Consumption Dynamics and Allocation in the Family*

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Abstract

This paper studies the dynamics of consumption and earnings in the family, and their allocation among family members, in the face of idiosyncratic labor market uncertainty. I develop a dynamic collective household model for individuals in a family who differ in preferences and bargaining power but are tied down together by a common budget constraint. Family members do not necessarily commit to each other for life; instead, the revelation of new information can change the allocation of bargaining power among them. The model features public consumption at the family level, private consumption and leisure at the individual level, and asset accumulation. I derive approximate closed form expressions for consumption and earnings and I use them to map the model to observed behavior. I point-identify a large set of gender-specific preference parameters, the unobserved allocation of consumption, and a rich set of bargaining effects utilizing data on individual wages and earnings, and aggregate family-level consumption. To achieve this, I need consumption information on single adult individuals just before they form a family. Preliminary results from the PSID (1999-2011) indicate that labor supply preferences differ between men and women but consumption preferences do not. The estimation allocates men a large share of consumption (60%); however this allocation is imprecisely estimated. Bargaining effects are large and statistically significant pointing to a rejection of full commitment.

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1 Introduction

How does family consumption respond to wage shocks by individual family members? And how do individual consumption and earnings? How is consumption shared among family members in the household? Which family members are the most responsive to wage changes? This paper develops a dynamic collective household model to study theoretically and investigate empirically the dynamics and the allocation of consumption and earnings in the family.[1] It does so admitting that a family is essentially a *group* of individuals who act collectively under common constraints (rather than a *single* economic agent) and thus respects the fundamental principle of methodological individualism (Manser and Brown, 1980; McElroy and Horney, 1981; Chiappori, 1988).

Specifically, I investigate how risk and uncertainty about individual family members' hourly wages transmit into earnings and consumption over the life cycle and thus ultimately affect welfare. I take into account a number of mechanisms that potentially come into play at the intersection of wages, earnings, and consumption such as self insurance through borrowing and saving, labor supply adjustments, diversification across consumption goods, or shifts of intra-family power across family members. A number of recent studies (Blundell et al., 2008; Heathcote et al., 2009; Blundell et al., 2012) pursue a similar investigation but they all abstract from issues such as intra-family allocations or intra-family inequality. With a few notable exceptions, such as Lise and Yamada (2014), this literature has ignored the possibility of unequal consumption allocations within the family, possibly because lack of appropriate data has impeded such discussion. On the contrary, this paper describes precisely the role played by the aforementioned mechanisms and also respects the possibility of heterogeneous preferences, bargaining, and asymmetric allocations among family members.[2]

From a modeling point of view, a family consists of two decision making individuals and possibly a few others without direct say about the household fortunes (such as young children). In what follows I use the terms "partners" or "individuals" to refer to the decision makers. Each partner has egotistical preferences over their own leisure, their own private (rival) consumption, and the household's public (non rival) consumption. In principle preferences differ across partners. I allow for a large set of complementarities between the different goods by letting individual preferences be intra-temporally non-separable. Up to this point the model shares many common features with the static approach of Blundell et al. (2005).

Before the individuals form a family they decide on their initial relative powers in the family; this initial allocation of power summarizes fully the original decision/bargaining process. If the partners fully commit to each other, they stick to those powers for ever without renegotiating them (full commitment benchmark). If contemporaneous news such as labor market shocks or shocks to prices matter for the allocation of power, then the allocation is adjusted to reflect such news (limited commitment). This limited commitment environment nests the full commitment benchmark within it and allows tests of one environment against the other like in an important

[1] Formally, a family refers to a multi-member group of financially dependent individuals whereas a household can be single-member too. Unless I clearly refer to single-member households, the terms "household" and "family" will be used interchangeably to imply a multi-member collectivity.

[2] Lise and Seitz (2011) provide evidence that ignoring intra-family allocations results in a misleading picture of consumption inequality in the UK between 1968 and 2001.

study by Mazzocco (2007). In each period, the partners choose the levels and the allocation of consumption and leisure to optimize the (expected, discounted, and inter-temporally separable) weighted sum of their respective utility functions over the life cycle given their relative powers, their hourly wages and prices, and subject to a common intertemporal budget constraint. The budget constraint is used to link family-level expenditure to family-level income in every period but also as a means to shifting resources across periods through the accumulation or decumulation of a risk-free asset.

I derive closed-form analytical expressions for individual hours of work and earnings, individual private consumption, and household public consumption based on Taylor approximations to the first order conditions and the intertemporal budget constraint. Similar approximations appear in Blundell and Preston (1998) and a sequence of papers thereafter. The analytical expressions are functions of the partners' hourly wages and the price of the consumption goods. These expressions are convenient because they provide a neat picture of the contribution of various components (preferences, relative powers, etc.) to the response of consumption or earnings to wage/price changes. Given the restrictions imposed by the model, I use the variance-covariance matrix of wages, earnings, and family consumption to identify a large set of gender-specific (i.e. partner-specific) preferences, the unobserved allocation of private consumption among partners, as well as a number of bargaining effects induced on the choice variables by shifts in the allocation of power.

Identification is demanding. A fundamental challenge arises from the fact that there are goods that are enjoyed individually but whose demands are only observed at the aggregate household level (such as private consumption). The literature has overcome this problem by estimating the sharing of family expenditure through restrictions on observed individual labor supplies (this is the approach undertaken by Chiappori, 1988, 1992), by utilizing assignable or exclusive goods (for example Browning et al., 1994), or by directly collecting consumption information at the individual level within the family (as in Cherchye et al., 2012; Lise and Yamada, 2014). A second challenge arises from the fact that individual preferences cannot be separated from intra-family decision powers unless one normalizes such powers (Lise and Seitz, 2011, normalize the relative powers to one when the partners' potential earnings are equal) or has access to distribution factors (variables that shift the relative powers without moving preferences or the budget set). This is the case of Chiappori et al. (2002), Voena (2012), and others. However, the economic foundation or relevance of a distribution factor may often be contestable.[3] A final and related challenge arises due to the many complementarities across goods that are allowed for in the model. For example, and as will later become clear, a shock to one partner's wage can produce static income and substitution effects on labor supply, bargaining effects through renegotiations of intra-family power, and long-run income (wealth) effects through shifts in the intertemporal budget constraint. The static effects usually consist of direct effects (for example, the effect of one's wage on own labor supply) as well as indirect ones (for example, the effect of one's wage on another's labor supply through the interdependence of preferences due to the public good). The literature has employed a number of restrictions in

[3] Bourguignon et al. (2009) is an excellent study of identification in the presence of distribution factors. A general overview of identification in the static collective model is given in Chiappori and Ekeland (2009).

order to distinguish between the different effects. Voena (2012) imposes separability restrictions on individual preferences shutting down many of the aforementioned effects. Dunbar et al. (2013) restrict the shape of Engel curves across family members or household types, whereas Browning et al. (2013) impose restrictions on how preferences differ between single and married individuals and utilize information on singles to pre-estimate a number of preference parameters.

In this paper I do not assume observability of assignable, exclusive, or individual goods other than leisures; I do not normalize the consumption allocation to take on a specific value if certain conditions are met; I do not impose any parametric or separability assumptions on partners' preferences and I do not claim the relevance of a distribution factor. Instead, I exploit information about the partners before they form a family, hence information on them as singles like in Browning et al. (2013). Specifically, if each partner's underlying consumption preferences just before they join the family remain the same after they join it, a large set of behavioral parameters (Frisch elasticities) as well as the level of the sharing of private consumption can be point identified. The rationale behind this result is the following: observability of individuals across two states of life (as singles, and in couples) is sufficient for recovering their preferences with respect to leisure and all types of consumption. When wage shocks hit, and conditional on those preferences, the model predicts the unobserved response of each partner's private consumption in the family. The observed total consumption change at the family level is the weighted sum of the two individual responses; and the weight is nothing but the consumption allocation between the two partners. An equivalent interpretation is the following: total family consumption responds to wage shocks (and this response is observed). The extent to which this response resembles the way one or another partner would have responded had they been hit by the same shock as singles is informative about the allocation of consumption between the two partners. This result is subject to the assumption that preferences are locally state-of-life-invariant; "locally" in the sense that only a small window is needed around the time of family formation when each family member must be observed as single (before) and partnered (after). If this is not true, separability of public consumption in individual preferences is needed for recovering preferences and sharing up to scale.

The data requirements are modest: panel data are needed on individual earnings and hours of work, household-level consumption of rival and non-rival items, and household-level assets in single- and multi-member households. The Panel Study of Income Dynamics (PSID) has collected such data after 1999 with biennial frequency. I utilize 7 waves in total (1999-2011).

Preliminary results suggest that men differ from women in their leisure - labor supply preferences but not in their (private - public) consumption preferences. This results in the consumption allocation[4] between partners being imprecisely estimated because the model can identify this allocation only if individual consumption preferences differ. A caveat is due here: this result is preliminary and may reflect a local minimum in the GMM estimation that I carry out. As of May 2015 I have not yet carried out a global optimization and, as a consequence, the above result may change in future versions of the paper. Finally, the effects induced on outcomes due to renegotiation of intra-family power (bargaining effects) are large and statistically significant

[4]Here the allocation refers to the following consumption items that I categorize as private: food, public transport, medical services (excluding health insurance), and prescriptions.

pointing to a rejection of full commitment between partners.

The contribution of this paper is threefold: (a) theoretically, it extends the collective model of household labor supply and consumption to allow for intertemporal dynamics and limited commitment and studies the implications these features have for a number of household outcomes without using distribution factors; (b) methodologically, it applies Taylor approximations to the collective first order conditions and provides the tools to recover gender-specific preferences and the sharing of resources in the family even though such sharing is not directly observed; the framework laid out is clear, tractable, and with standard data requirements; and (c) empirically, it estimates the parameters of a collective model and provides quantitative evidence on preferences, the allocation of consumption, and intertemporal commitment within US families.

This study is related to several strands of literature. In microeconomics, the collective approach to households has been used to rationalize a number of empirical violations of the traditional unitary approach. Chiappori (1988, 1992) triggered a series of papers that extend the basic model into household production (Chiappori, 1997), income taxation (Donni, 2003), public goods (Blundell et al., 2005), discrete labor supply (Blundell et al., 2007), many consumption items (Chiappori, 2011) and numerous other features. Early attempts to estimate the static collective model (with or without distribution factors) include Bourguignon et al. (1993); Browning et al. (1994); Chiappori et al. (2002). More recently, the static model has been extended to allow for dynamics: Voena (2012) structurally estimates a dynamic collective model and studies the effects of divorce legislation on household outcomes. She abstracts from public goods, imposes unitary preferences over spouses' consumption and labor market participation (preferences are "collective" only with respect to an additive component), and calibrates most of the parameters. Lise and Yamada (2014) allow for leisure, private and public goods, impose only a very general parametrization on preferences, but they need to observe consumption separately for each household member. The present paper contributes to the dynamics of the collective model providing identification and estimation based on general preferences and standard data requirements (i.e. without the need to observe individual consumption).

Another body of literature is devoted to understanding the relation between consumption and income changes over the life cycle (for example Blundell and Preston, 1998; Hyslop, 2001; Attanasio et al., 2002; Blundell et al., 2008, 2012; Heathcote et al., 2009) and, closely related, the degree of insurance or self insurance against various types of shocks (for example Low, 2005; Kaplan and Violante, 2010). A review appears in Meghir and Pistaferri (2011). These papers study the transmission of income (or wage) shocks of various persistence into consumption in a number of alternative environments (stretching from exogenous incomes and no insurance against permanent shocks to endogenous labor supply and partial insurance). The present paper advances most of those papers' previous results into the realm of the collective household.

Finally, this paper contributes to the literature on intra-household commitment. Mazzocco (2007) shows that the full commitment household Euler equations are nested within the limited commitment Euler equations and, using data from the Consumer Expenditure Survey, he provides evidence against the former. Lise and Yamada (2014) provide evidence from Japan against full commitment but only when households are hit by extreme news. In this paper I identify the effects induced on the outcomes by reallocations of intra-family power and test them against 0 that full commitment postulates.

The paper is structured as follows: section 2 lays out a dynamic collective model for a multi-member household, describes how a solution is obtained, and discusses identification. Section 3 repeats the same for a single-member household and discusses how the two types of households can be combined together. Section 4 illustrates the empirical implementation of this exercise, and section 5 presents the results and a number of robustness checks. Section 6 concludes.

2 A Life-Cycle Family Model With Limited Commitment

In this section I develop and describe a life-cycle model for a family of two decision-making partners. The partners do not necessarily have to be married; the structural model below is suitable for studying an opposite-sex nuclear family as well as more modern forms of cohabitation.

At a point in time two individuals consider forming a family. They decide upon the initial powers each of them will have in the family should one be formed. To do so they may first compare and contrast their actual or expected outside options, consider their expected lifetime earnings, the state of the marriage market, or their respective assets and non-labor income. Of course, the true nature of the initial decision process (the "bargaining" as part of the literature has called it) is ultimately unknown to the econometrician and the above claims are only speculative. If the individuals finally reach a consensus, they may stick to these powers forever (full commitment) or decide to renegotiate them when their circumstances change (limited commitment).

The model below describes the family *after* the individuals have decided to form one (see Persson, 2013, for a study of the marriage decision instead) and *before* they possibly decide to dissolve it (see Voena, 2012, for a study of the divorce margin). In the meanwhile, each partner enjoys utility from consumption (consumed publicly at the household level, or privately) and disutility from work. As a household, they aim to keep the discounted expected marginal utility of household wealth constant over time. I assume partners' choices are on the (ex-post) Pareto frontier: as the partners must interact a lot, cooperate, and know each other's preferences well, it is unlikely they do not exploit the Pareto frontier of their joint capabilities even if sometimes they have to reallocate powers between them (however see Udry, 1996).

2.1 The Family Problem

Formally, let H_{jit} be the continuous hours of work of individual j in family i at time t, $j = \{1, 2\}$. I normalize $H_{jit} \in (0, 1]$ and I abstract from participation decisions in the labor market (see however Blundell et al., 2007). Let C_{it} be the family's total *private* consumption at t whereas K_{it} the family's *public* consumption; both C_{it} and K_{it} are composite Hicksian goods. C_{it} is the sum of C_{1it} and C_{2it} with C_{jit} being partner j's *individual* private consumption. Finally, let $\mathbf{z}_{jit}$ be an $M_j \times 1$ vector of preference factors (such as race, age, education). Individual j's intra-temporal preferences are given by

$$U_j(K_{it}, C_{jit}, 1 - H_{jit}; \mathbf{z}_{jit})$$

whereby $1 - H_{jit}$ I denote leisure.[5] I assume that U_j has continuous second-order derivatives in K_{it}, C_{jit}, H_{jit}, and $U_{j,K} > 0$, $U_{j,C_j} > 0$, $U_{j,H_j} < 0$ (first derivatives), $U_{j,KK} < 0$, $U_{j,C_jC_j} < 0$, $U_{j,H_jH_j} > 0$ (second derivatives).

A good is deemed private if consumption of one unit of it by one partner implies that this given unit is no longer available to the other partner. Consider an indivisible bar of chocolate; if one family member treats himself to it, then his partner will no longer be able to enjoy the *same* chocolate bar.

On the contrary, a good is deemed public if consumption by one family member does not reduce the amount of the good available to the other family member. Consider watching a show on a single available TV channel; if one partner consumes (watches) this, the exact same amount of this good remains for the other partner to enjoy.[6] The existence of public goods generates economies of scale in the family as individuals share the expenditure for these goods, an expenditure which they would otherwise have to bear by themselves.

I assume the econometrician can distinguish between C_{it} and K_{it} given the detailed household expenditure data available nowadays. What is often unobserved, however, is the partition between the partners' private consumption that add up to C_{it} because consumption information is usually collected at the *household* level rather than the *individual* level.

