of cash transfers during a given year. This is particularly true if transfers are made as irregular small amounts over the course of the year, rather than in a single lump sum. Second, it is likely that a large fraction of transfers from parents to children are not made in cash. Transfers often result from either purchasing goods directly (such as meals or clothing) or through in-kind transfers (such as the use of the family car). For these reasons, I focus exclusively on the fraction of youths that receive a transfer, rather than the amount of transfers, when estimating the model, and view the data on transfer amounts as underestimates of true financial transfers.

Summary of Key Facts The facts documented in this section highlight some of the defining features of the economic environment for young males who do not go to college in the USA. We have seen that over the age range 16 to 23:

1. The fraction of youths living away from their parents increases with age.
2. Transitions in and out of the parental home are common.
3. Non-working youths are more likely to move back home than working youths.
4. Employment increases substantially with age, as does earnings when employed.
5. The labor market is unstable and separation rates are high.
6. The away-home difference in earnings is small and increases with age.
7. Youths hold very small amounts of financial wealth
8. Around one third of youths receive financial transfers from their parents.

[21] See the appendix for further details on the availability of wealth data in the NLSY97 and the construction of asset variables.

[22] See the appendix for details on the construction of transfer variables.

3 A Model of Coresidence, Labor Supply and Savings

I now present a model that is rich enough to account for these facts, yet places enough structure on the data to enable estimation of the key parameters governing coresidence, labor supply and transfers decisions. In this section, I outline the physical environment and the set of feasible allocations. In Section 4, I describe the timing protocol of a non-cooperative repeated game between parents and youths and outline the equilibrium concept that is used to choose among these allocations.[23] I discuss the implications of this choice and related efficiency issues in section 6.

Demographics Time is discrete and measured in months. I focus on the finite horizon $t = 0, 1...T$. The basic unit in the model is a family, which consists of a parent-youth pair. Families are indexed by j, and each comprises a parent (p) and a youth (y). In any month, t, the family can be in one of two residential states, labelled $r_{jt} \in \{0, 1\}$. When $r_{jt} = 0$ the youth lives in the parental home and when $r_{jt} = 1$ the youth lives in separate housing away from his parents.

Youth Preferences Youths have time-separable, expected-utility preferences, defined over consumption, labor supply and the residence state. Let U^y_{jt} denote the period utility for a youth from family j :

$$U^y_{jt} = u\left(c^y_{jt} + (1 - r_{jt})\, c^g_{jt}\right) - h_{jt}v + r_{jt}z_{jt} \tag{1}$$

Period utility is additively separable between consumption, labor supply and direct utility from independence. Total consumption consists of private consumption goods, c^y_{jt}, plus public consumption in the parental home, c^g_{jt}, for those youths living at home. The value of living away from home, z_{jt}, is stochastic and differs across youths. In any month, a youth can be either working, $h_{jt} = 1$, or not working, $h_{jt} = 0$. The disutility of working is constant and fixed at v. Lifetime utility for a youth is given by

$$V^y_0 = E_0\left\{\sum_{t=0}^{T} \beta^t U^y_{jt} + \beta^{T+1} V^y_{T+1}\right\} \tag{2}$$

where V^y_{T+1} is a terminal value function described below.

Preference shocks, z_{jt}, are assumed to follow a discrete-state Markov process, whose mean, $E[z_t] = \alpha_z + \beta_z t$, increases linearly with t, but whose variance, σ^2_z, and auto-correlation, ρ_z, are constant with age. The preference shocks play an important role in the model and should be interpreted as a reduced-form way of capturing the effects of non-labor market heterogeneity in

[23] In Section 6, I outline an alternate method for choosing among the set of technologically feasible allocations, that instead posits a 'family social planner' and restricts attention to Pareto-efficient allocations between parents and youths, taking prices and stochastic processes as given. In Appendix B, I describe a simplified static version of the model which admits a closed-form solution and is useful for demonstrating some of the key mechansims that are at work.

the relative preference for living away from home. Such shocks may include the formation and dissolution of cohabiting relationships, peer effects and changes in the demographic structure of the parental home. In reality, these effects are likely to exhibit an increasing trend with age, making living away from home an increasingly attractive option for young adults as they get older. For example, independence from one's parents is in itself something that becomes more attractive as youths move towards adulthood. To capture this feature of coresidence, the mean relative preference for living away from home, $E[z_t]$, is allowed to increase exogenously according to a linear trend, and may be negative (a direct preference for living with parents) at young ages.

It will become apparent that the model features a number of endogenous mechanisms for generating the observed increase in the fraction of youths living away from home between the ages of 16 and 23, all related to the labor market experience of youths.[24] If $E[z_t]$ were assumed to remain constant with age, the model would risk assigning an overly important role to the labor market in determining coresidence patterns. By allowing for flexibility in the mean growth, variance and autocorrelation of z, the model is such that in principal, either labor market or non-labor market factors could be the primary driver of coresidence outcomes. The features of the data that can identify these preference parameters, and hence distinguish between these two hypotheses, are discussed in Section 5.2.

Parent Preferences Parents have time-separable expected utility preferences and are altruistic towards their children. They have direct preferences over their own private consumption, c_{jt}^p, and public consumption, c_{jt}^g:

$$U_{jt}^p = u\left(c_{jt}^p + c_{jt}^g\right) \tag{3}$$

Their total utility, V_0^p, consists of their direct utility, $\widetilde{V}_0^p$, plus the utility of their child, V_0^y, weighted with an altruism factor, $\eta \geq 0$:

$$\begin{aligned} V_0^p &= \widetilde{V}_0^p + \eta V_0^y \\ \widetilde{V}_0^p &= E_0 \left\{ \sum_{t=0}^{T} \beta^t U_{jt}^p + \beta^{T+1} V_{T+1}^p \right\} \end{aligned}$$

This form of one-sided altruism has a long history in the modelling of parent-child interactions and has a number of implications for behavior.[25] First, altruism is the mechanism that is used to generate financial transfers from parental to youths. Second, note that when $z_{jt} > 0$, both parents and youths have a preference for the youth to live away. However, since in general $\eta < 1$, parents have a weaker direct preference for youths to live away than do youths themselves. This conflict may manifest itself in the form of multiple equilibria of a simultaneous-move version

[24] These mechanisms include: (i) an increasing probability of working; (ii) an increasing earnings profile conditional on working; and (iii) asset accumulation.

[25] See for example, Altonji et al. (1997) and references therein.

of the game described in Section 4, and motivates the need to specify an appropriate timing protocol for the game. Altruism also implies that parents have a stronger preference for youths to work at a given wage, generating a second form of conflict. Both forms of conflict can generate inefficiencies, which are discussed in Section 6.[26]

Youth Budget Constraint In each period, a youth can be in one of two labor market states: employed ($h_{jt} = 1$) or non-employed ($h_{jt} = 0$). An employed youth earns an idiosyncratic monthly wage w_{jt}, which is the outcome of a stochastic process, outlined in the section below on the labor market. A non-employed youth receives an exogenous amount b. This should be interpreted as a simple public unemployment insurance program. Labor income taxes are levied according to the function τ.[27]

Youths can use their income to purchase private consumption goods, c^y_{jt}, and to invest in a risk-free asset, $a_{j,t+1}$ which earns interest at a gross rate R.[28] In addition, a youth may receive a transfer $T_{jt} \geq 0$ from his parents. There is a per-period fixed monthly cost of housing, χ, payable by youths living away from home and a fixed cost κ of moving out of home. The per-period cost is meant to capture both direct housing costs such as rent and mortgage payments, as well as indirect costs such as gas and electricity bills. The fixed cost of moving out is intended to capture direct moving costs as well as indirect costs that may include purchases of new furniture and other durable consumption goods. There is no fixed cost for moving back home. The youth budget constraint is hence given by:

$$\begin{array}{llll} \text{Home:} & c^y_{jt} + a_{j,t+1} & & \leq w_{jt}h_{jt} - \tau\left(w_{jt}h_{jt}\right) + b\left(1 - h_{jt}\right) + Ra_{jt} \\ \text{Away:} & c^y_{jt} + a_{j,t+1} & -\chi - \kappa\left(1 - r_{j,t-1}\right) & \leq w_{jt}h_{jt} - \tau\left(w_{jt}h_{jt}\right) + b\left(1 - h_{jt}\right) + Ra_{jt} \quad +T_{jt} \end{array} \tag{4}$$

Parent Budget Constraints Parents have an exogenous constant income stream, I^p_j, which differs across families.[29] Parental income can be used to purchase private consumption, c^p_{jt}, and public consumption, c^g_{jt}, which is assumed to be a locally public good within the parental home.[30]

[26] Altruism is the mechanism that is used to generate financial transfers from parents to youths in the model. However when youth and parents have identical homothetic preferences over consumption, altruism places a strong restriction on the relationship between parental income and financial transfers. In particular, transfers are approximately linear in parental income (exactly linear in a static version of the model), which is at odds with the data, if the transfer data are taken at face value. This issue is discussed further and possible alternative formulations that relax this relationship are suggested in Section 5.3.

[27] The monthly wages from the NLSY97 which are used in the estimation of the model are gross of labor income taxes, which necessitates the inclusion of a tax function in the model. The assumed tax function is based on the US tax system in 2007 and is described in Appendix A.

[28] I assume that youths do not have the ability to borrow so $a_{j,t+1} \geq 0$.

[29] The assumption that parental income is constant could be relaxed without any additional difficulty. It is retained to allow the focus to be placed clearly on the interaction of coresidence and labor market shocks for youths. Studying the interaction between shocks to parents and shocks to youths is an important avenue for future research.

[30] The assumption that parents do not borrow or save is not innocuous. It implies that financial transfers to youths affect parental consumption in the period that they are made and cannot be spread over future periods. This limits the extent to which parents will use financial transfers to offset the effects of labor market shocks to the youths, relative to a case where parents could use their own savings to smooth the impact of financial transfers

In addition, parents can make non-negative financial transfers, T_{jt}, to youths. The extent to which there exist economies of scale within the parental home, is a key determinant of the value of coresidence and the impact of coresidence decisions on behavior. The model described thus far allows for two types of consumption goods, one for which there are no economies of scale $\left(c_{jt}^{y}, c_{jt}^{p}\right)$, and one for which there are full economies of scale $\left(c_{jt}^{g}\right)$. To allow for the fact that in reality, many consumption goods fall somewhere between these two extremes, I assume that only a fraction, ϕ, of parental income can be used to purchase public goods. When $\phi = 1$, all parental consumption is a public good and there are full economies of scale, when $\phi = 0$, all parental consumption is private and there are no economies of scale. The parental budget constraint is hence given by

$$
\begin{gathered}
c_{jt}^{p} + c_{jt}^{g} + T_{jt} \leq I_{j}^{p} - \tau\left(I_{j}^{p}\right) - \chi \\
c_{jt}^{g} \leq \phi I_{j}^{p}, \quad T_{jt} \geq 0
\end{gathered} \tag{5}
$$

Resource Sharing Across Generations It is worth taking stock of the various technologies in the model for transferring utility from parents to youths. The model features two forms of parental support: coresidence and financial transfers. For a youth living away from his parents, financial transfers are the only means parents have to share resources: providing an additional unit of assets to the youth requires the parent to forgo one unit of current period consumption.[31]

Coresidence is also a technology for intergenerational transfers. To use it requires a fixed monthly cost through forgone utility from independence (z). The return from paying this utility cost comprises two parts. First, there is a fixed monthly benefit from the savings in housing costs (χ). Second, coresidence reduces the cost of transferring additional units of resources from parents to youths, through the presence of the public good. The extent of this "cost-saving" benefit of coresidence is determined by the economies of scale (ϕ). Conditional on living at home, the marginal cost for the parent of providing an additional unit of resources to the youth is a step function with a discontinuity at the point ϕI_{j}^{p}.[32] Transfers below this cut-off are free since these can be made through public consumption. Transfers above this cut-off eat into parental consumption one for one.

Note also that the only component of coresidence that does not enter through consumption is the forgone utility from independence when living at home (z). With decreasing marginal

on their own consumption. However, relaxing this assumption would introduce an additional continuous state variable and significantly complicate computation and estimation of the model.

[31] Because a non-resident youth's savings and/or labor supply decision may adjust in response to a transfer from the parent, the cost to the parent of providing a unit of consumption to a non-resident youth may be different from 1. The actual cost is given by $\frac{\partial c^{y}}{\partial a}$ where a is the resources of the youth.

[32] It would have been possible to construct the model so as to generate a function for the implicit marginal cost of transfers that increases smoothly from 0 to 1, for example by specifiying the two types of consumption goods as imperfect substitutes. Modeling it as a step function captures the same trade-off: that effective transfes are cheaper inside the parental home than outside. Hence the basic mechanism in the model would remain unchanged. However, the solution for the provision of a public good is extremely simple to compute since the parent's choice of public good provision is almost always at a corner.

utility, this component dominates as consumption increases, implying that z becomes relatively more important (and hence coresidence less attractive) as the youth's assets increase.

Labor Market Search There are two labor market states: employment and non-employment. Labor market shocks are assumed to be realized at the beginning of each period. I thus describe the structure of the labor market from the vantage point of a youth's labor market status in the previous period. At the beginning of month t, a youth who was not working in month $t-1$ receives an offer to work with probability λ_0. Offers are assumed to be drawn from a lognormal distribution

$$\log w_{jt} \sim N(\mu_{0t}, \sigma_0)$$

A youth who receives an offer may accept it and work in period t, or reject it and hope to receive another offer in month $t+1$.[33].

At the beginning of month t, a youth who worked in month $t-1$ at a wage $w_{j,t-1}$ will find himself in one of three possible situations:

1. With probability δ the job is exogenously destroyed. A youth who loses his job in this way must spend period t not working $\Rightarrow h_{jt} = 0$.

2. With probability λ_1 the youth receives a new wage draw. Conditional on such a wage change, wages are assumed to follow a random walk in logs with drift.

$$\begin{aligned} \log w_{jt} &= \mu_d + \log w_{j,t-1} + \varepsilon_{jt} \\ \varepsilon_{jt} &\sim N(0, \sigma_1) \end{aligned}$$

   Note that the youth has the option of rejecting the new wage offer in favor of non-employment. In this case the youth spends period t not working. However, the youth does not have the option of staying at his current job at his existing wage: these wage shocks are intended to be a reduced-form way of capturing both fluctuations in the quality of worker-firm matches, and new job offers that arise from on-the-job search. Not surprisingly, μ_d will be estimated to be positive, implying that on average, on-the-job wage shocks represent good news, and youths face upward sloping expected earnings profiles (returns to tenure). However, there is some risk attached to a wage change, as new wages may be below existing wages. This feature is necessary to produce the non-negligible numbers of downward earnings movements that are observed in the data, without intervening periods of non-employment.[34]

[33] μ_{0t} increases with t, by an amount equal to the average increase in earnings, $\lambda_1\mu_d$. This is consistent with the sharp increase with age in the mean wage of new entrants observed in the data. In future work, I plan to relax this assumption an allow the increase in average wage offers to be generated endogenously.

[34] Nagypal (2005) provides evidence for these type of job transitions. The literature on labor market search has suggested other mechanisms to rationalize this sort of behavior. See for example Postel-Vinay and Robin (2002).

