Living Arrangements and Labor Market Volatility of Young Workers*

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Abstract

Household size is countercyclical, mainly because of young people moving into or delaying departure from the parental home. Those living in older households earn less and have more volatile hours than their peers living alone. We pose a theory of household formation and labor choice over the business cycle. Young people decide where to live depending on their wage, taste for living within the old household, and implicit transfers received. Our theory accounts for the bulk of the contribution of the households size volatility to the volatility of the aggregate hours. Including people with varying living arrangements yields an implied aggregate, or macro, Frisch elasticity around 70 percent larger than the assumed micro elasticity.

Keywords: Business cycles; Household formation; Aggregate risk; Elasticity of labor supply

JEL Classification: **E32, J22**

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1 Introduction

In macroeconomics, households and agents have traditionally been considered as the same entity.[1] This is especially true in business cycle research.[2] In this paper, we document how household composition varies over the cycle: household size is countercyclical, with the bulk of the variation accounted for by young people moving in and out of multiperson households. Moreover, young people move into larger households during recessions and reduce their hours worked. We then construct a business cycle model where agents adjust their household size and work hours. We use this model to generate aggregate variation in total hours that is far more significant than the variation of hours in response to shocks resulting from representative agent models with the same preferences. In this sense, we provide a novel channel through which the macro-labor elasticity is larger than the micro-labor elasticity.

The first contribution of our paper is to provide new evidence on aggregate business cycle movements in household size, living arrangements, and labor outcomes of young adults. Using quarterly data from the Current Population Survey (CPS), we document significant cyclical fluctuations in the average size of U.S. households. During economic expansions, households shrink, while during recessions, households expand. To quantify the overall importance of these movements, we construct a new series for aggregate hours per household and compare it to traditional measures of hours per person. We find that hours per person are around 20 percent more volatile than hours per household, with the difference due to the variation in household size. A substantial fraction of this variation is due to the part of the population that we term *unstable*: people whose household structure is most likely to vary over the business cycle. We identify groups of people that move in and out of households frequently and use these to partition the population into those that live in stable households and those that do not. Our analysis considers three such groups: people under 30, people who have never been married, and people who are both under 30 and have never been married. In addition to having significant volatility in household size, we show that these people work more hours when living alone than when living with other, more stable people, and have higher volatility of hours worked. Also, when living alone, they earn more and have similar volatility of wages relative to their peers living within households headed by stable people.

For at least two reasons, it is essential to recognize that living arrangements change with the business cycle and to incorporate these movements into macro models. First, despite labor market inputs being measured at the level of the individual, consumption is almost always measured at the household level. This reflects that for most of the population, spending decisions are made in the context of shared living arrangements, which in turn reflects the presence of economies of scale within households. Thus, the distinction between individuals and households is potentially

[1] In labor economics, much work treats them separately.

[2] Cubeddu and Ríos-Rull (2003) uses a growth model treating family composition as a shock while Aiyagari, Greenwood, and Güner (2000), Greenwood, Güner, and Knowles (2003), and Regalia, Ríos-Rull, and Short (2013) study the evolution of family arrangements. None of this work deals with business cycles.

crucial for analyzing the welfare costs of business cycles (and the welfare implications of policies that affect the cycle). This is true because, as we document, the relationship between persons and households features significant business cycle variation. However, almost no quantitative business cycle models make this distinction. Second, a growing literature has recognized that the labor supply decisions of individuals also reflect the opportunities and preferences of the people they live with.[3] Hence, changes in living arrangements can be significant for labor market variables, even at the individual level.

Our second contribution in this paper is to provide a joint quantitative theory of living arrangements and labor market outcomes over the business cycle. We develop a real business cycle (RBC) model with two types of individuals: stable (old) and unstable (young). The young, besides making labor supply decisions, choose whether to live with a stable (old) person or independently. We model the old household as a representative entity that the young agents can join. On the production side, we incorporate a technology that features complementarity between the labor input of the old and capital. However, from a production perspective, young individuals with different living arrangements are perfect substitutes.[4] A young person living within an old household receives an implicit consumption transfer in addition to their labor income but incurs a utility cost for shared living arrangements. This cost varies among young individuals in our model. A young person living alone relies solely on their market labor income to finance consumption. Thus, deciding where to live involves a trade-off between additional consumption and the cost of shared living arrangements. Besides utility cost differences, young individuals in the model differ in labor productivity. This heterogeneity leads to an *endogenous selection pattern* in living arrangements. Young people are indexed by both their productivity and their aversion to living with the old. Consequently, the less productive young individuals tend to live more frequently with the old despite high utility costs, while the more productive individuals live alone more often, even if they face lower disutility from living with older people.

This selection pattern is affected by the business cycle. In a recession, the marginal, less productive young people living alone and facing adverse labor market conditions move in with the old to benefit from the additional insurance associated with implicit consumption transfers. The opposite is true in an expansion, where the marginal, more productive young people living with the old who face improving labor market conditions move out to live alone and avoid the burden of utility costs. This mechanism leads to endogenous, countercyclical household size variation in the model, consistent with the empirical regularities we document in the data. Selection patterns also generate labor market outcomes for young adults that align with the empirical evidence we provide. Young people living with the old work less and earn less than their peers living alone, as they are, on average, less productive and receive implicit transfers from the old. In the face of limited intertemporal insurance opportunities for young people, these transfers lead to *endogenous* differences in Marshallian labor supply elasticities across living arrangements. A Mar-

[3]See for instance Guler, Guvenen, and Violante (2012).

[4]As demonstrated by Jaimovich, Pruitt, and Siu (2012), imperfect substitutability between the labor inputs of young and old is necessary to account for the asymmetric volatilities of hours and wages of young and old agents in the standard RBC model.

shallian, rather than Frisch, elasticity of labor supply determines the responses of hours worked by the young in our model, and it is higher for the young living with the old than for their peers living alone. Thus, our theory is consistent with empirical evidence on asymmetric labor supply responses to aggregate economic conditions along the living arrangement margin.

We discipline our quantitative model with sets of first and second moments related to labor supply and living arrangements of both stable and unstable people. The model matches the critical first moments well, including the fraction of young people living with the old and the average hours and wages across living arrangements. Notably, in addition to the first moments, we also target the volatility of hours for the unstable living alone, the volatility of hours for the unstable living in stable households, and the volatility of the fraction of unstable people living alone, *all relative to the volatility of hours worked by stable households.* It is crucial to understand the importance of targeting these volatilities relative to the hours' volatility of the stable group rather than their absolute magnitudes. This approach ensures that technology shocks, the unique and rather conventional source of fluctuations in our economy, do not account for more variance in the hours of the unstable than they do for the hours of the stable. Finally, we restrict stable people to have labor elasticity within the range measured by microeconomists. Our quantitative analysis yields several findings based on the calibrated model economy. First, the model accounts for around 85 percent of the contribution of household size variations to the volatility of total hours worked over the business cycle. Using model-generated data, we conduct identical decomposition as in the CPS data and find that the contribution of the movements in households per person (inverse of household size) to the hours per person volatility is 16 percent, compared to 19 percent in the data. Second, we quantify, through the lens of the model, the size of implicit transfers that the young living with the old receive. These transfers are not directly measurable in the data; thus, our inference relies on a well-specified and suitably disciplined model economy. By any measure used, these transfers are substantial. They account for around 12 percent of the consumption of the old household or 66 percent of the market consumption of the young individual living within the old household. Third, we quantify the wedge between Marshallian labor supply elasticities of young people living alone and within the old household. This elasticity for young adults living independently is equal to 0.36 under our baseline calibration, while for the young living with the old, it is 0.51, thus more than 40 percent higher.

The quantitative relevance of household size volatility holds important implications for measuring the macro-labor supply elasticity. To illustrate this point, we examine the volatility of total hours in the model and recover the implicit labor elasticity that a standard representative agent model with only stable people would need to replicate this volatility of hours worked. The required Frisch elasticity of the stand-in household is 71.6 percent higher than the micro estimates. The measurement of the aggregate, or macro, elasticity that we provide is consistent with micro estimates yet yields a much higher value. The rationale is that, due to available microdata, micro estimates of the Frisch elasticity tend to be based on the behavior of people who live in what we call *stable* households: people whose living arrangements do not change much over time. This usually means focusing on married people or people above a certain age. However, the labor force consists of many other people living in less stable households. Such people, including the young and the single, frequently change whom they live with: sometimes alone, sometimes with a partner, often with their parents. These movements are, in part, a response to changes in individual and aggregate labor market conditions, and thus, they contribute to the overall volatility of hours worked. We systematically measure this contribution and argue that the resulting macro-labor elasticity is substantially higher.

To further understand this higher volatility of hours worked, we decompose it into the explicit incorporation of agents that have a higher elasticity and, because they often change circumstances, have more volatile hours. Of the 71.6 percent higher implied Frisch elasticity, this inclusion accounts for 41.8 percentage points (p.p.). Explicitly recognizing that half of them co-reside, which both reduces their average hours and increases their volatility, implies a further increase of the implied Frisch elasticity to 67.0 percent. The remaining 4.6 p.p. is due purely to the movements in household size. Consequently, the key issue from including co-residence in the analysis is the increase in volatility associated with the people involved in co-residence changes and the fact that, while co-residing, their volatility is larger. If we were to impute the young volatile agents with the same curvature in the utility term of hours worked as the old (but recalibrating the curvature in consumption according to the logic of the baseline economy), we obtain a Frisch elasticity 56.4 percent higher than that of the standard representative agent economy. These calculations provide a characterization of the explicit mechanisms to make the case for the difference in the Frisch elasticity of people (the micro elasticity) and that of the economy as a whole (the macro elasticity), as raised by Prescott (2006) and Attanasio, Levell, Low, and Sanchez-Marcos (2018).

Macroeconomists often argue that the Frisch elasticity of labor supply is more significant than what microeconomists have measured (see Chetty, Guren, Manoli, and Weber (2011a), Ljungqvist and Sargent (2011), Keane and Rogerson (2012), Keane (2011), Blundell, Bozio, and Laroque (2011) for discussions of this issue) and sometimes insist that the elasticity of the stand-in household can be larger than that of any real household (see Prescott (2006), Erosa, Fuster, and Kambourov (2016), and Attanasio et al. (2018)). While microeconomists' arguments are based on measurements of this elasticity using data on the labor supply choices of actual people, the rationale for macroeconomists preferring a larger elasticity needs to be clarified. Macroeconomists' arguments are implicitly based on the desire to account for aggregate movements in hours worked through price movements. A more explicit or empirical argument for preferring a larger elasticity is based on criticisms of how microeconomists have performed their measurements. These criticisms suggest that the micro measurements miss margins relevant to an aggregate economy's behavior. Some of these criticisms, such as movements in the extensive margin, the existence of more volatile secondary earners in the family, and explicit consideration of lifetime labor supply, have been accounted for by microeconomists in recent work and have contributed to increasing the microeconomic assessment of the labor elasticity. However, the gap between the two views remains large. This paper aims to narrow it by highlighting a novel and quantitatively important channel of varying living arrangements. Our analysis fits into the argument that the heterogeneity at the micro level means that the aggregate labor supply elasticity is not a structural parameter: the aggregate elasticity is a function of the underlying demographic structure, living arrangements, and phase of the business cycle. Attanasio et al. (2018) raise similar points convincingly.

Related Literature

Lee and Painter (2013) documented that household formation is procyclical. They used PSID data, with its detailed record-keeping of family structures, and linked it with measures of the business cycle. Ermisch and Salvo (1997) found some effect of regional unemployment rates on young people living at home.

Clark and Summers (1981) first noted that labor volatility is high for young workers. Kydland (1984), Ríos-Rull (1992), Ríos-Rull (1993), Ríos-Rull (1996), and Gomme, Rogerson, Rupert, and Wright (2005) also documented differences in labor volatility by age or skill groups. They posed models with age or skill variation to explore the business cycle implications of these economies and the possible sources of the variation in volatility. More recently, Jaimovich and Siu (2009) exploited the higher volatility of the young to argue that the Great Moderation (the reduction in economic volatility between 1984 and 2007) was due in part (between one-fifth and one-third) to demographic change that reduced the share of young people in the G7 economies. These papers, and, to our knowledge, all existing studies of the business cycle, assume that household size is constant.[5]

Jaimovich et al. (2012) explore the role of imperfect substitution in production between young and old workers to account for the higher volatility of the young. They astutely argue that the relative volatility of wages between young and old workers points to an explanation based on differences in technology rather than preferences. In our paper, the focus is not on explaining the labor market volatility of young workers, but on the interaction between their living arrangements and hours fluctuations. Yet, the evidence on the relative movements of wages for the two groups points to (under perfect competition) a technology where both types of labor are not perfect substitutes. We find that the strategy followed by that paper, where the young have lower Frisch elasticity than the old, is not a good one to understand the relative behavior of both types of labor.[6] In our paper, the strategy of targeting the same fraction of the volatility of the young, both living alone and living with others, and of the co-residence accounted by the model as that accounted for by the volatility of hours of the old, yields higher labor elasticity for the young and a much higher macro elasticity (the elasticity of a representative agent model needed to replicate the movements in aggregate hours generated by our model).

Kaplan (2012) also studies the relationship between the labor market and the tendency for the young to move in with the old in response to labor market outcomes. He estimates a dynamic game between youths and their parents to understand the structural microeconomic relationship between changes in living arrangements and labor supply. In this paper, we model this interaction in a much simpler way to build a model that is amenable to equilibrium business cycle analysis with aggregate technology shocks.

[5]There are, of course, many papers about household formation outside of a business cycle context.

[6]Jaimovich et al. (2012) choose a Frisch elasticity for the old to match a large volatility of hours in response to productivity shocks. When they do that, to replicate the relative volatility of wages in the data, a lower Frisch for the young is needed.

Ozkan, Song, and Karahan (2023) demonstrate that the risk of unemployment declines significantly over the life cycle, although this decline is less pronounced for workers in the bottom quartile of the lifetime earnings distribution. Thus, they propose an alternative concept of "unstable" individuals. Our definition concentrates on the instability of living arrangements and its close relation to age, whereas their definition is based on an individual's relative position within the distribution of lifetime earnings.

The paper is organized as follows. Section 2 documents the business cycle properties of household composition and labor market variables. Section 3 introduces a business cycle model featuring two types of agents, old and young, with the latter moving in and out of the formers' households. Section 4 details the calibration of model parameters. Our findings for the baseline economy are discussed in Section 5. Section 6 introduces alternative calibrations of our economy. Section 7 examines the implications of our quantitative theory for macro-labor supply elasticity. Section 8 provides the concluding remarks.

2 Living Arrangements and Labor Market Variables over the Business Cycle

In this section, we show that living arrangements are varied and volatile. Living arrangements are varied in the sense that there is substantial cross-sectional heterogeneity in household structure, both in terms of household size and the relationships between the individuals in a given household. Living arrangements are volatile in the sense that the set of people that make up a household changes over time, in a way that is correlated with business cycles.