Formally, the household maximizes

$$\mathbb{E}_0 \sum_{t=0}^{T} \beta_t U_1\big(K_{it}, C_{1it}, 1 - H_{1it}; \mathbf{z}_{1it}\big) \tag{P}$$

subject to the series of constraints

$$\mathbb{E}_0 \sum_{t=0}^{T} \beta_t U_2\big(K_{it}, C_{2it}, 1 - H_{2it}; \mathbf{z}_{2it}\big) \geq \mathcal{U}_2 \tag{1}$$

$$U_1\big(K_{it}, C_{1it}, 1 - H_{1it}; \mathbf{z}_{1it}\big) \geq \bar{U}_{1t} \tag{2}$$

$$U_2\big(K_{it}, C_{2it}, 1 - H_{2it}; \mathbf{z}_{2it}\big) \geq \bar{U}_{2t} \tag{3}$$

$$A_{i0} + \mathbb{E}_0 \sum_{t=0}^{T} \frac{W_{1it}H_{1it} + W_{2it}H_{2it}}{(1+r)^t} = \mathbb{E}_0 \sum_{t=0}^{T} \frac{K_{it} + P_t C_{it}}{(1+r)^t}. \tag{BC}$$

The first constraint is the promise keeping constraint for partner 2's lifetime utility, the second and third constraints are the partners' participation constraints in the family (with $\bar{U}_{jt}$ indicating j's reservation utility or fall-back option at time t), and the last one is the intertemporal budget constraint. Let ϑ_{1i} multiply (P), ϑ_{2i} be the Lagrange multiplier on (1), $\widetilde{\vartheta}_{1it}$ be the Lagrange multiplier on (2), and $\widetilde{\vartheta}_{2it}$ on (3). Then the above programme is equivalent to

$$\max \mathbb{E}_0 \sum_{t=0}^{T} \beta_t \Big[\mu_{it} U_1(K_{it}, C_{1it}, 1 - H_{1it}; \mathbf{z}_{1it}) + (1 - \mu_{it}) U_2(K_{it}, C_{2it}, 1 - H_{2it}; \mathbf{z}_{2it})\Big] \tag{P'}$$

[5] I abstract from public elements in leisure because allowing for additional public goods will render the model intractable and jeopardize its empirical applicability. However see Fong and Zhang (2001).

[6] There may actually be more than one good involved when watching a TV show: the TV set which screens the show, the TV licence, the electricity which powers the TV, etc. For the sake of illustration I treat all these as a single item.

subject to (BC) so long as the reservation utilities $\bar{U}_{jt}$ do not depend on endogenous choices (Chiappori and Mazzocco, 2014). Intra-family power is represented by $\mu_{it} = \vartheta_{1i} + \frac{\widetilde{\vartheta}_{1it}}{\beta_t}$ (of partner 1) and $1 - \mu_{it} = \vartheta_{2i} + \frac{\widetilde{\vartheta}_{2it}}{\beta_t}$ (of partner 2). These powers have been normalized to add up to 1. As a consequence, μ_{it} and $1 - \mu_{it}$ are essentially the Pareto weights attached to each partner's utility function in the social planner's problem (P') subject to (BC). As Browning et al. (2014, section 6.2.2) point out, the outcome of the above problem at time t is not ex-ante (first-best) efficient; instead it is only ex-post (second-best) efficient in that there is no alternative outcome that is preferred to the chosen one and which does not violate one of the participation constraints above.

The partners share the same discount factor β; for simplicity discounting is geometric. Their choice variables at any time are H_{jit}, C_{jit}, $j = \{1, 2\}$, K_{it}, and next period's assets. This household problem can be decentralized using personal (Lindahl) prices for the public good (see Chiappori and Meghir, 2014).

The family assets at the beginning of $t = 0$ are A_{i0}. I abstract from individual-specific assets although this would be a meaningful extension especially if one is interested in marriage (Persson, 2013) and divorce (Voena, 2012) decisions too. The non-stochastic and known real interest rate is r.

Finally, I assume that labor markets are perfectly competitive and individuals are price-takers. W_{jit} is individual j's exogenous hourly wage at time t. It can be thought of as the value of that individual's skills in the labor market in that period. The relative price of private consumption at t is P_t and is assumed to be the same across families and partners within a family. The price of public consumption is normalized to one in all periods.[7]

2.1.1 The Prices

The primitive source of exogeneity and uncertainty the partners are faced with is the hourly wages they earn and (in principle) the relative price of private consumption. Other things remaining the same (such as the preference factors), the partners observe changes in W_{jit} and (in principle) P_t and respond by shifting their choice variables appropriately. In reality, changes in P_t will not be useful: I observe no cross-sectional variation in it;[8] I do observe variation over time but this will be absorbed by conditioning time dummies – see section 4.3. For this reason I will only focus on variation in W_{jit}.

I assume that both partners participate in the labor market because I need two wages for identification. The log of individual j's real hourly wage at t follows a permanent-transitory process and is given by

$$\begin{aligned} \ln W_{jit} &= \mathbf{x}_{jit}^{W\prime} \boldsymbol{\zeta}_{jt}^{W} + \ln w_{jit}^{P} + u_{jit} \\ \ln w_{jit}^{P} &= \ln w_{jit-1}^{P} + v_{jit}. \end{aligned}$$

[7] If P_t^k is the price of the public good at t, and P_t^c is the price of the private good, then the relative price of private consumption is defined as $P_t = {}^{P_t^c}/_{P_t^k}$. In other words, P_t^k is the deflator of all other monetary figures in the model, including assets and wages.

[8] Cross-sectional variation in P_t is not observed in the data unless one constructs family or individual specific prices given the basket of goods they consume or the state/county they reside in (for example Kiefer, 1984).

The vector $\mathbf{x}_{jit}^{W}$ contains observable characteristics known to the individual at time t; $\boldsymbol{\zeta}_{jt}^{W}$ is the vector of time-varying parameters. The permanent component $\ln w_{jit}^{P}$ follows a unit-root process and v_{jit} is the (permanent) shock to this process. Transitory deviations from one's wage profile are captured by u_{jit}. Combining these I get the usual permanent-transitory decomposition for the growth in residual wages given by

$$\Delta w_{jit} = v_{jit} + \Delta u_{jit} \tag{4}$$

where $\Delta w_{jit} = \Delta \ln W_{jit} - \Delta(\mathbf{x}_{jit}^{W\prime}\boldsymbol{\zeta}_{jt}^{W})$ and Δ the first difference operator.

Deviations from the deterministic path for wages occur because permanent and transitory shocks, positive or negative, hit the individuals. A permanent shock shifts the value of one's skills in the market permanently (for example, a technological shock, an accident causing some disability, a sudden promotion); a transitory shock is mean reverting (for example, fluctuations in one's effort on the job when effort is observed and linked to the wage, a short illness affecting productivity). When shocks hit, I assume the partners can perfectly observe and distinguish between them; moreover they hold no advance information about the shocks ($\mathbb{E}_{t-1}v_{jit} = 0$, $\mathbb{E}_{t-1}u_{jit} = 0$; $\mathbb{E}$ denotes subjective expectations).[9]

The properties of the shocks can be summarized as follows:

$$\mathbb{E}\left(v_{jit}v_{kit+s}\right) = \begin{cases} \sigma_{v_j,t}^{2} & \text{if} \quad j = k, s = 0 \\ \sigma_{v_j v_k,t} & \text{if} \quad j \neq k, s = 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{E}\left(u_{jit}u_{kit+s}\right) = \begin{cases} \sigma_{u_j,t}^{2} & \text{if} \quad j = k, s = 0 \\ \sigma_{u_j u_k,t} & \text{if} \quad j \neq k, s = 0 \\ 0 & \text{otherwise} \end{cases}$$

and $v_{jit} \perp u_{kit+s}\ \forall j, k, i, t, s$ (permanent shocks are independent of transitory ones). The process for each shock is in principle non-stationary. This reflects, for example, the possibility that some periods of time are more turbulent than others (for example, the financial crisis years). These claims will be tested empirically. Shocks of the same type can be correlated across partners, possibly reflecting assortative mating (positive correlation) or risk sharing agreements (negative correlation) when forming a family. Finally, shocks are serially uncorrelated.

Although the permanent-transitory representation of wages may seem restrictive at first, it does fit the PSID data very well and has been used extensively in the income dynamics literature. Recent attempts to relax restrictions of this process include Guvenen (2007), Browning et al. (2010) and Blundell et al. (2014).

2.1.2 The Powers

The relative powers (or Pareto weights) are central to the collective approach. In principle, changes in one partner's power will result in different household outcomes even if preferences or the family budget set remain unchanged.

[9] See Meghir and Pistaferri (2011) for a treatment of advance information in life cycle models.

The partners select their initial powers upon formation of the family; say these powers are μ_{i0} and $1 - \mu_{i0}$ respectively.[10] If the partners cannot fully commit for life, then relevant contemporaneous news may shift intra-family power. The individuals will reallocate power between them to reward the partner who receives favorable news (therefore increase her intra-family power). Such reallocation is micro-founded by considering the outside options available to this individual: as outside options get more attractive (an increase in $\bar{U}_{2t}$ in (3)), she must be rewarded with a higher intra-family decision power so as not to break her contract with the family (so as to satisfy her participation constraint). Examples of favorable news are an improved sex ratio in the marriage market (Chiappori et al., 2002), the introduction of unilateral divorce laws (Voena, 2012), or a sudden promotion and a higher permanent wage. Outside options may involve remarriage, single-hood, no cooperation in the family and other.

In this paper, news can arrive only in the form of wage shocks. If better or worse wage shocks affect the outside options $\bar{U}_{1t}$ and $\bar{U}_{2t}$, then such shocks are expected to affect μ_{it} too.[11] With this in mind I write intra-family power at time t as

$$\mu_{it} = \mu(w_{1it}^P, w_{2it}^P) + m(\mathbf{d}_{it}) + \mu_{it-1} \tag{5}$$

where $\mathbf{d}_{it}$ indicates a $d \times 1$ vector of relevant distribution factors (which, however, I do not need for identification). Under full commitment $\mu(\cdot)$ is $\mathbb{R}^2 \to 0$, $m(\cdot)$ is $\mathbb{R}^d \to 0$, and $\mu_{it} = \mu_{i0}, \forall t$. I assume that only permanent wage shocks matter for the outside options and the reallocation of power in the family. This assumption, not a very unrealistic one, is important for identification as will be discussed later.

If full commitment is not possible, then whenever (2) binds (because, say, of an increase in partner 1's permanent wage) $\widetilde{\vartheta}_{1it} > 0$ and 1's relative decision power increases by $\frac{\widetilde{\vartheta}_{1it}}{\beta_t}$. In turn, partner 2's relative power decreases by the same amount because the sum of the two is normalized to 1. Whenever (3) binds a similar rationale applies. Household members exert equal powers when $\mu_{it} = \frac{1}{2}$; member 1 is relatively more (less) powerful when $\mu_{it} > \frac{1}{2}$ ($\mu_{it} < \frac{1}{2}$).

2.2 The Solution To The Family Problem

My goal is to obtain the optimal path for hours, earnings, and consumption from (P') subject to (BC), (4), and (5). Assuming an interior, I derive the necessary first order conditions of the

[10] It is *relative* rather than *absolute* powers that matter in the household; thus the normalization that the two powers add up to one.

[11] Consider $\bar{U}_{jt}$ as the utility individual j can reach upon divorce (with divorce being a realistic fall-back event). Obviously, $\bar{U}_{jt}$ is likely affected by changes in j's permanent wage.

problem given by

$$
\begin{aligned}
[H_{1it}]: &\quad \mu_{it}(-U_{1,H_1}) = \lambda_{it} W_{1it} \\
[H_{2it}]: &\quad (1-\mu_{it})(-U_{2,H_2}) = \lambda_{it} W_{2it} \\
[C_{1it}]: &\quad \mu_{it} U_{1,C_1} = \lambda_{it} P_t \\
[C_{2it}]: &\quad (1-\mu_{it}) U_{2,C_2} = \lambda_{it} P_t \\
[K_{it}]: &\quad \mu_{it} U_{1,K} + (1-\mu_{it}) U_{2,K} = \lambda_{it} \\
[A_{it+1}]: &\quad \lambda_{it} = \beta(1+r)\mathbb{E}_t \lambda_{it+1}
\end{aligned}
\tag{6}
$$

with λ_{it} the Lagrange multiplier on the sequential budget constraint at time t (the marginal utility of wealth).[12] In each period t there are five intra-temporal and one inter-temporal optimality conditions. With general, unrestricted preferences the first order conditions for H_{jit} and C_{jit} will be functions of H_{jit}, C_{jit}, and K_{it}, whereas the first-order condition for K_{it} will be a function of H_{1it}, C_{1it}, H_{2it}, C_{2it}, and K_{it} (the latter is so because K_{it} bridges partners' preferences and is therefore interrelated with all other choice variables).

Keeping preferences non-parametric, I follow the approximation approach that has been employed by part of the literature and I apply Taylor approximations to the first order conditions and the intertemporal budget constraint. The resulting equations constitute an approximate mapping between the growth in the *observed* choice variables and the permanent & transitory shocks to wages given by

$$
\begin{pmatrix} \Delta k_{it} \\ \Delta c_{it} \\ \Delta y_{1it} \\ \Delta y_{2it} \end{pmatrix} \approx \mathbf{T}_{it4\times 4} \begin{pmatrix} v_{1it} \\ v_{2it} \\ \Delta u_{1it} \\ \Delta u_{2it} \end{pmatrix}. \tag{7}
$$

The variance covariance matrix of (7) will later become the cornerstone of the estimation. The left hand side vector involves the growth in the four observed choice variables: public consumption, *total* private consumption in the family, and the two partners' earnings. Δk_{it} denotes $\Delta \ln K_{it}$ net of changes in preference factors or observable characteristics, and similarly for the other outcome variables.[13] Also, I introduce earnings in place of working hours using the identity $Y_{jit} = W_{jit} H_{jit}$. Attanasio et al. (2002), Blundell et al. (2008), and Blundell et al. (2012) are recent applications of this approach whereas Blundell et al. (2013) assess how well the approximation performs under alternative regimes, discuss the few cases where it fails, and derive the approximation error. To the best of my knowledge, this is the first time the approximation approach is used outside the unitary context.

The elements of matrix $\mathbf{T}_{it4\times 4}$ are the transmission parameters of shocks into choice variables. They are complicated functions of a large set of Frisch (λ-constant) elasticities of each partner and additional parameters pertaining to financial and human wealth in the family, as

[12] Like before U_{j,x_j} denotes the first order partial derivative of U_j with respect to variable $x_j = \{K, C_j, H_j\}$, $j = \{1, 2\}$. U_{j,x_j} is i- and t-specific but I omit these subscripts to ease the notation.

[13] I assume that changes in preference factors or observable characteristics are anticipated by partners (and ex ante contracted upon) and therefore already accounted for in their optimal choices. Empirically, I clear wages, earnings, and consumption from a large set of covariates and thus I relate unexplained changes in choice variables to unexplained changes in wages.

well as the allocation of power and consumption. Table 1 introduces the full set of partner-specific Frisch elasticities that appear later in the paper and appendix A.1 defines these elasticities analytically. I report the transmission parameters in $\mathbf{T}_{it4\times 4}$ in appendix A.4.

TABLE 1 – FRISCH ELASTICITIES OF INDIVIDUAL j

Of labor supply		
$\eta_{j,h,w}$	:	j's hours with respect to own wage
η_{j,h,p^c}	:	j's hours with respect to the price of the private good
η_{j,h,p^k}	:	j's hours with respect to the price of the public good
Of private consumption		
$\eta_{j,c,w}$	:	j's private consumption with respect to j's wage
η_{j,c,p^c}	:	j's private consumption with respect to its price
η_{j,c,p^k}	:	j's private consumption with respect to the price of the public good
Of public consumption		
$\eta_{j,k,w}$	:	j's consumption of the public good with respect to j's wage
η_{j,k,p^c}	:	j's consumption of the public good with respect to the price of the private good
η_{j,k,p^k}	:	j's consumption of the public good with respect to its price

Notes: This table presents the full set of Frisch (λ-constant) elasticities that describe preferences U_j. These elasticities constitute an ordinal representation of j's preferences. 9 elasticities are defined in total, 3 own-price and 6 cross-price elasticities for each individual (there are 3 choice variables under an individual's control and 3 corresponding prices).

In what follows I describe briefly how I reach this solution:

1. For each period t I approximate the five intra-temporal first order conditions about last period's prices, choice variables (including λ_{it}), and intra-family power. These approximations appear in appendix A.2. The approximate expressions constitute a 5×5 system in the changes from $t-1$ to t in H_1, H_2, C_1, C_2, and K, which, when solved, produces unique closed-form expressions as functions of the growth in wages, λ_{it}, and μ_{it}. This is equation (A.8) in the appendix.