3. With probability $1-\delta-\lambda_1$ there is no change in the youth's current wage offer. The youth can choose to either continue to work at this wage ($h_{jt}=1$) or quit to the not working state ($h_{jt}=0$).

The labor market described here incorporates two types of risk, productivity and employment.[35] Note that conditional on remaining employed, all shocks to wages are permanent. The model also incorporates an option value to search, since not all new wage draws while working result in wage increases, and new draws can not be rejected in favor of the current wages. The equilibrium of the game between youths and parents will thus feature reservation wages that are a function of all the state variables.

Using data on wages and employment alone, situations 2 and 3 above, when combined with a quit, cannot be empirically distinguished from job destruction. Together with the fact that rejected offers to the non-employed are not observed, this implies that the labor market parameters cannot be estimated outside the model in a first stage and fed into the structural model. Instead they must be estimated along with the other structural parameters inside the model. The parametric assumptions on the distribution of shocks help to achieve identification.[36]

Without loss of generality we can define $w_{jt}=0$ as the state in which a youth does not have an offer to work at time t. Defined in this way the history w_j^t completely defines the labor market outcomes for youth j.[37]

Government Insurance In the NSLY97 sample described in section 2, 19% of male youths received a government benefit at some point during their time in the sample. With the exception of unemployment benefits which are received by 6% of the sample, these are all means-tested benefits.[38] Following Hubbard et al. (1995), I model means-tested benefits as a consumption floor, $\underline{c}$. Hubbard et al. (1995) show that allowing for the effects of means-tested benefits is important in understanding savings behavior of poor households. Unemployment benefits, b, are modelled as a constant benefit that is paid automatically to youths in any period that they are not working. The tax function, described in the Appendix, is progressive and as such is an additional form of government insurance.

Initial Conditions A complete description of the model also requires specification of initial conditions for assets, residence and labor market variables. Youths are assumed to have $a_0=0$ at age 16. This a reasonable assumption given the large fraction of youths with exactly zero

[35] This is in the spirit of much of the search literature, including Low et al. (2007) who attempt to evaluate the relative importance of each type of risk over the life-cycle.

[36] Identification of the labor market and other parameters is discussed further in Section 5.2.

[37] However, note that w_{jt} is not a first-order Markov process since the distribution w_{jt} conditional on $w_{j,t-1}$, depends also on $h_{j,t-1}$, which is an endogenous variable.

[38] Means-tested benefits include Food Stamps (FS), Aid to Families with Dependent Children (AFDC) and Women, Infants, Children (WIC). WIC is the most commonly (received by 9% of the sample). This is surprising because it is intended only for females. 83% of these recipients are in a cohabiting relationship, suggesting that respondents report benefits received by all members of the household.

assets reported in Section 2. All youths are assumed to be living at home at $t = -1$.[39] An exogenous fraction of youths are assumed to have been working at $t = -1$, and their wages are given by the observed distribution of monthly earnings at age 16.

Terminal Value Functions Because of the monthly frequency of the model, it is not computationally feasible to solve and estimate the model using a horizon T that corresponds to the end of the lifecycle. Moreover, because our interest is in producing a good model of high-frequency behavior around the time of entry to the labor market, it is not clear that this would be a preferred approach even if it were computationally feasible, given the inherent danger of misspecification in any model of behavior. Instead I choose to specify terminal value functions and solve backwards from these. In order to minimize the impact of assumptions about functional form, I solve the model for an additional two years (24 periods) past the point at which I have data.[40]

The assumption at $t = T$ is that the interaction between parents and youths ceases and no more financial transfers can be made. At this point, all youths still living at home are forced to move out, labor supply becomes inelastic and that there is no further uncertainty about future wages. These assumptions are sufficient to obtain closed form solutions for the value functions, which are then used as the terminal functions.[41]

4 A Non-Cooperative Repeated Game

Consider stochastic processes for labor market variables (w_t) and preference shocks (z_t), and an exogenously given interest rate, R, and cost of housing, χ. An allocation in this environment, s, is a sequence of functions that map histories of labor market outcomes and preference shocks, $\{w^t, z^t\}$, initial conditions $\{a_0, w_{-1}, h_{-1}, r_{-1}\}$ and heterogeneity in parental income $\{I^p\}$ into values for $\{r_t, h_t, c_t^p, c_t^y, c_t^g, T_t, a_{t+1}\}$. An allocation is feasible if it satisfies the parental budget constraint (5), the youth budget constraint (4) and the non-negativity constraint for transfers. Denote the set of feasible allocations by $\mathcal{S}$.

Markov Perfect Equilibrium There are a number of reasonable ways in which allocations could be determined in this environment. As a benchmark case, I consider a decentralized approach without commitment, whereby an equilibrium concept and a timing protocol are specified, and parents and youths make strategic decisions to maximize their expected discounted

[39] Note that this only places a minimal exogenous structure on r_0, which is due to the fixed cost of moving out. Since r_0 is itself a choice variable, youths are free to move out in the first model period.

[40] All results are unchanged when the model is solved with an additional 10 years (120 months).

[41] An alternative approach would be to specify the terminal value functions as unknown parametric functions of the state variables, and to estimate these functions along with the other structural parameters. For this approach to be feasible, it is necessary to have high quality data on the state variables in the final period. However after age 20, asset information in recent waves of the NLSY97 is only collected every 5 years, and hence is only available for a subset of the sample at age 23. Moreover, even with this asset information, it is unlikely that identification of the terminal value functions could be achieved without additional assumptions about functional forms.

lifetime welfare. In Section 6, I compare the estimated allocations to those from an alternate environment with full commitment, where attention is restricted to the subset of $\mathcal{S}$ which is Pareto-efficient between youths and parents. There I give arguments to support the decentralized approach without commitment as the preferred modelling choice.

The environment described in Section 3 has a natural interpretation as a stochastic repeated game in which action sets in the stage game are conditioned on a pay-off relevant state vector consisting of the current asset position, a_t, the residence state in the previous period, r_{t-1}, and the realized values of the two shocks (w_t, z_t).[42] In each repetition of the stage game, the youth chooses whether to reside at home or away, whether to work and how much to save and consume. The parent chooses monetary transfers to be paid to the youth, and the level of public consumption in the household if the youth lives at home. The distribution of (w_{t+1}, z_{t+1}) is determined by (h_t, w_t, z_t). The equilibrium concept that I propose is a Markov-Perfect Equilibrium (MPE) in which all actions are conditioned on only pay-off relevant variables, $x_t = (a_t, r_{t-1}, w_t, z_t)$.[43] The structure of the game is summarized in Table 5.

Timing of Stage Game In order to guarantee uniqueness of the MPE, I impose a particular extensive form of the stage game which specifies the order in which parents and youths make their decisions. Attention is then restricted to the unique sub-game perfect equilibrium of this sequential stage game. The assumed timing is as follows. First, the current state $x_t = (a_t, r_{t-1}, w_t, z_t)$ is observed. Then the youth chooses whether to live at home or away (r_t). Next, the parent chooses monetary transfers, T_t, and public consumption (c_t^g). Finally, the youth makes his current period labor supply, h_t, and consumption-savings decision, (c_t^y, a_{t+1}). The sequence of the stage game is illustrated in Figure 4.

The reason for specifying a timing protocol for the stage game is that the simultaneous-move version may contain multiple Nash equilibria. This is most easily demonstrated in the one-shot static version of the game with exogenous labor supply in Appendix B. The intuition for the appearance of multiple equilibria is that due to imperfect altruism ($\eta < 1$) parents have a weaker direct preference for the youth to live away from home than does the youth. This generates values for preferences, z, such that the youth prefers an equilibrium in which he lives away and receives the resulting optimal transfer, while the parent prefers an equilibrium in which the youth is induced to stay at home by the (non-credible) threat of low transfers if he were to move out. However with the assumed timing protocol, these latter equilibria are not sub-game perfect and are ruled out.

[42] The previous period's residence outcome, r_{t-1}, is included in the state vector as a result of the fixed cost, κ, of moving out. If there were no fixed cost it would not be a pay-off relevant variable.

[43] Due to the finite horizon and the fact that the adopted timing protocol guarantees a unique sub-game perfect equilibrium in the stage game, the unique Markov Perfect Equilibrium is also the unique sub-game perfect equilibrium of the dynamic game. Moreover, I show in section 6 that at the estimated parameters, the values from the game lie close to the Pareto frontier. Hence considering alternative timing protocols might lead to different equilibria, but not to more efficient ones.

This particular timing protocol is motivated in part by casual observation of the way that these interactions take place in reality. It seems reasonable that parents cannot force youths to adhere to a particular consumption/savings policy or labor supply decision rule. Rather, they can only influence these choices through their choice of financial transfers. Similarly, a youth cannot be forced to stay in the parental home if he wants to move out, but must accept whatever resulting transfer the parent decides to make. What he does with that transfer is up to him.

In Appendix C I show how the MPE can be described by a set of Bellman equations. For future reference, it is useful to define $Y_t(x_t)$ and $P_t(x_t)$ as the continuation value functions for youths and parents along the equilibrium path, and $\tilde{P}_t(x_t)$ as the corresponding value from *direct* utility for parents. Hence $P_t(x_t) = \tilde{P}_t(x_t) + \eta Y_t(x_t)$.

Determinants of Coresidence and Transfers There is no analytic solution to this game, hence the MPE must be computed numerically by backward induction. Nonetheless, a number of features of the determinants of transfers and coresidence can be described qualitatively. There are four features of the model that help to generate an increasing fraction of youths livings away from home: (i) an increasing earnings profile; (ii) an increasing probability of employment through search; (ii) asset accumulation; and (iv) an increasing preference for living away from home. Youths are more likely to live away from home when earnings, assets or the value of independence is higher. However, the probability of living away from home is ambiguous with respect to parental income. On the one hand, higher parental income generates higher parental transfers and hence a lower earnings/assets threshold for the youth to live away. On the other hand, higher parental income means higher consumption in the parental home, making living at home a more attractive option for the youth.

There are two distinct classes of reasons why a youth may move back home: (i) economic factors that include job loss, wage drops, lower than expected earnings growth and asset decumulation; and (ii) preference shocks (z). However the dynamics of coresidence outcomes for these two types of shocks are likely to be different. Because of the ability to run down assets, a labor market shock may lead to a move back in a subsequent period, rather than in the same period in which the shock occurred. However preference shocks, if they lead to a move back home, are likely to do so in the current period.

Parental transfers are characterized by equating their marginal value and marginal cost along the equilibrium path. The marginal cost is the reduction in current period consumption for parents. The marginal benefit comprises both the marginal value of assets for youths (scaled by the altruism factor) plus the marginal benefit to parents of higher assets for the youth, that accrues from lower expected transfers in the future:

$$u'\left(c_{jt}^{p} + c_{jt}^{g}\right) \leq \eta \frac{\partial Y_t^4}{\partial a_t} + \beta \frac{\partial E_t\left[\tilde{P}_{t+1}\right]}{\partial a_t} \quad (6)$$

$$T_{jt} = 0 \text{ if inequality is strict.} \quad (7)$$

Y_t^4 is the youth's value function conditional on the transfer and residence decisions[44], and $E\left[\tilde{P}_{t+1}\right]$ is the parent's expected next period direct value function, taking into account the optimal savings and labor supply decision of the youth. It is straightforward to see that other things equal, parental transfers are decreasing in youth assets, earnings and employment, and increasing in parental income.

5 Parameter Estimation

5.1 Estimation Strategy

A number of features make computation and structural estimation of this model difficult. The model incorporates strategic behavior, which means that two sets of Bellman equations must be solved simultaneously, each taking as input the optimal decisions from the other. The model also includes both discrete and continuous choice and state variables, a combination which is well known to cause computational difficulties.[45]

Externally Calibrated Parameters For some other parameters, structural estimation inside the model is less crucial than others. As such, the estimation approach involves fixing some parameters exogenously and estimating the remaining parameters using a set of moments from the NLSY97. Those parameters that are set exogenously are shown in Table 7, together with their values.

Both parents and youths are assumed to have constant relative risk aversion preferences, $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, where $\gamma = 1.5$ is the (common) coefficient of relative risk aversion.[46] The interest rate, R, is set at 3%; the monthly unemployment benefit, b, is set at \$500;[47] and the monthly consumption floor is set at \$200.[48] The distribution of parental income is consistently estimated from the NLSY97 data in a first stage. It is discretized to a four-point distribution, reflecting average parental income in each quartile.

The degree of economies of scale in the parental home, ϕ, and the costs of housing, χ, are particularly important parameters since they determine the economic benefits of coresidence.

[44] See Appendix C for a precise definition of Y_t^4. This is the youths'value function along the equilibrium path, just prior to the labor supply and savings decision.

[45] Both the discrete residence and labor supply choices can generate non-convexities in the decision problem for assets, even once current period choices of both the youth and the parent are conditioned on. This is due to the presence of *future* discrete choices. See Low et al. (2007) for a discussion of this problem within the context of a labor search model with assets.

[46] Since γ determines the desire to smooth consumption across time and states, it is likely to be important for quantitative values of insurance channels. For the next draft, I plan on performing robustness checks by re-estimating the model under different assumptions about the value of γ.

[47] Conditional on receiving unemployment benefits, the mean and median monthly benefits are \$780 and \$650. However, in the model all youths are eligible for unemployment benefits in all periods that they are not working. This is substantially more generous than in the US system, which requires that (i) a worker be laid off through no fault of his own; (ii) a worker satisfies an earnings and/or employment requirement over the previous year; and (iii) a worker collects unemployment benefits for no more than 26 weeks. To partially account for these differences, I reduce the mean amount in the data by around one-third to \$500.

[48] Combining AFDC, Food Stamps and WIC, the median monthly benefit for the NLSY97 sample is \$220.

Although there is some data in the NLSY97 on rental costs, it is missing for much of the sample. The mean reported monthly rent for youths living away from home is \$430, based on 137 observations out of a total of 874. This number is significantly lower than what is suggested by the 2001 American Housing Survey. For renter-occupied units with low annual household income (\$11,700 − \$17,550), the median monthly rent is \$601. In the model, χ refers to both direct and indirect costs of housing such as gas and electricity, so I set its value at \$650. At the estimated parameters, none of the allocations are significantly changed when this is varied up or down by 15%.[49]

Unfortunately, there is not enough information in the NLSY97 data to identify the economies of scale in the parental home, ϕ, based on observed choices.[50] Since there is no consumption data in the NLSY97 and the CEX only measures expenditures at a household level, I rather set ϕ exogenously at 0 and 1. These are upper and lower bounds for economies of scale. I estimate the model under these two extreme cases and discuss the differences in Section 5.3. The main result of the paper, that coresidence is a valuable insurance channel, is unaffected. However the quantitative value of coresidence is, not surprisingly, substantially lower without economies of scale.

Estimated Parameters The approach for estimating the remaining 15 parameters is to use average moments over the age-range from $16.5 - 22.5$. I choose moments that are sufficient to identify all the parameters and discuss further which moments help to pin down which parameters in Section 5.2. The full set of moments is shown in Table 6. Of these moments, the only one that relates labor market outcomes to coresidence outcomes is the *cross-sectional* difference in log earnings between youths living at home and away. This allows me to use the effect of labor market outcomes on coresidence *dynamics* as an informal out-of-sample test of the mechanisms at work in the model.