The extent of this variability and volatility differs across sub-groups of individuals. For prime-age married couples, living arrangements are relatively homogeneous and constant over time; hence we refer to these individuals as stable. For other sub-groups, such as younger unmarried individuals, living arrangements are heterogeneous and cyclical; hence we refer to these individuals as unstable. We show that unstable individuals are also the group whose labor market outcomes (employment, hours, and wages) vary most over the business cycle, and that the labor market outcomes of unstable individuals differ depending on their living arrangements. These findings suggest that the household structure within which any individual lives is an important factor in understanding their hours, employment, and wages.

Much, but not all, of the variability and volatility in living arrangements can be attributed to parental co-residence for young people, or more generally, unstable individuals moving in and out of the homes of stable individuals. We also document facts about the cyclicality of this form of co-residence alongside household composition more generally. These facts about co-residence form the basis of our calibration targets for our structural model.

2.1 Data

We use data from the Basic Monthly Surveys from the Current Population Survey (CPS) to measure hours, employment, and living arrangements. The CPS is an ideal data set for measuring aggregate movements in household composition at business cycle frequencies because it contains data on hours and employment of all individuals in a given household. Our monthly data cover a large cross section of individuals from 1979 to 2022, which we use to construct de-seasonalized (with X-12-ARIMA) quarterly series from 1979:Q1 to 2022:Q4. For data on wages and earnings, we use the Annual Social and Economic Supplement to the CPS, commonly known as the March CPS. Since earnings data are not available in the monthly surveys, we are restricted to computing wage and earnings statistics at an annual frequency.

We define a household in the same way that the CPS defines a household: as the set of all persons occupying a dwelling unit. A dwelling unit is defined as "a room or group of rooms intended for occupation as separate living quarters and having either a separate entrance or complete cooking facilities for the exclusive use of occupants." The empirical definition in the CPS closely aligns with the conceptual definition of a household as a set of people who benefit from economies of scale in consumption.

Because we use cross-sectional samples from the CPS, we cannot discuss the notion of who moves in with whom when household composition changes. We can only observe the other people that an individual is living with, not the physical structure in which he or she is living. To know who physically does the moving, we would need panel data. However, large enough panel data with the required information on living arrangements and labor market outcomes are not available for the United States.

2.2 Household Composition: Variation in the Cross-Section

In the first column of Table 1, we illustrate the distinction between an individual and a household by reporting statistics on the distribution of household size for the population of adults aged 18 and over. On average, adults in the United States live in households with 1.27 other people. Thus, although it may seem trivial, the distinction between an individual and a household is significant. Moreover, this average household size masks substantial heterogeneity across individuals in the number of other people with whom they live. Column 1 of Table 1 reports a breakdown of this distribution: 17% of adults live alone, 55% live with one other person, 17% live with two other people, and 11% live with three or more other people. We will demonstrate that this variation in living arrangements is intimately related to labor market outcomes both in the cross-section and over the business cycle. There is more cross-sectional heterogeneity in living arrangements for some sub-groups than for others. The remaining columns of Table 1 report the distribution of household size for individuals of different ages and marital status. Young people (who we define as those aged 18 to 30) and individuals who have never been married live with more people on average than older people (aged 31 and over) and married individuals. Within these groups, there is also a greater diversity of living arrangements. For example, 18 to 30 year-olds live in households with 1.59 other people on average, with a standard deviation of 9%, compared with 31 to 65 year-olds, who live in households with 1.22 other people on average, with a standard deviation of 4%.

Table 1: Variation and volatility in household composition

	Age				**Marital status**	
	18+	**18-30**	**31-65**	**65+**	**Never married**	**married**
av hh size	2.27	2.59	2.22	1.90	2.58	2.22
frac alone	0.17	0.12	0.15	0.31	0.22	0.11
frac 1 other	0.55	0.46	0.59	0.55	0.29	0.65
frac 2 other	0.17	0.23	0.17	0.10	0.27	0.16
frac 3 or more other	0.11	0.20	0.09	0.04	0.22	0.08
st dev hh size	0.04	0.09	0.04	0.03	0.11	0.03
cyclical st dev hh size	0.63%	0.93%	0.52%	0.48%	1.05%	0.51%
cyclical corr with total hours 18+	-0.62	-0.63	-0.58	-0.32	-0.58	-0.61

Notes: The table reports variation and volatility in household composition across different age groups (18+, 18-30, 31-65, and 65+) and different marital status (never married, married). The first row (av hh size) presents average household size. The second row reports (frac alone) fraction of individuals across groups who live alone, the third row (frac 1 other) reports fraction of individuals across groups who live with one other person, the fourth row (frac 2 other) reports the fraction of individuals across groups who live with two other people, the fifth row (frac 3 or more other) reports the fraction of individuals across groups who live with three or more people. The sixth row presents standard deviation of household size (st dev hh size). The last two rows report cyclical standard deviation of the household size and its correlation with total hours.

These statistics suggest that drawing a distinction between an individual and the household in which he or she lives is more important for some demographic groups than others. The evidence that follows demonstrates a pattern in who these individuals are: the same groups of people that exhibit the most diversity in living arrangements in the cross-section are also those with the most volatile living arrangements over the business cycle and the most volatile labor market outcomes (hours, employment, and wages) over the business cycle. Anticipating these findings, we will use the label stable to refer to groups of individuals with homogeneous and relatively constant living arrangements (and labor market outcomes), and the label unstable to refer to groups of individuals with diverse and volatile living arrangements (and labor market outcomes).

We propose three definitions of the stable/unstable distinction that partition the set of individuals aged 18 to 65 in different ways. These definitions, which are shown in Table 2, reflect how we will calibrate our model in Section 4. Definition 1 is based purely on age. According to Definition 1, unstable individuals are those aged 18 to 30, and stable individuals are those aged 31 to 65. Since this is our baseline definition, we will frequently refer to the unstable as young and the stable as old. Definition 2 is based purely on marital status. According to Definition 2, unstable individuals are those aged 18 to 65 who have never been married, and stable individuals are all other individuals aged 18 to 65. Definition 3 is the intersection of these two definitions: according to Definition 3, unstable individuals are those aged 18 to 30 who have never been married, and stable individuals are all other individuals aged 18 to 65. All three definitions of the unstable individuals include students.

Table 2 reports the fraction of unstable individuals amongst all adults aged 18 to 65 according to the three definitions: 31%, 28%, and 19%, respectively. Much of the relevant cross-sectional variation in the living arrangements of the unstable is reflected by whether they live in a household that contains a stable individual (not living with a stable individual may entail either living alone or living with other unstable individuals). Table 2 shows that the fraction of unstable individuals who live with a stable individual is 52%, 50%, and 66% for the three definitions, respectively. Thus, most of the cross-sectional diversity in living arrangements for unstable individuals is captured by only an indicator for living in the home of a stable individual. With a slight abuse of language, we will use the adjective "together" to describe an unstable person who lives with a stable person, the adjective "apart" to describe one who does not, and the label co-residence to describe the state in which an unstable person lives with a stable one.

Table 2: Variation and volatility in household composition

	Definitions of Unstable		
	Aged 18-30	**Never Married**	**Aged 18-30** & **Never married**
frac unstable	0.31	0.28	0.19
frac unstable live old	0.52	0.50	0.66
st dev live together	1.72%	1.57%	1.39%
corr with hours 18-65	-0.73	-0.62	-0.71

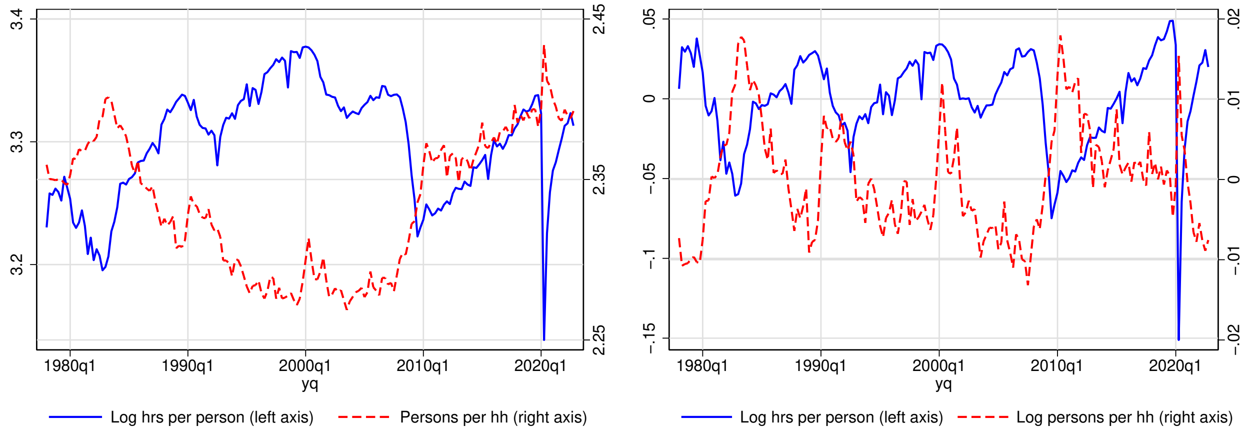
Notes: The table presents statistics on variation and volatility in household composition across various definitions of the young (unstable) people. The first row (frac unstable) reports a fraction of unstable individuals in the population. The second row (frac unstable live old) reports the fraction of unstable individuals living within the old household. The third row (st dev live together) reports the standard deviation of the fraction of unstable individuals living with the old. The fourth row reports correlation of the unstable fraction with hours worked for 18-65 population.

2.3 Cyclical Volatility of Household Composition

Living arrangements are not only varied, but they are also cyclically volatile, particularly for unstable individuals. We demonstrate this first for average household size in the total adult population, and then for co-residence of the unstable.

Figure 1a plots the raw time series for average household size and average hours worked per person aged 18 and over.[7] The plots show a clear negative correlation between the two series:

[7] For consistency with the statistics in Table 1, average household size is computed as the average across individuals



(a) Raw time series

(b) HP-filtered series

Figure 1: Persons per household, hours per person

Notes: All people 18 years and over. Households with no people aged 18 years and over included. Quarterly data, 1979:Q1-2022:Q4, authors' calculations from Basic Monthly CPS. Deseasonalized with X-12-ARIMA. HP-filtered 100,000.

overall, this correlation is -0.71. The correlation between the two series is exacerbated at business cycle frequencies. There is a sharp increase in household size in the 1981, 2008, and 2020 recessions, and a smaller increase in the milder recessions of 1990 and 2001. Figure 1b plots the corresponding HP-filtered series. The plot shows a significant negative correlation (-0.62) that is also exacerbated during the two large recessions.

The cyclical volatility of household size is more pronounced for unstable individuals. The bottom two rows of Table 1 report the standard deviation of HP-filtered log household size and its correlation with average hours worked for the entire adult population and for sub-groups defined by age and marital status. The differences in volatility are large: for example, the time-series standard deviation of HP-filtered log household size is almost twice as large for individuals aged 18 to 30 as it is for individuals aged 31 to 65.

Table 2 shows that the co-residence rate (i.e., the fraction of unstable people living with a stable person) is volatile and counter-cyclical for each of the three definitions. For the baseline definition based on age, the standard deviation of the HP-filtered log co-residence rate for young people is 1.72%. Its correlation with average hours worked of 18 to 65 year-olds is -0.7.

of the number of people in the household that they live in. Computing average household size as the total number of households divided by the total number of people aged 18 and over yields very similar results.

2.4 Household composition and the labor market

It is well established that younger and single individuals have more volatile hours and employment than older and married individuals (Kydland (1984), Ríos-Rull (1996), Gomme et al. (2005), Jaimovich and Siu (2009)). Jaimovich et al. (2012) show that, in addition, the wages of younger individuals are more volatile than the wages of older individuals. It is also well known that average wages and hours are both lower for younger individuals.

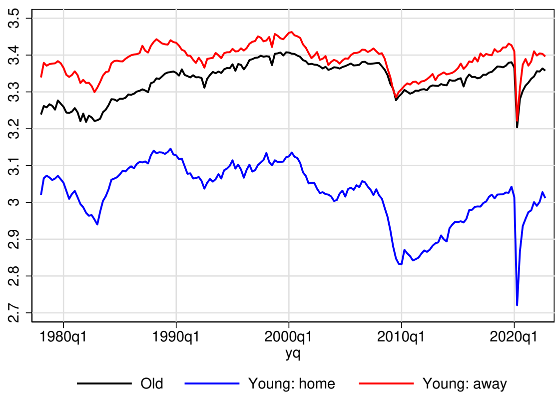
All of these features of the data are inherited by our three definitions of stable and unstable people. Table 3 reports average hours and wages, and the variance of HP-filtered log wages and log hours for the unstable (young), all expressed relative to the corresponding statistics for the stable (old). The differences are large. For example, according to the first definition, hours volatility is nearly three times larger and wage volatility is 1.4 times larger for the young than for the old.

This simple fact, that the young have more volatile hours and wages than the old, is the focus of Jaimovich et al. (2012). They show that by augmenting a representative agent business cycle model with young people who are imperfect substitutes for old people in production, they can generate both larger hours volatility and larger wage volatility for the young, and thus higher overall hours volatility than in a model that excludes young people. However, this existing literature has overlooked an important aspect of the differences in labor market volatility between young and old people: young people themselves exhibit very different labor market volatility depending on who they live with.

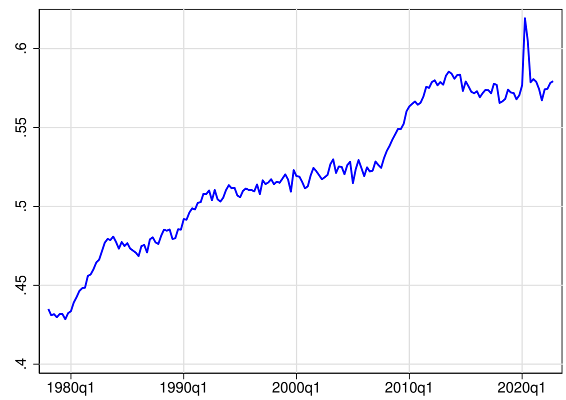
Table 3 demonstrates the importance of distinguishing young people by their living arrangements by reporting analogous labor market statistics separately for the unstable living apart from stable individuals and the unstable living together with a stable individual. These statistics show that young people who live apart from old people have average hours and wages, and hours volatility, that is much more similar to old people than the young people who live together with the old people. Most importantly, for the young living together, HP-filtered log hours is over 4.3 times more volatile than for the old, while it is only 1.6 times more volatile than the old for the young living apart. Similarly, average hours of the young living together are 0.74 of average hours of the old, while average hours of the young living apart are actually higher than average hours of the old. Thus, the observed labor market differences between unstable and stable individuals, which have been the focus of the existing literature, are actually less about whether people are young and single, and more about whether or not they live inside the homes of old or married people.

Figure 2a illustrates this distinction by plotting the raw time series for the three groups, according to definition 1: individuals aged 31-65, and individuals aged 18-30 living apart and together. Figure 2b plots the raw time series for the fraction of young living with the old. Figure 2c plots the HP filtered log hours and log of fraction of young living with the old. The two series are clearly negatively correlated.