2. I apply a first order Taylor approximation to μ_{it}, given by (5), around μ_{it-1} assuming that the distribution factors $\mathbf{d}_{it}$ remain unchanged. I can write the growth in μ_{it} as

$$\Delta \ln \mu_{it} \approx \eta_{\mu,w_1,t} v_{1it} + \eta_{\mu,w_2,t} v_{2it}$$

where the surplus extraction elasticity $\eta_{\mu,w_j,t}$, $j = \{1, 2\}$, captures the sensitivity of function $\mu(\cdot)$ to permanent wage shocks scaled by the ratio of $\mu(\cdot)$, evaluated at $t-1$, over μ_{it-1}. $\eta_{\mu,w_j,t}$ varies with time through its dependence on μ_{it-1}, w^P_{1it-1}, and w^P_{2it-1}.

3. A second order Taylor approximation to the inter-temporal first order condition (the Euler equation) decomposes $\Delta \ln \lambda_{it}$ into two additive terms (see (A.10) and derivations

in appendix A.2). The first component ω_{it} reflects the partners' motives for prudence over their lifetime (i.e. precautionary savings). To achieve tractability I assume that $\omega_{it} \equiv \omega_t$ does not vary cross-sectionally. The second component ϵ_{it} is an innovation term which captures idiosyncratic revisions to λ_{it} made by partners when wage shocks hit them.

4. I apply a first order Taylor approximation to the intertemporal budget constraint given by (BC) and I derive a linear mapping from the wage shocks the partners are hit by to ϵ_{it}. My aim is to replace $\Delta \ln \lambda_{it}$ in (A.8) with an expression involving wage shocks only and therefore render equation (A.8) empirically useful. The specifics of this approximation appear in appendix A.3.

   In brief, I log-linearize the intertemporal budget constraint locally, I take expectations at t and $t-1$, and I difference the resulting expressions. This enables me to map individuals' permanent wage shocks v_{1it} and v_{2it} into the innovation to the marginal utility of wealth ϵ_{it} assuming that either partner's current earnings are negligible compared to his / her expected lifetime earnings. This assumption is likely to be satisfied if individuals are sufficiently young and have a long time horizon ahead. It implies that transitory wage shocks do not shift the intertemporal budget constraint and are smoothed out perfectly from one period to the next. Transitory shocks still induce *contemporaneous* income and substitution effects on the outcomes which I later exploit to identify several parameters of interest.

   The resulting mapping between ϵ_{it} and the permanent wage shocks, given by (A.13) in appendix A.3, involves preferences (the full set of partner-specific Frisch elasticities in table 1), the allocation of private consumption and power in the household, as well as three quasi-reduced form parameters pertaining to the relative importance of each of the components of the intertemporal budget constraint: $\xi_{it} \approx \frac{\text{Lifetime Spending on } K_{it}}{\text{Lifetime Total Spending}_{it}}$ is the ratio of public to total expected lifetime family expenditure, $s_{it} \approx \frac{\text{Lifetime Earnings}_{1it}}{\text{Lifetime Earnings}_{it}}$ is the share of individual 1's expected lifetime earnings (human wealth) in the family's total expected lifetime earnings, and $\pi_{it} \approx \frac{\text{Assets}_{it}}{\text{Assets}_{it}+\text{Lifetime Earnings}_{it}}$ is the "partial insurance" parameter (term due to Blundell et al., 2008) which captures the family's financial wealth relative to their total financial and human wealth combined.

5. I obtain solution (7) above replacing the growth in λ_{it} and μ_{it} in (A.8) with expressions involving wage shocks only. One last approximation is needed to link unobserved individual private consumption to observed total private consumption in the family, namely $\Delta \ln C_{it} \approx \varphi_{it-1} \Delta \ln C_{1it} + (1 - \varphi_{it-1}) \Delta \ln C_{2it}$ where φ_{it} is the unobserved allocation of private consumption between partners.

   In (7) the impact of permanent shocks on the choice variables differs from that of transitory shocks by the bargaining effect (through their impact on intra-family power) and dynamic income-wealth effects (through their impact on the marginal utility of wealth) they induce. Permanent shocks also induce static income and substitution effects on the outcome variables, exactly like transitory ones.

2.3 The Family's Response To Shocks

Before discussing identification in (7) I will build some intuition by illustrating how a transitory shock is transmitted into the outcome variables. For simplicity I assume $v_{1it} = v_{2it} = \Delta u_{2it} = 0$ for a particular household i at time t but $\Delta u_{1it} > 0$ (i.e. individual 1 is hit by a positive transitory shock). I will focus on two outcomes only, his leisure time l_{1it} and the family's public consumption k_{it}; the discussion of more outcomes is straightforward. The response of these outcomes to Δu_{1it} is given by

$$\begin{aligned} \Delta l_{1it} &= -\left(\eta_{1,h,w} - \eta_{1,k,w} \cdot (1-\nu_{it-1}) \cdot \frac{\eta_{1,h,p^k}}{\bar{\eta}_{k,p^k}}\right) \cdot \Delta u_{1it} \\ \Delta k_{it} &= \eta_{1,k,w} \cdot \nu_{it-1} \cdot \frac{\eta_{2,k,p^k}}{\bar{\eta}_{k,p^k}} \cdot \Delta u_{1it} \end{aligned} \tag{8}$$

where $\eta_{1,h,w}$ is partner 1's own-wage labor supply elasticity, $\eta_{1,k,w}$ is his elasticity of the public good with respect to his wage, and η_{1,h,p^k} is his labor supply elasticity with respect to the price of the public good (the full set of elasticities is defined in table 1).[14] ν_{it-1} is a mixture of preferences (marginal utilities) and intra-family power and $\bar{\eta}_{k,p^k} = (1-\nu_{it-1})\eta_{1,k,p^k} + \nu_{it-1}\eta_{2,k,p^k}$ is a weighted average of the partners' elasticities of the public good with respect to its price η_{j,k,p^k}.[15,16]

I illustrate what is going on after the transitory shock hits using a simple graph. Figure 1 depicts the public good - leisure plane of individual 1 assuming that these goods are substitutes (this restriction is used for the purposes of this illustration and is not imposed on the model). The bold downward slopping curve ("`Indifference curve 1`") represents his preferences between leisure and the public good at the beginning of t whereas the straight line passing from `A` represents the original contemporaneous budget constraint in the same period. The scale of the axes is irrelevant. This individual consumes initially at `A` ($\mathtt{L_A}$ and $\mathtt{K_A}$ respectively).

The transitory wage shock does not move the contemporaneous budget constraint outwards or inwards. The reason for this is the assumption that transitory shocks do not shift the intertemporal budget constraint and, therefore, they must also leave the total available budget at t unchanged. The positive transitory shock to wage (i.e. the price of leisure) tilts the budget constraint around the initial indifference curve making leisure relatively more expensive and the public good relatively cheaper. The new budget constraint is the straight line passing from `B`. If individual 1 can adjust leisure and the public good freely, he will now consume at `B` ($\mathtt{L_B}$ and $\mathtt{K_B}$ respectively). In this case the (absolute) change in his leisure is given by his own-wage labor supply elasticity ($\Delta l_{1it} = -\eta_{1,h,w}\Delta u_{1it}$) and the change in the public good is given by its elasticity with respect to his wage ($\Delta k_{it} = \eta_{1,k,w}\Delta u_{1it}$). Both stem from (8) after setting $\nu_{it-1} = 1$ (and observing that as a result $\frac{\eta_{2,k,p^k}}{\bar{\eta}_{k,p^k}} = 1$). Consumption bundle `B` is an extreme outcome after the transitory shock and it corresponds to individual 1 being a "dictator" in his

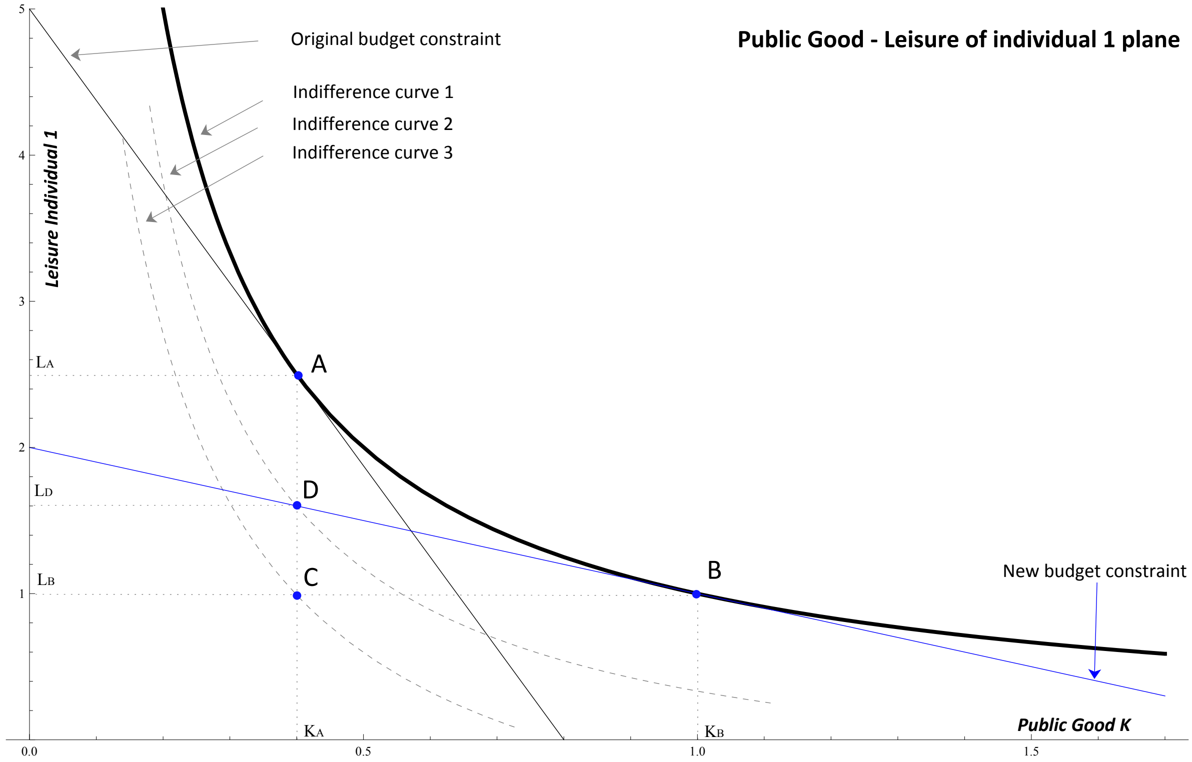
---

[14] The following is the general rule governing the notation for the Frisch elasticities in this paper: $\eta_{j,x,\chi}$ is individual j's elasticity of own outcome variable $x = \{k, c_j, h_j\}$ with respect to price $\chi = \{p^k, p^c, w_j\}$.

[15] $\nu_{it} = (1 + \frac{1-\mu_{it}}{\mu_{it}}\frac{U_{2,K}}{U_{1,K}})^{-1}$ where $U_{j,K}$ is j's marginal utility of the public good at t. Expect that $\nu_{it} \in (0,1)$.

[16] The transmission parameters of Δu_{1it} onto Δl_{1it} and Δk_{it} are essentially $1-\tau_{it}^{33}$ and τ_{it}^{13} respectively, where $\{\tau_{it}^{\#\#}\} = \mathbf{T}_{it4\times4}$. The expression for Δl_{1it} holds if total hours are allocated roughly equally between work and leisure (as the model has been actually solved for working hours, not leisure).

Figure 1 – The Impact of $\Delta u_{1it} > 0$ on Leisure and Public Consumption



household (he holds all intra-household power).

In the opposite extreme case, individual 1 holds no power in his household and his partner is the "dictator". One should now expect that $\nu_{it-1} = 0$ and as a result public consumption, which he no longer controls, does not change after *his* transitory shock ($\Delta k_{it} = 0$). As the household keeps the public good at $\mathtt{K_A}$, it is suboptimal for individual 1 to change his leisure like he would do if he was the "dictator": in that case he would consume at $\mathtt{C}$ ($\mathtt{L_B}$ and $\mathtt{K_A}$ respectively) which is way below his budget set and a profound deterioration in his welfare. Individual 1 should adjust his leisure so that he ends on the budget frontier given $k_{it} = \mathtt{K_A}$: that is consumption bundle $\mathtt{D}$. His leisure response is now given by $\Delta l_{1it} = -(\eta_{1,h,w} - \eta_{1,k,w}\frac{\eta_{1,h,p^k}}{\eta_{1,k,p^k}})\Delta u_{1it}$ which stems from (8) after plugging in $\nu_{it-1} = 0$. This differs from the first best response of leisure by the second term in the above parentheses; that is the product of his optimal response of K had he been free to adjust it freely ($\eta_{1,k,w}$) and the relative importance he attaches to leisure over the public good ($\frac{\eta_{1,h,p^k}}{\eta_{1,k,p^k}}$).

In more realistic cases, neither partner would be a "dictator" and individual 1 should land somewhere between the extreme bundles $\mathtt{B}$ and $\mathtt{D}$. The final response is given by (8). It is determined by $\eta_{1,h,w}$, $\eta_{1,k,w}$, η_{1,h,p^k} and also by a weighted average of both partners' public good elasticities with respect to its price, where the weights are functions of the allocation of power between them (ν_{it-1}).

Extending the discussion to all 5 outcome variables is straightforward. The difference between the impact of Δu_{1it} on k_{it}, l_{1it}, c_{1it} on one hand and l_{2it}, c_{2it} on another is that there are direct and indirect effects induced on the former set, whereas there are only indirect effects induced on the latter set. The direct effects exist because of non-separabilities in the utility function of each individual whereas the indirect effects exist because the public good bridges both partners' preferences.

Finally, the impact of a permanent shock follows a similar discussion. On top of the *static* effects, exactly like the effects transitory shocks induce, permanent shocks induce *bargaining* effects (that restrict by how much the static budget constraint can tilt) as well as long-run income - *wealth* effects (that move the budget constraint inwards or outwards).

2.4 Identification Of The Family Structure

In this section I exploit the response of the outcome variables to wage shocks as well as the features of the wage process as a means to identify the parameters of interest. In each period there are 6 wage variances and covariances ($\sigma^2_{v_1,t}$, $\sigma^2_{v_2,t}$, $\sigma_{v_1v_2,t}$, $\sigma^2_{u_1,t}$, $\sigma^2_{u_2,t}$, $\sigma_{u_1u_2,t}$), 18 Frisch elasticities (2 partners $\times$ 9 elasticities each; see table 1), two location parameters reflecting respectively the sharing of private consumption and the allocation of power between partners (φ_{it}, ν_{it}), and 8 bargaining effects induced by v_{1it} and v_{2it} on four observed outcomes (public consumption, total private consumption, partners' earnings). These amount to 34 economically relevant parameters in each time period. Identification does not require these parameters to be stationary. The remaining parameters ξ_{it}, s_{it}, and π_{it} are obtained directly from the data (see section 4.2).

The parameters of the wage process are identified independently of preferences. The following moments of the joint distribution of individual wages deliver identification:

$$
\begin{aligned}
\sigma^2_{v_j,t} &= E[\Delta w_{jit}(\Delta w_{jit-1} + \Delta w_{jit} + \Delta w_{jit+1})] \\
\sigma_{v_1v_2,t} &= E[\Delta w_{1it}(\Delta w_{2it-1} + \Delta w_{2it} + \Delta w_{2it+1})] \\
\sigma^2_{u_j,t} &= E[\Delta w_{jit}\Delta w_{jit+1}] \\
\sigma_{u_1u_2,t} &= E[\Delta w_{1it}\Delta w_{2it+1}]
\end{aligned}
\tag{9}
$$

where Δw_{jit} is given by (4) and $j = \{1, 2\}$. Identification follows the logic illustrated in Meghir and Pistaferri (2004) and earlier studies. $\sum_{t-1}^{t+1} \Delta w_{jit}$ strips Δw_{jit} of its transitory component and therefore the covariance $E[\Delta w_{jit} \sum_{t-1}^{t+1} \Delta w_{jit}]$ identifies the variance of the permanent component. Similarly, the covariance between Δw_{jit} and $\sum_{t-1}^{t+1} \Delta w_{kit}$, $j \neq k$, striped of contemporaneous transitory components, identifies the covariance between the partners' permanent shocks. The covariance between Δw_{jit} and Δw_{jit+1} identifies the variance of the transitory component because consecutive transitory shocks must be autocorrelated due to mean reversion. Similarly, the covariance between Δw_{jit} and Δw_{kit+1}, $j \neq k$, pins downs the covariance between the partners' transitory shocks. Overidentifying restrictions are available.