The estimated parameters are displayed in Tables 8 and include the labor market parameters $(\delta, \lambda_0, \lambda_1, \mu_0, \sigma_0, \mu_d, \sigma_1)$, the preference shock parameters $\left(\alpha_z, \beta_z, \sigma_z^2, \rho_z\right)$, the altruism factor, η, the disutility of work, υ, the discount factor, β, and the fixed cost of moving out of home, κ. These parameters are estimated using a simulated minimum distance estimator with a diagonal weighting matrix.[51] Asymptotic confidence intervals are calculated using a bootstrap estimator for the covariance matrix of sample moments.

[49] I have not yet re-estimated the model using alternative assumptions for χ. Since this is an important determinant of the value of coresidence I plan on performing these alternative estimations for the next draft.

[50] With panel data on household level expenditures, one could plausibly use changes in consumption expenditure when an additional member joins or leaves a household as a source of identification. See Lise and Seitz (2005) for an example of this approach using two-person husband-wife households. Identifying economies of scale within households is a long standing research topic in applied econometrics, and one which is beyond the scope of this paper.

[51] Estimates are not sensitive to alternative choices of weighting matrices, since all moments are matched well in the estimation.

5.2 Where Does Identification Come From?

Whenever structural parameters are estimated on the basis of simulated moments, a question of identification naturally arises. Although it is not possible to provide an analytical proof that the parameters are identified using a given set of moments, I address the question of identification in three ways. I follow two approaches that are accepted as reasonable in the existing literature. First, I examine a numerical estimate of the Hessian of the minimum-distance criterion at the estimated parameter values and ensure that it is non-singular. Second, I verify that the estimation strategy can recover good estimates of the structural parameters using data that is simulated from the model.[52] Finally, I provide an informal argument that each of the parameters is identified by a subset of the chosen moments and give some intuition for why this is the case. This approach should be persuasive, since it delivers an understanding of why the available moments are sufficient to pin down the parameters. [53]

The features of the data that pin down the parameters are as follows:

Disutility of Work ($\boldsymbol{v}$) Conditional on values for the labor market parameters (see below), the disutility of work is identified by the average fraction of youths who are working in a given month.

Labor Market Parameters ($\boldsymbol{\lambda_0, \lambda_1, \delta, \mu_0, \sigma_0, \mu_1, \sigma_1}$) Since this is a search model, a standard identification challenge arises as a result of the fact that rejected job offers are not observed. Identification comes from a combination of functional form assumptions for the unconditional and conditional wage offer distributions, and the structural relationship between the disutility of labor and the reservation wage. The two arrival rates, (λ_0, λ_1), are identified from the probability of working conditional on not working in the previous month and the probability of earnings changing between two months, conditional on working in both months. The job destruction rate (δ) is identified from the probability of not working, conditional on working in the previous month. Given the assumption of log-normality, the four parameters of the wage offer distributions $(\mu_0, \mu_1, \sigma_0, \sigma_1)$ are identified from the mean and variance of the distribution of earnings conditional on working, the distribution of earnings conditional on having not worked in the previous period and the mean increase in earnings conditional on an earnings change.

Altruism Factor ($\boldsymbol{\eta}$) The altruism factor is identified by the average fraction of youths that receive positive transfers from their parents in a given year. From equation (6) one can see that an increase in the altruism factor leads to an increase in the marginal benefit of transfers,

[52] Both of these checks only suggest local identification. To check for other local minima, a thorough search of the parameter space was peformed and no better fit was found.

[53] The plots in Figure 5 only illustrate that each parameter is pinned down, *given the estimated values of the other parameters*. They are intended merely to provide intuition as to where identification comes from, and not as a proof of local (let alone global) identification.

and hence a decrease in the asset threshold at which optimal parental transfers become zero. Panel (A) of Figure 5 illustrates this effect.

Preference Shocks $(\boldsymbol{\alpha}_z, \boldsymbol{\beta}_z, \boldsymbol{\sigma}_z^2, \boldsymbol{\rho}_z)$ The intercept in the mean utility, α_z, from independence is identified from the average fraction of youths living away from home. This is shown in panel (B) of Figure 5. The variance of preference shocks, σ_z^2, which determines the amount of heterogeneity in the relative preference for living away is identified from the average difference in earnings between youths living at home and youths living away from home. Recall from Figure 2 that the earnings of youths at home and away is very similar. If there were no preference heterogeneity $(\sigma_z^2 = 0)$, then all coresidence movements would be driven by earnings and asset accumulation, and youths living away from home would, on average, have far higher earnings than youths living at home. As σ_z^2 increases, the amount of non-labor market heterogeneity increases. This additional heterogeneity reduces the away-home differential in earnings, as illustrated in panel (C) of Figure 5. The mean growth in preferences, β_z, is identified by the mean growth in the fraction of youths living away from home from age 16.5 to 22.5. First, note that since average earnings, assets and employment increase with age, the fraction of youths living away may also increase, purely due to labor market factors. Second, note that a high amount of preference heterogeneity, σ_z^2, will tend to flatten this age profile, since youths with high z values are likely to live away, and youths with low z values are likely to live at home, regardless of their age (see panel (D) of Figure 5). β_z is identified by the difference between these two effects: how much mean preferences have to grow to generate the slope observed in the data, given the values for labor market parameters and preference heterogeneity (see panel (E) of Figure 5).[54] The persistence of preferences, ρ_z, is identified by the within-person time-series variation in parental coresidence. Two moments are used: the monthly auto-correlation of coresidence outcomes and the fraction of youths who *ever* move back home at least once by the age of 22.5 (see panels (F) and (G) of Figure 5).

Fixed Cost of Moving Out ($\boldsymbol{\kappa}$) The fixed cost of moving has an asymmetric impact on coresidence movements: its impact on movements out of the parental home is greater than on movements back into the parental home. Hence, conditional on the auto-correlation of preference shocks and the arrival rates for job offers, I use the mean duration of spells back home as the identifying moment (panel (H) of Figure 5). To see why this works, consider an extreme environment in which the fixed cost is zero. With no fixed cost to moving out, the duration back home for a youth who moves back in response to an unemployment shock will be similar to the duration of unemployment. The extent to which spells back home are longer duration than spells out of work, identifies the fixed cost.

[54] One could plausibly argue that there is also an exogenous trend in the disutility of labor over this age range. However, given the additive nature of preferences, it would be difficult to separately identify this trend from the trend in the value of independence. Hence, it may be more appropriate to interpret the effects of β_z as changes in the relative preference for working vs independence over this age range.

Discount Factor($\boldsymbol{\beta}$) The discount factor is identified from the mean level of assets at age 20.[55] The extent to which assets are accumulated during these years, given the amount of risk that youths face and the implicit insurance from parental transfers and coresidence, identifies the degree of impatience.

5.3 Results of Estimation: What Determines Living Arrangements?

The estimated parameter values for the baseline model are shown in Table 8. The fit of the model, as a function of age, is shown in Figures 6 and 7. In this section I discuss the parameter estimates in terms of their implication for the determinants of living arrangements and transfers, focussing on the case with full economies of scale ($\phi = 1$).[56]

Preference Shocks and Coresidence Patterns The model is able to account for the key coresidence patterns in the data, shown in panels (A)-(D) of Figure 7. The average value of living away from home is most easily interpreted in terms of the number of months of disutility of work to which it is equivalent. Since labor supply and coresidence enter the utility function in an additively separable manner, these two utilities can be directly compared. The estimates for α_z and β_z imply that at age 16, youths have a direct preference for living at home that is equivalent to 17 months disutility of work. The value of independence then increases sharply, to 12 months of leisure by age 22. These numbers seem intuitively reasonable, and suggest that for young males who are not in college, there is relatively little disutility from full-time work, but a large value to independence.[57]

The degree of non-stationarity in preferences, β_z, can also be measured in terms of the extent to which it accounts for the increase in the fraction of youths living away home from age 16 to 22. When β_z is set to 0, with all other parameters left at their estimated values, the model generates 29% of the increase in the fraction of youths living away from home. This implies that just over two-thirds of the increase in the fraction living away is due to an increasing preference for independence. The other one-third is driven by purely economic factors: increasing earnings, employment and the accumulation of assets.[58]

As discussed in Section 5.2, a large amount of heterogeneity in preferences, σ_z, is needed to match the very small difference in earnings between youths away and at home. This difference

[55] Although partial asset information is obtained at other ages, the most comprehensive set of data on youth assets in the NLSY97 is collected in the first interview after the respondent turns 20.

[56] The effects of reducing the level of economies of scale away from this upper bound are discussed at the end of this section.

[57] Recall from section 5.2 that in fact β_z only identifies the change in the *relative* preference for living away from home vs working. Hence part of this increase in the value of independence may reflects a decrease in the disutility of full-time work.

[58] Without economies of scale in the parental home, when β_z is set to 0 the results are starker: there is no increase in the fraction of youths living away. Preferences account for all of the cross-sectional differences in living arrangements. This is because when $\phi = 0$ the values for σ_z and β_z are estimated to be substantially larger in order to fit the same data. The reasons for this are discussed below.

is shown in panel (D) of Figure 7. Notice that the model is able to endogenously generate the increasing age profile of the away-home earnings difference that is observed in the data. The reason is as follows. At young ages, the only individuals who move out are those with a very strong preference for living away from home (high z). To finance their strong desire to live away from home, these youths lower their reservation wage and accept lower paying jobs than youths who are living at home. This selection effect generates a negative away-home earnings difference at the youngest ages. However, as the mean value of independence increases and youths have time to receive more offers and accumulate assets, the mix of youths who are living away from home shifts to comprise of those who have received more favorable labor market shocks. The difference thus becomes positive at older ages. The high value for σ_z ensures that there are always some low-earning youths living away from home, and some high-earnings youths living at home, as is implied by the small overall away-home earnings difference in the data.

Next consider the auto-correlation of preference shocks, ρ_z. This correlation is estimated to be 0.99 at a monthly frequency, which translates to an annual auto-correlation of 0.72. Thus, although there is a large amount of *cross-sectional* variation in the relative preference for living away from home (indicated by the high value of σ_z) there is much less *within-person time-series* variation in preferences. This implies that although non-labor market heterogeneity plays a large role in explaining cross-sectional differences in coresidence outcomes, the labor market is the key factor in explaining individual *movements* in and out of the parental home.

To illustrate this point, I decompose coresidence patterns *in the benchmark equilibrium.* I do this by performing a standard within-groups/between-groups variance decomposition for cross-sectional (a) coresidence outcomes; and (b) indicator variables for whether a youth moved in or out of home. These decompositions answer questions of the form: How much of the fact that one youth moved back home in a particular month, while another youth did not, is due to the fact that they received different histories of preference shocks?[59] I find that only 15% of cross-sectional differences in coresidence are accounted for by labor market shocks. However, a far greater fraction of movements in and out of home are due to labor market events: 40% of movements back home and 63% of movements out of home.[60]

[59] Consider the cross-sectional variation in residence states, r_t. This can be decomposed as $Var\left[r_t\right] = Var\left[E\left(r_t|z^t\right)\right] + E\left[Var\left(r_t|z^t\right)\right]$ where z^t denotes the entire history of preference shocks up to time t. The first term is the "between" component: variation in r_t that is due to cross-sectional differences in the history of realized preferences for living away from home. The second term is the "within" component: differences in coresidence states that exist even within groups of individuals who have experienced exactly the same history of preferences for independence. The fraction that is not accounted for by preferences, and hence is driven purely by labor market differences, is that due to the "within" component: $\frac{E\left[Var\left(r_t|z^t\right)\right]}{Var[r_t]}$. In order to calculate this fraction, it is necessary to calculate $E\left[r_t|z^t\right]$, which is a high-dimensional object. To do this, two approximations are made. First, the history is truncated after d periods. Second, I use a flexible nonparametric estimator for the conditional expectation, $E\left[r_t|z_t..z_{t-d}\right]$. Note that the decomposition could also have been specified in terms of histories of labor market shocks, w^t. The reason for preferring the decomposition in terms of preferences is that there is much less history dependence in the effects of z than w, for the reasons discussed in the text. The calculation is done with $d = 3$, and the results are unchanged if a larger value is used.

[60] The corresponding fractions when $\phi = 0$ are 7% (cross-section of coresidence), 18% (movements back home)

An alternative way to assess the relative importance of the labor market and preference for coresidence, is to compare the benchmark model with an alternate model where preference shocks are shut down, but preference heterogeneity is retained.[61] This is done by leaving all parameters at their estimated values, except for the transition matrix for preferences, which is replaced with an identity matrix. Hence individuals do not experience changes to their value for z over time. I find that without shocks to preferences the model generates 33% of the number of youths who ever move back home, and reduces the median duration of spells back home from 9 to 3.5 months. The fact that the average length of spells back home decreases, illustrates the fact that spells back home due to labor market shocks are shorter duration on average than spells back home due to preference shocks.

Altruism Factor and Transfers The value of the altruism factor that is needed to match the fraction of youths receiving a positive transfer is 0.47. One area where the model fails to fully account for the data is in predicting the *level* of transfers, conditional on receiving a transfer. This can be seen in panel (F) of Figure 7, which show that median transfers are much larger in the model than in the data. In part, this is due to the fact that in reality a large proportion of transfers are in-kind - such as the use of a parent's car or the purchase of meals or clothing. The NLSY97 data does not include these amounts. It thus may be possible to interpret the difference between transfer amounts in the model and the data as the degree of financial support that parents provide that is unmeasured.

One reason for the high level of financial transfers in the model is the homotheticity of preferences that derives from altruism. This effect can be seen clearly in the simpler static version of the model in Appendix B. There I show that the combination of altruism and identical preferences for youths and parents imply that transfers increase linearly with parental income whereas in the data, transfer amounts are relatively flat with parental income. To simultaneously match the low levels of transfers, high fraction of youths receiving transfers and flat transfers with parental income, the model would need to be changed in a way that generated non-linear Engel curves for parents' expenditures on youths, such as different curvatures of utility for the two generations.[62]

Other Parameters Estimates All of they key labor market characteristics are matched

and 31% (movements out of home). Intuition for the differences betwen the economies with $\phi = 1$ and $\phi = 0$ is discussed below.

[61] The hypothetical questions posed in this previous paragraphs ask what would happen to coresidence patterns if the stochastic structure for preferences were changed, and parents and youths optimally adjusted their behavior. In the previous paragraph the question being asked was with respect to the outcomes that we actually observe - what fraction of observed coresidence movements in the benchmark equilibrium are due to the labor market?

[62] There are other simple changes to the model that would yield one extra parameter that could be used to match the level of transfers in the data. For example, a simple iceberg cost of transferring resources from the parent to the youth. However, such mechanisms are somewhat artificial and imply that parents are extremely altruistic (to match the high fraction of youths who receive transfers) but that the cost of making transfers is extremely high (to match the low transfer amounts). An alternative modification to the model would be to allow a negative correlation between altruism and parental income.

well by the model and are shown in Figure 6. The parameters that govern the degree of earnings instability suggest that young males who do not go to college face substantial risk in the labor market. There is a 4% monthly probability that a job is destroyed, which translates to an annual probability of just under 40%. However, this is compensated by fairly high arrival rates of wage offers: just under 23% per month when not working and 27% when working.