This distinction is important because, while it is relatively simple to observe in panel data sets



(a) Log mean hours worked



(b) Fraction of young living with old

(c) HP-filtered series

Figure 2: Hours worked and fraction young living with old

Notes: Individuals aged 18-65 years. Young are aged 18-30, old are aged 31-65. Quarterly data, 1979:Q1-2022:Q4, authors' calculations from Basic Monthly CPS. Deseasonalized with X-12-ARIMA. HP-filtered 100,000.

Table 3: Household composition and the labor market

		Definitions of Unstable		
		Aged 18-30	**Never Married**	**Aged 18-30** & **Never married**
Av Hours	all unstable	0.89	0.88	0.83
	unstable, apart	1.06	1.01	1.06
	unstable, together	0.74	0.74	0.72
Av Wages (annual data)	all unstable	0.56	0.61	0.50
	unstable, apart	0.72	0.82	0.71
	unstable, together	0.41	0.41	0.38
Var log hours	all unstable	2.98	3.11	3.74
	unstable, apart	1.63	1.87	1.74
	unstable, together	4.34	4.95	4.96
Var log wages (annual data)	all unstable	1.42	1.42	1.52
	unstable, apart	1.55	1.48	1.77
	unstable, together	1.54	1.51	1.78
fraction due to mov. in x		15%	7%	13%

Notes: All number are reported relative to the stable population. The table reports average hours (Av Hours), average wages (Av Wages), variance of log of hours (Var log hours) and variance of log of wages (Var log wages) for three groups: (i) all unstable; (ii) unstable, apart; (iii) unstable, together. These statistics are reported in consecutive columns for three definitions of unstable individuals: (i) aged 18-30; (ii) never married; (iii) aged 18-30 & never married. The last row reports (fraction due to mov. in x) the contribution of the coresidence channel to the overall variance of the hours of the unstable as defined in equation 1.

(such as the PSID) the labor market outcomes of young and single people when they are living apart from stable people, it is much more difficult to observe their labor market outcomes when they are living inside the homes of stable people. As a result, almost all existing empirical studies that measure labor elasticities do not include the unstable living together as part of their sample. Yet this is precisely the group that differs the most from the old. Thus, we believe that in order to augment a representative agent business cycle model to capture the high hours volatility of the young, it is crucial to model their living arrangements, particularly their co-residence with the old.

There are two channels through which allowing for variation in living arrangements among the unstable group helps to replicate their high hours volatility. Both channels are important empirically, and both will be active in our model. The first channel arises because the hours volatility of the unstable together as a group is larger than the hours volatility of the unstable apart as a group. For Definition 1, Table 3 shows this difference to be a factor of 2.98. Thus, even if living arrangements were constant over the business cycle, the mere fact that there is cross-sectional variation in living arrangements (captured by the inclusion of the young together) yields an increase in overall hours volatility of the unstable. In our model, this additional volatility will arise because of shared consumption inside the homes of the unstable. Since young people have very little liquid wealth available to smooth consumption, their hours fluctuations are governed by income rather than substitution effects, and it is their Marshallian, rather than Frisch, elasticity that matters for the size of their hours volatility. Living inside the homes of stable people increases their consumption and hence their Marshallian labor elasticity.

The second channel through which living arrangements matter for hours volatility is that, as we demonstrated in Tables 1 and 2, the fraction of unstable people who live inside the home of a stable person is itself volatile. Thus, even if the hours volatility of the unstable apart and the unstable together were the same, the fact that the average hours of the young apart is 1.43 times higher than the average hours of the young together means that total hours of the unstable would vary mechanically as the fraction of unstable individuals in each group varies. In the bottom row of Table 3, we provide a statistic that measures the size of this channel by computing the volatility of a counterfactual series for hours that is constructed by holding the co-residence rate fixed at its steady-state values.

$$
\begin{aligned}
M &= 1 - \frac{Var\left(\log\left[x_{SS} h^{yT} + (1 - x_{SS})\, h^{yA}\right]\right)}{Var\left(\log\left[x h^{yT} + (1 - x)\, h^{yA}\right]\right)} \\
&= 1 - \frac{Var\left(\log\left[x_{SS} h^{yT} + (1 - x_{SS})\, h^{yA}\right]\right)}{Var\left(\log h^{y}\right)}.
\end{aligned} \tag{1}
$$

The difference between the volatility of this counterfactual series and the volatility of total hours of the unstable measures the contribution of volatility in living arrangements to hours volatility. For definition 1, the contribution is 15%.

2.5 A useful decomposition: hours per household vs hours per person

We conclude the section by conducting a decomposition that is useful for measuring the contribution of cyclical movements in household size to the cyclical volatility of hours and employment more broadly. Let hours be denoted by H, the number of employed individuals by E, the number of households by F, and the total number of individuals by N. Then we can decompose total hours per person as

$$
\frac{H}{N} = \frac{H}{F} \times \frac{F}{N}.
$$

This decomposition expresses hours per person (the traditional measure of aggregate hours) as the product of hours per household and households per person. Similarly, we can decompose total employment per person as

$$\frac{E}{N} = \frac{E}{F} \times \frac{F}{N}.$$

Taking logs and variances yields

$$V\left(\log\frac{H}{N}\right) = V\left(\log\frac{H}{F}\right) + V\left(\log\frac{F}{N}\right) + 2COV\left(\log\frac{H}{F}, \log\frac{F}{N}\right). \tag{2}$$

A similar transformation can be applied to the total employment per person. Table 4 reports the results of this decomposition for employment and hours, using HP-filtered data at annual and quarterly frequencies. The results suggest that around 20% of fluctuations in per person labor market variables over the business cycle are offset at the household level by endogenous changes in household structure. Table 4 also reports analogous calculations when the data are de-trended using a linear trend rather than an HP-filter. De-trending the data in this way yields an even larger contribution of movements in the number of persons per household. Since the difference between the two methods of de-trending is the effect of medium-frequency secular changes due to episodes such as the productivity slowdown during the 1990s, these results imply that the mechanisms we are highlighting in this paper may be important for understanding labor movements over longer frequencies in addition to business cycles.

Table 4: Decomposition of hours and employment per person

	Quarterly Data		**Annual Data**	
	HP-filter	**Linear trend**	**HP-filter**	**Linear trend**
	(%)	(%)	(%)	(%)
Hours: $V\left(\log\frac{H}{N}\right)$				
Households per person + covariance	19	34	17	34
Employment: $V\left(\log\frac{E}{N}\right)$				
Households per person + covariance	26	42	19	40

Notes: The table reports the results of decomposition of variance of hours per person and empoyment per person as defined in equation 2. Columns report accordingly numbers for computed using quarterly and annual data (using HP and linear trend for each).

3 The Model

In this section, we present a parsimonious business cycle model with endogenous living arrangements. The model features old and young agents, where the latter make a decision about where to live depending on the realization of individual and aggregate shocks.

Demographics. There are two types of agents in the model: (i) stable, representing old, independent, or married households; and (ii) unstable, representing young, dependent, or unmarried individuals. In what follows, we refer to the former as the *old* and the latter as the *young*. Old agents in the model, like the agents in standard models, have preferences over consumption and leisure in the current and all future periods. Consequently, they make savings and labor decisions. In addition, the old are associated with some young agents whose company they enjoy in a separable and unmodeled way, but over whom they have no altruistic feelings. In this framework, if a young agent chooses to join the old household, she is welcomed in and shares part of the consumption of the old due to the presence of economies of scale within the household. The arrival of the young occurs after the old have chosen how much to work and save.

We model the young as hand-to-mouth agents, which is convenient in the business cycle model and reflects their limited insurance opportunities. They make consumption, labor, and living arrangement decisions within the period. They are heterogeneous in their labor productivity and living arrangement preferences, which we model as i.i.d. shocks in the cross-section and over time. As a result, the living arrangement choice of the young is a function of idiosyncratic productivity, the amount of extra consumption due to economies of scale, and preference for living alone. In an ironic twist, we assume that the young and the old never age.[8] We build this structure on top of a standard growth model suitable for quantitative macroeconomic analysis.

The Old There is a measure μ of the old agents who live in stable households of size γ agents per household. Consequently, there are $\frac{\mu}{\gamma}$ of these households. All old household members have identical preferences and, consequently, make unanimous decisions. Old-agent households can be joined by a young agent, but only after they have made their choice of consumption and hours worked.[9] Consequently, old agents consider the probability of being joined by a young agent, but the history of young agents living at home is irrelevant. Let x denote the probability that (or the fraction of) young agents choose to join an old household. Given the relative sizes of the population groups, the per-period utility function of an old agent must take into account the household size, both in the event of being joined by a young person and when not, and is given by:

[8] This model is isomorphic to another model where agents do age, and the young inherit the assets of the old.

[9] Alternatively, we could have assumed insurance markets among the old. With separable utility, this would imply that those joined by a young agent receive a transfer from those not joined, without affecting hours worked. In any case, all households would hold the same assets in the following period, keeping the model simple. We consider this a trivial simplification.

$$u(c^o, h^o, x) = \left[1 - \frac{x(1-\mu)\gamma}{\mu}\right]\left[\frac{1}{1-\phi^o}\left(\frac{c^o}{\zeta^o}\right)^{1-\phi^o} - \psi^o \frac{(h^o)^{1+\frac{1}{\nu^o}}}{1+\frac{1}{\nu^o}}\right] + \frac{x(1-\mu)\gamma}{\mu}\left[\frac{1}{1-\phi^o}\left(\frac{c^o}{\zeta^o+\zeta^y}\right)^{1-\phi^o} - \psi^o \frac{(h^o)^{1+\frac{1}{\nu^o}}}{1+\frac{1}{\nu^o}}\right], \quad (3)$$

where the first term refers to the household being composed of only old agents and the second term refers to being joined by a young agent. Here, ζ^o indicates the economies of scale among the old: if c^o is spent by a household of size γ, then $\frac{c^o}{\zeta^o}$ is enjoyed on a per capita basis. Similarly, the parameters $\{\psi^o, \nu^o\}$ account for the disutility on a per capita basis of having household members work a total amount of h^o hours per period. Given the functional form, ν^o is the Frisch elasticity of labor supply. The additional parameter ζ^y reflects the strain imposed by the young. Notice that there is no pooling of resources when the young join the old household. The old discount the future at rate β and face the following period budget constraint:

$$c^o + a' = w^o\, h^o + (1+r)\, a, \quad (4)$$

where a represents the assets held by the household, w and r are factor prices, and we have normalized the efficiency units of labor of the old to 1.

The Young There is a measure $1-\mu$ of young agents. These agents have preferences over consumption, leisure, and the type of household they live in but are completely impatient (hand-to-mouth). Every period, they draw two i.i.d. shocks: $\varepsilon \sim F_\varepsilon$, which affects labor productivity, and $\eta \sim F_\eta$, which affects the disutility of sharing a household with an old agent. They can change their residence status after observing all relevant information within the period: the realizations of ε, η, and the aggregate state of the economy that determines prices and allows them to forecast the relevant decisions of the old.

If an agent chooses to live alone, denoted by A, her utility is given by:

$$u\left(c^{yA}, h^{yA}\right) = \frac{\left(c^{yA}\right)^{1-\phi^y}}{1-\phi^y} - \psi^y \frac{\left(h^{yA}\right)^{1+\frac{1}{\nu^y}}}{1+\frac{1}{\nu^y}}, \quad (5)$$

where ϕ^y controls the curvature in consumption, ψ^y controls the disutility from labor, and ν^y is the labor supply elasticity. When a young agent chooses to live together with an old household, denoted by T, her utility is given by:

$$u\left(c^{yT}, h^{yT}\right) = \frac{\left(c^{yT} + g\left(c^{o}\right)\right)^{1-\phi^{y}}}{1-\phi^{y}} - \psi^{y} \frac{\left(h^{yT}\right)^{1+\frac{1}{\nu^{y}}}}{1+\frac{1}{\nu^{y}}} - \eta. \tag{6}$$

Here, $g\left(c^{o}\right)$ is a transfer function depending on the consumption of the old, which reflects the economies of scale in the old household, or, in effect, how much free riding the young get from the old.

The young living alone choose $\{c^{yA}, h^{yA}\}$, while the young living together choose $\{c^{yT}, h^{yT}\}$. Both choices satisfy the budget constraint of the young:

$$c^{yj} = \varepsilon\, w^{y}\, h^{yj}, \quad j \in \{A, T\}, \tag{7}$$

where ε^{y} represents the idiosyncratic efficiency units of the young, and w^{y} is the wage of the young.

Production. This structure is integrated into a standard growth model. In all of our analysis, we assume that production exhibits constant returns to scale and that final goods are produced by perfectly competitive firms. Similarly to Jaimovich et al. (2012), we impose the following CES aggregate production technology:

$$F(K, N^{y}, N^{o}, z) = \left[\theta\,(zN^{y})^{\sigma} + (1-\theta)\left(\lambda K^{\rho} + (1-\lambda)\,(zN^{o})^{\rho}\right)^{\sigma/\rho}\right]^{1/\sigma}, \tag{8}$$

where N^{y} and N^{o} are the labor inputs of young and old, respectively, and K is the aggregate capital stock. The model economy is subject to a labor-augmenting, aggregate productivity shock z. The parameter θ controls the share of young workers in production, while λ controls the share of capital in a $K - N^{o}$ composite. Whenever $\sigma \neq \rho$, the degree of diminishing marginal product differs between young and old. The elasticity of substitution between old workers and capital is given by $(1-\rho)^{-1}$, while the elasticity of substitution between young workers and the $K - N^{o}$ composite is given by $(1-\sigma)^{-1}$. For $\sigma > \rho$, the technology features ***capital-age*** complementarity. Importantly, the production technology specified in (8) ***does not*** depend on living arrangements; thus, we do not impose any asymmetries related to this margin on the model.

The resource constraint is standard:

$$C + [K' - (1-\delta K)] = Y, \tag{9}$$

where C is aggregate consumption, K is aggregate capital, Y is output, and N is the aggregate labor input (not total hours worked). Investment is also standard, i.e., $I = K' - (1-\delta K)$.

Aggregation. Despite the fact that our model features multiple types of agents and households, aggregation in this environment is relatively simple. Every period, there are three types of households in the economy: old households without young agents (a measure $\frac{\mu}{\gamma} - x(1-\mu)$), old households with young agents (a measure $x(1-\mu)$), and young agents living alone (with a measure $(1-x)(1-\mu)$).[10] To determine the aggregates, we first describe the indifference condition:

$$\eta^*(\varepsilon) \quad = \quad \frac{\left(c^{yT} + g\left(c^o\right)\right)^{1-\phi^y}}{1-\phi^y} - \psi^y \frac{\left(h^{yT}\right)^{1+\frac{1}{\nu^y}}}{1+\frac{1}{\nu^y}} - \left[\frac{\left(c^{yA}\right)^{1-\phi^y}}{1-\phi^y} - \psi^y \frac{\left(h^{yA}\right)^{1+\frac{1}{\nu^y}}}{1+\frac{1}{\nu^y}}\right], \tag{10}$$

i.e., it defines a threshold $\eta^*(\varepsilon)$ for each ε in the space of disutility shock realizations, above which the agent chooses to live alone at their residence, and below which the agent chooses to move into the old household. The fraction of young individuals living with the old households is then given by:

$$x \quad = \quad \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\eta}}^{\eta^*(\varepsilon)} dF_\eta \; dF_\varepsilon, \tag{11}$$

where $\varepsilon \in (\underline{\varepsilon}, \bar{\varepsilon})$ and $\eta \in \left(\underline{\eta}, \bar{\eta}\right)$.