The transmission parameters of wage shocks into consumption and earnings are identified by the covariance between these outcomes and wages. Consider for example the transmission of shocks into the public good. I define the following moments of the joint distribution of public consumption and wages:

$$
\begin{aligned}
m^{k1}_t &= E[\Delta k_{it}(\Delta w_{1it-1} + \Delta w_{1it} + \Delta w_{1it+1})] \\
m^{k2}_t &= E[\Delta k_{it}(\Delta w_{2it-1} + \Delta w_{2it} + \Delta w_{2it+1})]
\end{aligned}
$$

$$m_t^{k3} = E[\Delta k_{it} \Delta w_{1it+1}]$$
$$m_t^{k4} = E[\Delta k_{it} \Delta w_{2it+1}]$$

where Δk_{it} is given by (7). The transmission of shocks in the cross section is identified as

$$E[\tau_{it}^{11}] = \frac{m_t^{k1}\sigma_{v_2,t}^2 - m_t^{k2}\sigma_{v_1v_2,t}}{\sigma_{v_1,t}^2\sigma_{v_2,t}^2 - \sigma_{v_1v_2,t}^2} \qquad E[\tau_{it}^{13}] = -\frac{m_t^{k3}\sigma_{u_2,t}^2 - m_t^{k4}\sigma_{u_1u_2,t}}{\sigma_{u_1,t}^2\sigma_{u_2,t}^2 - \sigma_{u_1u_2,t}^2}$$
$$E[\tau_{it}^{12}] = \frac{m_t^{k1}\sigma_{v_1v_2,t} - m_t^{k2}\sigma_{v_1,t}^2}{\sigma_{v_1v_2,t}^2 - \sigma_{v_1,t}^2\sigma_{v_2,t}^2} \qquad E[\tau_{it}^{14}] = -\frac{m_t^{k3}\sigma_{u_1u_2,t} - m_t^{k4}\sigma_{u_1,t}^2}{\sigma_{u_1u_2,t}^2 - \sigma_{u_1,t}^2\sigma_{u_2,t}^2}$$

where $\left(\tau_{it}^{11}, \tau_{it}^{12}, \tau_{it}^{13}, \tau_{it}^{14}\right)$ is the first row in the transmission matrix $\mathbf{T}_{it4\times4}$ in (7).

Identification rests on the following idea: if permanent wage shocks impact on public consumption the contemporaneous covariance between j's wage (striped of its transitory components) and public consumption must pick up the variance of j's permanent shock scaled by its loading factor onto public consumption. Similarly, if public consumption varies with next period's wage then this must be due to the mean reverting component which impacts on consumption through a loading factor. In both cases adjustments are made to account for the correlation of wages in the family. The transmission parameters of transitory shocks capture static effects on the outcome variables whereas those of permanent shocks capture static, bargaining, and long-run income-wealth effects together (see section 2.3 for a discussion).

Identification of the remaining transmission parameters (into total private consumption and individual earnings) follows the same logic. There is a total of 16 such reduced-form parameters (including those into the public good above) which in turn are complicated functions of the aforementioned 34 structural parameters (see appendix A.4 for a full illustration). There are obviously not enough identifying equations for all the structural parameters. The most one can identify is a few uninformative ratios of Frisch elasticities. The rich model with unrestricted preferences implies a large number of margins along which family members can substitute leisure and consumption when shocks hit; this feature alongside the non-observability of individual consumption impedes identification of the family structure from system (7).

To overcome this lack of identification I have to either bring in additional information or impose restrictions on preferences. Precisely, in section 2.4.1 I look into the nature of additional information that must be brought in the model in order to obtain identification. In section 2.4.2 I discuss what restrictions must be imposed onto preferences so that (7) suffices for identification.

2.4.1 Non-Separable Preferences And External Information

Transitory shocks induce static effects on consumption and labor supply; these are effects of the sort described in section 2.3. Permanent shocks induce the *same* static effects and additionally bargaining and long-run income-wealth effects (recall the assumption that transitory shocks neither impact on intra-family power nor shift the intertemporal budget constraint). The reason why permanent and transitory shocks induce the same static effects is straightforward: in a single-period model permanent shocks are indistinguishable from transitory and must therefore exert the same impact on outcomes.

I use the impact of transitory shocks to identify the intra-temporal structure of the family (including the contemporaneous allocation of private consumption between partners). This amounts to identifying 20 parameters: 18 Frisch elasticities (2 partners $\times$ 9 elasticities each; see table 1) and the two location parameters φ_{it} and ν_{it}. The transmission of transitory shocks into outcomes is given by the 3$^{\text{rd}}$ and 4$^{\text{th}}$ columns of $\mathbf{T}_{it4\times4}$. These are 8 equations in total; I need to impose restrictions as I am short of 12 equations = 20 parameters − 8 equations.

A natural set of restrictions is symmetry of each individual's matrix of substitution effects. After a constant marginal-utility-of-wealth price change (essentially a transitory shock), the matrix of substitution effects (A.1) is given by the inverse Hessian of the individual utility function scaled by the marginal utility of wealth λ_{it}. Symmetry of this matrix follows from symmetry of the Hessian. In turn, this implies 6 linear restrictions between the cross-price Frisch elasticities of each partner, namely $\eta_{j,h,p^c} = -\eta_{j,c,w}\frac{P^c C_j}{W_j H_j}$, $\eta_{j,h,p^k} = -\eta_{j,k,w}\frac{P^k K}{W_j H_j}$, and $\eta_{j,c,p^k} = \eta_{j,k,p^c}\frac{P^k K}{P^c C_j}$, $j = \{1, 2\}$.[17]

A stronger set of restrictions refers to the way consumption preferences of each partner compare across two states of life: singlehood and partnership. If the two partners are separately observed just before they form the family (i.e. as singles) and if their consumption preferences remain unchanged at least for a short period before and after they join the family, two crucial pieces of information become available: (a) their consumption response to wages ($\eta_{j,c,w}$ and $\eta_{j,k,w}$; 4 parameters), and (b) the sum of the remaining consumption elasticities per consumption good ($\eta_{j,c,p^c} + \eta_{j,c,p^k}$ and $\eta_{j,k,p^c} + \eta_{j,k,p^k}$; 4 items). These parameters, alongside the equations and restrictions described above, suffice for identification of the intra-temporal structure of the family and the contemporaneous allocation of private consumption.[18] Section 3 illustrates how observing each partner as single can recover (part of) their consumption preferences.

The rationale behind identification is the following: observing individuals across the two states of life is sufficient for recovering their leisure and consumption preferences. When transitory shocks hit, and conditional on those preferences, the model predicts the unobserved response of each partner's private consumption. The observed total consumption change at the family level is the weighted sum of the two individual responses; and the weight must be the consumption allocation between them. An equivalent interpretation is the following: the extent to which the response of family consumption to wage shocks resembles the way one or another partner would have responded had they been single is informative about the allocation of consumption between them.

Permanent shocks induce static, bargaining, and long-run income-wealth effects. As the static effects are identified through transitory shocks, the identification problem reduces to separating between bargaining and wealth effects. It turns out that the wealth effects, which are presented analytically in appendix A.4, are functions of the intra-temporal family structure (identified through transitory shocks), the bargaining effects, and ξ_{it}, s_{it}, and π_{it} that are obtained directly from the data. The only parameters that deserve identification are essentially the bargaining effects; the impact of permanent shocks on the observed outcomes can deliver

[17] See appendix A.1 for more details. Subscripts i and t are removed so as to keep the notation clear.

[18] To obtain this result I treat all Frisch elasticities and the two location parameters as cross-sectionally invariant once observable covariates and preference shifters have been carefully removed. In Theloudis (2013) I allow for unobserved preference heterogeneity in unitary households and I identify first and second moments of the distribution of preferences under strong separability restrictions. It is unclear, however, whether similar restrictions can deliver identification in the context of this -more complicated- model.

this.[19] A technical summary of the key points of identification is presented in appendix A.5.1.

2.4.2 Separable Preferences

If preferences change across the two states of life, identification of a smaller set of parameters obtains by (a) restricting the public good to be additively separable from leisure and private consumption, and (b) shutting down reallocations of power over time (bargaining effects). See appendix A.5.2 for the details. Additive separability implies that individual j's utility function is given by $U_j = \mathcal{U}_j^K(K_{it};\mathbf{z}_{jit}) + \mathcal{U}_j^{CH}(C_{jit}, 1-H_{jit};\mathbf{z}_{jit})$. Such preferences imply that private consumption and leisure cannot be substituted or complemented by public consumption leading to $\eta_{j,h,p^k} = \eta_{j,c,p^k} = \eta_{j,k,w} = \eta_{j,k,p^c} = 0$. Changes in wages still trigger changes in the public good but only through the budget constraint. Absence of reallocations of power over time implies that the Pareto weight is $\mu_{it} = \mu_{i0}$, $\forall t$, meaning that bargaining effects are set to 0 (full commitment).

A note of caution is due here: commodity demand (such as the demand for the public good) has been found nonseparable from hours of work (see, for example, Browning and Meghir, 1991). Casual arguments suggest that water or electricity consumption may increase if individuals spend more time at home; similarly motor vehicle utilization may be higher when people drive to work. The direction of the relationship between leisure and consumption is theoretically ambiguous and usually depends on whether changes in labor supply occur at the intensive or the extensive margin.[20] Additive separability of the public good also implies that one partner's earnings do not vary with another's wages thus striping earnings of an "added worker" effect (see Lundberg, 1985). In this model this effect works through the interdependence of preferences due to the nonseparable public good and it vanishes otherwise. Finally, shutting down the bargaining effect of permanent shocks renders this collective model indistinguishable from a unitary one. Working with first differences of outcomes after removing taste shifters and observable characteristics implies that the Pareto weight does not vary cross-sectionally (which would be one way to distinguish between collective and unitary models). The Pareto weight can vary inter-temporally if bargaining effects are permitted, and this serves as the test of one model against the other.

3 A Life-Cycle Model For Singles

In this section I develop a dynamic model for leisure, consumption, and savings choices of single individuals until the time they join a family. Section 3.1 describes the singles' problem in detail and section 3.2 discusses the assumption needed to put information on partnered and single individuals together.

[19] The bargaining effects are actually complicated functions of Frisch elasticities, the allocation of private consumption, the level of the Pareto weight μ_{it}, and the surplus extraction elasticities $\eta_{\mu,w_j,t}$. As it is not possible to separate between the Pareto weight itself and the surplus extraction elasticities, I only identify "quasi-reduced" form bargaining effects disregarding their deeper structure.

[20] Blundell et al. (2012) find evidence of complementarities between consumption and leisure in a unitary household model when labor supply changes along the intensive margin (their consumption measure does not distinguish between private and public consumption).

3.1 The Singles' Problem

Single individuals consume the same set of goods like their non-single counterparts. Public consumption K is no longer "public" in the sense that it is no longer enjoyed together with a partner; it still comprises however the same goods that partners would generally consume together in the family (such as last section's TV show or TV licence). Private consumption C also comprises the same goods as in the previous section. Although a distinction between K and C is now less meaningful, I do not collapse them to a single Hicksian commodity because I want to maintain consistency with the family problem.

I illustrate the main points focusing on single j. The chronology of the events is as follows: at some point in time the single individual joins the labor force and starts earning labor income. After a number of years have passed, the individual meets his/her partner, they form a family, and the model of section 2.1 comes into play describing their joint choices over the life-cycle. Using a time index s, the single's problem before a family is formed is given by

$$\max \mathbb{E}_{s=0} \sum_{s=0}^{\mathcal{S}} \beta_s U_j(K_{jis}, C_{jis}, 1 - H_{jis}; \mathbf{z}_{jis}) \tag{10}$$

subject to an intertemporal budget constraint

$$\widetilde{A}_{ji0} + \mathbb{E}_{s=0} \sum_{s=0}^{\mathcal{S}} \frac{W_{jis} H_{jis}}{(1+r)^s} = \mathbb{E}_{s=0} \sum_{s=0}^{\mathcal{S}} \frac{K_{jis} + P_t C_{jis}}{(1+r)^s} \tag{11}$$

where $\mathcal{S}$ indicates the number of years between the time j joins the labor force and the time he/she forms a family. The public good is now subscripted by j to indicate its assignability to single j; assets are also assignable (and thus subscripted by j too). $\widetilde{A}_{ji0} = A_{ji0} - \mathbb{E}_{s=0}[A_{ji\mathcal{S}}]/(1+r)^{\mathcal{S}+1}$ indicates initial period assets net of assets/debts the individual expects to transfer to his/her future family. The true horizon as single will not be crucial either for identification or for estimation. The rest of the notation, as well as the properties of U_j, remain exactly the same as in section 2.1. The residual wage process is given by (4). Obviously, C_{jis} is now observed and fully assignable to individual j.

The solution to this problem follows similar steps like in section 2.2 and therefore omitted here. I obtain an approximate closed-from solution for single j's choice variables given by

$$\begin{pmatrix} \Delta k_{jis} \\ \Delta c_{jis} \\ \Delta y_{jis} \end{pmatrix} \approx \begin{pmatrix} \eta_{j,k,w} \\ \eta_{j,c,w} \\ \eta_{j,h,w} + 1 \end{pmatrix} \Big(v_{jis} + \Delta u_{jis} \Big) + \begin{pmatrix} \eta_{j,k,p^k} + \eta_{j,k,p^c} + \eta_{j,k,w} \\ \eta_{j,c,p^k} + \eta_{j,c,p^c} + \eta_{j,c,w} \\ \eta_{j,h,p^k} + \eta_{j,h,p^c} + \eta_{j,h,w} \end{pmatrix} \epsilon_{jis}. \tag{12}$$

ϵ_{jis} is the innovation to the marginal utility of single's wealth at time s (more on this to follow); the rest of the notation is standard (see table 1). The impact of a permanent shock differs from that of a transitory by the dynamic income-wealth effects it induces (but not by bargaining effects any more).

If individual preferences, represented by U_j, remain unchanged at least for a short period of time before and after joining a family, then observability of j as single in the "before" period suffices for filling the required information when j is in the family. To see why consider the following moments of the single's joint consumption-earnings-wage distribution:

$$\begin{aligned} E[\Delta k_{jis} \Delta w_{jis+1}] &= -\eta_{j,k,w} \sigma^2_{u_j,s} \\ E[\Delta c_{jis} \Delta w_{jis+1}] &= -\eta_{j,c,w} \sigma^2_{u_j,s} \\ E[\Delta y_{jis} \Delta w_{jis+1}] &= -(\eta_{j,h,w} + 1) \sigma^2_{u_j,s} \end{aligned}$$

Given that the variance of the transitory shock is identified by (9), the first two moments identify the Frisch elasticity of (public-private) consumption with respect to the singles' wage ($\eta_{j,k,w}$ and $\eta_{j,c,w}$).

The last moment identifies the labor supply response to wage $\eta_{j,h,w}$. Given $\eta_{j,k,w}$ and $\eta_{j,c,w}$ symmetry of the matrix of substitution effects implies $\eta_{j,h,p^k} = -\eta_{j,k,w} \frac{P^k K_j}{W_j H_j}$ and $\eta_{j,h,p^c} = -\eta_{j,c,w} \frac{P^c C_j}{W_j H_j}$. If needed, these provide overidentifying restrictions to the family problem. Conditional on $\eta_{j,h,w}$, η_{j,h,p^c}, and η_{j,h,p^k}, $E[\Delta y_{jis}(\Delta w_{jis-1} + \Delta w_{jis} + \Delta w_{jis+1})]$ (impact of permanent shock on j's earnings) identifies the covariance between the innovation to the marginal utility of wealth and the permanent shock, that is $\mathrm{Cov}[\epsilon_{jis}, v_{jis}]$. Given this covariance and the parameters identified above, the impact of permanent shock on public and private consumption identifies the sums $\eta_{j,k,p^c} + \eta_{j,k,p^k}$ and $\eta_{j,c,p^c} + \eta_{j,c,p^k}$ respectively which complete the information needed for identification of the family structure in section 2.4.1.

The time horizon one stays single for is obviously important for the true content of a single's intertemporal budget constraint in (11). However, the budget constraint is not really needed for identification of the consumption preferences. I have to identify the covariance between the innovation to the marginal utility of wealth ϵ_{jis} and the permanent shock v_{jis}, but that I do without having to apply a Taylor approximation to the singles' intertemporal budget constraint. Of course, if the true shape of this constraint is known, then one can replace ϵ_{jis} by an expression involving preferences, quasi-reduced form parameters (pertaining to the relative importance of assets and the different consumption goods), and the permanent shock. This expression would look like (A.15) in appendix A.3. Transitory shocks still need to leave the budget constraint unchanged which is unlikely to hold if singles are very young and liquidity constrained. In this case consumption elasticities will probably be underestimated.