Expressed annually, the estimated discount factor is low: 0.83.[63] This reflects the very small degree of asset accumulation between ages 16 and 20 that is observed in the data. Both the increase in average log assets, and the distribution of assets at age 20, are well accounted for by the model and are shown in panels (G) and (H) of Figure 7.

The fixed cost of moving out is estimated to be $1,290 or about twice the monthly rent.[64] Panel (C) of Figure 7 shows that this generates a distribution of duration of spells back home that is very similar to the data. Note that only the mean duration, rather than the whole distribution, was used in estimation.

Effect of ϕ on Parameter Estimates Why does the degree of economies of scale inside the parental home (ϕ) have such a large effect on the estimated parameter values? Consider the effect of reducing ϕ from 1 to 0. The first thing to note is that without public consumption there is a much stronger incentive for parents to make financial transfers to youths who live at home. However, since the altruism factor, η, is estimated to match the same fraction of youths receiving a positive transfer, this implies a much lower estimated value for η (0.07 vs 0.47), which in turn implies a much lower *level* of average transfers. With lower transfers, even for youths living away from home, there is more incentive to work. Hence to match the same fraction of youths not working, the estimated disutility of labor is estimated to be much higher (0.45 vs 0.05). Similarly, with lower transfers from parents, there is far more incentive to save for precautionary reasons and to facilitate moving out of home when the preference for independence (z) increases. Hence the estimated discounted factor is substantially lower since it is being chosen to match the same average increase in assets (0.967 vs 0.985).

The other important effect of ϕ is on the estimated values for preferences. Since raw consumption levels are more equal across coresidence states with $\phi = 0$, coresidence decisions are determined more by preferences and less by labor market factors. This implies that more heterogeneity (σ_z) is need to match the away-home difference in average earnings, and steeper exogenous trend in the relative preference for living away from home (β_z). These last two factors imply that the labor market is far less important, and preferences far more important, for determining coresidence patterns, when there are no economies of scale in the parental home.

[63] Note that because of the low estimated discount factors for this group, this minimizes the effect of the form of the terminal value assumption. With $\phi = 0$ the estimate for β is even lower: 0.67.

[64] The estimates for κ have large standard errors, particularly in the case with $\phi = 0$, where the point estimate is $37 with a standard error of $480. Plots similar to those in Figure 5 show that when $\phi = 0$, κ is not well identified based on data on durations back home.

Effect of Labor Market on Coresidence Dynamics As an informal over-identification test of the mechanisms in the model that relate coresidence to labor market outcomes, Table 9 shows the monthly probability of moving in and out of home by employment status in the data and in the estimated model. Note that no moments relating the labor market to coresidence *dynamics* were used for estimation. The model does well in generating probabilities of moving that are effected by employment status in roughly the same way in the model and in the data. The magnitudes in the data (both in terms of overall levels and the difference by employment status) lie in between the predictions of the model with full economies of scale ($\phi = 1$) and no economies of scale ($\phi = 0$). This suggests that estimating the model using an intermediate value ϕ, could allow the model to generate the same size effects as in the data.[65]

6 Pareto Efficiency

There are a number of reasons why the MPE allocations may be inefficient, relative to an environment where parents and youths can commit at $t = 0$ to fully history dependent allocations.[66] To examine how severe are these inefficiencies, and thus the sensitivity of the results to alternative choices about how to determine allocations, I construct the Pareto-efficient frontier between parents and youths, at the estimated parameter values. I then look at the difference in welfare and allocations between the MPE and nearby points on the Pareto frontier. For a given value for the youth, $\overline{V_0^y}$, define efficient allocations to be the subset of S that satisfy

$$\overline{V_0^p} = \max_{s \in S} V_0^p \text{ subject to } V_0^y \geq \overline{V_0^y} \tag{8}$$

and the efficient frontier as the subset of the locus $\left(\overline{V_0^y}, \overline{V_0^p}\right)$ for which the constraint $V_0^y \geq \overline{V_0^y}$ binds.[67]

Note that the problem in (8) can be re-written as

$$\max_{s \in S} \tilde{V}_0^p + (\eta + \lambda) V_0^y \tag{9}$$

where λ is a Lagrange multiplier that can be interpreted as a relative Pareto weight on the youth. Since only the combined altruism factor / Pareto weight, $\eta + \lambda$, is important for determining

[65] Estimating the model with an intermediate value for ϕ is in progress for the next draft of the paper. These results also suggest that it may be possible to estimate a value or ϕ, using moments that relate the labor market to coresidence dynamics.

[66] There are three possible sources of inefficiency. First, since parents cannot commit to transfers before youths make their coresidence decision, there may be inefficient delays in moving out of home, and inefficient movements back home. Second, since youths cannot commit to accept a job before parents make their transfer decisions, there may be inefficiently low transfers. Finally, a version of the Samaritan's dilemma is at work, whereby youths savings are inefficiently low because they seek to raise their marginal value of resources in order to induce higher transfers from parents.

[67] Due to the presence of altruism, there may be feasible values for $\overline{V_0^y}$ for which this constraint does not bind. In these cases, both the youth and the parent can be made better off by increasing the welfare of the youth. Clearly such allocations are not Pareto-efficient and so are not included as part of the Pareto frontier.

allocations, the assumption of efficiency alone is not sufficient for identification of η. I construct the Pareto frontier by fixing η at its estimated value and solving the problem in (9) for different values of λ.

Game is Nearly Efficient Figure 8 shows the computed efficient frontiers $\left(\overline{V_0^y}, \overline{V_0^p}\right)$ for the four parental income groups, and the corresponding value pairs (Y_0, P_0) from the MPE. Panel (A) is the case with $\phi = 1$ and panel (B) is the case with $\phi = 0$. These figures show that in both cases, the actual inefficiencies in the game are small and for higher parental income groups are non-existent. Note also that in the cases where the game is efficient, the MPE lies on a point on the Pareto frontier that puts essentially no direct weight on the utility of the youth i.e. $\lambda \approx 0$. If the game were indeed to generate efficient allocations, then this would necessarily be the case. To see why, it is useful to compare equation (6) that determines transfers in the game, with the corresponding equation in the efficient allocations:

$$\begin{aligned} u'\left(c_{jt}^p + c_{jt}^g\right) &\leq (\eta+\lambda)\frac{\partial V_t^y}{\partial a_t} + \beta\frac{\partial E\left[\tilde{V}_{t+1}^p\right]}{\partial a_t} \\ T_{jt} &= 0 \text{ if inequality is strict} \end{aligned} \tag{10}$$

It is clear that if the value functions in (6) and (10) are to coincide, then the only way that the game could generate an efficient level of transfers is if $\lambda = 0$.

Why Prefer the Game as the Baseline? If the inefficiencies generated by the game are so small, then why focus on the MPE, which requires additional assumptions about timing and commitment, as the preferred model of behavior?[68] There are a number of reasons. First, the game is intuitive and generates some outcomes that appeal to introspection about the nature of parent-youth interactions. For example, parents may make substantial transfers even though they would prefer the youth to live at home. Also, parents can not control the labor supply and savings of non-resident youths directly, but can only partially influence them through their choice of financial transfers. If a youth has a strong enough preference for independence, he will move out regardless of the parent's actions.

Second, the particular specification of the game implicitly assumes that parents and youths cannot commit to future decisions. This seems more in touch with reality than the assumption implicit in the Pareto-efficient allocations - that parents and youths can commit at age 16 to a full set of contingent allocation rules for coresidence, labor supply, consumption and savings.

Third, there is an important advantage of the game in terms of identification of structural parameters. Under the assumption of Pareto-efficiency, only the combined Pareto-weight and altruism factor, $\eta + \lambda$, is identified, which makes it difficult to use the model to do policy experiments and examine counterfactual exercises. Only a locus of possible counterfactual outcomes are identified, indexed by how the estimated value for $\eta+\lambda$ is split between η and λ. The implicit

[68] Note also that Pareto-efficient allocations are much simpler to calculate than the MPE.

bargaining weight, λ, may respond endogenously to changes in the environment, an issue which is not of concern when using the game to determine allocations.[69]

Finally, it is useful to be able to connect with the existing literature on parent-youth interactions, which has predominantly used a non-cooperative game-theoretic approach to model behavior.[70]

7 Putting the Model to Work: Coresidence as Insurance

In this section I quantify the importance of parents in general, and coresidence in particular, as a means of insuring shocks in the labor market. First, I define a measure of insurance against shocks and use it to compare the value of the different insurance channels in the model, with respect to the loss of a job. Next, I compare youths' consumption response to shocks when they do and do not have access to their parents as a means of insurance. I use these consumption responses to illustrate the potential for crowding out of private transfers within the family by public programs.

7.1 Measuring Insurance Against Shocks

Consider a youth and a parent at the beginning of time t, after the realization of the shock (w_t, z_t) for that period. Recall that the state variables in the MPE are $x_t = (a_t, r_{t-1}, w_t, z_t, I)$ with a corresponding value function $Y_t(x_t)$ for the youth. I measure insurance as the degree to which a youth is indifferent between particular realizations of a shock.[71] Focusing on job destruction as a shock, define the difference in continuation values due to a job loss as

$$\Delta_t(x_t) \equiv Y_t(a_t, r_{t-1}, w_t, z_t, I) - Y_t(a_t, r_{t-1}, 0, z_t, I)$$

A youth is *fully insured* against a job loss if he is indifferent between losing and not losing his job, i.e. if $\Delta_t(x_t) = 0$. When a youth is not fully insured, we can define the *degree of partial insurance*, $\xi_t(x_t)$, as the compensating asset variation that is necessary to make him indifferent between losing and not losing the job[72]:

$$Y_t(a_t + \xi_t, r_{t-1}, 0, z_t, I) - Y_t(a_t, r_{t-1}, 0, z_t, I) = \Delta_t(x_t)$$

[69] If the efficient allocations were implemented through some decentralized system, then λ would refelects the implicit bargaining power given to the youth and hence the resulting point on the Pareto frontier. However, depending on the details of the decentralization, changes in the environment may change the effective value of λ, leading to a different point on the Pareto frontier being chosen. In the dynamic game, the assumption about the timing of actions pins down the effective bargaining power of youths and parents.

[70] Games with a similar structure to the one analyzed here are used in Rosenzweig and Wolpin (1993), Rosenzweig and Wolpin (1994), Ermisch and Di Salvo (1997)and Becker et al. (2002). However, note that in contrast to the model in Rosenzweig and Wolpin (1993) and Rosenzweig and Wolpin (1994), I specify that it is the youth, rather than the parent who makes the coresidence decision. An exception is the static model estimated by McElroy (1985), which assumes that cooperative Nash bargaining determines coresidence outcomes.

[71] This definition of insurance departs frome some of the existing literature by defining insurance as equalization of utility, rather than equalization of the marginal utility of consumption. I refer to this alternative definition as *consumption* insurance and examine the consumption response to shocks in Section 7.3.

[72] An alternative (and equivalent way) to write this is $Y_t(a_t + \xi_t, r_{t-1}, 0, z_t, I) = Y_t(a_t, r_{t-1}, w_t, z_t, I)$.

$\xi_t(x_t)$ is the answer to the question of how much additional wealth we would have to give a youth with state vector x_t to make him indifferent about becoming jobless.

Now consider a modification to the environment that removes a particular insurance channel. Denote the analogous continuation value difference in the resulting MPE as $\hat{\Delta}_t(x_t)$. Once again, define the extent of partial insurance, $\hat{\xi}_t(x_t)$, as the compensating asset variation for the job loss, but valued according to the value functions in the *benchmark* equilibrium:

$$Y_t\left(a_t + \hat{\xi}_t, r_{t-1}, 0, z_t, I\right) - Y_t\left(a_t, r_{t-1}, 0, z_t, I\right) = \hat{\Delta}_t(x_t)$$

The reason for using the value functions from the benchmark equilibrium is that we want to express the value differences in the benchmark and alternative environments using the same units. However, since the marginal value of assets may differ across the two equilibria, if we were to calculate $\hat{\xi}$ as the compensating asset variation implied by $\hat{Y}_t$, we would risk concluding that the utility loss from losing a job in one environment is larger than in another, simply because assets are not very valuable in that environment.[73] The way that $\hat{\xi}$ has been defined, it will always be the case that $\hat{\xi}_t(x_t) = \xi_t(x_t)$ whenever $\hat{\Delta}_t(x_t) = \Delta_t(x_t)$. We can then define the value of a particular insurance channel against the loss of a job at x_t as the percentage increase in the cost of a job loss due to removing that channel.

$$\omega_t(x_t) = \hat{\xi}_t(x_t) / \xi_t(x_t) - 1$$

There are a number of benefits to measuring insurance in this way:

Substitution of Independence for Consumption Measuring insurance in terms of the smoothness of consumption is not appropriate (although I do this below, in order to connect with the existing literature, which has largely focussed on this measure) since youths can adjust the inputs to their own welfare (consumption, labor supply, independence) in response to exogenous shocks. Consider for example a youth who moves back home as a result of a job loss shock. This youth is unambiguously worse off as a result of the shock (since he could always have quit his job), but his consumption may actually *increase* due to the public consumption in the parental home, and reduction in housing costs. For this youth, the welfare cost of the job loss is not realized through a drop in consumption but rather through a loss of independence. On the other hand, if he were restricted from moving back home, he would retain his utility from independence, but suffer a drop in consumption. $\omega_t(x_t)$ takes both components of welfare into account, trading them off in the same way that the youth himself would.

[73] Consider for example the case of removing unemployment insurance. Without unemployment insurance, assets are particularly valuable: so even if the utility loss from losing a job is large, the amount of assets that would be needed to compensate for the job loss may be small. Removing an insurance channel affects (i) the level of continuation values; (ii) the difference in continuation values between having and not having a job; and (iii) the marginal continuation value of additional assets. The measure of insurance defined in this section is designed to measure only the second of these effects.

Absence of Level Effects An arguably more standard way of measuring the welfare costs from the removal of insurance channels would be to simply compare the equilibrium value functions in the two environments. However this comparison confounds two differences across the environment - differences in the overall level of welfare; and differences in how welfare is affected by shocks. The insurance value of the change in the environment is only the latter effect, which is what $\omega_t(x_t)$ measures. This distinction is particularly relevant in this model, since the presence of public consumption inside the parental home means that the removal of the option of coresidence reduces the opportunity set for consumption. Even in a world without shocks, a youth would be worse off simply because there is less consumption available. The size of this effect is directly linked to the level of public goods in the parental home, something which I have already argued is difficult to pin down. It is thus preferable to value coresidence using a measure which is relatively robust to the overall availability of consumption and hence is robust to the value of ϕ.

7.2 The Value of Parents as Insurance

I start by calculating the value of different insurance channels for a typical 21 year-old youth. I consider a youth with the median preference for living away from home and the median assets ($\$7,700$) and monthly earnings ($\$1,990$) among youths with that preference for independence.

Median Welfare Cost of a Job Loss Table 10 contains the results of this calculation. For each parental income group, the first two rows show the welfare cost of losing a job in the benchmark MPE. Consider first the case with full economies of scale. Expressed in terms of assets, the welfare costs of a job loss are around $\$8,000-\$9,000$ and are relatively flat across the parental income distribution. These welfare costs translate to an immediate one-time transfer equivalent to around 4.5 months of earnings. The next three rows show how much these costs are increased by the removal of insurance channels. Removing the option to move back home, increases the cost of a job loss substantially, but this effect decreases as we move up the parental income distribution. The value of moving back home as insurance, as measured by ω^I, is 137% for a youth from the bottom quartile of the parental income distribution, and decreases to 43% for a youth from the top quartile. The main reason for these differences is that without the option to move back home, wealthier parents compensate by increasing financial transfers when a youth becomes unemployed, while poorer parents cannot afford to do so.