Aggregate labor inputs of young agents living alone and young agents living together are:

$$N^{yA} \quad = \quad \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\eta^*(\varepsilon)}^{\bar{\eta}} \varepsilon h^{yA}(\varepsilon) dF_\eta dF_\varepsilon, \tag{12}$$

$$N^{yT} \quad = \quad \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\eta}}^{\eta^*(\varepsilon)} \varepsilon h^{yT}(\varepsilon) \; dF_\eta dF_\varepsilon. \tag{13}$$

Analogously, the total hours worked by young agents living alone and young agents living together are:

[10] The relative sizes of the young and the old, as well as the nature of the processes for η and ε, guarantee that there are not more young agents moving in with the old than the number of old households.

$$
\begin{aligned}
H^{yA} &= \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\eta^*(\varepsilon)}^{\bar{\eta}} h^{yA}(\varepsilon)\, dF_\eta dF_\varepsilon, && (14)\\
H^{yT} &= \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\eta}}^{\eta^*(\varepsilon)} h^{yT}(\varepsilon)\, dF_\eta dF_\varepsilon. && (15)
\end{aligned}
$$

Total consumption of the young agents living alone and young agents living together are:

$$
\begin{aligned}
C^{yA} &= \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\eta^*(\varepsilon)}^{\bar{\eta}} w^y \varepsilon h^{yA}(\varepsilon)\, dF_\eta dF_\varepsilon, && (16)\\
C^{yT} &= \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\eta}}^{\eta^*(\varepsilon)} w^y \varepsilon h^{yT}(\varepsilon)\ dF_\eta dF_\varepsilon. && (17)
\end{aligned}
$$

Using the aggregates for the young agents, the aggregate values for consumption (C), labor input (N), and hours (H), are given by:

$$
\begin{aligned}
C &= \frac{\mu}{\gamma} c^o + (1-\mu)\ \ [C^{yT} + C^{yA}], && (18)\\
N^o &= \frac{\mu}{\gamma} h^o, && (19)\\
N^y &= (1-\mu)[N^{yT} + N^{yA}], && (20)\\
N &= N^o + N^y, && (21)\\
H &= \frac{\mu}{\gamma} h^o + (1-\mu)\ \ [H^{yT} + H^{yA}]. && (22)
\end{aligned}
$$

Capital is owned by the old, so wealth is equal to total capital: $K = a\,\frac{\mu}{\gamma}$.

Equilibrium. Our model is simple enough such that the objects required to define an equilibrium are the same as in a standard representative agent model. The aggregate state of the economy is $s = \{z, K\}$, since these are sufficient statistics for wealth and prices.

Definition 1. *A recursive equilibrium is a set of functions for capital,* $K'(s)$*; consumption* $\left\{C^{yA}(s), C^{yT}(s), c^o(s)\right\}$*; hours worked* $\left\{H^{yA}(s), H^{yT}(s), H^o(s)\right\}$*; the threshold* $\eta^*(\varepsilon)$*; the fraction of* *young that move in with the old $x(s)$; and competitive factor prices $\{r(s), w(s)\}$, such that*

1. *The young maximize given the choice of the old. This includes the choices of consumption, hours worked when together, hours worked when alone, and household type.*

2. *The fraction of the young moving in with the old satisfies (11), and the marginal young are indifferent, i.e., $\eta^*(\varepsilon)$ satisfies (10) for each ε.*

3. *The old maximize given the expected choices of the young, and when imposing the representative agent condition, their choices yield $\{K'(s), c^o(s), h^o(s)\}$.*

4 Mapping the Model to the Data

In this section, we take the model to the data. We discipline the model parameters using a combination of first and second moments associated with macroeconomic variables, labor market statistics, and living arrangements data. There are two sets of parameters in our model. The first set contains the parameters that can be assigned without solving the model. We discipline them by using their direct data counterparts or by relying on existing micro estimates. There are 9 parameters like that in our baseline model. The parameters in the second set have to be identified jointly, and the procedure requires solving the model. Importantly, given the structure of the model, we cannot separately discipline parameters based on first and second moments, so we have to solve for the stochastic equilibrium, rather than just the steady-state, every time in the calibration procedure. We have 15 parameters in the second set, and we use 15 moments to discipline them.

4.1 Targeted Moments

The model period is a quarter, and the sample period is 1978-2022. We discipline model parameters by demanding that the model matches a combination of first and second moments from the data, which are presented in Table 5 together with their model counterparts. The set of targets we use can be divided into three categories: (i) macroeconomic aggregates, (ii) labor market statistics, and (iii) living arrangements statistics. For the macroeconomic variables, we target a quarterly interest rate of 1 percent, an investment-output ratio of 25 percent, and a share of capital income in GDP equal to 0.36.

The second set of targeted statistics consists of labor market variables. In the CPS data, young adults who live within old households work on average 30 percent less and earn 40 percent less than their peers living alone. At the same time, their hours worked are 1.6 times more volatile than those of their peers living separately (measured in terms of relative standard deviations), while their wages vary similarly over the business cycle (both vary more than the wages of the old). We impose these regularities on our model by targeting several first moments: the average hours worked and relative (to the old) wages, both conditional on living arrangements. We also target several second moments: (i) the relative standard deviation of hours of young agents, $\sigma(h^y)/\sigma(h^o)$; (ii) the relative standard deviation of hours of young agents living with the old, $\sigma(h^{yT})/\sigma(h^o)$; (iii) the relative standard deviation of hours of young agents living alone, $\sigma(h^{yA})/\sigma(h^o)$; (iv) the relative standard deviation of wages of young agents, $\sigma(w^y)/\sigma(w^o)$; (v) the relative standard deviation of wages of young agents living with the old, $\sigma(w^{yT})/\sigma(w^o)$; and (vi) the relative standard deviation of wages of young agents living alone, $\sigma(w^{yA})/\sigma(w^o)$.[11]

The third set of targeted moments is related to the living arrangements of young adults and their variation over the business cycle. First, we ensure that the model replicates the average fraction of young adults living with the old in the CPS data, which is 52 percent. Second, as documented in the empirical section, the living arrangements of young adults are volatile, and the fraction of young adults living within old households is countercyclical. To capture these regularities in our model economy, we target the relative standard deviation of the fraction of young adults living with the old, $\sigma(x)/\sigma(h^o)$, and its negative correlation with aggregate hours worked, $Corr(x, h)$.

It is important to highlight that we chose to match relative rather than absolute values of the standard deviations. An alternative approach would be to choose parameters so that the model generates the same volatility of hours for young people and the same volatility of living arrangements as in the data. We believe that such a procedure would give a misleading answer because it would implicitly assume that *all* movements in these variables are due to technology shocks, even though only a small fraction of the volatility of hours of the old are due to technology shocks in the model. Instead, we choose parameters so that the technology shock accounts for the same fraction of the variances of all types of hours worked and the variance of living arrangements.

4.2 Parametrization

In what follows, we discuss the model parameters, choices of functional forms imposed on the model economy, and the identifying assumptions made in the process of bringing the model to the data. The parameters, their symbols, and their values are presented in Table 7.

Demographics. In our baseline calibration, we identify the unstable young as those aged below 30, and the stable old as those aged 30 to 65. Unless stated otherwise, the calibration and findings reported in the main text refer to this definition. The fraction of old agents is 0.69, which is the average fraction of people aged 18 to 65 who are 30 and above over the sample period in our CPS data. Most of these people are married, generating an average household size of 2.01. Thus,

[11] It is important to note that matching the relative standard deviations of young agents living alone and with the old does not guarantee that the model will correctly match the relative standard deviations of the overall population of the young to the old. The latter is affected by the movements in composition and crucially by the covariance terms.

Table 5: Targeted Moments: Baseline Model

Moment	**Data**	**Model**
First Moments		
Investment/Output	0.25	0.26
Mean Hours Old	0.56	0.57
Mean Hours Young Together	0.21	0.20
Mean Hours Young Alone	0.30	0.30
Fraction of Young living with Old	0.52	0.51
Wage of young alone/Wage Old	0.72	0.63
Wage of young together/Wage Old	0.41	0.50
Capital Income Share	0.36	0.36
Second Moments		
$\sigma(h^y)/\sigma(h^o)$	1.73	1.73
$\sigma(h^{yT})/\sigma(h^o)$	2.08	2.35
$\sigma(h^{yA})/\sigma(h^o)$	1.28	1.22
$\sigma(x)/\sigma(h^o)$	0.71	0.45
$\sigma(w^y)/\sigma(w^o)$	1.07	1.23
$\sigma(w^{yT})/\sigma(w^{yA})$	1.00	0.91
Corr(x, h)	-0.72	-0.73
Fit in L^2 norm		0.00021

we set μ and γ accordingly based on these numbers.

Technology. We adopt a nested CES technology, as in equation (8), with both young and old labor, where the labor input of the old is complementary to the capital stock, and the old labor-capital composite is an imperfect substitute for the labor input of the young, following Jaimovich et al. (2012). We assume that the aggregate shock follows the standard AR(1) process, i.e.,

$$\log z' = \rho_z \log z + \vartheta_z, \tag{23}$$

where $\vartheta_z \sim N(0, \sigma^z)$. We set $\rho_z = 0.97$ and $\sigma^z = 0.007$ across all experiments, which are standard values in the business cycle literature.

To discipline the shocks governing the productivity of the young, ε, we rely on the following identifying assumption. We impose that this idiosyncratic productivity is drawn from the log-normal distribution, i.e., $\varepsilon \sim \ln N\left(\mu_\varepsilon, \sigma_\varepsilon^2\right)$, where μ_ε controls the mean and σ_ε controls the standard deviation of the shock. Parameters governing the aggregate shock, individual young productivity, and other technology parameters, i.e., the share of young in production, θ, the share of capital in production λ, and the parameters governing elasticities in production, σ and ρ, are jointly identified by targeting moments reported in Table 5.

Preferences of the Old. We impose preferences for the old that are separable in consumption and hours worked and potentially take into account the probability of the arrival of the young, as seen in (3). In our baseline calibration, we consider log utility in consumption ($\phi^o = 1$). Parameters governing the economies of scale ζ^o and ζ^y are directly set using OECD estimates. For the Frisch elasticity of labor supply for the old, ν^o, we use an estimate that captures both the extensive margin and the typical existence of a couple in an old household. Our baseline value of 0.72 is based on Heathcote, Storesletten, and Violante (2010), which is also close to the value 0.82 reported by Chetty et al. (2011a) in their meta-analysis of estimates for the Frisch elasticity using micro data.[12] The disutility of working parameter, ψ^o, and the discount factor, β, are disciplined jointly by targeting moments reported in Table 5.

Preferences of the Young. Preferences of the young are summarized by equations (5) and (6) and depend on: (i) three standard parameters of the utility function, i.e., curvature in consumption, ϕ^y, weight on hours worked, ψ^y, and elasticity of labor supply, ν^y; (ii) disutility of living with the old household, η; and (iii) transfers received by young agents living with the old, $g(c^o)$. The degree of risk aversion, ϕ^y, is particularly important. With log utility and no patience, hours are constant, irrespective of the wage rate. When risk aversion is greater than unity, hours move countercyclically, since the income effect of wage changes dominates the substitution effect. This means that in our calibrated economy, the risk aversion of the young is less than 1. The weight on hours worked and elasticity of labor supply are mostly pinned down by the levels and volatilities of hours worked by the young relative to the old. We assume that the distaste of living with the old, η, is drawn from a flexible, two-parameter distribution. We chose a type 1 extreme value distribution (Gumbel distribution), with location parameter μ_η and scale parameter σ_η, i.e., $\eta \sim Gumbel\left(\mu_\eta, \sigma_\eta\right)$. It is crucial that we allow these idiosyncratic shocks to be drawn from the two-parameter distribution. If there were only one parameter, it would be pinned down by the mean fraction of the young living with the old. However, what matters for our question is the slope of the cumulative distribution function (CDF) at this value, since this is what determines the mass of young agents that are induced to change their living arrangements in response to small changes in the wage rate. Another identifying assumption that we impose on the model is the functional form of the implicit transfers from the old household to the young agents living together with the old. In our baseline calibration, we pose an affine transfer function

[12] We also note that with one possible exception (the 1987 Iceland zero tax year studied by Bianchi, Gudmundsson, and Zoega (2001)), none of the studies analyzed by Chetty et al. (2011a) or Chetty, Guren, Manoli, and Weber (2011b) are based on data that include the type of unstable marginal workers emphasized in this paper.

$g(c^o) = \zeta_0 + \zeta_1 c^o$, which depends linearly on the consumption of the old. This feature generates procyclical transfers, slowing down the movements of the young in the model in and out of the old household. All the parameters related to the preferences of the young are disciplined jointly by targeting moments reported in Table 5.

5 Findings

In this section, we present the main findings from our quantitative analysis. We begin by discussing the model's performance relative to targeted and untargeted moments. We then explore the endogenous selection of the young into various living arrangements in the model's equilibrium. Next, we illustrate the dynamic properties of the model by inspecting impulse response functions following an aggregate shock. Finally, we discuss two measurements based on model simulations: (i) the wedge in labor elasticities across living arrangements and (ii) the size of implicit transfers from the old to the young living with them.

5.1 Model vis-à-vis the Data

Table 5 presents the model's performance relative to targeted moments. Our model matches these moments relatively well. First, we account for labor market differences across living arrangements. We replicate the wedge between the mean hours of young agents living together and those living alone. The former work around 30 percent less than the latter. We also account for most of the wage difference between young agents with different living arrangements observed in the data. In the steady state of our model, those living alone earn 26 percent more than their peers living with the old. In our quantitative model, the hours of young agents living with the old are more than twice as volatile as those of the old, while their peers living alone have a relative volatility of 1.2 in the model. The calibrated model replicates the relative volatility of wages between the young and the old, and across the young with different living arrangements. We also correctly account for the composition of young agents, its volatility over the business cycle, and its covariance with aggregate economic conditions. In line with the data, our model generates 52 percent of young agents living with the old in the steady state. However, our calibration falls short in replicating the volatility of the living arrangement margin relative to the hours of the old, accounting for around 65 percent of the variance of x observed in the data. Our interpretation of this finding is that the aggregate technology shock is insufficient to generate enough movement in the living arrangements of the young at the business cycle frequency, at least through the lens of our model. Finally, in our model, young agents move into old households during recessions and move out during expansions, implying a negative correlation of -0.73 between x and aggregate hours worked, consistent with its data counterpart.