3.2 State-Invariance Of Individual Preferences

If partners $j = 1$ and $j = 2$ are *separately* observed as singles, the family problem laid out in section 2 can recover all the remaining preference parameters, the unobserved allocation of private consumption, as well as any bargaining effects induced by limited commitment. The crucial piece of information that singles offer is the consumption elasticities with respect to wages as well as the sum of all other remaining consumption elasticities. The assumption needed in order to put this information alongside the family problem is that individual preferences do not change across the two states of life or change only through their dependence on taste shifters and observables.

This does not have to be a global restriction on preferences. It suffices that preferences are state-of-life invariant *locally* and specifically around the time a single individual meets a partner. If that individual is observed before the cutoff time (as single) and after (in the family) then the identification result holds no matter how (and if) preferences change at later stages of the life-cycle.

The main limitation of state-invariant preferences is that a class of preferences are excluded from U_j. Individual j cannot be altruistic and therefore caring for his/her partner's welfare as that would imply a change of preferences from singlehood to partnership. As single one cannot care for another person (as there is no one to care for in the household). When partnered, one will still have to not care about the other's utility (other than caring through the common public good); otherwise preferences change and that violates the assumption of state-of-life invariance.

4 Empirical Implementation

The model is estimated on data from the 1999-2011 waves of the PSID; descriptive statistics are presented since the 1997 wave.[21] The PSID started in 1968 interviewing a -then- nationally representative core sample of roughly 3,000 households; repeated annually until 1997 the survey collected information on employment, income, health, education and other demographics of the adult members of these households and their linear descendants should they split off and establish their own households. A second smaller sample of low income households, consisting roughly of 2,000 units in 1968, has also been interviewed consistently. I estimate the model on the core sample only because weights for properly combing the two are not provided.

After 1997 the survey becomes biennial but starting in 1999 it collects richer information on the aforementioned items as well on expenditure, wealth, philanthropy, and numerous other topics. The sample size has grown consistently over the years reaching 5,495 core sample households in 2011 (this reflects tracking of an increasing number of the original families' first or subsequent generations split-offs).

The PSID is suitable for the model laid out in the previous sections due to a number of desirable features: (i) detailed data on household assets and spending are available after 1999, along with data on earnings, hours of work, and demographics for the main earners, (ii) consecutive information on the same households is available, and (iii) multi-member, as well as single-member households are interviewed.

4.1 Sample Selection And Variables Definitions

Given that the model in section 2 is written in terms of "partner 1" and "partner 2", a natural question is *who in the data are these individuals?* I consider opposite-sex couples, with partners that are cohabiting but who are not necessarily married. I treat the male partner as "partner 1" and the female partner as "partner 2". Their single counterparts in the data are single males and single females respectively.

I select a baseline sample of couples such that both partners are present in the household at the time of the interview, both are between 25 and 65 years old and they have no missing demographics (such as race, education, and state of residence). Both partners participate in the labor market and earn an hourly wage at least equal to \$0.5. The family consumes non-zero amounts of both the public and the private goods and reports usable information on their wealth

[21] More information on the PSID, as well as access to all the data, is available online at psidonline.isr.umich.edu.

(precise definitions of the variables follow). Finally, wages, earnings, and family consumption must not experience extreme changes from one period to another that probably signal the presence of measurement error.

Singles in the baseline sample have similar characteristics to those in couples: they participate in the labor market earning an hourly wage at least equal to $0.5, they consume non-zero public-private consumption, their wages, earnings, and consumption show no extreme jumps, and they have no missing information on assets or demographics. I restrict my attention only to single males and females who have got married / cohabited in the past or will get married / cohabit in the future: in this way I discard information on individuals who never got / get married. These may have tastes against living with a partner that could perhaps invalidate the assumption that preferences are state-of-life invariant.

I report the relevant sample sizes in table 2. In total there are 12,204 family-year observations satisfying the above selection criteria, 2,284 single male-year, and 3,571 single female-year (the totals include year 1996).[22] There are more single females than males because of more widowed or divorced women in all years of the data.

Table 3 presents average demographics and labor market outcomes by year (1996-2010), gender (male-female), and state of life (as single, in family). Individuals in couples are on average in their early 40s (with women slightly younger). Single men are usually slightly younger than men in couples whereas single females slightly older (reflecting the larger proportion of older widows or divorcees). The vast majority of the sample consists of white individuals; among the whites the proportion of those living in couples is bigger than the proportion among the blacks. Average years of education as well as the likelihood of having been to college increases over time for both males and females in couples, with the latter outperforming the former in the late years. There is mixed evidence on the educational attainment of singles (single males have progressively fewer years of schooling, single females have more). Women earn consistently less than men across both states of the world but they also work fewer hours. Single men work fewer hours than men in couples; this is opposite for women. Finally, 88.22% (79.46%) of all men in couples (women in couples) participate in the labor market compared to 82.67% (80.61%) of all single men (single women) – these results do not appear in table 3.

The PSID collects information on numerous elementary expenditure items (see Blundell et al., 2012, for how these compare to information from the National Income and Product Accounts). To meet the requirements of the model in sections 2 and 3 I categorize and aggregate these items into private and public goods considering which items *may* be rival among family members and which *may not*. There is no easy way to draw a line between private and public and I treat the following categorization as *baseline* – private consumption comprises food at home, food out, public transport, medical services excluding health insurance, and prescriptions; public consumption comprises housing services, home insurance, health insurance, utilities including gas, electricity, water and sewer, children's education costs, child care, and vehicle usage costs including motor fuel.[23]

[22] The PSID data are retrospective, i.e. information in the 1997 wave of the survey refers to calendar year 1996. I report descriptive statistics respecting this feature.

[23] This categorization excludes goods that have been added in the survey after wave 2005 such as clothing and apparel, recreational goods, and telecommunications.

Table 4 breaks down average private consumption to its elementary items by year. The first row presents the aggregate nominal expenditure amounts for families in the baseline sample, the second row presents the fraction of those amounts consumed by single men in the sample, and the third row displays the fraction consumed by single women. The subsequent rows provide information on the elementary components of the private good; for each such component a nominal monetary amount refers to the average expenditure by families whereas the two numbers that follow underneath refer to the fraction of that expenditure enjoyed by single men and single women respectively. Average value of families' private consumption is \$8,397 in 1998; this steadily increases to reach \$11,560 in 2010 (partly reflecting inflation). Single men consume roughly 66.2% of those figures whereas single women 62.3% (averages taken over 1998-2010).

Table 5 breaks down average public consumption to its elementary items by year. The information is displayed in the same format as in table 4. Average value of families' public consumption is \$19,489 in 1998; this almost steadily increases to reach \$32,375 in 2010 (partly reflecting inflation). Single men consume roughly 54.5% of those figures whereas single women 59.2% (averages taken over 1998-2010). Public consumption is consistently the biggest portion of a household's expenditure across both states of life; it amounts to 69.9% of a couple's total expenditure in 1998 and increases steadily towards 73.7% in 2010 (reflecting partly an increase in the relative price of public consumption during the early years).[24] The change is smaller for single males (69.5% to 69.8%) and single females (70.6% to 72.1%). The figures in tables 4 and 5 have not been adjusted by family size.

Information on asset holdings is needed for the construction of π_{it} (π_{jis} for singles). The PSID collects data on home equity (house value net of mortgages), value of other real estate, vehicles, farms and businesses, shares, stocks and other investments, savings accounts and bond holdings, individual retirement accounts and annuities, and miscellaneous assets. Data on household debt are also collected including credit card debt, student loans, medical and legal bills, and loans to relatives. As I am interested in the household's net worth I aggregate the above asset categories into one figure ("wealth") that captures total household assets and home equity net of outstanding debts (excluding vehicle loans). Table 6 mimics the style of the consumption tables above and presents the average values of net worth and its components by year and state of life. Single males hold roughly half of a multi-member household's wealth, although this varies a lot with time. Single females hold consistently lower amounts of wealth. Household net worth increases in the first years of the data but suddenly drops in 2008.

Finally, data on hourly wages for each individual are needed. I obtain such information dividing annual earnings by annual hours of work.

4.2 Pre-Estimated Parameters

Before proceeding to the main estimation of the model I pre-estimate the parameters pertaining to the relative importance of the components of the intertemporal budget constraint. For

[24] I have constructed a series of price indices for the public and private goods combining data from the PSID and the Consumer Price Index (online access to CPI data at www.bls.gov/cpi). The price of the public good steadily increases relative to that of the private good in the first years of the data. It remains flat in the last years albeit in higher relative levels. The series are available upon request.

families, these are

$$\xi_{it} \approx \frac{\mathbb{E}_t\left[\text{Lifetime Spending on } K_{it}\right]}{\mathbb{E}_t\left[\text{Lifetime Total Spending}_{it}\right]}$$
$$s_{it} \approx \frac{\mathbb{E}_t\left[\text{Lifetime Earnings}_{1it}\right]}{\mathbb{E}_t\left[\text{Lifetime Earnings}_{it}\right]}$$
$$\pi_{it} \approx \frac{\text{Assets}_{it}}{\text{Assets}_{it} + \mathbb{E}_t\left[\text{Lifetime Earnings}_{it}\right]}$$

where "Lifetime" here refers to the time between $t = 0$ and $t = T$ (adopting the notation of section 2). For singles, the parameters are defined similarly, except that "Lifetime" there refers to one's life cycle as single (i.e. from $s = 0$ to $s = \mathcal{S}$ adopting the notation in section 3). Exact expressions appear in appendix A.3.

To make some progress, notice that

$$\mathbb{E}_t\left[\text{Lifetime Spending on } K_{it}\right] = K_{it} + \sum_{\varsigma=1}^{T} \frac{\mathbb{E}_t K_{it+\varsigma}}{(1+r)^{\varsigma}}.$$

I deal with expectations by pooling families' K_{it} across all periods of time and regressing it on a set of predictable characteristics including each partner's race, education, a quadratic in age, a quadratic in their youngest child's age (if they have any), and a rich set of interactions. This regression can be written as $K_{it} = \mathbf{Q}_{it}^{k\prime}\boldsymbol{\beta}^k + \varepsilon_{it}^k$ where the notation is obvious. To derive the expected household public consumption, say at $t+2$, I use $\mathbb{E}_t K_{it+2} = \mathbf{Q}_{it+2}^{k\prime}\hat{\boldsymbol{\beta}}^k$ and I set $r = 2\%$. I repeat the same for *total* family private consumption. It follows that $\mathbb{E}_t\left[\text{Lifetime Total Spending}_{it}\right] = \mathbb{E}_t\left[\text{Lifetime Spending on } K_{it}\right] + \mathbb{E}_t\left[\text{Lifetime Spending on } C_{it}\right]$. The process to derive ξ_{it} in the case of singles differs only in that the explanatory variables comprise solely j-specific characteristics (and j's youngest child's).

Similarly, for s_{it} I write

$$\mathbb{E}_t\left[\text{Lifetime Earnings}_{jit}\right] = Y_{jit} + \sum_{\varsigma=1}^{T} \frac{\mathbb{E}_t Y_{jit+\varsigma}}{(1+r)^{\varsigma}};$$

then I pool j's earnings over the years and I regress them on j's race, education, a quadratic in age, and their interactions. This regression is given by $Y_{jit} = \mathbf{Q}_{jit}^{y\prime}\boldsymbol{\beta}_j^y + \varepsilon_{jit}^y$. Like before, to derive j's expected earnings, say, at $t+2$ I use $\mathbb{E}_t Y_{jit+2} = \mathbf{Q}_{jit+2}^{y\prime}\hat{\boldsymbol{\beta}}_j^y$. I repeat the same steps for both family members' earnings separately; then $\mathbb{E}_t\left[\text{Lifetime Earnings}_{it}\right] = \sum_j \mathbb{E}_t\left[\text{Lifetime Earnings}_{jit}\right]$. For singles $s_{it} = 1$ because $\mathbb{E}_t\left[\text{Lifetime Earnings}_{it}\right] = \mathbb{E}_t\left[\text{Lifetime Earnings}_{jit}\right]$.

Constructing π_{it} is now trivial as it relies on assets (see section 4.1) and $\mathbb{E}_t\left[\text{Lifetime Earnings}_{it}\right]$. Assets have been decided before any consumption-leisure choices are made at t and no endogeneity issues arise. This "partial insurance" parameter measures the share of assets in a household's total lifetime wealth (comprising financial and human wealth). It is therefore reasonable to expect younger households, such as single-member households, to have lower values for π: they are early on in their life-cycle, they have likely not accumulated many assets yet, and they have higher expected human wealth.

I present a series of figures that plot average ξ_{it}, π_{it}, and s_{it} against the age of the household head in 5-yearly bands (in multi-member families the head is a male). A 95% confidence interval is also plotted around the mean (in grey shade). In figure 2a the expected share of lifetime public consumption in total spending stays roughly fixed around 0.71 over the whole range of ages. A small drop at later ages is apparent but the samples in those ages are also relatively smaller. Single females expect on average to spend significantly more on K than males; around middle age they also expect to spend significantly more than multi-member families. Figure 2b illustrates that young households (of any type) hold very low assets (less than 10% of their expected human and financial wealth combined) but π_{it} steadily increases in a convex way. By age 60, assets consist of half of their total wealth. There are no significant differences between families and singles across most ages. Finally, figure 2c plots the share of lifetime male earnings in the family's total earnings. For most of the family's lifetime, males dominate earnings contributions, although at later ages their contribution declines probably because they retire earlier than their wives / partners. Notice that figures 2b and 2c are very similar to the partial insurance graphs in Blundell et al. (2012).

4.3 Estimation Procedure

In this section I describe the precise steps I take to estimate the model and I discuss challenges that arise such as measurement error in the data and inference.

First I estimate residual wages separately for males and females. I regress $\ln W_{jit}$ on a set of observable and predictable characteristics including dummies on year, state of residence, race, year of birth, education and household type (single-member household, multi-member household) as well as education-year and race-year interactions. If wages are measurement error-ridden and such error is classical (which implies, among others, that it is independent of the covariates) the estimated residual is

$$\widetilde{w}_{jit} = w_{jit} + e^{w}_{jit}$$

where w_{jit} is the error-free residual and e^{w}_{jit} is the measurement error in j's log wage at t.

I stack changes in error-ridden residual wages from one period to another together: $\boldsymbol{\Delta}\widetilde{\mathbf{w}}_{ji} = (\Delta\widetilde{w}_{ji1999}; \Delta\widetilde{w}_{ji2001}; \ldots \Delta\widetilde{w}_{ji2011})'$. I use the second moments of $\boldsymbol{\Delta}\widetilde{\mathbf{w}}_{ji}$ across i, $j = \{1, 2\}$, to estimate the parameters of the wage process, i.e. the variances and covariances of shocks in every period. I estimate these jointly for partners and singles; I use GMM and the identity matrix as weight. The measurement error, however, presents a challenge as it is not possible to estimate the variance of the transitory shock separately from the variance of the error. To get around this, I remove a priori the variability in wages which is attributed to error using a well known validation study for the PSID. Bound et al. (1994) compare interview responses and official records for a sample of workers in a single large manufacturing firm; they extrapolate their findings appropriately to representative samples and argue that measurement error is responsible for 7.2% to 16.2% of the variability in log hourly wages. I adopt an estimate in the middle of that range (13%; Blundell et al., 2012, have used the same number too) and I assume that measurement error is serially uncorrelated as well as uncorrelated across partners.[25]

[25]The major caveat using Bound et al. (1994)'s validation study is that their estimates come from years 1982

Similarly, I estimate residual earnings separately for males and females. I regress $\ln Y_{jit}$ on the same set of observable characteristics like above, as well as on the number (and change in the number) of children, number of family members in the household, age of youngest child, employment status at the time of the interview, and dummies for additional earners in the household other than the main two (main one for single-member households) and outside recipients of financial support. I admit that earnings are observed with (classical) error; the estimated residual is

$$\widetilde{y}_{jit} = y_{jit} + e^y_{jit}$$

where y_{jit} is error-free residual earnings and e^y_{jit} is measurement error in j's log earnings at t. I stack changes in residual earnings from one period to another together and I obtain $\mathbf{\Delta\widetilde{y}}_{ji}$. Bound et al. (1994) report that roughly 4% of the variability of log earnings is attributed to measurement error; I use this estimate to correct the second moments of $\mathbf{\Delta\widetilde{y}}_{ji}$. I also remove the error variance from $E[\mathbf{\Delta\widetilde{w}}_{ji}\mathbf{\Delta\widetilde{y}}_{ji}]$. Given that log hourly wages are calculated as log annual earnings minus log annual hours

$$E[e^w_{jit}e^y_{jit}] = E[(e^y_{jit} - e^h_{jit})e^y_{jit}] = E[{e^y_{jit}}^2] - E[e^h_{jit}e^y_{jit}]$$

and

$$E[e^h_{jit}e^y_{jit}] = 1/2\left(E[{e^y_{jit}}^2] + E[{e^h_{jit}}^2] - E[{e^w_{jit}}^2]\right)$$

where e^h_{jit} is the measurement error in j's log annual hours at t. Bound et al. (1994) report that 17.9% to 26.6% of the variability in log annual hours is due to measurement error; I adopt an estimate in the middle of that range (23%). Again, I assume that the errors are serially uncorrelated and uncorrelated across partners.