Accordingly, the value of financial transfers moves in the opposite direction with parental income. Since youths with low parental incomes are less reliant on financial transfers for insurance in the benchmark equilibrium, removing this channel has only a small effect on the welfare cost of a job loss: $< 1\%$ for those in the bottom quartile, 20% for those in the second quartile. However, for youths from wealthy families, the cost of removing financial transfers is large: 117% for a youth from the top quartile of the parental income distribution. There are two contributing factors to the high insurance value of financial transfers for these youths. First, restricting transfers has the direct effect of reducing their net income available for consumption. Second, restricting transfers forces some youth from wealthy families to move back home upon losing a job, reducing their utility from independence.

Summarizing the main findings, we have seen that for poorer families, coresidence is the most important channel of insurance, while for wealthier families, financial transfers are the more important insurance channel. The right four columns in Table 10 show that the relative importance of the different components of parental support remain, even when there are no economies of scale in the parental home.

Welfare Cost of a Job Loss By Earnings and Assets Figures 9 and 10 plot the welfare cost of a job loss, $\xi_t(x_t)$, in the benchmark equilibrium and with each insurance channel removed, as a function of the youth's earnings immediately prior to the job loss. The four panels plot this function for each quartile of the parental income distribution, again at the median asset level. Not surprisingly, all lines are upwards sloping, reflecting the fact that it is more costly to lose a higher paying job. The relative position of the four lines illustrate the fact that the relative importance of the different insurance channels discussed above, is robust across the wage distribution.

Figures 11 and 12 plot the same welfare costs as a function of assets, at the median earnings level. In all versions of the model other than the one without the option to move back home, the welfare cost of a job loss is roughly constant across the asset distribution. This is because a job loss entails a lower utility loss at higher asset levels, but assets are less valuable so more has to be given to compensate for the same utility loss. Figures 11 and 12 illustrate that these two effects approximately cancel each other out. The exception is the increase in the welfare cost of a job loss when the option to move back home is removed, for youths from poor households. In this case, the youths' own savings do matter. For example, for a youth with no assets from the bottom quartile of the parental income distribution, the value of moving back home as insurance, $\omega_t(x_t)$, is over 300%.

7.3 Consumption Response to Shocks

An alternative way to measure insurance is to focus exclusively on consumption fluctuations and ignore compensating utility gains from increased leisure (and reinforcing utility drops from the loss of independence). Much of the existing literature on insurance against labor market shocks has followed this approach. In particular, Blundell et al. (2008) use data from the Consumer Expenditure Survey and the Panel Study of Income Dynamics to measure the extent to which household consumption responds to household-level income shocks in the USA. Kaplan and Violante (2008) compare their findings with the predictions from a model where the only mechanism for smoothing consumption is self-insurance through a risk-free security. They find that in such a world, consumption responds substantially more to income shocks than in the US economy, particularly for young households and for households that are borrowing constrained. In this section I provide some indirect evidence that coresidence may constitute one of the additional mechanisms that young workers use to smooth consumption.[74]

Coresidence Improves Consumption Smoothing Table 11 reports the average percentage drop in consumption associated with a loss of a job. In the benchmark equilibrium this drop is 20%. Consumption responds more to a job loss when $\phi = 0$ (no economies of scale) because the consumption benefits from coresidence are much smaller without a public good in the parental home. When youths are restricted from living with their parents the consumption response from a job loss in the resulting equilibrium increases by 10 percentage points (pp) and 5 pp relative to the benchmark respectively. This suggests that coresidence has a significant impact on the ability of youths to smooth consumption, even in absence of economies of scale, when the only benefits of shared residence are savings on direct housing costs.

The same is not true for financial transfers. In the model with full economies of scale, consumption responds *less* to a job loss when financial transfers are restricted, by 8 pp. The reason is that removing financial transfers causes many youths to delay moving out of home, or to immediately move back home upon losing their job, since their parents can not provide direct financial support.[75] This means that relative to the benchmark, the utility drop from the loss of a job is realized more through loss of independence, and less through a fall in consumption. In contrast, without economies of scale, removing financial transfers has almost no impact on coresidence outcomes, because of the low estimated altruism factor. The only effect on the consumption response to a job loss is the direct effect of removing financial transfers, which increases the fall in consumption by 2 pp.

Coresidence Reduces the Consumption Smoothing Benefits of Unemployment Insurance It is interesting to explore whether the presence of coresidence as a form of within-family transfers, can limit the value of social insurance programs for young workers. To do this, I compute the increase in the consumption response to a job loss when the simple unemployment benefits in the model are set to zero. I then compare this increase, with the increase in the consumption response when the same experiment is done in a world where youths cannot live at home. If the increase is substantially larger in the latter case, it suggests that the recognizing the option to live at home can alter our evaluation of the consumption smoothing benefits of unemployment insurance. With economies of scale in the parental home, this is exactly what I

[74] In this model household formation is endogenous and the focus is on individual-level consumption of the youth, whereas in the CEX data, households are taken to be a fixed unit and consumption is measured at the household level. The results are intended to indicate that when coresidence is an option, consumption responds less to shocks that if it were ignored. It is not possible to calculate corresponding individual-level consumption drops directly from CEX data.

[75] The equilibrium without financial transfers has on average 24% fewer youths living away from home, and 16% more youths ever moving back home, when compared with the benchmark.

find: setting $b = 0$ in the benchmark equilibrium, increases the average fall in consumption only 5 pp. However without coresidence, removing unemployment benefits increases the consumption response by 22 pp.

8 Putting the Model to Work: Coresidence and Labor Supply

Labor Supply Elasticity Rios-Rull (1996), Gomme et al. (2004) and Jaimovich and Siu (2006) have all provided empirical evidence that the contribution of low-skilled young workers to aggregate labor market fluctuations is disproportionately large. In this section, I show that recognizing that young people can have the option to live with their parents can shed light on this evidence and provides a plausible explanation for why the overall labor elasticity of this group is so large.

In models with a discrete individual labor supply decision, the aggregate labor supply elasticity is determined by the sensitivity of the distribution of reservation wages to changes in the distribution of wage offers.[76] In general, this elasticity is large whenever there is a large mass of workers with reservation wages near their current offered wage, i.e. a large number of workers are close to being indifferent about working at their offered wage.

When coresidence is ignored, it turns out that very few young workers are marginal - virtually all offers are accepted, leaving little room for labor supply to respond to changes in the distribution of wage offers. When coresidence is modelled, youths who choose to live at home have access to public consumption, even when they are not working. This results in a much larger number of offers being rejected, and hence a far greater fraction of young workers are nearly indifferent about accepting job offers. The quantitative size of this effect depends on the consumption benefits of living at home.[77]

To illustrate the potential size of these effects, Table 12 reports two types of average labor supply elasticities, for the benchmark equilibrium and for the equilibria without coresidence and without financial transfers. First, the elasticity of labor supply with respect to an offer, ε^o, is defined as the probability of accepting an offer, conditional on receiving one while unemployed:

$$\varepsilon^o = \frac{\partial \mathbf{1}\left(h_t = 1\right)}{\partial \mathbf{1}\left(w_t > 0\right)} = \Pr\left(h_t = 1 | w_t > 0, w_{t-1} = 0\right)$$

Second, the elasticity of labor supply with respect to the offered wage, ε^w, is defined as the average increase in the probability of working given a 1% increase in the offered wage, conditional on having a job offer:

$$\varepsilon^w = \left. \frac{\partial \mathbf{1}\left(h_t = 1\right)}{\partial \log w_t} \right|_{w_t > 0}$$

[76] See, for example, Chang and Kim (2005).

[77] Other possible explanations for why young workers may have more elastic labor supply than older workers, have been given in the literature. Nagypal (2004) suggests that learning about match quality may be important, while Imai and Keane (2004) emphasize the role of human capital accumulation on the job.

With full economies of scale, the overall probability that an offer is accepted in the baseline model (ε^o) is 0.60. However there is a large difference between youths living at home and youths living away from home: the acceptance rate for youths living at home (0.50) is much lower than for youths living away from home (0.96). A corollary is that when coresidence is ruled out, the overall acceptance rate increases substantially, to 0.92.

In contrast, when financial transfers are restricted but coresidence is allowed, there is almost no effect on the acceptance rate, relative to the benchmark (0.61). Hence the way in which parental support impacts on labor supply behavior, is primarily through coresidence, rather than through financial transfers.

The results for the elasticity with respect to changes in the offered wage (ε^w), tell the same story - removing the option to live at home reduces this elasticity by a factor of 5. Without economies of scale, the qualitative effects are still present, but their magnitude is greatly reduced.[78]

Earnings Shocks, Preference Shocks and Intergenerational Correlations The fact that reservation wages are lower for youths living at home, has other potentially important consequences. First, it induces an endogenous correlation between preference shocks and labor market outcomes. Youths who receive large positive shocks to the value of living independently early on, have a large incentive to move out. Since moving out entails a loss of consumption, these youths have a higher marginal value of consumption and hence lower their reservation wages relative to youths still living at home. As a result youths with a strong direct preference for living away from their parents while still young tend to also have low earnings.

This effect then generates an endogenous intergenerational correlation in earnings. Richer parents can afford to make financial transfers to youths who have a strong desire to move out, enabling them to wait for better job offers. For poorer parents transfers are more costly, hence youths with a high value of independence end up accepting lower wage jobs than similar youths with richer parents.

In the model, both of these effects slowly wear off, as the overall preference for living away and mean wage offers drift upwards with age. By age 23 there is no remaining intergenerational earnings correlation, nor correlation between earnings and early preference shocks. However, this is because in its current form, the model does not have a strong mechanism for generating long term-effects of early labor market outcomes. A more detailed version of the model that allows for the choice between occupations with different level-growth trade-offs would likely induce larger long-term effects of early preference shocks and stronger intergenerational correlations.

[78]The findings in Table 12 are intended to illustrate the potential for coresidence to play a quantitatively important role in accounting for aggregate labor supply elasticities. However the detailed model estimated in this paper is not fully appropriate for studying how large these effects might be in general equilibrium, once fluctuations in housing prices, labor demand and labor supply of other groups are considered. In Kaplan (2008*b*), which is in progress, I outline an equilibrium business cycle model that incorporates coresidence decisions and calibrate it to US data over the last 30 years.

Understanding the quantitative implications of these features of coresidence and labor supply in a more general model is left for future research.

9 Conclusions

This paper started by documenting several new facts about the dynamics of parental coresidence and labor market outcomes for low-skilled youths in the USA. I showed that the living arrangements of many young adults are characterized by a transitional phase between adolescence and adulthood, in which youths alternate between periods of living with their parents and periods of living independently. These coresidence movements take place against a backdrop of substantial labor market risk, at an age when minimal use is made of traditional insurance mechanisms. By estimating the structural parameters of a dynamic model of the interactions between youths and their altruistic parents, I showed that the option to move in and out of home is a valuable form of insurance against shocks in the labor market, particularly for youths from low-income households.

In order for the model to simultaneously account for both the cross-sectional and panel dimension of the data, two types of exogenous shocks were needed. The first were a stochastic process for preferences that directly alter youths' relative desire to live away from their parents. The second were labor market shocks, that take the form of the arrival of job offers, job destruction and productivity changes on the job. By exploiting the panel dimension of the data, it was possible to disentangle the relative contribution of each type of shock to coresidence outcomes. It turned out that while the cross-section of living arrangements is determined primarily by cross-sectional differences in preferences, labor market shocks are an important determinant of the dynamics of movements in and out of the parental home.

This link between the labor market and coresidence helps to shed light on other important aspects of young workers' behavior. I argued that through its effect on reservation wages, coresidence can generate a plausible mechanism for explaining recent findings in Gomme et al. (2004) that the aggregate labor supply of low-skilled young workers fluctuates substantially more over the business cycle than for prime-age workers. I also showed that by reducing the consumption response to labor market shocks, the option to live at home can help explain the findings in Kaplan and Violante (2008) that young households have access to insurance possibilities over and above that implied by self-insurance through savings.

At a policy level, the implications of parental coresidence are also potentially far-reaching. The fact that living arrangements respond endogenously to the realization of labor market shocks, suggests the possibility of substantial crowding out by social insurance programs. Since many public programs are designed to insure against the same types of idiosyncratic labor market shocks that living arrangements respond to, it is important to consider the impact on coresidence when evaluating their welfare implications. Examples of policies that condition on living arrangements include those that require means-testing at a household level (e.g. Food Stamps Program) and those that link benefit entitlements to the structure of households (e.g. Temporary Assistance for Needy Families).

There are a number of important avenues for future research. First, endogenous household formation may also play an important role as insurance for other subgroups. For example, college-educated youths may use coresidence in a similar way once they enter the labor market. Older workers may use the formation and dissolution of marriages and cohabiting relationships as an insurance channel against individual-level shocks. Second, macroeconomics has traditionally studied childhood and adulthood in isolation, as two distinct and separate stages of the lifecycle. This paper suggests that there is an important transitional phase, where interactions between housing, career and marital decisions may have long-term implications.

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A Data and Sample Selection

[TO BE WRITTEN]

B A Static Game

In this appendix I describe the structure and Nash equilibria of a static version of the game in the full model with exogenous labor supply. Since this version of the model admits closed form solutions it is useful to demonstrate some of the key mechanisms at work in the full model.

Consider a static version of the game in which youth income is exogenous, there is no fixed cost of moving out and there are no savings. In this simplified version of the game the only actions are the residential choice $r \in \{0,1\}$ for the youth and the transfer amount, $T \in [0, \phi I^p]$ for the parent. The wage offer of youth, w, the income of the parent, I^p, and the utility from independence are taken as exogenously given parameters. The payoffs in this game are given by:

$$\begin{array}{ll} \text{Youth:} & U^y = \log\left(c^y + (1-r)\, c^g\right) + rz \\ \text{Parent:} & U^p = \log\left(c^p + c^g\right) + \eta U^y \end{array}$$

with the following budget constraints:

$$\begin{array}{rcl} c^y + r\chi & \leq & w + T \\ c^p + c^g + T & \leq & I^p \\ c^g & \leq & \phi I^p, \quad T \geq 0 \end{array}$$

Note that when the youth lives at home, it is always weakly optimal for the parent to set $c^g = \phi I^p$. Hence, the payoffs can be written as functions of (r, T):

$$\begin{array}{ll} \text{Youth:} & U^y\left(r,T\right) = \log\left(w + T - r\chi + (1-r)\,\phi I^p\right) + rz \\ \text{Parent:} & U^p\left(r,T\right) = \log\left(I^p - T\right) + \eta U^y\left(r,T\right) \end{array}$$

The assumption of log utility is not essential to obtain a closed form solution, however it simplifies the algebra.