Table 6 presents the model's performance against non-targeted moments. The first statistic, reported as "Contribution H/F" in the table, is the model counterpart of the contribution of households per person and covariance terms to the volatility of total hours worked, as defined in

Table 6: Non-Targeted Moments: Baseline Model

Moment	**Data**	**Model**
Contribution H/F	0.19	0.16
Moment M	0.15	0.07
Correlation of hours of old and hhs size	-0.58	-0.64
Correlation of hours of young and hhs size	-0.63	-0.79
Correlation of total hours and hhs size	-0.62	-0.73

(2) and reported in Table 4. Our model accounts for 84 percent of the contribution reported in the empirical section. Thus, our quantitative theory of living arrangements explains a significant portion of the movements in household size over the business cycle and their contribution to the variability of hours worked. As we argue in Section 2.4, there are two channels through which variation in living arrangements among the young contributes to their high hours' volatility. The first channel arises because the volatility of hours worked by the young living together with the old is larger than that of their peers living alone. We directly discipline this margin by imposing targets reported in Table 5. The second channel through which living arrangements matter for hours volatility is that the fraction of young living with the old, x, varies over the cycle. In the empirical section, we construct a measure that quantifies the size of this channel (see (1)). The moment M in the data is 0.15, whereas its non-targeted model counterpart is 0.07. Thus, our quantitative theory accounts for 47 percent of the size of this channel, which we consider a success given the parsimonious nature of our model. Finally, the last three rows of Table 6 report correlations of hours of the old, hours of the young, and total hours with household size. The model qualitatively reflects the differences between these correlations. Quantitatively, the model captures the negative correlation between the hours of the old and household size but overshoots the correlation with the hours of the young, leading to an overshoot in the correlation of total hours with household size. Overall, we view the model's performance against the non-targeted business cycle moments related to living arrangements as corroboration of our mechanism and its quantitative relevance.

5.2 Selection into Living Arrangements

Young individuals in the model are heterogeneous with respect to living arrangements, hours worked, and wages. Consequently, there is a cross-sectional distribution of labor market variables conditional on living arrangements in the model. Young individuals endogenously self-select into living alone or with the old after observing the realization of two idiosyncratic shocks: (i) a productivity shock ε, and (ii) a disutility shock η. The key equilibrium condition for this choice is equation (10), which defines the threshold $\eta^*(\varepsilon)$ in the domain of the disutility shock. This

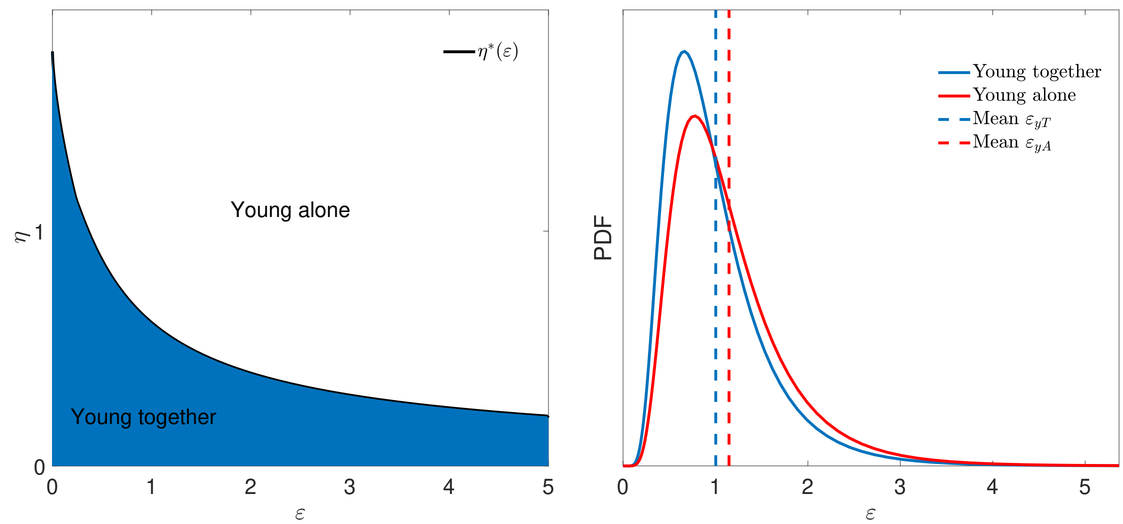
Table 7: Parameter Values: Baseline Model

Parameter description	**Symbol**	**Value**	**Discipline**
Params set without solving the model			
Fraction of the old in the Population	μ	0.693	CPS data
Frisch elasticity for the Old	ν^o	0.720	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.028	Targeted Moments
Disutilty of labor for the Old	ψ^o	3.311	Targeted Moments
Disutilty of labor for the Young	ψ^y	5.080	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.523	Targeted Moments
Labor elasticity of the Young	ν^y	1.240	Targeted Moments
Mean of the prod. of the Young	μ_ε	3.846	Targeted Moments
Std of the prod. of the Young	σ_ε	0.524	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.575	Targeted Moments
Std of the disutility for living with Old	σ_η	0.550	Targeted Moments
Share of Young in production	θ	0.044	Targeted Moments
Share of Old in capital-labor CES	λ	0.273	Targeted Moments
Production technology elasticity	ρ	0.168	Targeted Moments
Production technology elasticity	σ	0.592	Targeted Moments
Constant in the transfer function	ζ_0	0.014	Targeted Moments
Slope of the transfer function	ζ_1	0.151	Targeted Moments

threshold is illustrated in the left panel of Figure 3.

A young individual entering the period moves into the old household if, for every productivity shock ε, the disutility shock falls below $\eta^*(\varepsilon)$. For any realization above this threshold, the young individual chooses to live alone. The independence of the shocks over time implies that the previous living arrangement of the young individual is irrelevant to the choice in the current period. The downward-sloping threshold implies a sharp selection pattern emerging from our model. On average, young, unproductive agents will live within the old household, even for very high realizations of their disutility shock. As productivity increases, moving to the right on the horizontal axis of Figure 3a, it takes a lower value of the disutility shock for the young agent to move out and live alone. This selection mechanism gives rise to a pattern of productivity distributions conditional on living arrangements (Figure 3b). The average productivity of young agents living alone is higher than that of their peers living with the old, with the distribution mass shifted to the right in the productivity domain. Note that the distribution of wages of the young in the model is isomorphic to the productivity distribution. Therefore, young individuals living alone have, on average, higher wages than their peers living in larger households.[13]

Figure 3: Selection of the young agents into living arrangements.



(a) Indifference curve $\eta^*(\varepsilon)$. (b) Productivity distribution among young.

Notes: Units on the horizontal and vertical axes are normalized by means of ε and η accordingly. Both the indifference curve and the pdfs are truncated at 5 times the average of ε.

5.3 The Dynamics of the Model

Figure 4 presents impulse responses of the baseline model to the aggregate technology shock, which help illustrate the mechanics of our model. As labor-augmenting productivity rises (Figure 4a), the marginal products of the young and the old increase, as is evident from our production specification in equation (8). Recall that the production function features age-capital complementarity. Since capital, a state variable, is inelastic in the short run, the demand for labor rises disproportionately across age groups; the demand for labor of the young increases more. To see this more clearly, suppose that old labor is a perfect complement to capital (i.e., $\rho \to -\infty$), while young labor is an imperfect substitute ($\sigma > \rho$). Then, with capital being fixed in the short run, a productivity shock generates no response in the quantity of old labor hired; the only variation is

[13] The wage rate is simply the product of w^y and ε.

in the quantity of young labor. As a result, the hours of the young respond more strongly (Figure 4d).

The more pronounced response of the hours of the young can be further decomposed into responses conditional on living arrangements and changes in composition (Figure 4g). On impact, following an increase in demand for young labor and associated marginal products, both groups of the young increase their hours worked. The higher Marshallian elasticity of labor supply for the young living together (see Section 5.4) implies that they respond more strongly than their peers living alone. At the same time, the composition of young households changes as more young agents move out of old households to live independently; this is reflected in the short-run drop in x in Figure 4g. The dynamics of x translate into changes in the average household size (Figure 4i), which declines on impact and is negatively correlated with aggregate hours, in line with the data.

As for the old households, on impact, they invest more following the rise in the marginal product of capital, and the rise in their consumption is backloaded and hump-shaped (Figure 4c). As this rise in the consumption of the old kicks in during the medium run and the impact of the technology shock diminishes, the incentives for marginal young agents living alone to move back increase due to the implicit transfers $g(c^o)$. This is reflected in the reversal of household size in the medium run. Finally, the impulse responses reveal how, in our model, the margin of the number of households interacts with the movements in aggregate hours worked (Figure 4h).

5.4 Model-Implied Labor Supply Elasticities

Our joint theory of living arrangements and labor market outcomes over the business cycle has sharp predictions for the differences in the variance of hours worked across age and living arrangement dimensions, as documented in the previous sections. The implicit transfers from the old to the young living with them are key to capturing these regularities observed in the data and matched in the model. To see this, note that the labor supply of young individuals living alone, who receive an ε labor productivity shock, in our economy is given by:

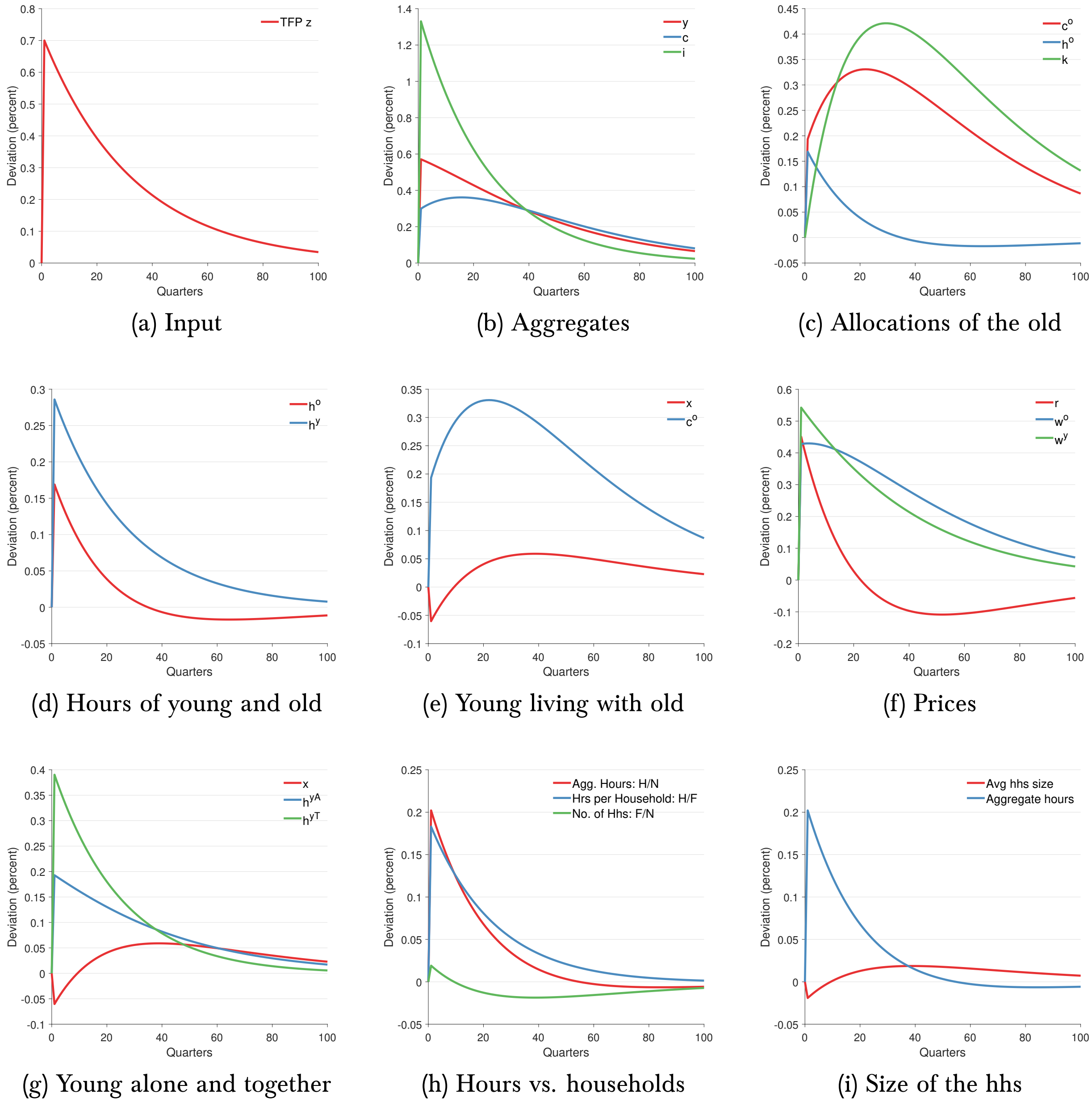
$$h^{yA} = \left(\frac{(w^y \varepsilon)^{1-\phi^y}}{\psi} \right)^{\frac{\nu^y}{1+\phi^y \nu^y}}.$$

The Marshallian elasticity of labor supply is independent of the realization of any idiosyncratic shocks and is given by (see Appendix A for the details of derivation):

$$\epsilon_{w^y}^{h^{yA}} = \frac{(1-\phi^y)\,\nu^y}{1+\phi^y \nu^y}. \tag{24}$$

At the same time, the labor supply of a young individual living with the old, who receives an

Figure 4: Impulse Response Functions to Aggregate Technology Shock



(a) Input

(b) Aggregates

(c) Allocations of the old

(d) Hours of young and old

(e) Young living with old

(f) Prices

(g) Young alone and together

(h) Hours vs. households

(i) Size of the hhs

ε labor productivity shock, does not exhibit a closed-form solution due to the presence of the implicit transfers $g(c^o)$. However, one can derive the following formula for the Marshallian elasticity of labor supply:

$$\epsilon_{w^y}^{h^{yT}}(\varepsilon) = \frac{\nu^y(1-\sigma^y)}{1+\sigma^y\nu^y} \frac{\left[1+\left(\frac{g(c^o)}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1-\sigma^y}\right)\right]}{\left[1+\left(\frac{g(c^o)}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1+\sigma^y\nu^y}\right)\right]} = \epsilon_{w^y}^{h^{yA}} \frac{\left[1+\left(\frac{g(c^o)}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1-\sigma^y}\right)\right]}{\left[1+\left(\frac{g(c^o)}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1+\sigma^y\nu^y}\right)\right]}. \tag{25}$$

In the absence of intertemporal concerns, these two Marshallian elasticities, rather than the Frisch elasticity, control the response of the hours of young individuals living alone and those living together to aggregate fluctuations. Our theory predicts that the hours of young individuals living together respond more strongly than the hours of those living alone over the business cycle, as long as $g(c^o) > 0$ (i.e., implicit transfers are strictly positive). Our calibration quantifies this difference. First, observe that if $\sigma^y < 1$, which we argued is the case, then for any $g(c^o) > 0$, we have:

$$\epsilon_{w^y}^{h^{yA}} < \epsilon_{w^y}^{h^{yT}}(\varepsilon) = \epsilon_{w^y}^{h^{yA}} \frac{\left[1 + \left(\frac{g(c^o)}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1-\sigma^y}\right)\right]}{\left[1 + \left(\frac{g(c^o)}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1+\sigma^y \nu^y}\right)\right]} \quad \forall \varepsilon,$$

indicating that the presence of positive implicit transfers induces a *strictly* larger labor supply elasticity for young individuals living together compared to those living alone. Moreover, observe that the elasticity of young individuals living together, $\epsilon_{w^y}^{h^{yT}}(\varepsilon)$, is an increasing function of the fraction of consumption that the young receive from the old. The larger the transfers, the more strongly the hours of the young living together respond to changes in the wage rate, and the larger, ceteris paribus, the gap relative to those living alone.