Finally, I estimate residual private and public consumption. For families, I regress total private consumption on the previous set of covariates of both partners; for singles, I only include one set of covariates. I repeat the same process for public consumption too. I admit that consumption is observed with (classical) error; the estimated residuals are respectively

$$\widetilde{c}_{it} = c_{it} + e^c_{it}$$
$$\widetilde{k}_{it} = k_{it} + e^k_{it}$$

where c_{it} (k_{it}) is error-free residual private (public) consumption of the whole family and e^c_{it} (e^k_{it}) is measurement error in log private (public) consumption at t. For singles, I replace c_{it} (k_{it}) with c_{jit} (k_{jit}). I stack changes in consumption from one period to another together and I get $\mathbf{\Delta\widetilde{c}}_i$ and $\mathbf{\Delta\widetilde{k}}_i$ (with Δc_{i1999} and Δk_{i1999} both missing as consumption information was first collected in 1999).[26]

Given the parameters of the wage process, I estimate the remaining parameters via GMM (identity matrix) by mapping the variance-covariance matrix of (7) and (12) into the second

and 1986, i.e. almost two decades before the bulk of the data I am using here. It is not known how the importance of measurement error has changed over time or after the restructuring of the PSID in 1997. Another caveat comes from using the same estimates to correct female wages too because the validation study sampled male individuals only.

[26]For single-member households $\mathbf{\Delta\widetilde{c}}_i$ and $\mathbf{\Delta\widetilde{k}}_i$ are replaced by $\mathbf{\Delta\widetilde{c}}_{ji}$ and $\mathbf{\Delta\widetilde{k}}_{ji}$ respectively.

moments of $\mathbf{\Delta}\widetilde{\mathbf{w}}_{ji}$, $\mathbf{\Delta}\widetilde{\mathbf{y}}_{ji}$, $\mathbf{\Delta}\widetilde{\mathbf{c}}_{i}$ and $\mathbf{\Delta}\widetilde{\mathbf{k}}_{i}$ across i, $j = \{1, 2\}$.[27] I identify the variance of the measurement error in consumption through the first-order auto-covariance of consumption (given that the covariance between consumption and *wages* identifies the consumption structure).[28]

For inference I adopt the block bootstrap (see for example Section 4 in Horowitz, 2001). I draw 500 random samples from the original baseline sample (see section 4.1) and repeat all stages of the estimation for each new sample (i.e. first stage regressions for wages, earnings, consumption; GMM estimation of the parameters of the wage process; GMM estimation of the remaining parameters). I account in this way for arbitrary forms of heteroscedasticity across and serial correlation within blocks as well as the fact that I use pre-estimated residuals in the main GMM estimations.

5 Results (preliminary)

This section[29] illustrates the main empirical results, namely the estimates of the parameters of the wage process, the preference parameters (gender-specific Frisch elasticities), the allocation of private consumption between partners, as well as the bargaining effects due to limited commitment. These results are preliminary as of May 2015.

First I estimate the wage process for male and female individuals imposing stationarity over time. I estimate it separately on couples (panel A table 7) but also jointly on couples *and singles* (panel B table 7). The results are very similar. In both cases the variances of permanent and transitory shocks of males are slightly higher than those of females possibly indicating that men's initial career paths are more disperse than women's or that men change jobs more often. The covariance of shocks between partners (using information on couples only) is weakly positive implying a correlation of approximately $\rho_{v_1 v_2} = 0.08$ for permanent shocks and $\rho_{u_1 u_2} = 0.21$ for transitory ones (suggesting possibly a positive assortative mating in the marriage market).

The assumption of stationarity imposed on wages is not important. Relaxing it leaves the estimated variances and covariances reasonably similar to those in table 7 but, as expected, the standard errors are relatively higher due to the smaller sample sizes applicable per parameter. There is no obvious time trend over the 1999-2011 period. These results are available upon request.

Then I present the results for the main set of parameters. I distinguish between two cases regarding preferences. The most general case is when individual preferences are non-separable between leisure and the two types of consumption; to estimate the full set of parameters I use information on partnered and single individuals as well as the wage parameters from panel B

[27] I map the model into the variances and first order auto-covariances of the joint distribution of wages, earnings, and consumption over time. Higher-order auto-covariances are almost always insignificantly different from 0.

[28] I allow the variance of the measurement error in consumption to differ across couples, single males, and single females. See table 10 in appendix B.1 for estimates of the variance.

[29] The results presented in this section are preliminary and may reflect a local minimum in the GMM estimation. As of May 2015 I have not yet carried out a global optimization and, as a consequence, the above result are likely to change in future versions of the paper. Moreover, a few parameters are hitting their imposed bounds in the estimation (see text for more details) despite their being formally identified. In future rounds of the estimation I will address this problem by imposing additional restrictions that I have not fully exploited yet.

of table 7 (wage estimates based on couples and singles). A discussion of which parameters are identified (and why) was presented in section 2.4.1. A more specific case is when individual preferences are restricted to be additively separable between the public good and the rest; in this case I estimate a much smaller set of parameters but I do not require information on singles. In this case I use the wage parameters from panel A of table 7 (wage estimates based on couples only). A discussion of identification in this case was presented in section 2.4.2.

5.1 Results With Nonseparable Preferences

These results are from a GMM estimation using 300 second moments (variances, covariances and auto-covariances) of the growth in wages, earnings and consumption across multiple periods of time.

The behavioral and location parameters appear in columns 1 across blocks I-III of table 8. An own-wage labor supply elasticity of 0.76 for men and 1.23 for women is within the range of other studies (and consistent with them, females' elasticity is higher than males'; for a review see Keane, 2011). For men in families the labor supply elasticity with respect to the price of the private good is negative (implying leisure and private consumption are substitutes); for women it is also negative and bigger in absolute value. In both cases the parameters are imprecisely estimated. The evidence about the relationship between leisure and the public good is mixed: the labor supply elasticity with respect to the price of the public good is essentially 0 for men and positive for women (implying that for women the two goods are complements). Note, however, that Blundell et al. (2012) have found positive signs for the unitary elasticity of hours with respect to the price of *total* consumption (in the present exercise public consumption is roughly 70% of total household consumption).

The elasticity of private consumption with respect to the wage is a scaled reciprocal of the aforementioned labor supply elasticity with respect to the price of the private good (see appendix A.1); for this reason the two sets of elasticities have opposite signs. The own price elasticity of the private good is negative for both men and women but very imprecisely estimated (more on this to follow). The private consumption elasticity with respect to the price of the public good turns out negative for both (and again very imprecisely estimated).

The last set of elasticities refers to public consumption. The elasticity with respect to the wage is a scaled reciprocal of the labor supply elasticity with respect to the price of the public good; the elasticity with respect to the price of the private good is a scaled reciprocal of the private good elasticity with respect to the price of the public good (see appendix A.1). Finally, the own price elasticity of the public good is imprecisely estimated.

Moving to block III of table 8, the first line reports the estimate of the allocation of private consumption between partners after imposing stationarity of that allocation over time. Men in families consume approximately 60% of total private consumption. The estimate comes with a large standard error. Notice though that this model identifies the consumption allocation only if consumption preferences differ among men and women. However, the evidence so far points to the opposite: consumption preferences of the two genders are not far apart and definitely not statistically different.

These estimates are problematic and should not be taken as final. A few parameters, including η_{2,c,p^c} and η_{2,k,p^k}, hit their 0 upper bound that I impose on the optimizer. Negative such elasticities are justified by the law of demand if the goods involved are not Giffen (a restriction very likely to be satisfied). That these parameters hit bounds makes the corresponding bootstrap standard errors erroneous and "drags" η_{2,c,p^k} and η_{2,k,p^c} to zero (these are essentially scaled reciprocals of the previous elasticities). This also affects the estimate of the consumption allocation which is by construction sensitive to the consumption preferences of the partners. As of May 2015 I believe this estimation has converged to an undesired local minimum and, as a consequence, these results are likely to change exploring additional restrictions that I have not yet imposed on the problem.

Table 9 presents the estimates of the bargaining effects induced by permanent shocks on the outcome variables. Column (1) presents the bargaining effects due to v_{1it} (male permanent shock) and column (2) presents the effects due to v_{2it} (female permanent shock). These effects are non-zero so long as $\eta_{\mu,w_1,t}$ (for the effects in column (1)) and $\eta_{\mu,w_2,t}$ (for the effects in column (2)) are non-zero (see section 2.2 for a discussion and appendix A.4 for an analytical illustration). These effects are big and half of them are statistically significant.[30] Keeping everything else fixed, a positive permanent male shock of 0.1 (10% permanent wage increase) changes male earnings by -0.5273×0.1 (5.3% decrease). Men gain in bargaining power after their wage increases permanently; their earnings fall because their labor supply falls as they can enjoy more leisure in a household where they have become more powerful relatively to their position one period ago. Of course the *total* effect on male earnings due to the permanent shock is not -0.5273×0.1; instead the aforementioned number describes the effect due to the reallocation of power triggered by the shock, keeping aside any income or substitution effects that it also induces (and which could work to the opposite direction). Similarly, a positive permanent female shock of 0.1 changes female earnings by -0.4414×0.1. Own positive permanent shocks induce positive bargaining effects on the opposite spouse's earnings (consistent with making them less powerful) but these effects are not statistically significant. Finally, bargaining effects on private and public consumption are positive and significant after a female permanent shock (with public consumption experiencing a bigger increase); male shocks also induce positive bargaining effects on consumption but these effects are now insignificant.

The results for the bargaining effects suggest that spouses engage in some kind of reallocation of power when permanent shocks hit them. The model that allows for limited commitment can fit the data better and offer evidence against intra-household commitment over time. This evidence is in line with Mazzocco (2007) who also rejects full spousal commitment using Consumer Expenditure Survey data from 1982-1995.

5.2 Results With Separable Preferences

The results appear in columns 2 across blocks I-III of table 8. These results are presented so as to understand what one would estimate out of this model if information on singles was not used but an assumption was imposed that the public good was additively separable from the other goods. The results are from a GMM estimation using 216 second moments (variances, covariances and auto-covariances) of the growth in wages, earnings and consumption across

[30] I impose stationarity of the bargaining effects over time.

multiple periods of time.

The own-wage labor supply elasticities of 0.56 for men and 0.98 for women are again within the range of other studies (see for example Keane, 2011). The evidence about the relationship between leisure and the private good is mixed and inconclusive: the labor supply elasticity with respect to the price of private consumption is positive for men and negative for women. In both cases the estimates are very close to zero and insignificant.

In block III I estimate the private consumption elasticity with respect to wage *up to scale*, where the scale is each family member's share of private consumption (so I estimate $\eta_{1,c,w} * \varphi$ for men and $\eta_{2,c,w} * (1-\varphi)$ for women). Given that $\eta_{j,c,w}$, $j = \{1, 2\}$, is the reciprocal of η_{j,h,p^c} (appears in blocks I and II), these estimates are mixed in signs and statistically insignificant.

Finally, two "quasi reduced form" household level elasticities are identified and estimated: that is the household's response of public consumption to its price, $\widetilde{\eta}_{k,p^k} = \frac{\eta_{1,k,p^k}\eta_{2,k,p^k}}{(1-\nu)\eta_{1,k,p^k}+\nu\eta_{2,k,p^k}}$ and the household's response of private consumption to its price, $\bar{\eta}_{c,p^c} = \varphi\eta_{1,c,p^c} + (1-\varphi)\eta_{2,c,p^c}$. The former is estimated at -0.68 whereas the latter at -0.44. Given the shares of public and private consumption of the average household over the period 1999-2011, these numbers imply a household consumption elasticity approximately equal to -0.5 (assuming away any relative price changes between public and private goods). For comparison reasons, in column 1 of block III I construct the corresponding "quasi reduced form" parameters when preferences are nonseparable (and information on singles is used).

6 Discussion & Conclusion

In this paper I develop a realistic dynamic collective model which describes the basic economic behavior of two individuals belonging to one household. The individuals (or the partners as they have been called throughout this paper) make decisions about how much to consume, how much to save, and how much to work on the intensive margin in every period of their working life. Consumption is decomposed into two commodities, a private (rival) one and a public (non-rival) one; in this way this model can incorporate aspects of household life, such as expenditure on children, that other collective models have ignored. The model is dynamic but it does not assign constant weights on each individual's utility function (full commitment); instead it allows contemporaneous news about the partners' productivity in the market to change these weights (limited commitment). For the empirical implementation, these weights (or relative powers as they have been called throughout the paper) are modeled as functions of permanent wage shocks. This follows from an assumption that the value of a partner's outside option (and thus the Lagrange multiplier on their participation constraint) is shifted by such shocks but not by transitory ones. I obtain approximate closed-form expressions for the outcome variables because I apply Taylor approximations to the first order conditions of the model as well as the intertemporal budget constraint; these expressions are functions of permanent and transitory wage shocks of the two partners. The transmission parameters of these shocks into the outcome variables suffice for identifying the rich set of underlying structural parameters if a small number of consumption Frisch elasticities are available from single individuals just before they get married. The model identifies gender-specific Frisch elasticities, the allocation of private consumption, and the bargaining effects due to limited commitment; each such parameter plays a distinct role in the response of consumption or earnings to wage shocks and this role has been described in section 2.3.

The paper uses recent PSID data and finds that male and female labor supply preferences differ substantially but their consumption preferences do not. The consumption allocation is estimated at a noisy 60% in favor of men; however, the model actually identifies this allocation if consumption preferences differ across partners which is not the case given the aforementioned data. The bargaining effects are big and statistically significant pointing to a rejection of full commitment. The implementation of the estimation has not been problem-free; I ran into many convergence problems and numerous local minima because nearly all parameters appear multiplicatively in every single moment (in a total of 300 moments). Even when converge was finally achieved, a few parameters hit bounds, the standard errors were still fairly large and sensitive to different sets of restrictions.

A number of tasks still need to be completed. Although the proportion of female partners participating in the labor market is fairly large, I need to account explicitly for selection into the labor market. I also need to restrict the pool of singles to those young enough who will soon get married (whereas now I am considering any single individual who will be or has ever been married). I need to provide evidence on the main identifying assumption in this paper, this is that consumption preferences are locally state-of-life invariant, and perhaps relax it using outside estimates of consumption-wage elasticities of men and women. Finally, I have to allow for permutations among the components of private and public consumption and study the robustness of my findings to different groupings of goods.

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Tables & Figures

Table 2 – Sample Sizes: Baseline Sample

Year	Couples	Single males	Single females	*Total*
1996	1420	295	413	2128
1998	1463	284	452	2199
2000	1505	321	453	2279
2002	1536	348	473	2357
2004	1536	292	446	2274
2006	1592	262	434	2288
2008	1638	252	456	2346
2010	1514	230	444	2188
Total:	12204	2284	3571	18059

Notes: This table summarizes the sizes of the baseline samples of couples, single males, and single females by year (section 4.1). Column 1 enumerates the years covered by the sample; column 2 presents the number of couples in the baseline sample whereas column 3 (4) presents the number of single males (singles females). The last column illustrates the yearly sum.