Best Response of Parent The optimal transfer for a parent is given by:

$$\begin{array}{rcl} T^*\left(0\right) & = & \begin{cases} \frac{1}{\eta+1}\left[\left(\eta - \phi\right) I^p - w\right] & \text{if} \quad \left(\eta-\phi\right) I^p \geq w \\ 0 & \text{if} \quad \left(\eta-\phi\right) I^p < w \end{cases} \\ T^*\left(1\right) & = & \dfrac{1}{\eta+1}\left[\eta I^p - w + \chi\right] \end{array}$$

I assume that $w \leq \eta I^p + \chi$ to simplify the algebra - this assumption just says that parental income plus housing costs are much larger than the youths earnings. Note that away from the corner, the optimal transfer is larger when the youth lives away from home than when the youth lives at home, by an amount equal to $\chi + \phi I^p$, which is the direct and indirect consumption benefits of living at home. That is,

$$\chi + \phi I^p \geq T^*\left(1\right) - T^*\left(0\right) \geq 0$$

Best Response of Youth For a given transfer amount T, the youth will live away from home if $U^y\left(1,T\right) \geq U^y\left(0,T\right)$ where

$$\begin{array}{rcl} U^y\left(1,T\right) & = & \log\left(w + T - \chi\right) + z \\ U^y\left(0,T\right) & = & \log\left(w + T + \phi I^p\right) \end{array}$$

which generates a reservation transfer for living away from home given by:

$$\tilde{T} \geq \frac{e^z \chi + \phi I^p}{e^z - 1} - w$$

where I have assumed $w \geq \chi$ so that it is always feasible for the youth to live away from home and $z > 0$. The best response of a youth is to live away from home it $T \geq \tilde{T}$ and at home otherwise.

Nash Equilibria There is a Nash equilibrium where the youth lives away as long as $T^*(1) \geq \tilde{T}$ and a Nash equilibrium where the youth lives at home if $T^*(0) \leq \tilde{T}$. Since $T^*(1) - T^*(0) \geq 0$, a Nash equilibrium will always exist, however it need not be unique. In particular if $T^*(1) \geq \tilde{T} \geq T^*(0)$ there will be both an away equilibrium and a home equilibrium.

The payoffs for the youth and the parent in each equilibrium are given by

$$\begin{aligned} U^y(0, T^*(0)) &= \begin{cases} \log\left(\frac{\eta}{\eta+1}(w + [1+\phi] I^p)\right) & \text{if} \quad (\eta - \phi) I^p \geq w \\ \log(w + \phi I^p) & \text{if} \quad (\eta - \phi) I^p < w \end{cases} \\ U^y(1, T^*(1)) &= \log\left(\frac{\eta}{\eta+1}(w - \chi + I^p)\right) + z \end{aligned}$$

$$\begin{aligned} U^y(0, T^*(0)) &= \begin{cases} \log\left(\frac{1}{\eta+1}(w + [1+\phi] I^p)\right) + \eta \log\left(\frac{\eta}{\eta+1}(w + [1+\phi] I^p)\right) & \text{if} \quad (\eta - \phi) I^p \geq w \\ \log(I^p) + \eta \log(w + \phi I^p) & \text{if} \quad (\eta - \phi) I^p < w \end{cases} \\ U^p(1, T^*(1)) &= \log\left(\frac{1}{\eta+1}(w - \chi + I^p)\right) + \eta \log\left(\frac{\eta}{\eta+1}(w - \chi + I^p)\right) + \eta z \end{aligned}$$

The youth prefers the away equilibrium whenever

$$\begin{array}{ll} z \geq \log\left(\frac{w+[1+\phi]I^p}{w-\chi+I^p}\right) & \text{if} \quad (\eta - \phi) I^p \geq w \\ z \geq \log\left(\frac{w+\phi I^p}{w-\chi+I^p}\right) - \log\left(\frac{\eta}{\eta+1}\right) & \text{if} \quad (\eta - \phi) I^p < w \end{array}$$

but the parent prefers the home equilibrium if

$$\begin{array}{ll} z \leq \frac{1+\eta}{\eta} \log\left(\frac{w+[1+\phi]I^p}{w-\chi+I^p}\right) & \text{if} \quad (\eta - \phi) I^p \geq w \\ \log(I^p) + \eta \log(w + \phi I^p) \geq (1+\eta)\log(w - \chi + I^p) + \log\left(\frac{1}{\eta+1}\right) + \eta \log\left(\frac{\eta}{\eta+1}\right) + \eta z & \text{if} \quad (\eta - \phi) I^p < w \end{array}$$

$$z \leq \log\left(\frac{w + \phi I^p}{w - \chi + I^p}\right) - \log\left(\frac{\eta}{\eta+1}\right) + \frac{1}{\eta}\log\left(\frac{(\eta+1) I^p}{w - \chi + I^p}\right)$$

Case 1: $(\eta - \phi) I^p \geq w$

If $z \geq \frac{1+\eta}{\eta} \log\left(\frac{w+[1+\phi]I^p}{w-\chi+I^p}\right)$ then both the youth and the parent prefer the away equilibrium, i.e. it Pareto-dominates the home equilibrium. If $z < \log\left(\frac{w+[1+\phi]I^p}{w-\chi+I^p}\right)$ then both the youth and parent prefer the home equilibrium: it Pareto dominates. In both of these cases, if a timing protocol were specified then the sub-game perfect equilibrium would be the same regardless of who chose first.

However if

$$\log\left(\frac{w + [1+\phi] I^p}{w - \chi + I^p}\right) \leq z \leq \frac{1+\eta}{\eta}\log\left(\frac{w + [1+\phi] I^p}{w - \chi + I^p}\right)$$

then the youth prefers the equilibrium where he lives away and the parent prefers the equilibrium in which the youth lives at home. If the youth were to chooses first, then then he would choose to live away and this would be the sub-game perfect equilibrium. However if the parent were to choose first, they would choose $T^*(0)$ and the home equilibrium would ensue. In this case the timing the timing protocol does matter.

Case 2: $(\eta - \phi) I^p < w$

In this case the same is true since there is an open interval of width $\frac{1}{\eta}\log\left(\frac{(\eta+1)I^p}{w-\chi+I^p}\right)$ within which z can lie to generate disagreement as to which equilibrium is preferred.

C Markov Perfect Equilibrium

The MPE of this game can be described by a set of Bellman equations. Define $Y_t^m(x_t^m)$ and $P_t^m(x_t^m)$ as the expected discounted value along the equilibrium path at the beginning of phase m of the period t stage game, for the youth and the parent, respectively. The four phases of the stage game, and the corresponding state variable, x_t^m, are outlined in Table 1. Optimal decisions for the youth and the parent are denoted with a star ($*$). The value functions for the youth are given in equations (11) to (13). (11) is the expected value at the beginning of period t, before the current period shocks have been realized, (12) describes the discrete residence decision, taking into account the equilibrium transfer strategy of the parent and (13) is the labor supply and savings decision, which takes into account future values along the equilibrium path, summarized in $Y_{t+1}^1\left(x_{t+1}^1\right)$.

Phase	Conditioning Variables	Choice	By Whom	Strategies	Value Function
1	$x_t^1 \equiv a_t, r_{t-1}, h_{t-1}, w_{t-1}, z_{t-1}$	w_t, z_t	Nature		$Y_t^1\left(x_t^1\right), P_t^1\left(x_t^1\right)$
2	$x_t^2 \equiv a_t, r_{t-1}, w_t, z_t$	r_t	Youth	$r_t^*\left(x_t^2\right)$	$Y_t^2\left(x_t^2\right)$
3	$x_t^3 \equiv a_t, r_{t-1}, r_t, w_t, z_t$	T_t	Parent	$T_t^*\left(x_t^3\right)$	$P_t^3\left(x_t^3\right)$
4	$x_t^4 \equiv a_t, r_{t-1}, r_t, w_t, z_t, T_t$	h_t, a_{t+1}	Youth	$h_t^*\left(x_t^4\right), a_{t+1}^*\left(x_t^4\right)$	$Y_t^4\left(x_t^4\right)$

Table 1: State Variables for Different Phases of the Stage Game

$$\begin{aligned}
Y^1\left(x_t^1\right) &= \sum_{w_t, z_t} Y_t^2\left(x_t^2\right) \Pr\left(w_t | w_{t-1}, h_{t-1}\right) \Pr\left(z_t | z_{t-1}\right) && (11)\\
Y_t^2\left(x_t^2\right) &= \max_{r_t} \left\{ Y_t^4\left(a_t, r_{t-1}, r_t, w_t, z_t, T_t^*\left(x_t^3\right), c_t^{g*}\left(x_t^3\right)\right)\right\} && (12)\\
Y_t^4\left(x_t^4\right) &= \max_{h_t, a_{t+1}} \begin{array}{c}\left\{u\left(c_t^y + (1-r_t)\, c_t^g\right) - vh_t + r_t z_t\right.\\ \left. +\beta Y_{t+1}^1\left(x_{t+1}^1\right)\right\}\end{array} && (13)\\
&\quad \text{subject to (4)}
\end{aligned}$$

Equations (14) to (16) describe the problem faced by a parent along the equilibrium path. Equation (14) is the expected value for the parent at the beginning of period t, which depends on the residence choice of the youth. Equation (15) is the optimal transfer decision if the youth lives away, which takes into account the induced labor supply and savings decisions of the youth as well as the residence decision in the following period. If the youth lives at home, no decision is made by the parent in phase 3.

$$\begin{aligned}
P_t^1\left(x_t^1\right) &= \sum_{w_t, z_t} P_t^3\left(a_t, r_{t-1}, r_t^*\left(x_t^2\right), w_t, z_t\right) \Pr\left(w_t | w_{t-1}, h_{t-1}\right) \Pr\left(z_t | z_{t-1}\right) && (14)\\
P^3\left(a_t, r_{t-1}, r_t, w_t, z_t\right) &= \max_{c_t^g, T_t} \begin{array}{c}\left\{u\left(c_t^y + c_t^g\right) + \eta\left[u\left(c_t^{y*}\left(x_t^4\right) + (1-r_t)\, c_t^g\right) - vh_t^*\left(x_t^4\right) + r_t z_t\right]\right.\\ \left. +\beta P_{t+1}^1\left(a_{t+1}^*\left(x_t^4\right), r_t, h_t^*\left(x_t^4\right), w_t, z_t\right)\right\}\end{array} && (15)\\
&\quad \text{subject to (5)} && (16)
\end{aligned}$$

D Numerical Solution of the Model

[TO BE WRITTEN]