Also, observe that as $g(c^o) \to 0$, then $\epsilon_{w^y}^{h^{yT}}(\varepsilon) \to \epsilon_{w^y}^{h^{yA}}$, and $\epsilon_{w^y}^{h^{yT}}(\varepsilon) = \epsilon_{w^y}^{h^{yA}}$ when $g(c^o) = 0$. In other words, as transfers disappear, the two elasticities, and hence the response to aggregate fluctuations, become identical. Our theory of living arrangements builds upon the idea of economies of scale in old households, which implies free-riding consumption for young individuals living together, and predicts that precisely this force accounts for the differences in the variance of hours worked over the business cycle across different living arrangements of the young. The calibration strategy we follow allows us to match exactly the relative variances of hours, and hence we can back out the difference in elasticities driven by economies of scale.

The implied value of the elasticity of young individuals living alone in our baseline calibration is $\epsilon_{w^y}^{h^{yA}} = 0.36$. The mean elasticity for those living together is given by:

$$\bar{\epsilon}_{w^y}^{h^{yT}} = \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\eta}}^{\eta^*(\varepsilon)} \epsilon_{w^y}^{h^{yT}}(\varepsilon)\, dF_\eta dF_\varepsilon, \tag{26}$$

and in our baseline calibration, it is equal to 0.51. Both numbers are comfortably within the range of existing empirical estimates.

These numbers contrast sharply with the results of Jaimovich et al. (2012), who require a Frisch elasticity of 25 for the young to match the relative variances of hours between young and old, or a Frisch elasticity of 7 to match the relative variance of wages between these two groups. In both exercises, they assume an *infinite* Frisch elasticity for the old, which is in stark contrast with existing estimates from the microeconometric literature (see Chetty et al. (2011a), Chetty et al. (2011b), Keane (2010)).[14] Our model closely matches the relative variance of hours and wages between young and old and delivers reasonable Marshallian elasticities of labor supply for the young, as discussed above. At the same time, we constrain ourselves by respecting the micro measurement of the Frisch elasticity for stable, old households, setting it to 0.72.

5.5 The Size of Implicit Transfers

The analysis of labor supply elasticities in the previous section underscores the critical role of implicit transfers, denoted as $g(c^o)$, in transmitting aggregate productivity shocks. These transfers are not directly observable and thus cannot be directly measured in the data. However, through our modelcalibrated with macroeconomic aggregates, labor market statistics, and moments of living arrangementswe can estimate their magnitude. In the following discussion, we introduce five measures of these implicit transfers.

1. Fraction of the consumption of the old: $g(c^o)/c^o$. This measure informs us how large the implicit transfers are as a fraction of the old household's consumption.

2. Fraction of the market consumption of the young living together: $\frac{g(c^o)}{\bar{c}^{yT}}$. This measure compares implicit transfers to the average market consumption of the young living together.

3. Fraction of the market consumption of the young living alone: $\frac{g(c^o)}{c^{yA}}$. This compares implicit transfers to the market consumption of the young living alone.

4. Additional average hours the young living together would need to work on the market to achieve the same utility as with the implicit transfers. We define this measure as follows:

$$\Delta_h = \left(\frac{\hat{h}^{yT} - \bar{h}^{yT}}{\bar{h}^{yT}}\right)$$

   where $\bar{h}^{yT}$ is the mean hours worked by the young living together under the baseline calibration, and $\hat{h}^{yT}$ is the hours required to keep utility unchanged in the absence of transfers (see Appendix B.1 for derivation).

5. Additional productivity the young living together would need to have on the market to obtain the same utility as with the implicit transfers:

$$\Delta_\varepsilon = \left(\frac{\hat{\varepsilon} - \bar{\varepsilon}}{\bar{\varepsilon}}\right)$$

[14] See Table 5 in Jaimovich et al. (2012).

where $\bar{\varepsilon}$ is the mean productivity of the young living together in the baseline calibration, and $\hat{\varepsilon}$ is the mean productivity required to keep utility unchanged in the absence of transfers (see Appendix B.2 for derivation).

Table 8: Measures of the implicit transfers (%)

	Measures of implicit transfers (%)				
	$\frac{g(c^o)}{c^o}$	$\frac{g(c^o)}{c^{yT}}$	$\frac{g(c^o)}{c^{yA}}$	Δ_h	Δ_ε
Baseline model	12.4	66.1	42.9	44.1	62.7

Table 8 presents the values of implicit transfers according to all five measures. Regardless of the metric used, the transfers are sizeable. When measured as a percentage of the consumption of old agents, they amount to 12 percent. As a percentage of the market consumption of young agents, whether living together or alone, these transfers reach 66 percent and 43 percent, respectivelyboth significant figures. Young agents living with the old would need to work, on average, 44 percent more to account for the implicit transfer they receive due to economies of scale. Alternatively, holding their hours worked constant, they would need to be 63 percent more productive on average to compensate for the transfers. Our interpretation of these results suggests that the channel of endogenous living arrangements, operationalized through the presence of implicit transfers, is quantitatively significant.

6 Robustness

In this section we introduce alternative calibrations of our model, which correspond to three alternative definitions of unstable individuals.

6.1 Unstable: Never Married

Following Definition 2, which classifies individuals based solely on marital status, as introduced in the empirical section of the paper, we redefine the notion of unstable individuals within the model. According to this definition, unstable individuals are those aged 18 to 65 who have never been married, while stable individuals encompass all others within the same age range. Under this alternative definition, unstable individuals constitute 28 percent of the population, compared to 31 percent under our baseline definition. Among these, an equal half live within the old household, compared to 52 percent under our baseline definition. Qualitatively, the patterns observed in the data are consistent with those under the baseline definition. Individuals who are young and living alone tend to work more hours and receive higher wages compared to their counterparts residing in households with older individuals. Those who co-reside exhibit more volatile working hours. We present the model's fit to the data in Table 18 and the associated parameter values in Table 19. The implications of this definition for aggregate labor supply elasticity are examined and compared to the baseline in the subsequent section.

6.2 Unstable: 18-30 and Never Married

Next, we revise the definition of unstable individuals in the model to align with Definition 3, as presented in the empirical section. This definition represents the intersection of our baseline definition and Definition 2. According to this criterion, unstable individuals are those aged 18 to 30 who have never been married, while stable individuals include all others aged 18 to 65. Under this alternative definition, unstable individuals make up 19 percent of the population, which is significantly narrower than both the baseline and marital-status-based definitions. Among these, two-thirds reside within old households, a proportion substantially higher than that observed with the previous two definitions. Nevertheless, qualitatively, the patterns of hours worked and wages across different living arrangements remain consistent with those identified under the earlier definitions. We present the model's fit to the data in Table 20 and the associated parameter values in Table 21. The implications of this definition for aggregate labor supply elasticity are examined and compared to the baseline in the subsequent section.

6.3 Unstable: Implicit definition

Finally, our third definition of unstable individuals is implicit. We pose the question: What fraction of unstable agents would be necessary for the model to account fully for the 19 percent contribution of household size variability to the overall variance of hours worked, as documented in Table 4 in the empirical section? To address this, we calibrate the parameter μ, representing the fraction of old agents in the economy, in addition to all parameters in the baseline model, while keeping all other targets unchanged. This calibration exercise yields a value of $\mu = 0.44$, implying that, according to our model, the fraction of unstable individuals would need to be 66 percent to fully account for the observed contribution of household size variability to the variance in hours worked. We present the model's fit to the data in Table 22 and the associated parameter values in Table 23. The implications of this definition for aggregate labor supply elasticity are examined and compared to the baseline in the subsequent section.

7 Implications for the "macro" labor elasticity

The objective of this paper is, in part, to show that the macro labor elasticity is indeed different from its micro counterpart, even while remaining scrupulously respectful of the measurements of the micro elasticity that are based on direct empirical evidence. Consequently, we now ask the question of how much higher the macro elasticity is when we are explicit about both the existence of young people and the existence of movements in household size. To answer this question, we

Table 9: Macro Elasticity: Alternative Frisch Elasticities for the Old

Economy	**Variance of the aggregate hours**	**Implied Frisch in RA RBC**	**Proportional Change (%)**
Baseline: $\nu^o = 0.72$	0.172	1.236	+ 71.6
$\nu^o = 0.3$	0.042	0.491	+ 63.7
$\nu^o = 1.0$	0.229	1.564	+ 56.4
$\nu^o = 2.0$	0.491	4.105	+ 105.3

Notes: Results are based on baseline definition of the unstable: individuals aged 18 to 30.

calibrate a standard representative agent business cycle model by choosing the Frisch elasticity so that the representative agent model generates the same volatility of total hours as the model economies that we study in this paper.

Table 9 reports these findings. For our baseline definition of the young, we find that the implied macro Frisch elasticity is 1.24. Since the elasticity of the old in our baseline economy was 0.72; our findings suggest an increase in the Frisch elasticity of 71.6 percent, which we find quite sizable. This number is informative about the strength of the propagation mechanism of the aggregate shock in our model, which operates primarily through the channel of living arrangements.

Alternative assumptions for micro Frisch elasticity. A concern that may arise is whether the increase in the Frisch elasticity when transitioning from a representative agent economy to an economy with unstable agents is influenced by the actual micro Frisch elasticity.[15] This concern stems from the non-linearity of the underlying model. To investigate this issue, we analyze three alternative economies with Frisch elasticities for stable older agents set at {0.3, 1.0, 2.0}. Initially, for each alternative Frisch elasticity, we recalibrate all model parameters to match the same set of targets as in the baseline model. The model's fit to targeted, as well as the parameter values, are documented in Tables 12 through 17. Subsequently, for each economy, we compute the implied Frisch elasticity in a representative agent model that would be required to generate an identical variance of hours worked. The findings, outlined in rows two to four of Table 9, indicate that the required proportional increase in the implied Frisch elasticity ranges from 56.4 percent (for $\nu^o = 1.0$) to 105.3 percent ($\nu^o = 2.0$), demonstrating that our model's propagation mechanism functions independently of the assumed value of the Frisch elasticity for unstable agents.

Alternative calibrations. We now transition to the analysis of the alternative model calibrations introduced in Section 6. For each alternative definition of unstable agents, we compute the

[15] Chetty et al. (2011a) and Chetty et al. (2011b) conduct a meta-analysis of micro estimates of the Frisch elasticity. Among the studies they reviewed, only one could be considered to include individuals with unstable living arrangements similar to those focused on in our paper: the study on Iceland's temporary tax holiday by Bianchi et al. (2001). The rest should be seen as estimates of the Frisch elasticity for stable or older individuals.

Table 10: Macro Elasticity: Alternative Definitions of the Unstable

Economy	**Variance of the aggregate hours**	**Implied Frisch in RA RBC**	**Proportional Change (%)**
Baseline	0.172	1.236	+ 71.6
Never married	0.210	1.189	+ 65.1
Never married, 18 – 30	0.173	1.345	+ 86.8
Implicit definition	0.237	1.933	+ 168.5

Notes: We recalibrate model parameters for each alternative definition of unstable agents. To compute the economies labeled "Never married" and "Never married, 18–30," we utilize targets adjusted accordingly; refer to Tables 18 and 20 in the Appendix for details. For the economy under the "Implicit definition," we employ targets from the "Baseline" definition of the unstable agents.

implied Frisch elasticity in a representative agent real business cycle model. The results are presented in Table 10. Independently of the definition applied for unstable individuals, we observe a significant increase in the implied elasticity. For the marital-status-only based definition (row two in Table 10), the increase is 65.1 percent. For a narrower definition of unstable agents, specifically those who are never married and aged 18-30 (row three in Table 10), the increase is even larger at 86.8 percent. This reflects the fact that under this calibration, more than two-thirds of the unstable individuals reside within older households.[16] Finally, and unsurprisingly, the largest increase is associated with our implicit definition of unstable individuals (row four in Table 10). In this model, we force the parameters to match the contribution of variation in household size to the overall variance of total hours worked. The implied Frisch elasticity is 1.93, an increase of 168.5 percent relative to the baseline value of 0.72 set in the model. This analysis suggests that the propagation mechanism associated with varying living arrangements operates independently of the specific definition of unstable agents used.

Counterfactuals. Finally, we move to the analysis of the counterfactual economies to shed light on the roles of coresidence and preference heterogeneity as the key drivers of our results. We consider four economies and report the results in Table 11.

We begin with an economy where we fix the coresidence margin labeled "Fixed coresidence ($x = x_{ss}$)" in Table 11. In this scenario, we compel the unstable agents to live alone or within an old household. However, they cannot adjust their living arrangements in response to aggregate or idiosyncratic shocks. Unlike the baseline economy, which features endogenous selection into living arrangements based on a combination of productivity and disutility shocks (see Figures 3a

[16] One might question why similar variances of aggregate hours in the "Baseline" and the "Never married, 18-30" definition lead to different implied Frisch elasticities in the representative agent RBC model. The reason lies in how the implied Frisch is computed; we impose on the RBC model the properties of the allocation, such as the investment to output ratio or capital share, as found in the reference economy. Since the "Baseline" definition and the "Never married, 18-30" definition differ in these aspects–as shown in Tables 5 and 20–this accounts for the differences in the implied Frisch.

Table 11: Macro Elasticity: Counterfactual Economies

Economy	**Variance of the aggregate hours**	**Implied Frisch in RA RBC**	**Proportional Change (%)**
Baseline	0.172	1.236	+ 71.6
Fixed coresidence ($x = x_{ss}$)	0.166	1.204	+ 67.0
No coresidence ($x = 0$)	0.135	1.021	+ 41.8
Full coresidence ($x = 1$)	0.196	1.392	+ 93.3
Equal curvature ($\nu^y = \nu^o = 0.72$)	0.160	1.126	+ 56.4

Notes: Results are based on the baseline definition of unstable individuals, specifically those aged 18 to 30. For the economies labeled "Fixed coresidence," "No coresidence," and "Full coresidence," we retain parameters from the baseline calibration. For the "Equal curvature" economy, we recalibrate the parameters, excluding ν^y, to match the same set of targets as in the baseline.

and 3b), this economy prohibits selection. A fixed fraction of young agents, precisely 52 percent, reside within old households regardless of productivity level. This economy exhibits a variance of aggregate hours at 0.165, implying a Frisch elasticity in the representative agent real business cycle model of 1.20, an increase of 67 percent. The difference in the volatility of aggregate hours between the baseline and this counterfactual economy should not be misconstrued as indicating the insignificance of the volatility margin of living arrangements. First, it is essential to note that the contribution of the household size volatility margin to the variance of aggregate hours is reduced to zero by construction, an unequivocal force pushing the volatility of hours worked downward. However, this is counteracted by substituting insurance through the living arrangement margin with increased volatility of hours worked by agents living within the old households. Faced with the same aggregate and idiosyncratic shocks, and given that model parameters are unchanged, their hours worked respond more relative to the benchmark and covary more positively with the hours of their peers living alone. This latter effect largely offsets the impact of the fixed living arrangement margin.