Table 3 – Demographics and Labor Market Outcomes by Year, Gender, and State of Life

	1996				1998			
	Couples		Singles		Couples		Singles	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Married couple %	98.38		*N/A*	*N/A*	98.36		*N/A*	*N/A*
# of children	1.19		0·26	0·88	1.11		0·25	0·76
Age	41·45	39·45	38·46	41·38	42·26	40·30	39·05	41·74
Race: white %	92·04	91·69	85·42	80·63	91·93	92·62	85·21	81·42
Race: black %	4·65	4·23	9·49	15·25	4·65	3·9	10·21	13·94
Years of schooling	13·80	13·67	13·52	13·38	13·85	13·76	13·44	13·44
Been to college %	59·01	56·55	54·92	54·24	60·01	59·54	50·7	55·75
Self employed %	11·83	9·58	7·12	5·33	10·80	9·84	7·75	6·19
Hours of work	2250·98	1648·24	2121·83	1898·90	2336·30	1675·37	2186·32	1955·07
Earnings	45837·05	23960·33	32624·22	25571·46	51830·41	25542·78	38288·58	27179·32
N	1420		295	413	1463		284	452

	2000				2002			
	Couples		Singles		Couples		Singles	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Married couple %	97.48		*N/A*	*N/A*	97.40		*N/A*	*N/A*
# of children	1.05		0·22	0·68	0.99		0·28	0·70
Age	42·25	40·38	39·21	42·41	42·80	40·89	40·16	43·06
Race: white %	91·50	92·49	84·74	80·79	91·67	92·51	86·78	80·34
Race: black %	5·18	4·39	11·21	14·57	4·88	3·84	9·48	15·01
Years of schooling	13·85	13·86	13·41	13·28	13·91	13·94	13·35	13·33
Been to college %	60·73	61·53	52·02	55·63	61·13	62·43	50·00	56·24
Self employed %	10·70	9·57	8·41	3·31	13·35	11·13	10·63	7·40
Hours of work	2262·60	1713·19	2164·69	1864·99	2255·96	1722·24	2199·59	1863·59
Earnings	56605·68	28762·72	41991·08	29530·37	58479·04	31339·88	42462·57	28280·32
N	1505		321	453	1536		348	473

PREVIOUS TABLE CONTINUED

	2004				2006			
	Couples		Singles		Couples		Singles	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Married couple %	96.42		N/A	N/A	95.48		N/A	N/A
# of children	0.97		0·27	0·75	0.99		0·29	0·79
Age	43·15	41·38	39·60	43·61	43·15	41·44	41·62	43·18
Race: white %	92·19	92·58	85·27	78·92	91·33	91·71	87·02	79·49
Race: black %	4·56	4·04	10·27	16·37	5·15	4·40	10·69	16·36
Years of schooling	13·97	14·05	13·36	13·39	13·94	14·12	13·26	13·59
Been to college %	63·28	65·43	49·32	55·38	63·19	66·27	47·33	60·14
Self employed %	13·09	10·03	12·67	6·05	12·88	8·42	9·92	5·99
Hours of work	2259·34	1731·00	2220·27	1859·88	2241·64	1697·68	2088·96	1904·95
Earnings	62014·65	34216·78	46859·98	30527·82	65844·45	36774·31	46357·56	33259·31
N	1536		292	446	1592		262	434

	2008				2010			
	Couples		Singles		Couples		Singles	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Married couple %	95.12		N/A	N/A	94.25		N/A	N/A
# of children	0.99		0·23	0·76	1.01		0·32	0·81
Age	43·11	41·35	42·76	43·51	42·96	41·29	43·80	44·47
Race: white %	91·51	92·67	88·49	80·70	91·55	92·87	85·22	79·28
Race: black %	5·43	4·15	8·73	14·47	5·35	4·16	11·74	15·54
Years of schooling	14·03	14·21	13·24	13·58	14·04	14·33	13·03	13·66
Been to college %	64·59	68·74	45·24	59·43	65·65	70·41	45·65	61·26
Self employed %	12·82	8·73	14·68	7·46	11·23	8·39	18·26	7·66
Hours of work	2122·15	1681·92	2032·66	1775·98	2135·09	1695·48	2014·36	1755·13
Earnings	70680·81	39924·06	51726·88	35111·17	68049·90	40031·17	47722·31	36624·74
N	1638		252	456	1514		230	444

Notes: This table presents average demographics and labor market outcomes by year (1996-2010), gender (male-female), and state of life (in family-as single). "Married couple %" indicates the proportion of families with a formal union between the partners, "# of children" indicates the average number of children for families and single individuals. "Been to college %" indicates the proportion of people with more than 12 years of formal schooling. Monetary amounts (earnings) are nominal.

Table 4 – Breakdown of Average Private Consumption

	1998	2000	2002	2004	2006	2008	2010
couples:	8396.9	9066.4	9452.7	10288	10858.8	10978.3	11559.7
single males %:	0.65	0.76	0.67	0.69	0.66	0.68	0.64
single females %:	0.62	0.62	0.61	0.62	0.6	0.64	0.64
Breakdown of Private Consumption:							
Food at Home	5167.4	5374.9	5596.6	5960	6282.5	6443.2	6755.1
	0.56	0.75	0.6	0.62	0.58	0.61	0.57
	0.62	0.63	0.59	0.6	0.62	0.64	0.66
prepared at home	5030.7	5228.9	5418.8	5798.4	6115.1	6298.9	6629.2
	0.55	0.74	0.58	0.6	0.57	0.61	0.56
	0.61	0.63	0.6	0.59	0.62	0.64	0.65
delivered at home	136.7	146	177.8	161.6	167.4	144.3	125.9
	0.95	0.95	1.02	1.16	0.84	0.69	1.09
	0.82	0.68	0.46	0.7	0.7	0.57	1.12
Food Out	2095.3	2274.6	2436.1	2695.7	2655.1	2582.2	2775.9
	0.92	0.91	0.87	0.92	0.92	0.88	0.81
	0.61	0.62	0.58	0.59	0.58	0.59	0.57
Public Transport	291.5	326.9	280.5	242.7	307.4	299.4	250.2
	0.63	0.63	1.01	1.21	0.51	0.74	1.08
	0.36	0.35	0.57	0.68	0.45	0.85	0.57
buses and trains	41.7	52.8	62.7	59.7	55.1	69.6	82.2
	0.54	0.35	0.52	1.09	0.78	0.84	0.74
	0.86	0.4	0.6	0.59	1.18	0.78	0.71
other means	249.8	274	217.8	182.9	252.3	229.8	168.0
	0.65	0.68	1.15	1.25	0.45	0.71	1.25
	0.28	0.34	0.56	0.71	0.29	0.87	0.5
Medical Services	656.4	823.2	822.5	994.3	1189.8	1232.8	1341.8
	0.54	0.52	0.54	0.47	0.57	0.64	0.64
	0.68	0.54	0.75	0.68	0.52	0.57	0.59
nurses-hospitals	201.5	198.2	232.7	284.5	427.1	397.7	514.5
	0.55	0.87	0.83	0.73	0.79	1.22	0.7
	0.71	0.7	1.05	0.68	0.48	0.65	0.42
professionals	454.9	625	589.8	709.7	762.7	835.1	827.3
	0.53	0.41	0.42	0.36	0.45	0.37	0.6
	0.68	0.49	0.63	0.68	0.53	0.53	0.69
Prescriptions	186.4	266.9	317	395.4	424	420.7	436.7
	0.46	0.5	0.51	0.53	0.56	0.65	0.59
	0.87	0.89	0.88	0.98	0.71	0.9	0.92

Notes: This table breaks down average private consumption into its elementary items by year. The first row presents the aggregate nominal amounts for families in the baseline sample, the second row presents the fraction of those amounts consumed by single men in the sample, and the third row displays the fraction enjoyed by single women. The following rows provide information on the components of the private good; information is displayed following the above logic. Food at home comprises food prepared at home and food delivered at home (for recipients and non-recipients of food stamps). Public transport comprises buses and trains and all other means (including taxicabs). Medical services comprise payments to nurses, hospitals, physicians, and other professionals. All figures are nominal. Principal components are highlighted by gray.

Table 5 – Breakdown of Average Public Consumption

	1998	2000	2002	2004	2006	2008	2010
couples:	19488.9	22526.6	24889.2	29263	32143.8	30684.2	32374.9
single males %:	0.64	0.56	0.56	0.53	0.54	0.56	0.53
single females %:	0.64	0.62	0.59	0.59	0.58	0.59	0.59
Breakdown of Public Consumption:							
Housing Services	8911.4	10245.8	11935.2	14683.2	16108.5	14936.6	14746.5
	0.72	0.63	0.6	0.56	0.54	0.6	0.53
	0.68	0.64	0.6	0.58	0.59	0.62	0.63
renters	971.3	1104.5	1072.2	1089.3	1615.6	1608.6	2091.3
	3.18	3.1	2.96	3.39	2.13	2.76	1.92
	2.79	2.57	2.74	2.75	2	2.29	1.97
owners	7940	9141.3	10863	13594	14492.9	13327.9	12655.2
	0.42	0.33	0.37	0.33	0.37	0.34	0.31
	0.43	0.41	0.39	0.41	0.43	0.42	0.41
Home Insurance	429.6	472.4	557.3	619.5	663	711.9	789.2
	0.39	0.39	0.45	0.44	0.47	0.37	0.43
	0.49	0.5	0.5	0.55	0.56	0.46	0.48
Health Insurance	982.2	1190.8	1454.5	1695.8	1821.3	2097.2	2197.8
	0.58	0.54	0.59	0.45	0.44	0.47	0.48
	0.65	0.6	0.51	0.51	0.54	0.51	0.43
Utilities	2047.4	2327.2	2293.6	2502.8	2769.2	3056.7	3124.3
	0.59	0.55	0.59	0.54	0.57	0.55	0.55
	0.71	0.76	0.69	0.71	0.75	0.72	0.72
heating-electricity	1718.4	1982.2	1934.5	2131	2369.5	2601.7	2633.1
	0.6	0.56	0.59	0.55	0.58	0.57	0.56
	0.71	0.76	0.69	0.71	0.76	0.72	0.71
water and sewer	329	345	359.1	371.9	399.8	454.9	491.2
	0.54	0.48	0.58	0.5	0.48	0.46	0.52
	0.71	0.75	0.66	0.7	0.69	0.69	0.76
Kids' Education	2030.4	2293.5	2457.5	2662.1	2884.7	2747.2	2903.3
	0.48	0.27	0.27	0.33	0.26	0.39	0.29
	0.47	0.39	0.43	0.42	0.4	0.35	0.32
Child Care	646.5	743	780	835.3	802	937.3	1095
	0.17	0.21	0.2	0.24	0.18	0.11	0.18
	0.64	0.47	0.46	0.43	0.48	0.39	0.38
Auto Vehicles	4441.5	5253.9	5411	6264.3	7095.1	6197.4	7518.8
	0.67	0.62	0.63	0.63	0.7	0.68	0.69
	0.61	0.64	0.63	0.67	0.6	0.63	0.64
motor fuel	1406.7	2012.4	1891.3	2690.2	3394.1	2673	3811.9
	0.65	0.61	0.64	0.63	0.62	0.6	0.65
	0.57	0.53	0.57	0.57	0.54	0.58	0.57
insurance	1539.8	1598	1922.3	1962.3	1927.5	1834.9	1820.2
	0.61	0.57	0.61	0.56	0.57	0.63	0.57
	0.6	0.66	0.65	0.62	0.63	0.62	0.64
repairs	1440.1	1572.1	1516.8	1543	1711.5	1624.2	1826.9
	0.77	0.69	0.66	0.72	1.02	0.89	0.9
	0.67	0.78	0.7	0.89	0.7	0.7	0.77

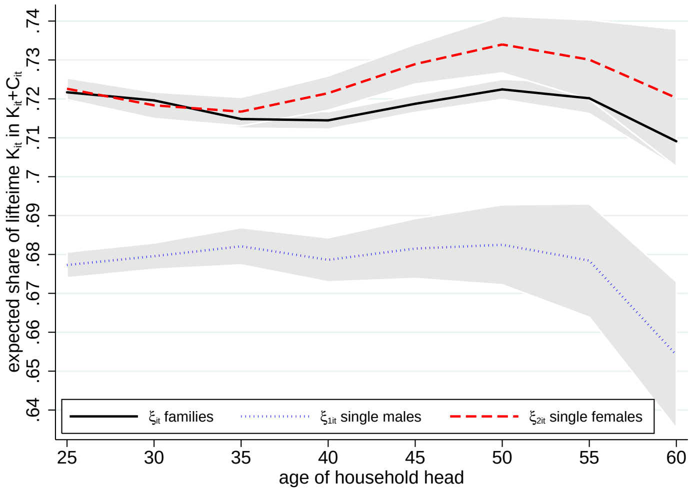
Notes: This table breaks down average public consumption into its elementary items by year. The first row presents the aggregate nominal amounts for families in the baseline sample, the second row presents the fraction of those amounts consumed by single men in the sample, and the third row displays the fraction enjoyed by single women. The following rows provide information on the components of the public good; information is displayed following the above logic. Housing services comprise services rendered to renters and services rendered to owners. I proxy the latter as 6% of the self-reported house value per year. For those who have been offered public or similar housing I utilize a self-reported estimate of a rent-equivalent. Utilities comprise gas, electricity, water and sewer. Auto vehicles comprise vehicle insurance, motor fuel, repair costs, and parking fees. A statistical imputation is used to obtain information on vehicle insurance (698 values imputed) and water & sewer (150 values imputed) when the time unit of such expenses is missing. All figures are nominal. Principal components are highlighted by gray.

Table 6 – Breakdown of Average Household Wealth

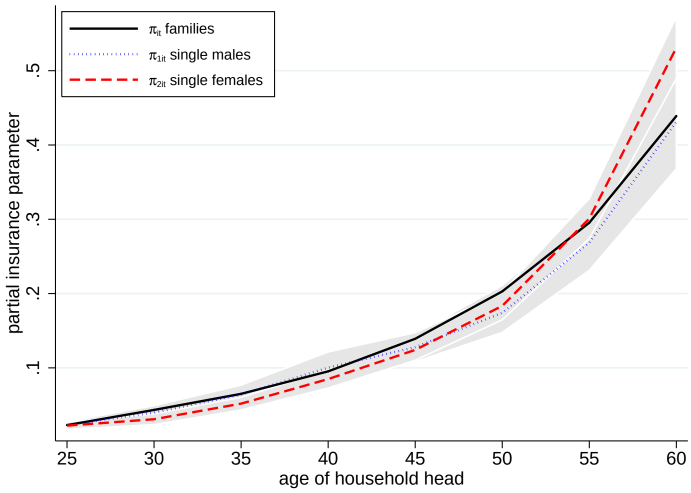
	1998	2000	2002	2004	2006	2008	2010
couples:	239496	270854	267862	320887	379889	319146	335283
single males %:	0.46	0.38	0.61	0.65	0.41	0.64	0.43
single females %:	0.37	0.29	0.47	0.45	0.34	0.36	0.33
Breakdown of Wealth:							
Home Equity	66284	77640	91764	119698	128027	101918	90903
	0.48	0.33	0.36	0.32	0.33	0.34	0.37
	0.46	0.43	0.44	0.46	0.48	0.44	0.45
Other Assets	180472	202364	185988	213078	265310	232490	261733
	0.47	0.41	0.74	0.85	0.46	0.78	0.45
	0.36	0.25	0.51	0.45	0.3	0.35	0.31
other real estate	21967	30577	26939	34331	45790	36738	30396
	0.63	0.41	0.52	0.32	0.38	0.96	0.23
	0.6	0.16	0.23	0.64	0.26	0.29	0.38
vehicles	18341	18043	19589	19866	20079	19865	20464
	0.55	0.63	0.59	0.54	0.67	0.64	0.58
	0.39	0.37	0.42	0.44	0.4	0.41	0.41
farms-businesses	36532	53211	46539	43374	64887	53042	52174
	0.5	0.41	1.62	1.6	0.74	1.28	0.67
	0.52	0.05	0.66	0.27	0.17	0.27	0.12
stocks-shares	42727	35192	30416	38351	43003	34079	50125
	0.26	0.33	0.33	0.64	0.24	0.16	0.45
	0.19	0.43	0.26	0.42	0.38	0.37	0.35
IRA-annuities	33562	36916	32265	40637	53291	41032	63321
	0.3	0.27	0.29	0.61	0.33	0.36	0.28
	0.19	0.26	0.81	0.32	0.29	0.3	0.32
savings accounts	15206	15264	18540	21805	24818	27331	26866
	0.59	0.57	0.62	0.65	0.44	1	0.55
	0.39	0.55	0.5	0.49	0.5	0.53	0.46
miscellaneous assets	12137	13160	11700	14714	13441	20403	18388
	1.07	0.48	0.47	1.74	0.29	0.87	0.48
	0.42	0.31	0.49	0.98	0.23	0.47	0.19
Other Debts	7260	9150	9890	11890	13447	15263	17352
	0.84	0.65	0.78	0.73	0.72	0.75	0.51
	0.85	0.78	0.84	0.69	0.83	0.81	0.68

Notes: This table breaks down net household wealth into its elementary items by year. The first row presents the monetary amounts for families in the baseline sample, the second row presents the fraction of those amounts held by single men, and the third row displays the fraction held by single women. The following rows provide information on the components of net worth; information is displayed following previous logic. Household wealth comprises home equity (house value net of any mortgages) and value of other assets net of other debts. Other assets comprise other real estate, vehicles, farms and businesses, stocks, shares and other investments, individual retirement accounts and annuities, savings accounts, and miscellaneous assets. Other debts comprise credit card debt, student loans, medical and legal bills, and loans to relatives, but excludes vehicle loans. All figures are nominal. Principal components are highlighted by gray.