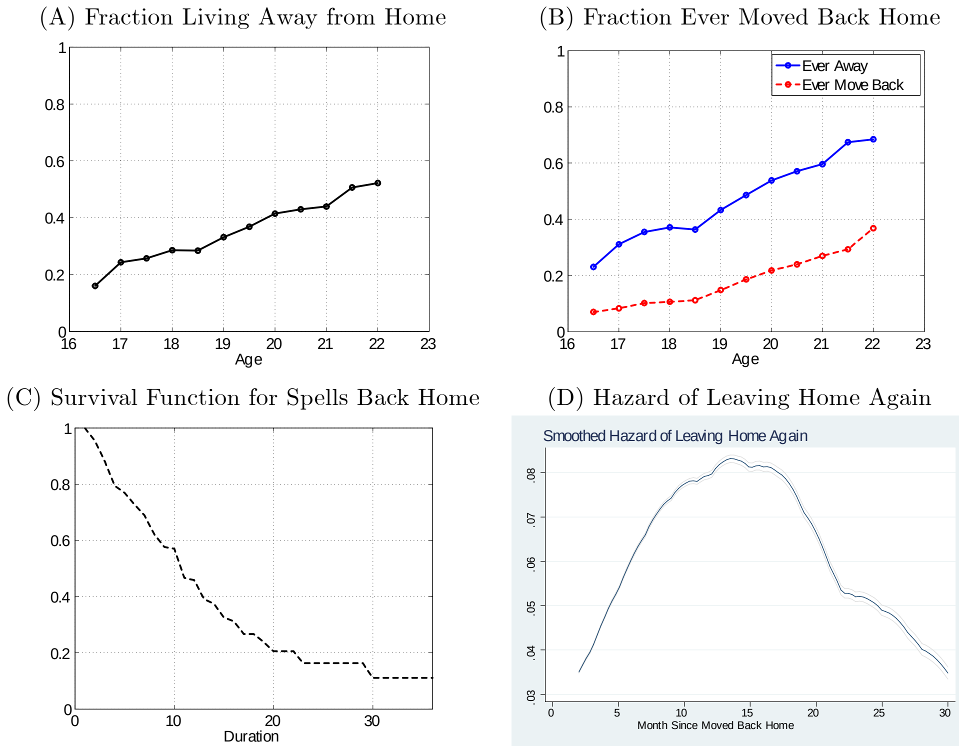

Figure 1: Coresidence statistics from NLSY97

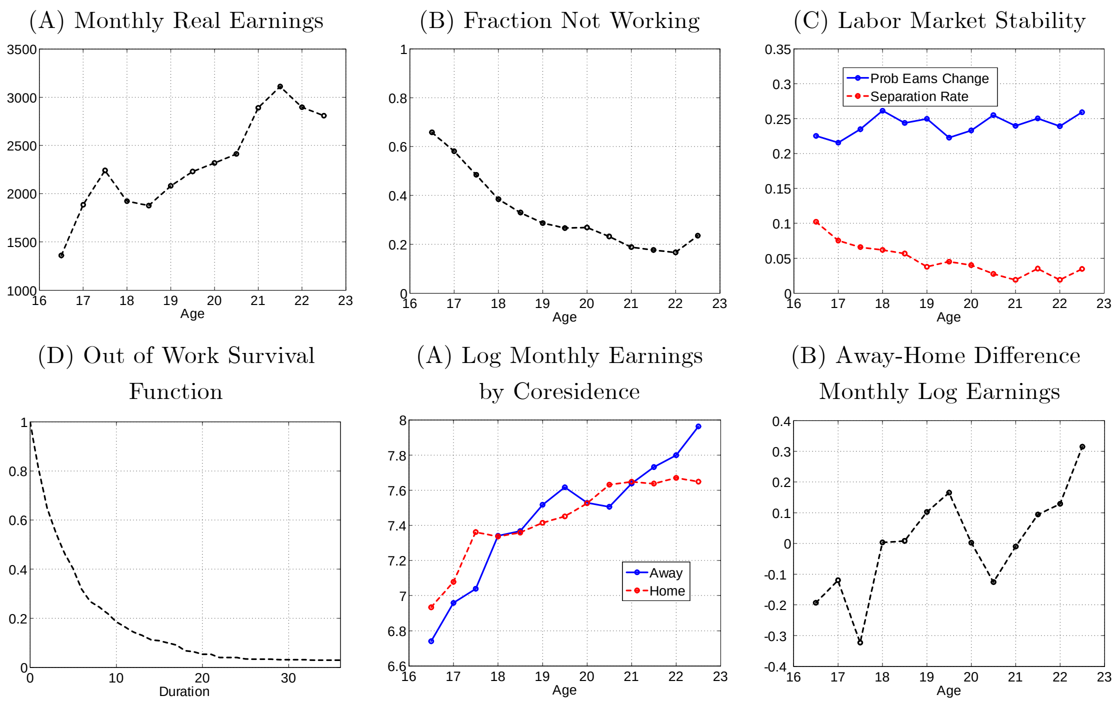

Figure 2: Labor market statistics from NLSY97

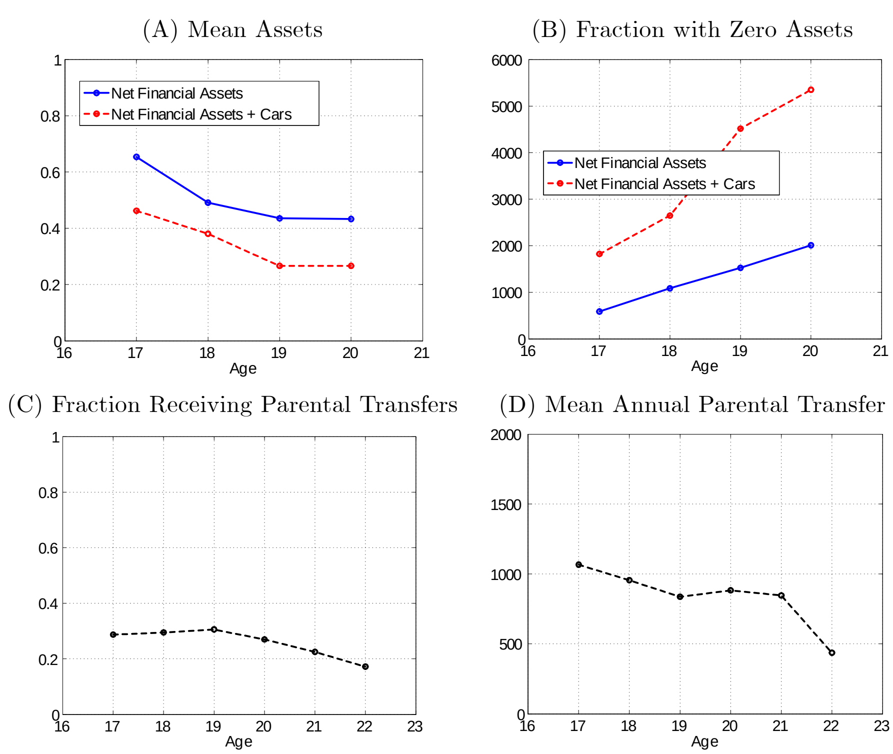

Figure 3: Asset and parental transfer statistics from NLSY97

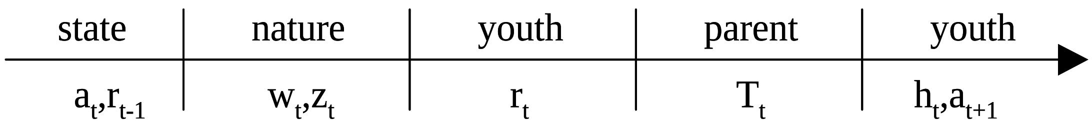

Figure 4: Sequence of the stage game

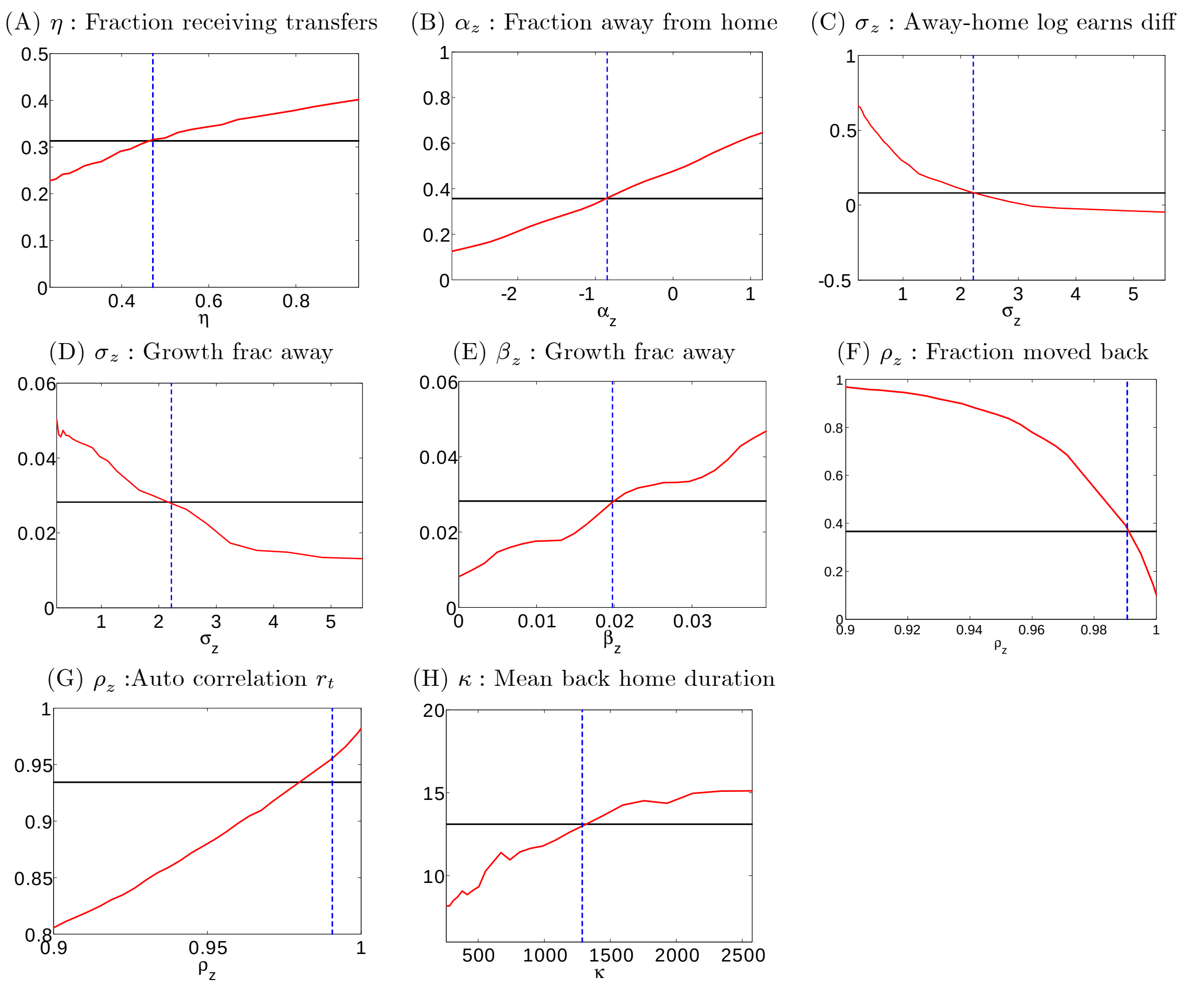

Figure 5: Relationship between selected moments and parameters at parameter estimates. Based on estimation with $\phi = 1$. Blue dashed line shows point estimate, black solid line shows data. Red line shows how a particular moment in the model deviates from the corresponding moment in the data, as the parameter is moved away from the point estimate.