Next, in the experiment labeled "No coresidence ($x = 0$)" in Table 11, we hold all parameters constant and eliminate the possibility of co-residence. This arrangement forces young agents to live independently, isolating them from older individuals. In this setup, the distinctions between young and old agents are confined to their preferences and intertemporal considerations. As a result, the variance of aggregate hours decreases by 21 percent compared to the Baseline calibration, leading to an implied Frisch elasticity in the representative agent RBC model of 1.02, compared to 1.24 in the Baseline. This translates to a nearly 30 percentage point reduction in change of the implied Frisch elasticity (as shown in column 3), underscoring the significant role of living arrangement channels in influencing the volatility of aggregate hours and, consequently, the aggregate labor supply elasticity.

Further, in the counterfactual labeled "Full coresidence ($x = 1$)" in Table 11, we maintain all parameters at their baseline levels and compel all unstable agents to reside within old households.

This scenario represents the opposite extreme compared to the previous one, testing the upper limits of the impact of coresidence margins on the volatility of hours worked. Under this scenario, the variance of aggregate hours increases to 0.196, which implies a Frisch elasticity in a representative agent RBC model of 1.39. This represents a substantial 93.3 percent increase relative to the elasticity imposed in our model.

To further explore the role of living arrangements and preference heterogeneity, we equalize the curvature in labor supply between young and old, setting $\nu^y = \nu^o = 0.72$; this experiment is labeled "Equal curvature ($\nu^y = \nu^o = 0.72$)" in Table 11. In this instance, we recalibrate 14 model parameters–one fewer than in the Baseline–to match the same set of 15 targets. The model fit and parameter values are reported in Tables 24 and 25 in the Appendix, respectively. Despite the additional parameter restriction, we achieve a comparable fit to the data (2.1×10^{-4} vs. 2.9×10^{-4} in the L^2 norm). Additionally, the variance of aggregate hours in this economy is 0.159, compared to 0.172 in the Baseline, as shown in column 2 of Table 11. This translates to a Frisch elasticity in the representative agent RBC model of 1.13, compared to 1.24 in the Baseline, an increase of 56.4 percent versus 71.6 percent in the Baseline (78.8 percent of the increase observed in the Baseline). This experiment highlights that even when young and old share identical labor supply curvatures, the living arrangement channel significantly enhances the propagation of aggregate shocks.

8 Conclusions

In this paper, we have documented countercyclical movements in household size over business cycles. We found that these cyclical movements are substantial: changes in the average number of households per person account for around 20 percent of the cyclical variation in hours worked per person. A significant portion of these changes in household composition is due to young or unstable individuals moving in and out of the homes of older, stable individuals. We also document that the labor market outcomes of young individuals living with the old differ considerably from their peers: they work and earn less and experience higher volatility in hours worked.

We then proposed a model with both stable and unstable individuals, where household composition is optimally chosen by the unstable agents. Our model features endogenous selection into living arrangements by young individuals, consistent with the patterns observed in the data. Furthermore, we used the model to assess the role of the household attachment channel in various contexts. We estimate that implicit transfers received by the young living with the old are substantial. These transfers also imply a wedge between the elasticities of labor supply among the young with different living arrangements, with those living with the old exhibiting significantly larger elasticity than their peers living alone.

We then calculated the size of the Frisch elasticity a representative agent model would need to display the same volatility of total hours as our model (with old agents having a Frisch elasticity of labor of 0.72). We found that its implied value is 1.24, an increase of 71.6 percent.

We conclude that macroeconomists now have a compelling argument to claim that the macro labor elasticity is larger than that suggested by micro studies, based on the fact that young agents exhibit both more volatile wage behavior and a variable household structure (both across time and in the cross-section).

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Appendix

A Labor supply elasticities

Start with the labor supply of young alone, which is independent on the living arrangement at the beginning of a period, given by

$$h^{yA} = \left(\frac{(w^y \varepsilon)^{1-\sigma^y}}{\psi^y}\right)^{\left(\frac{\nu^y}{1+\sigma^y \nu^y}\right)}. \tag{27}$$

Taking derivative of (27) with respect to wage w^y yields

$$\begin{aligned} \frac{dh^{yA}}{dw^y} &= \left(\frac{\nu^y}{1+\sigma^y \nu^y}\right)\left(\frac{(w^y)^{1-\sigma^y}\,\varepsilon^{1-\sigma^y}}{\psi^y}\right)^{\left(\frac{\nu^y}{1+\sigma^y \nu^y}-1\right)}(1-\sigma^y)\left(\frac{(w^y)^{-\sigma^y}\,\varepsilon^{1-\sigma^y}}{\psi^y}\right) \\ &= \left(\frac{(1-\sigma^y)\,\nu^y}{1+\sigma^y \nu^y}\right)\left(\frac{\varepsilon^{1-\sigma^y}}{\psi^y}\right)^{\left(\frac{\nu^y-1-\sigma^y \nu^y}{1+\sigma^y \nu^y}+1\right)}(w^y)^{-\sigma^y}\left((w^y)^{1-\sigma^y}\right)^{\left(\frac{\nu^y-1-\sigma^y \nu^y}{1+\sigma^y \nu^y}\right)}. \end{aligned}$$

By the fact that

$$\begin{aligned} \left(\frac{\nu^y-1-\sigma^y \nu^y}{1+\sigma^y \nu^y}+1\right) &= \frac{\nu^y}{1+\sigma^y \nu^y} \\ (1-\sigma^y)\left(\frac{\nu^y-1-\sigma^y \nu^y}{1+\sigma^y \nu^y}\right) &= \frac{\nu^y-1-2\sigma^y \nu^y}{1+\sigma^y \nu^y} \end{aligned}$$

we get

$$\frac{dh^{yA}}{dw^y} = \left(\frac{(1-\sigma^y)\,\nu^y}{1+\sigma^y \nu^y}\right)\left(\frac{\varepsilon^{1-\sigma^y}}{\psi^y}\right)^{\left(\frac{\nu^y}{1+\sigma^y \nu^y}\right)}(w^y)^{\frac{\nu^y-1-2\sigma^y \nu^y}{1+\sigma^y \nu^y}}.$$

Hence the uncompensated, Marshallian elasticity of labor supply for young alone is

$$\begin{aligned}
\eta_{w^y}^{h^{yA}} &= \left(\frac{w^y}{h^{yA}}\right)\frac{dh^{yA}}{dw^y} \\
&= \frac{1}{h^{yA}}\left(\frac{(1-\sigma^y)\,\nu^y}{1+\sigma^y\nu^y}\right)\left(\frac{\varepsilon^{1-\sigma^y}}{\psi^y}\right)^{\left(\frac{\nu^y}{1+\sigma^y\nu^y}\right)}(w^y)^{\frac{\nu^y-1-2\sigma^y\nu^y+1+\sigma^y\nu^y}{1+\sigma^y\nu^y}} \\
&= \left(\frac{(1-\sigma^y)\,\nu^y}{1+\sigma^y\nu^y}\right)\left((w^y)^{1-\sigma^y}\right)^{-\left(\frac{\nu^y}{1+\sigma^y\nu^y}\right)}(w^y)^{\frac{\nu^y-\sigma^y\nu^y}{1+\sigma^y\nu^y}}.
\end{aligned}$$

Notice that

$$-\frac{(1-\sigma^y)\,\nu^y}{1+\sigma^y\nu^y}+\frac{\nu^y-\sigma^y\nu^y}{1+\sigma^y\nu^y}=0$$

implying

$$\eta_{w^y}^{h^{yA}}=\frac{(1-\sigma^y)\,\nu^y}{1+\sigma^y\nu^y} \tag{28}$$

which is the formula 24 in the main body of the paper. The labor supply of the young together is implicitly defined by the following first order condition

$$\left(w^y h^{yT}\varepsilon+g\left(c^o\right)\right)^{-\sigma^y}w^y\varepsilon-(\psi^y)\left(h^{yT}\right)^{\frac{1}{\nu^y}}=0. \tag{29}$$

Define

$$G\left(w^y,h^{yT}\right)=\left(\frac{w^y\varepsilon}{\psi^y}\right)^{-\frac{1}{\sigma^y}}\left(w^y h^{yT}\varepsilon+g\left(c^o\right)\right)-\left(h^{yT}\right)^{-\frac{1}{\sigma^y\nu^y}}=0$$

then the Marshallian elasticity of labor supply is given by

$$\eta_{w^y}^{h^{yT}}=\left(\frac{w^y}{h^{yT}}\right)\frac{dh^{yT}}{dw^y}=\left(\frac{w^y}{h^{yT}}\right)\left(-\frac{\partial G/\partial w^y}{\partial G/\partial h^{yT}}\right)$$

where the second equality comes from the implicit function theorem. After some algebra we get

$$\frac{\partial G\left(h^{yT},w^y\right)}{\partial w^y} = \left(\frac{\sigma^y-1}{\sigma^y}\right)\left(\frac{w^y\varepsilon}{\psi^y}\right)^{-\frac{1}{\sigma^y}}\left[\varepsilon h^{yT}-\frac{\zeta c^o}{(\sigma^y-1)\,w^y}\right] \tag{30}$$

$$\frac{\partial G\left(h^{yT},w^y\right)}{\partial h^{yT}} = \left(\frac{(w^y)^{1-\sigma^y}\varepsilon^{1-\sigma^y}}{\psi^y}\right)^{-\frac{1}{\sigma^y}}+\left(\frac{1}{\sigma^y\nu^y}\right)\left(h^{yT}\right)^{-\frac{1}{\sigma^y\nu^y}-1}. \tag{31}$$

The optimality condition (29) implies

$$\left(h^{yT}\right)^{-\frac{1}{\sigma^y\nu^y}} = \left(\frac{w^y\varepsilon}{\psi^y}\right)^{-\frac{1}{\sigma^y}}\left(w^y h^{yT}\varepsilon + \zeta c^o\right),$$

which plugged into the (31) after rearranging yields

$$\frac{\partial G\left(h^{yT}, w^y\right)}{\partial h^{yT}} = \left(\frac{w^y\varepsilon}{\psi^y}\right)^{-\frac{1}{\sigma^y}}\left[w^y\varepsilon\left(\frac{1+\sigma^y\nu^y}{\sigma^y\nu^y}\right) + \frac{\zeta c^o}{h^{yT}\sigma^y\nu^y}\right].$$

Combining all elements the elasticity of interest becomes

$$\begin{aligned}\eta_{w^y}^{h^{yT}} &= \left(\frac{w^y}{h^{yT}}\right)\frac{\left(\frac{\sigma^y-1}{\sigma^y}\right)\left[\varepsilon h^{yT} - \frac{\zeta c^o}{(\sigma^y-1)w^y}\right]}{\left[w^y\varepsilon\left(\frac{1+\sigma^y\nu^y}{\sigma^y\nu^y}\right) + \frac{\zeta c^o}{h^{yT}\sigma^y\nu^y}\right]}\\ &= \frac{\nu^y\left(1-\sigma^y\right)}{1+\sigma^y\nu^y}\frac{\left[1+\left(\frac{\zeta c^o}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1-\sigma^y}\right)\right]}{\left[1+\left(\frac{\zeta c^o}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1+\sigma^y\nu^y}\right)\right]},\end{aligned}$$

where second inequality follows after some algebra. As a result we get

$$\eta_{w^y}^{h^{yT}} = \eta_{w^y}^{h^{yA}}\frac{\left[1+\left(\frac{\zeta c^o}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1-\sigma^y}\right)\right]}{\left[1+\left(\frac{\zeta c^o}{\varepsilon w^y h^{yT}}\right)\left(\frac{1}{1+\sigma^y\nu^y}\right)\right]} \tag{32}$$

which is the formula 25 in the main body of the paper.

B Measures of implicit transfers

B.1 Hours measure

This measure is developed as follows. Consider the utilities of the young with transfers and no transfers for an individual who enters the period living together or alone and chooses to live with the old in the current period. Fix productivity ε and threshold $\eta^*(\varepsilon)$ defined by 10 and let $\widehat{h}_{\varepsilon}^{yT}$

be hours worked which would make the individual indifferent, i.e.

$$\left[\frac{\left(\varepsilon w^{y}h^{yT}+\zeta c^{o}\right)^{1-\sigma^{y}}}{1-\sigma^{y}}-\varphi^{y}\frac{\left(h^{yT}\right)^{1+\frac{1}{\nu^{y}}}}{1+\frac{1}{\nu^{y}}}-\eta^{*}(\varepsilon)-\right]$$
$$\left[\frac{\left(\varepsilon w^{y}\widehat{h}_{\varepsilon}^{yT}\right)^{1-\sigma^{y}}}{1-\sigma^{y}}-\varphi^{y}\frac{\left(\widehat{h}_{\varepsilon}^{yT}\right)^{1+\frac{1}{\nu^{y}}}}{1+\frac{1}{\nu^{y}}}-\eta^{*}(\varepsilon)\right]=0$$

therefore averaging across young individuals living together we yield at

$$\widehat{h}^{yT}=\int_{0}^{\infty}\int_{0}^{\eta^{*}(\varepsilon)}\widehat{h}_{\varepsilon}^{yT}dF_{\eta}dF_{\varepsilon}$$

and hence the measure

$$\Delta_{h}=\left(\frac{\widehat{h}^{yT}-\overline{h}^{yT}}{\overline{h}^{yT}}\right)\times 100$$

where $\overline{h}^{yT}$ is the mean hours worked of the young together in the baseline calibration.

B.2 Productivity measure

This measure is developed as follows. This measure is developed as follows. Consider the utilities of the young with transfers and no transfers for an individual who enters the period living together or alone and chooses to live with the old in the current period. Fix hours worked h^{yT} and the threshold $\eta^{*}(\varepsilon)$ defined by 10 and let $\overline{\varepsilon}_{T}$ be the productivity which would make the individual indifferent, leading to

which yields

$$\widehat{\varepsilon}_{T}=\frac{\varepsilon w^{y}h^{yT}+\zeta c^{o}}{w^{y}h^{yT}}.$$

therefore averaging across young individuals living together we yield at

$$\widehat{\varepsilon}=\int_{0}^{\infty}\int_{0}^{\eta^{*}(\varepsilon)}\widehat{\varepsilon}_{T}\ dF_{\eta}dF_{\varepsilon}$$

and hence the measure is

$$\Delta_{\varepsilon} = \left(\frac{\widehat{\varepsilon} - \overline{\varepsilon}}{\overline{\varepsilon}} \right) \times 100.$$

where $\overline{\varepsilon}$ is the mean productivity of the young together in the baseline calibration.

C Additional tables

Table 12: Targeted Moments: Frisch for Old = 0.3

Moment	**Data**	**Model**
First Moments		
Investment/Output	0.25	0.25
Mean Hours Old	0.56	0.57
Mean Hours Young Together	0.21	0.20
Mean Hours Young Alone	0.30	0.30
Fraction of Young living with Old	0.52	0.51
Wage of young alone/Wage Old	0.72	0.56
Wage of young together/Wage Old	0.41	0.44
Capital Income Share	0.36	0.32
Second Moments		
$\sigma(h^y)/\sigma(h^o)$	1.73	1.72
$\sigma(h^{yT})/\sigma(h^o)$	2.08	2.28
$\sigma(h^{yA})/\sigma(h^o)$	1.28	1.28
$\sigma(x)/\sigma(h^o)$	0.71	0.34
$\sigma(w^y)/\sigma(w^o)$	1.07	1.02
$\sigma(w^{yT})/\sigma(w^{yA})$	1.00	0.97
Corr(x, h)	-0.72	-0.73
Fit in L^2 norm		0.00025

Table 13: Parameter Values: Frisch for Old = 0.3

Parameter description	**Symbol**	**Value**	**Discipline**
Params set without solving the model			
Fraction of the old in the Population	μ	0.693	CPS data
Frisch elasticity for the Old	ν^o	0.300	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.034	Targeted Moments
Disutilty of labor for the Old	ψ^o	10.445	Targeted Moments
Disutilty of labor for the Young	ψ^y	6.625	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.659	Targeted Moments
Labor elasticity of the Young	ν^y	0.916	Targeted Moments
Mean of the prod. of the Young	μ_ε	1.845	Targeted Moments
Std of the prod. of the Young	σ_ε	1.155	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.600	Targeted Moments
Std of the disutility for living with Old	σ_η	0.913	Targeted Moments
Share of Young in production	θ	0.112	Targeted Moments
Share of Old in capital-labor CES	λ	0.237	Targeted Moments
Production technology elasticity	ρ	0.222	Targeted Moments
Production technology elasticity	σ	0.331	Targeted Moments
Constant in the transfer function	ζ_0	0.002	Targeted Moments
Slope of the transfer function	ζ_1	0.064	Targeted Moments

Table 14: Targeted Moments: Frisch for Old = 1.0

Moment	**Data**	**Model**
First Moments		
Investment/Output	0.25	0.23
Mean Hours Old	0.56	0.55
Mean Hours Young Together	0.21	0.20
Mean Hours Young Alone	0.30	0.30
Fraction of Young living with Old	0.52	0.52
Wage of young alone/Wage Old	0.72	0.57
Wage of young together/Wage Old	0.41	0.50
Capital Income Share	0.36	0.31
Second Moments		
$\sigma(h^y)/\sigma(h^o)$	1.73	1.69
$\sigma(h^{yT})/\sigma(h^o)$	2.08	2.29
$\sigma(h^{yA})/\sigma(h^o)$	1.28	1.22
$\sigma(x)/\sigma(h^o)$	0.71	0.24
$\sigma(w^y)/\sigma(w^o)$	1.07	1.22
$\sigma(w^{yT})/\sigma(w^{yA})$	1.00	0.92
Corr(x, h)	-0.72	-0.74
Fit in L^2 norm		0.00035

Table 15: Parameter Values: Frisch for Old = 1.0

Parameter description	Symbol	Value	Discipline
Params set without solving the model			
Fraction of the old in the Population	μ	0.693	CPS data
Frisch elasticity for the Old	ν^o	1.000	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.029	Targeted Moments
Disutilty of labor for the Old	ψ^o	2.911	Targeted Moments
Disutilty of labor for the Young	ψ^y	4.057	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.517	Targeted Moments
Labor elasticity of the Young	ν^y	1.489	Targeted Moments
Mean of the prod. of the Young	μ_ε	3.118	Targeted Moments
Std of the prod. of the Young	σ_ε	0.551	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.603	Targeted Moments
Std of the disutility for living with Old	σ_η	0.809	Targeted Moments
Share of Young in production	θ	0.063	Targeted Moments
Share of Old in capital-labor CES	λ	0.305	Targeted Moments
Production technology elasticity	ρ	0.079	Targeted Moments
Production technology elasticity	σ	0.616	Targeted Moments
Constant in the transfer function	ζ_0	0.024	Targeted Moments
Slope of the transfer function	ζ_1	0.130	Targeted Moments

Table 16: Targeted Moments: Frisch for Old = 2.0

Moment	**Data**	**Model**
	First Moments	
Investment/Output	0.25	0.25
Mean Hours Old	0.56	0.55
Mean Hours Young Together	0.21	0.20
Mean Hours Young Alone	0.30	0.31
Fraction of Young living with Old	0.52	0.51
Wage of young alone/Wage Old	0.72	0.71
Wage of young together/Wage Old	0.41	0.62
Capital Income Share	0.36	0.33
	Second Moments	
$\sigma(h^y)/\sigma(h^o)$	1.73	1.61
$\sigma(h^{yT})/\sigma(h^o)$	2.08	2.04
$\sigma(h^{yA})/\sigma(h^o)$	1.28	1.30
$\sigma(x)/\sigma(h^o)$	0.71	0.12
$\sigma(w^y)/\sigma(w^o)$	1.07	1.24
$\sigma(w^{yT})/\sigma(w^{yA})$	1.00	0.93
Corr(x, h)	-0.72	-0.73
Fit in L^2 norm		0.00047

Table 17: Parameter Values: Frisch for Old = 2.0

Parameter description	Symbol	Value	Discipline
Params set without solving the model			
Fraction of the old in the Population	μ	0.693	CPS data
Frisch elasticity for the Old	ν^o	2.000	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.032	Targeted Moments
Disutilty of labor for the Old	ψ^o	2.103	Targeted Moments
Disutilty of labor for the Young	ψ^y	3.511	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.366	Targeted Moments
Labor elasticity of the Young	ν^y	1.681	Targeted Moments
Mean of the prod. of the Young	μ_ε	2.359	Targeted Moments
Std of the prod. of the Young	σ_ε	0.697	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.698	Targeted Moments
Std of the disutility for living with Old	σ_η	0.907	Targeted Moments
Share of Young in production	θ	0.120	Targeted Moments
Share of Old in capital-labor CES	λ	0.322	Targeted Moments
Production technology elasticity	ρ	0.103	Targeted Moments
Production technology elasticity	σ	0.641	Targeted Moments
Constant in the transfer function	ζ_0	0.111	Targeted Moments
Slope of the transfer function	ζ_1	0.126	Targeted Moments

Table 18: Targeted Moments: Young Never Married

Moment	**Data**	**Model**
	First Moments	
Investment/Output	0.25	0.23
Mean Hours Old	0.57	0.57
Mean Hours Young Together	0.21	0.21
Mean Hours Young Alone	0.29	0.29
Fraction of Young living with Old	0.50	0.50
Wage of young alone/Wage Old	0.78	0.49
Wage of young together/Wage Old	0.41	0.42
Capital Income Share	0.36	0.35
	Second Moments	
$\sigma(h^y)/\sigma(h^o)$	1.61	1.55
$\sigma(h^{yT})/\sigma(h^o)$	1.88	1.92
$\sigma(h^{yA})/\sigma(h^o)$	1.24	1.27
$\sigma(x)/\sigma(h^o)$	0.61	0.15
$\sigma(w^y)/\sigma(w^o)$	1.11	1.11
$\sigma(w^{yT})/\sigma(w^{yA})$	1.05	0.94
Corr(x, h)	-0.62	-0.63
Fit in L^2 norm		0.00031

Table 19: Parameter Values: Young Never Married

Parameter description	**Symbol**	**Value**	**Discipline**
Params set without solving the model			
Fraction of the old in the Population	μ	0.720	CPS data
Frisch elasticity for the Old	ν^o	0.720	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.018	Targeted Moments
Disutilty of labor for the Old	ψ^o	3.153	Targeted Moments
Disutilty of labor for the Young	ψ^y	4.121	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.390	Targeted Moments
Labor elasticity of the Young	ν^y	1.089	Targeted Moments
Mean of the prod. of the Young	μ_ε	1.978	Targeted Moments
Std of the prod. of the Young	σ_ε	0.746	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.515	Targeted Moments
Std of the disutility for living with Old	σ_η	0.650	Targeted Moments
Share of Young in production	θ	0.095	Targeted Moments
Share of Old in capital-labor CES	λ	0.218	Targeted Moments
Production technology elasticity	ρ	0.231	Targeted Moments
Production technology elasticity	σ	0.494	Targeted Moments
Constant in the transfer function	ζ_0	0.034	Targeted Moments
Slope of the transfer function	ζ_1	0.093	Targeted Moments

Table 20: Targeted Moments: Young 18-30 and Never Married

Moment	**Data**	**Model**
First Moments		
Investment/Output	0.25	0.30
Mean Hours Old	0.56	0.55
Mean Hours Young Together	0.20	0.19
Mean Hours Young Alone	0.30	0.31
Fraction of Young living with Old	0.66	0.65
Wage of young alone/Wage Old	0.71	0.60
Wage of young together/Wage Old	0.38	0.51
Capital Income Share	0.36	0.41
Second Moments		
$\sigma(h^y)/\sigma(h^o)$	1.26	1.32
$\sigma(h^{yT})/\sigma(h^o)$	1.58	1.64
$\sigma(h^{yA})/\sigma(h^o)$	0.93	0.93
$\sigma(x)/\sigma(h^o)$	0.52	0.06
$\sigma(w^y)/\sigma(w^o)$	1.07	0.93
$\sigma(w^{yT})/\sigma(w^{yA})$	1.28	0.94
Corr(x, h)	-0.72	-0.73
Fit in L^2 norm		0.00062

Table 21: Parameter Values: Young 18-30 and Never Married

Parameter description	**Symbol**	**Value**	**Discipline**
Params set without solving the model			
Fraction of the old in the Population	μ	0.816	CPS data
Frisch elasticity for the Old	ν^o	0.720	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.028	Targeted Moments
Disutilty of labor for the Old	ψ^o	3.409	Targeted Moments
Disutilty of labor for the Young	ψ^y	4.583	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.437	Targeted Moments
Labor elasticity of the Young	ν^y	0.989	Targeted Moments
Mean of the prod. of the Young	μ_ε	2.733	Targeted Moments
Std of the prod. of the Young	σ_ε	1.037	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.404	Targeted Moments
Std of the disutility for living with Old	σ_η	1.693	Targeted Moments
Share of Young in production	θ	0.071	Targeted Moments
Share of Old in capital-labor CES	λ	0.203	Targeted Moments
Production technology elasticity	ρ	0.325	Targeted Moments
Production technology elasticity	σ	0.270	Targeted Moments
Constant in the transfer function	ζ_0	0.112	Targeted Moments
Slope of the transfer function	ζ_1	0.130	Targeted Moments

Table 22: Targeted Moments: Young Implicit Definition

Moment	**Data**	**Model**
	First Moments	
Investment/Output	0.25	0.25
Mean Hours Old	0.56	0.52
Mean Hours Young Together	0.21	0.20
Mean Hours Young Alone	0.30	0.31
Fraction of Young living with Old	0.52	0.52
Wage of young alone/Wage Old	0.72	0.66
Wage of young together/Wage Old	0.41	0.52
Capital Income Share	0.36	0.31
	Second Moments	
$\sigma(h^y)/\sigma(h^o)$	1.73	1.72
$\sigma(h^{yT})/\sigma(h^o)$	2.08	2.21
$\sigma(h^{yA})/\sigma(h^o)$	1.28	1.30
$\sigma(x)/\sigma(h^o)$	0.71	0.33
$\sigma(w^y)/\sigma(w^o)$	1.07	1.18
$\sigma(w^{yT})/\sigma(w^{yA})$	1.00	0.98
Corr(x, h)	-0.72	-0.75
Fit in L^2 norm		0.00039

Table 23: Parameter Values: Young Implicit Definition

Parameter description	**Symbol**	**Value**	**Discipline**
Params set without solving the model			
Fraction of the old in the Population	μ	0.442	CPS data
Frisch elasticity for the Old	ν^o	0.720	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.037	Targeted Moments
Disutilty of labor for the Old	ψ^o	3.969	Targeted Moments
Disutilty of labor for the Young	ψ^y	4.337	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.543	Targeted Moments
Labor elasticity of the Young	ν^y	1.594	Targeted Moments
Mean of the prod. of the Young	μ_ε	2.042	Targeted Moments
Std of the prod. of the Young	σ_ε	0.806	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.503	Targeted Moments
Std of the disutility for living with Old	σ_η	0.669	Targeted Moments
Share of Young in production	θ	0.195	Targeted Moments
Share of Old in capital-labor CES	λ	0.333	Targeted Moments
Production technology elasticity	ρ	0.158	Targeted Moments
Production technology elasticity	σ	0.540	Targeted Moments
Constant in the transfer function	ζ_0	0.012	Targeted Moments
Slope of the transfer function	ζ_1	0.091	Targeted Moments

Table 24: Targeted Moments: $\nu^y = \nu^o = 0.72$

Moment	Data	Model
First Moments		
Investment/Output	0.25	0.21
Mean Hours Old	0.56	0.56
Mean Hours Young Together	0.21	0.20
Mean Hours Young Alone	0.30	0.30
Fraction of Young living with Old	0.52	0.52
Wage of young alone/Wage Old	0.72	0.49
Wage of young together/Wage Old	0.41	0.38
Capital Income Share	0.36	0.29
Second Moments		
$\sigma(h^y)/\sigma(h^o)$	1.73	1.70
$\sigma(h^{yT})/\sigma(h^o)$	2.08	2.11
$\sigma(h^{yA})/\sigma(h^o)$	1.28	1.35
$\sigma(x)/\sigma(h^o)$	0.71	0.26
$\sigma(w^y)/\sigma(w^o)$	1.07	1.16
$\sigma(w^{yT})/\sigma(w^{yA})$	1.00	0.89
Corr(x, h)	-0.72	-0.72
Fit in L^2 norm		0.00029

Table 25: Parameter Values: $\nu^y = \nu^o = 0.72$

Parameter description	**Symbol**	**Value**	**Discipline**
Params set without solving the model			
Fraction of the old in the Population	μ	0.693	CPS data
Frisch elasticity for the Old	ν^o	0.720	Heathcote et al. (2010)
Equivalence scale within the Old	ζ^o	1.700	OECD data
Equivalence scale for Old with Young	ζ^y	0.500	OECD data
Size of the Old household	γ	2.010	CPS data
Params requiring solving the model			
Discount factor	β	0.990	$r = 0.01$
Depreciation Rate	δ	0.028	Targeted Moments
Disutilty of labor for the Old	ψ^o	3.491	Targeted Moments
Disutilty of labor for the Young	ψ^y	6.077	Targeted Moments
Curvature in consumption of the Young	ϕ^y	0.364	Targeted Moments
Labor elasticity of the Young	ν^y	0.720	Targeted Moments
Mean of the prod. of the Young	μ_ε	2.941	Targeted Moments
Std of the prod. of the Young	σ_ε	0.867	Targeted Moments
Mean of the disutility of living with Old	μ_η	0.595	Targeted Moments
Std of the disutility for living with Old	σ_η	0.531	Targeted Moments
Share of Young in production	θ	0.051	Targeted Moments
Share of Old in capital-labor CES	λ	0.249	Targeted Moments
Production technology elasticity	ρ	0.136	Targeted Moments
Production technology elasticity	σ	0.595	Targeted Moments
Constant in the transfer function	ζ_0	0.145	Targeted Moments
Slope of the transfer function	ζ_1	0.107	Targeted Moments