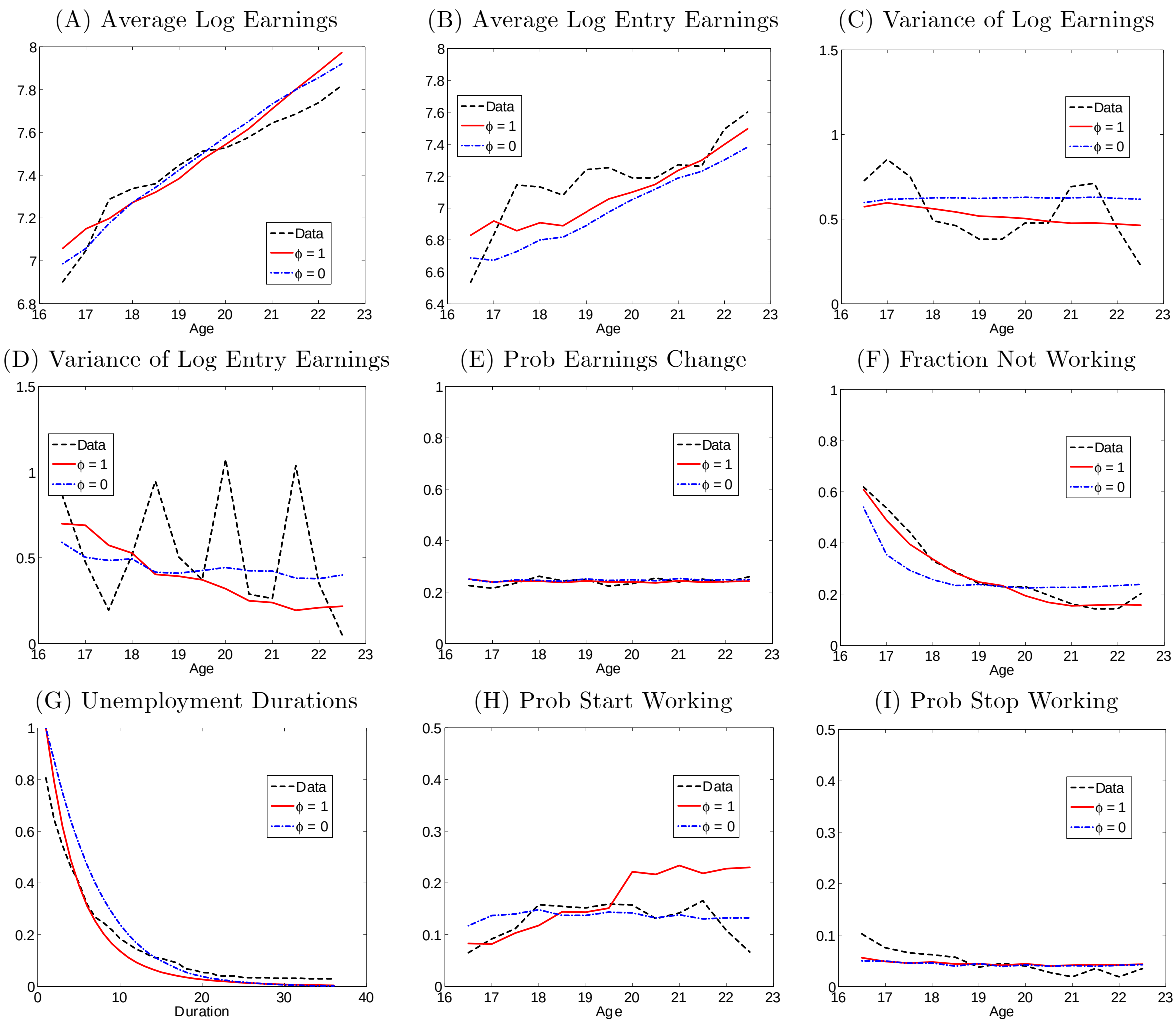

Figure 6: Benchmark model fit: Earnings distrbutions and dynamics

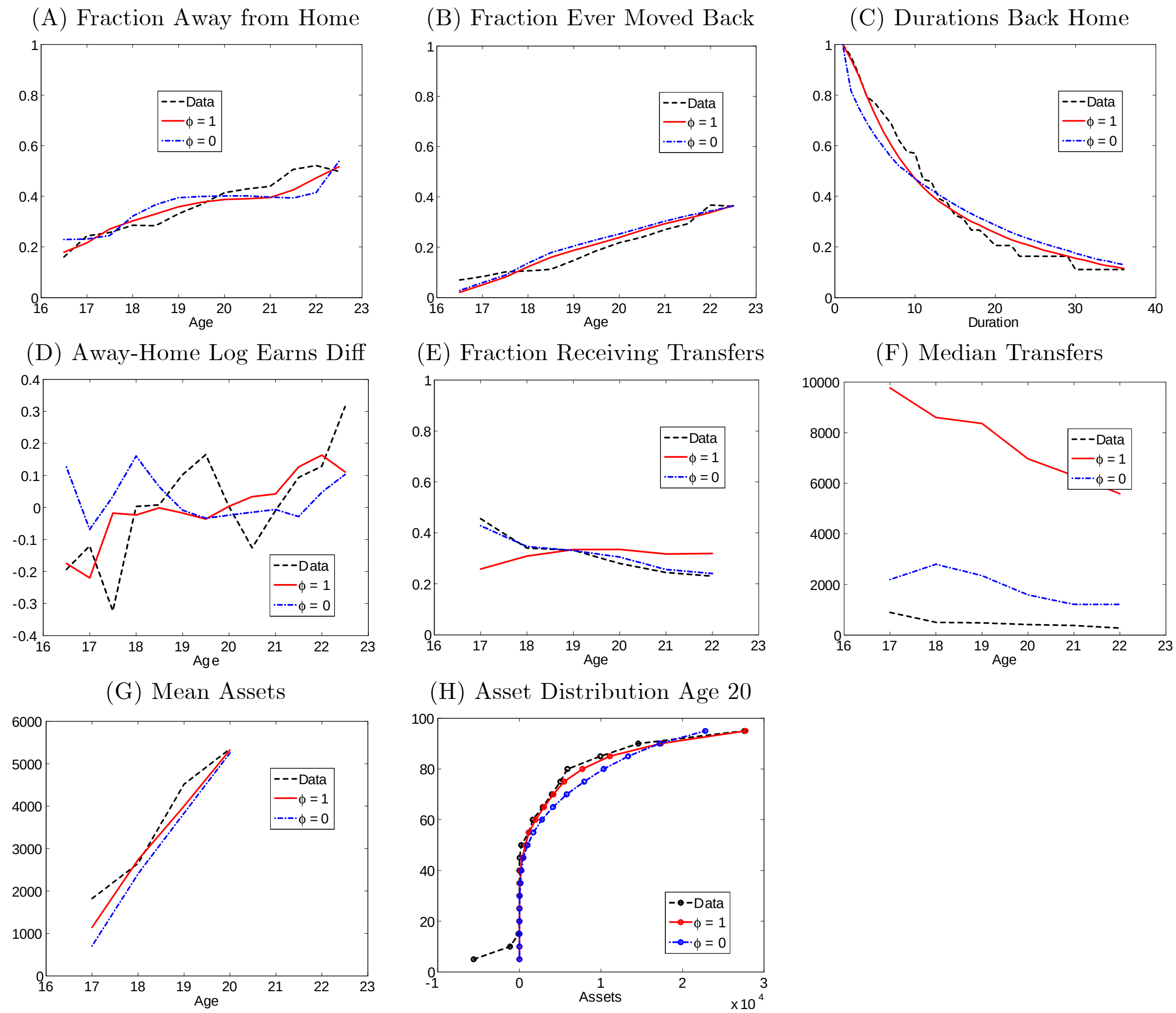

Figure 7: Benchmark model fit: Coresidence, transfers and assets

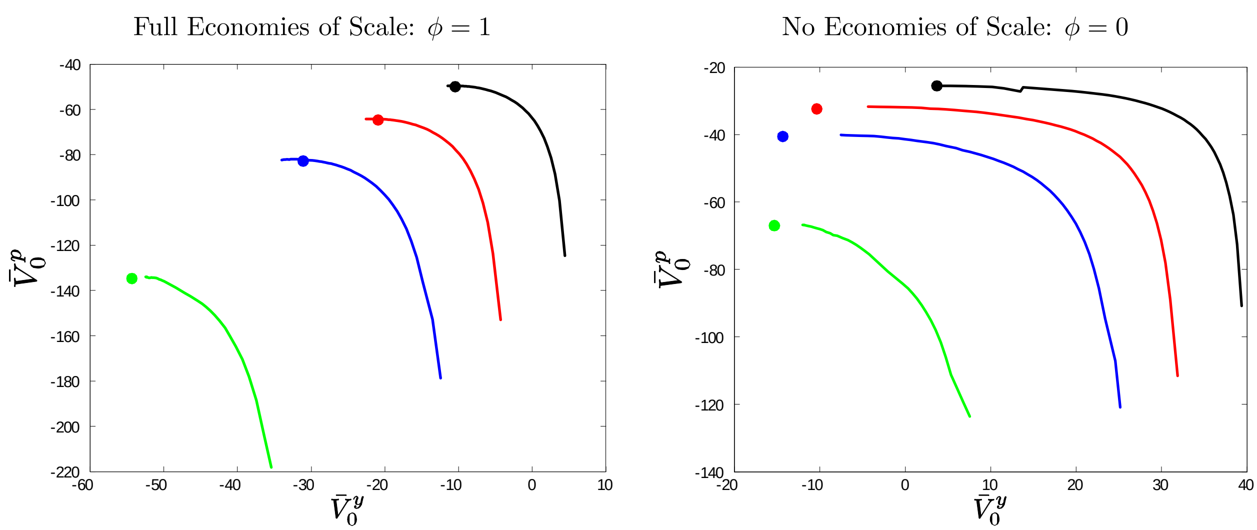

Figure 8: Pareto Frontiers for Each Quartile of the Parental Income Distribution

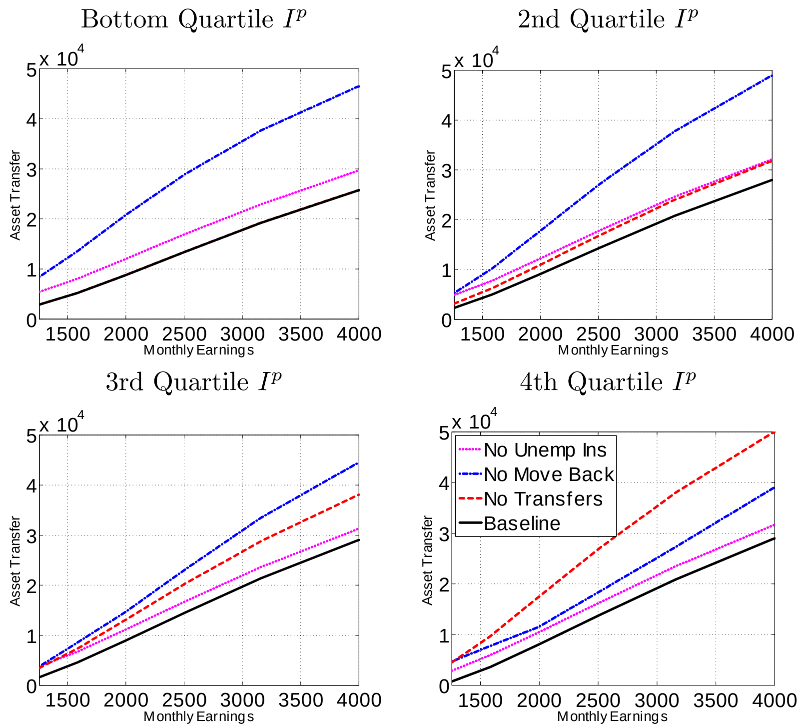

Figure 9: Cost of job loss in terms of compensating asset variation, by monthly earnings. Full economies of scale ($\phi = 1$)

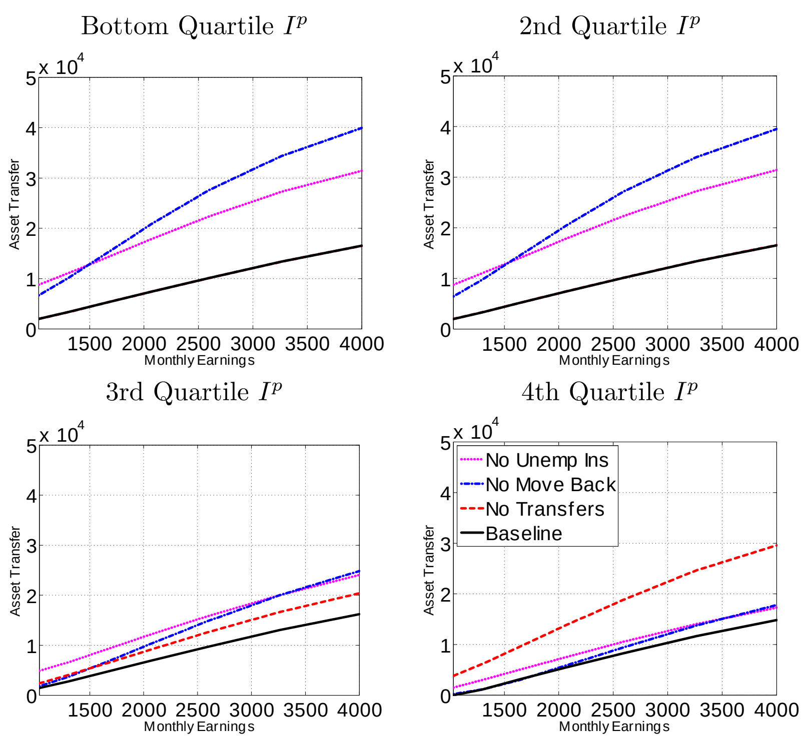

Figure 10: Cost of job loss in terms of compensating asset variation, by monthly earnings. No economies of scale ($\phi = 0$)

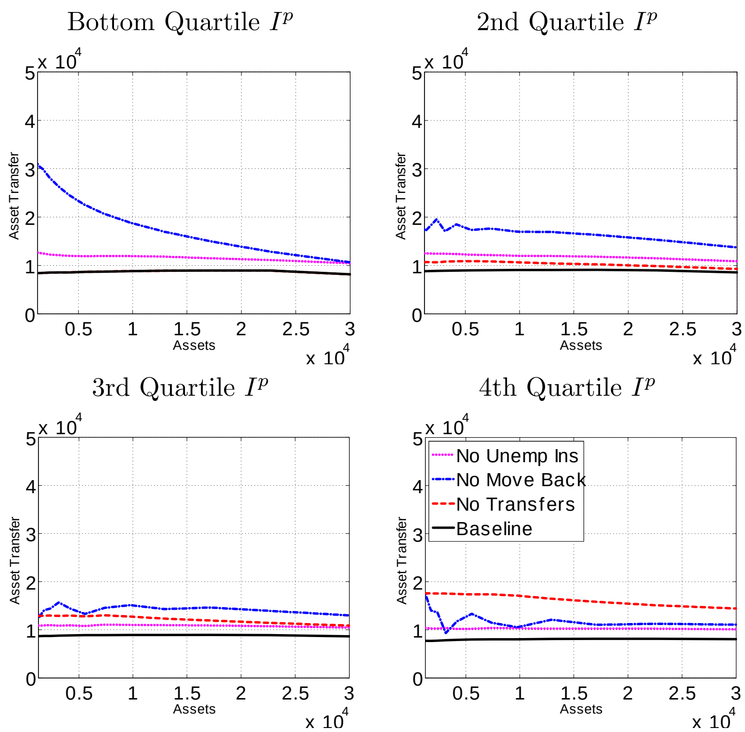

Figure 11: Cost of job loss in terms of compensating asset variation, by assets. Full economies of scale ($\phi = 1$)

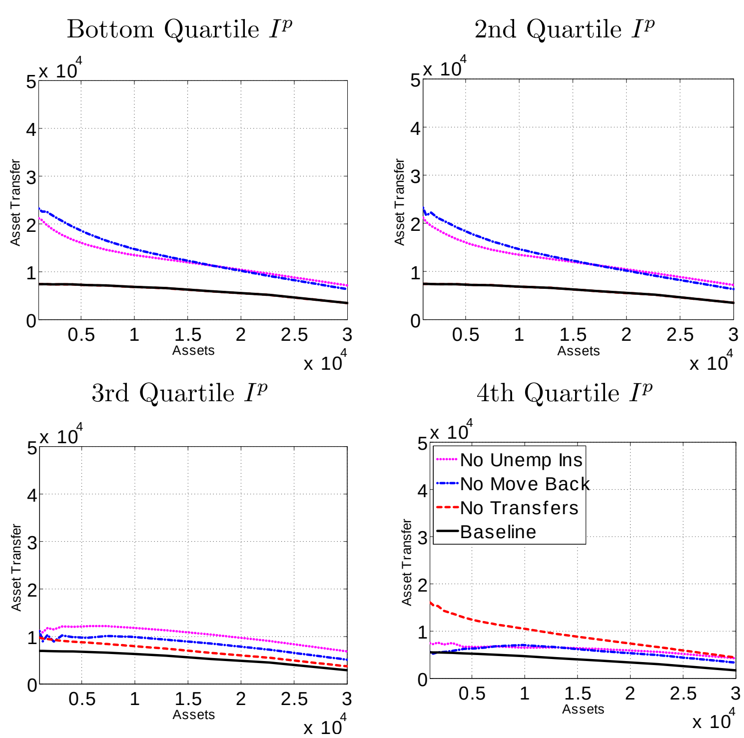

Figure 12: Cost of job loss in terms of compensating asset variation, by assets. No economies of scale ($\phi = 0$)

	Males	
	Lost	Remaining
Raw NLSY97		4599
Drop resp with only 1997 interview	76	4523
Drop resp who achieve more than high school	2826	1697
Drop resp who dropped out of college	89	1608
Drop resp who return to FT education in future	343	1265
Drop resp with missing coresidence data	205	1060
Drop resp who ever in military	50	1010
Drop resp with gaps in data	26	984
Drop resp who ever have all parents dead	8	976
Drop months at ages<16	0	976
Final Sample		976

Table 2: Number of respondents lost at each stage of sample selection

Individual-level Fixed Variables		**Monthly Variables**	
Number Observations	976	Number Observations	25526
White	0.74	Age	19.52
Black	0.16	Away	0.36
Hispanic	0.13	Married	0.03
Age First Observed	18.22	Cohabiting	0.16
Age Last Observed	20.37	Working	0.73
Highest Grade Completed	11.75	Monthly Earnings	2282
High School Graduate	0.86	**Annual Variables**	
Ever Away During Sample	0.53	Number Observations	2481
Ever Home During Sample	0.90	Has Child	0.18
Move Out During Sample	0.39	Number of Children	1.28
Move Back During Sample	0.22	Receive Transfer	0.31
Ever In Jail	0.07	Annual Transfer Amount	1031
Months in Sample	26.77	**Characteristics of Parents**	
		Number Observations	2481
		Number of Parents	2.21
		Average Age	44.66
		Biological Parents Married	0.42
		Total Parents Income	46005

Table 3: Sample summary statistics

	Prob Move Back Home (%)	Prob Move Out of Home (%)
Overall	3.0	2.9
Working	4.0	2.6
Not Working	2.6	3.0

Table 4: Monthly probability of a youth moving in and out of home, by labor market status

Predetermined States	a_t, r_{t-1}
Stochastic States	w_t, z_t
Youth Actions	r_t, h_t, c_t^y, a_{t+1}
Parent Actions	c_t^p, c_t^g, T_t

Table 5: States and actions for the non-cooperative game

Labor Market Moments	**Coresidence Moments**	**Other Moments**
mean, variance log earns	fraction away from home	fraction receiving transfers
mean, variance log entry earns	mean growth rate in fraction away	mean assets at age 20
av growth mean log earns	mean duration spells back home	
prob start work	fraction ever moved back	
prob stop work	auto-correlation coresidence	
prob earnings change	diff: mean log earns, home vs away	
mean log earns change		
fraction not working		

Table 6: Moments used In estimation

Parameter	**Description**	**Benchmark**
R	Annual interest rate	3%
γ	Coefficient of relative risk aversion	1.5
b	Unemployment benefit	\$500
$\underline{c}$	Consumption floor	\$200
χ	Monthly housing cost	\$650

Table 7: Parameters fixe outside the model

Parameter	**Description**	$\phi = 1$	$\phi = 0$
Labor Market Parameters			
δ	Job destruction probability	0.042 (0.003)	0.036 (0.004)
λ_0	Job offer probability (no working)	0.234 (0.052)	0.160 (0.016)
λ_1	New job offer probability	0.268 (0.010)	0.282 (0.005)
μ_0	Mean log wage offer distribution	1.898 (0.080)	3.513 (0.064)
σ_0	St dev log wage offer distribution	4.14 (0.156)	3.631 (0.054)
μ_d	Mean change log wage | new offer	0.057 (0.001)	0.043 (0.001)
σ_1	St dev change log wage | new offer	0.486 (0.077)	0.819 (0.009)
Preference Shocks			
α_z	Intercept for mean value of living away	−0.849 (0.546)	−7.062 (0.690)
β_z	Age slope for mean value of living away	0.020 (0.007)	0.103 (0.003)
σ_z^2	Variance of value of living away	4.921 (1.980)	99.2 (14.2)
ρ_z	Autocorrelation of value of living away	0.991 (0.005)	0.990 (0.005)
Other Parameters			
η	Altruism factor	0.472 (0.307)	0.073 (0.021)
v	Disutility of work	0.049 (0.011)	0.447 (0.103)
β	Monthly discount factor	0.985 (0.009)	0.967 (0.002)
κ	Fixed cost of moving out of home	\$1287 (1026)	\$37 (478)

Table 8: Parameters estimates, standard errors in parentheses

	Prob Move Back Home (%)			Prob Move Out of Home (%)		
	Data	$\phi = 1$	$\phi = 0$	Data	$\phi = 1$	$\phi = 0$
Overall	3.0	2.0	4.6	2.9	1.9	3.5
Working	4.0	3.7	5.6	2.6	1.2	3.4
Not Working	2.6	1.6	4.3	3.0	2.2	3.6
Difference	1.4	2.1	1.3	−0.4	−1.0	−0.2

Table 9: Monthly probability of moving in and out of home, by labor market status

	$\phi = 1$				$\phi = 0$			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Cost of Job Loss, ξ_t								
-Compensating asset transfer	\$8700	\$9000	\$8900	\$8000	\$7400	\$7400	\$6900	\$5400
-Number of months of earnings	4.4	4.5	4.6	4.0	3.6	3.6	3.3	2.6
Value of insurance channels, ω_t^I		(%)				(%)		
- option to move back home	137	96	64	43	180	175	49	8
- financial transfers	0.2	20	46	117	0.0	0.3	32	153
- unemployment insurance	37	35	25	30	141	141	76	38

Table 10: Cost of job loss and value of insurance for 21 year-old with median assets, earnings and preference for independence

	$\phi = 1$		$\phi = 0$	
	With UI (%)	No UI (%)	With UI (%)	No UI (%)
Benchmark	20	25	39	58
No coresidence	30	52	44	60
No transfers	12	16	41	64

Table 11: Average consumption drop in response to the loss of a job

	$\phi = 1$		$\phi = 0$	
	ε^o	ε^w	ε^o	ε^w
Benchmark:				
Overall	0.60	0.050	0.85	0.047
Home ($r_{j,t-1} = 0$)	0.50	0.078	0.84	0.058
Away ($r_{j,t-1} = 1$)	0.96	0.006	0.89	0.028
No coresidence ($r_{j,t-1} = 1$)	0.92	0.009	0.85	0.026
No transfers	0.61	0.051	0.88	0.033

Table 12: Implied labor supply elasticities