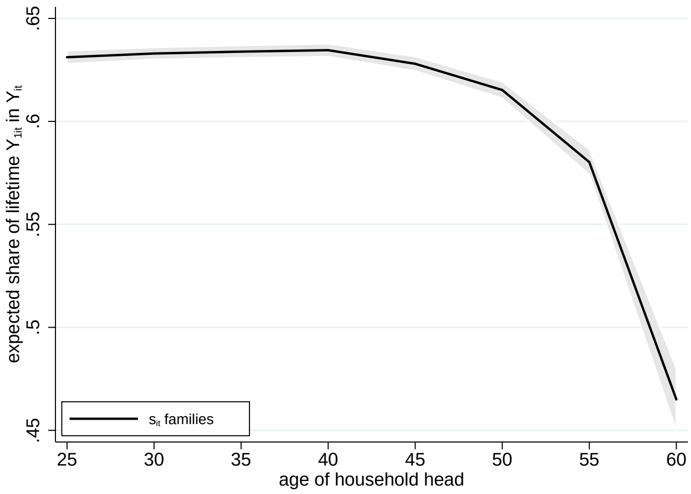
Figure 2 – Pre-Estimated Parameters Of The Budget Constraint



(a) Expected Share Of Lifetime K_{it} In Total Spending



(b) Partial Insurance Parameter



(c) Expected Share of Lifetime Y_{1it} in Y_{it}

Notes: These figures plot the averages of ξ_{it}, π_{it}, and s_{it} against the age of the household head in 5-yearly bands (in multi-member families the head is a male). A 95% confidence interval is plotted around the mean (in grey shade).

Table 7 – Wage Parameters

	I. Men		II. Women		III. Family			
			Panel A: *Couples only*					
Permanent:	$\sigma^2_{v_1}$	0.0458	$\sigma^2_{v_2}$	0.0397	$\sigma_{v_1 v_2}$	0.0036	$\rho_{v_1 v_2}$	0.0845
		(0.0051)		(0.0040)		(0.0020)		(0.0464)
Transitory:	$\sigma^2_{u_1}$	0.0234	$\sigma^2_{u_2}$	0.0216	$\sigma_{u_1 u_2}$	0.0049	$\rho_{u_1 u_2}$	0.2156
		(0.0046)		(0.0046)		(0.0023)		(0.1005)
			Panel B: *Couples and singles jointly*					
Permanent:	$\sigma^2_{v_1}$	0.0453	$\sigma^2_{v_2}$	0.0440	$\sigma_{v_1 v_2}$	0.0036	$\rho_{v_1 v_2}$	0.0808
		(0.0048)		(0.0039)		(0.0021)		(0.0472)
Transitory:	$\sigma^2_{u_1}$	0.0266	$\sigma^2_{u_2}$	0.0197	$\sigma_{u_1 u_2}$	0.0049	$\rho_{u_1 u_2}$	0.2121
		(0.0047)		(0.0041)		(0.0023)		(0.0993)

Notes: The table presents the GMM estimates of the parameters of the wage process. Block bootstrap standard errors are in parentheses. Panel A uses the couples' sample only; panel B uses the couples' and the singles' samples (in this case the covariances between shocks are still estimated on couples only).

Table 8 – Behavioral and Location Parameters

	I. Men			II. Women			III. Household	
	(1) nonseparable	(2) separable		(1) nonseparable	(2) separable		(1) nonseparable	(2) separable
$\eta_{1,h,w}$	0.7599	0.5554	$\eta_{2,h,w}$	1.2288	0.9772			
	(0.1692)	(0.1581)		(0.2827)	(0.1266)			
η_{1,h,p^c}	-0.0397	0.0187	η_{2,h,p^c}	-0.0809	-0.0083	ϕ_1	0.6011	
	(0.0691)	(0.0186)		(0.0826)	(0.0399)		(0.3520)	
η_{1,h,p^k}	-0.0081		η_{2,h,p^k}	0.0423				
	(0.1213)			(0.0927)				
$\eta_{1,c,w}$	0.1689		$\eta_{2,c,w}$	0.2577		$\phi_1 * \eta_{1,c,w}$	0.1015	-0.0714
	(0.2919)			(0.2601)				(0.0710)
η_{1,c,p^c}	-0.1679		η_{2,c,p^c}	-0.0000		$\phi_2 * \eta_{2,c,w}$	0.1028	0.0126
	(1.3828)			(1.0489)				(0.0598)
η_{1,c,p^k}	-0.4387		η_{2,c,p^k}	-0.0000		$\widetilde{\eta}_{k,p^k}$	0.0000	-0.6808
	(3.5876)			(3.1839)				(0.1524)
$\eta_{1,k,w}$	0.0156		$\eta_{2,k,w}$	-0.0523		$\bar{\eta}_{c,p^c}$	-0.1009	-0.4431
	(0.2362)			(0.1146)				0.0920
η_{1,k,p^c}	-0.1526		η_{2,k,p^c}	-0.0000				
	(1.2571)			(0.9536)				
η_{1,k,p^k}	-0.3988		η_{2,k,p^k}	-0.0000				
	(3.2615)			(2.8945)				

Notes: The table presents the GMM estimates of the behavioral and location parameters in the model. Block bootstrap standard errors are in parentheses. Column (1) estimates nonseparable preferences; column (2) estimates separable preferences. φ is the men's share of private consumption and $1-\varphi$ is the women's share of private consumption.

Table 9 – Bargaining Effects

	(1) from v_{1it}	(2) from v_{2it}
On Δy_{1it}	-0.5273	0.0878
	(0.2269)	(0.2391)
On Δy_{2it}	0.0742	-0.4414
	(0.4303)	(0.2098)
On Δc_{it}	0.2502	0.3073
	(0.2582)	(0.1408)
On Δk_{it}	0.2099	0.4906
	(0.1824)	(0.1935)

Notes: The table presents the GMM estimates of the bargaining effects induced by permanent shocks. Block bootstrap standard errors are in parentheses. Column (1) presents the effects due to the male permanent shock; column (2) presents the effects due to the female permanent shock.

A Model Appendix

A.1 Frisch Elasticities

There are nine Frisch (λ-constant) elasticities for each individual j in the family (see Table 1 in the main text for verbal descriptions). The analytical expressions of these elasticities appear below (I suppress subscripts i and t to avoid cumbersome notation):

$$
\begin{aligned}
\eta_{j,h,w} &\equiv \left.\frac{\partial H}{\partial W}\frac{W}{H}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,H_j}}{H_j}(U_{j,KK}U_{j,C_jC_j}-U_{j,KC_j}^2)\\
\eta_{j,h,p^c} &\equiv \left.\frac{\partial H}{\partial P^c}\frac{P^c}{H}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,C_j}}{H_j}(U_{j,KC_j}U_{j,KH_j}-U_{j,KK}U_{j,C_jH_j})\\
\eta_{j,h,p^k} &\equiv \left.\frac{\partial H}{\partial P^k}\frac{P^k}{H}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,K}}{H_j}(U_{j,KC_j}U_{j,C_jH_j}-U_{j,C_jC_j}U_{j,KH_j})\\
\eta_{j,c,w} &\equiv \left.\frac{\partial C}{\partial W}\frac{W}{C}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,H_j}}{C_j}(U_{j,KH_j}U_{j,KC_j}-U_{j,KK}U_{j,C_jH_j})\\
\eta_{j,c,p^c} &\equiv \left.\frac{\partial C}{\partial P^c}\frac{P^c}{C}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,C_j}}{C_j}(U_{j,KK}U_{j,H_jH_j}-U_{j,KH_j}^2)\\
\eta_{j,c,p^k} &\equiv \left.\frac{\partial C}{\partial P^k}\frac{P^k}{C}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,K}}{C_j}(U_{j,KH_j}U_{j,C_jH_j}-U_{j,KC_j}U_{j,H_jH_j})\\
\eta_{j,k,w} &\equiv \left.\frac{\partial K}{\partial W}\frac{W}{K}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,H_j}}{K}(U_{j,KC_j}U_{j,C_jH_j}-U_{j,KH_j}U_{j,C_jC_j})\\
\eta_{j,k,p^c} &\equiv \left.\frac{\partial K}{\partial P^c}\frac{P^c}{K}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,C_j}}{K}(U_{j,KH_j}U_{j,C_jH_j}-U_{j,KC_j}U_{j,H_jH_j})\\
\eta_{j,k,p^k} &\equiv \left.\frac{\partial K}{\partial P^k}\frac{P^k}{K}\right|_{j,\lambda\text{-cons.}} &=& D_j^{-1}\frac{U_{j,K}}{K}(U_{j,C_jC_j}U_{j,H_jH_j}-U_{j,C_jH_j}^2)
\end{aligned}
$$

The partial effects are calculated at the individual level (*not* the family level) keeping everything else fixed and λ constant in expected discounted terms.

With U_{j,x_j} I denote the partial first order derivative of U_j with respect to $x_j = \{H_j, C_j, K\}$. Similarly, $U_{j,x_j\chi_j}$ denotes the partial second order derivative with respect to x_j and χ_j (the latter draws elements from the same set as the former). D_j is the determinant of the Hessian of U_j given by

$$D_j = U_{j,KK}\left(U_{j,C_jC_j}U_{j,H_jH_j}-U_{j,C_jH_j}^2\right)-U_{j,KC_j}^2U_{j,H_jH_j}-U_{j,KH_j}^2U_{j,C_jC_j}+2U_{j,KH_j}U_{j,KC_j}U_{j,C_jH_j}.$$

The above analytical expressions are the elements of the matrix of substitution effects after a marginal-utility-of-wealth compensated price change. This matrix can be written as

$$\begin{pmatrix} -\frac{dH_j}{dW_j} & -\frac{dC_j}{dW_j} & -\frac{dK}{dW_j} \\ \frac{dH_j}{dP^c} & \frac{dC_j}{dP^c} & \frac{dK}{dP^c} \\ \frac{dH_j}{dP^k} & \frac{dC_j}{dP^k} & \frac{dK}{dP^k} \end{pmatrix} = \lambda I_3 \mathbf{H}^{-1} \tag{A.1}$$

where λ is the Lagrange multiplier on the intertemporal budget constraint from the constrained maximization of individual j's utility function U_j, I_3 is a 3×3 identity matrix, and $\mathbf{H}$ is the Hessian of U_j. One can derive the matrix of substitution effects by totally differentiating the intra-temporal first order conditions of the problem with respect to prices and noting that $\Delta\lambda = 0$ in expectations.[31]

As the right hand side of (A.1) is a 3×3 symmetric matrix (the Hessian is symmetric by Young's theorem and standard regularity assumptions on U_j), it follows that $\frac{dH_j}{dP^c} = -\frac{dC_j}{dW_j}$, $\frac{dH_j}{dP^k} = -\frac{dK}{dW_j}$, and $\frac{dC_j}{dP^k} = \frac{dK}{dP^c}$. Simple manipulations yield the restrictions on the "reciprocal" Frisch elasticities in the main text (for more information see section 2.4 in Phlips, 1974).

[31]The first order conditions, compactly written, are $U_{j,K} = \lambda P^k$, $U_{j,C_j} = \lambda P^c$, $U_{j,H_j} = -\lambda W_j$ and the intertemporal Euler equation. The notation should be obvious.

A.2 First Order Conditions Of The Family Problem

In this section I show how I apply a Taylor approximation to the first-order conditions given by (6). For convenience I assume that $U_j(K_{it}, C_{jit}, 1-H_{jit}; \mathbf{z}_{jit}) = U_j(\widetilde{K}_{it}, \widetilde{C}_{jit}, 1-\widetilde{H}_{jit})$ where $\widetilde{K}_{it} = K_{it}\exp(-\sum_j \mathbf{z}^{K}_{jit}{}'\boldsymbol{\zeta}^{K}_{jt})$, $\widetilde{C}_{jit} = C_{jit}\exp(-\mathbf{z}^{C}_{jit}{}'\boldsymbol{\zeta}^{C}_{jt})$, and $\widetilde{H}_{jit} = H_{jit}\exp(-\mathbf{z}^{H}_{jit}{}'\boldsymbol{\zeta}^{H}_{jt})$. $\mathbf{z}^{K}_{jit}$, $\mathbf{z}^{C}_{jit}$, and $\mathbf{z}^{H}_{jit}$ are individual-specific preference factors relevant to each choice variable.[32]

Consider the first-order conditions for H_{1it} and H_{1it-1}; apply logs on both sides and subtract the expression at $t-1$ from that at t to get

$$\Delta \ln\left(-U_{1,H_1}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it})\right) = \Delta \ln \lambda_{it} + \Delta \ln W_{1it} - \Delta \ln \mu_{it}$$

where Δ denotes the first difference operator (in time). A first order Taylor approximation of $\ln(-U_{1,H_1}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it}))$ about $\{\widetilde{K}_{it-1}, \widetilde{C}_{1it-1}, \widetilde{H}_{1it-1}\}$ yields

$$\Delta \ln\left(-U_{1,H_1}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it})\right) \approx \frac{U_{1,H_1K}}{U_{1,H_1}}\Delta\widetilde{K}_{it} + \frac{U_{1,H_1C_1}}{U_{1,H_1}}\Delta\widetilde{C}_{1it} + \frac{U_{1,H_1H_1}}{U_{1,H_1}}\Delta\widetilde{H}_{1it} \tag{A.2}$$

where $U_{j,x_j\chi_j}$ denotes the second order partial derivative of U_j with respect to x_j and χ_j (both draw elements from $\{K, C_j, H_j\}$, $j=\{1,2\}$). All partial derivatives in (A.2) are evaluated at $\{\widetilde{K}_{it-1}, \widetilde{C}_{1it-1}, \widetilde{H}_{1it-1}\}$.

In a similar way I approximate the first order conditions for H_{2it}, C_{1it}, and C_{2it}. All four of them together (preserving the order) are:

$$\frac{U_{1,H_1K}}{U_{1,H_1}}\Delta\widetilde{K}_{it} + \frac{U_{1,H_1C_1}}{U_{1,H_1}}\Delta\widetilde{C}_{1it} + \frac{U_{1,H_1H_1}}{U_{1,H_1}}\Delta\widetilde{H}_{1it} \approx \Delta \ln \lambda_{it} + \Delta \ln W_{1it} - \Delta \ln \mu_{it} \tag{A.3}$$

$$\frac{U_{2,H_2K}}{U_{2,H_2}}\Delta\widetilde{K}_{it} + \frac{U_{2,H_2C_2}}{U_{2,H_2}}\Delta\widetilde{C}_{2it} + \frac{U_{2,H_2H_2}}{U_{2,H_2}}\Delta\widetilde{H}_{2it} \approx \Delta \ln \lambda_{it} + \Delta \ln W_{2it} + \widetilde{\mu}_{it-1}\Delta \ln \mu_{it} \tag{A.4}$$

$$\frac{U_{1,C_1K}}{U_{1,C_1}}\Delta\widetilde{K}_{it} + \frac{U_{1,C_1C_1}}{U_{1,C_1}}\Delta\widetilde{C}_{1it} + \frac{U_{1,C_1H_1}}{U_{1,C_1}}\Delta\widetilde{H}_{1it} \approx \Delta \ln \lambda_{it} + \Delta \ln P_{t} - \Delta \ln \mu_{it} \tag{A.5}$$

$$\frac{U_{2,C_2K}}{U_{2,C_2}}\Delta\widetilde{K}_{it} + \frac{U_{2,C_2C_2}}{U_{2,C_2}}\Delta\widetilde{C}_{2it} + \frac{U_{2,C_2H_2}}{U_{2,C_2}}\Delta\widetilde{H}_{2it} \approx \Delta \ln \lambda_{it} + \Delta \ln P_{t} + \widetilde{\mu}_{it-1}\Delta \ln \mu_{it}. \tag{A.6}$$

To obtain these expressions I also apply a first order Taylor approximation to $\ln(1-\mu_{it})$ about μ_{it-1} that allows me to write $\Delta\ln(1-\mu_{it}) \approx -\widetilde{\mu}_{it-1}\Delta\ln\mu_{it}$ with $\widetilde{\mu}_{it-1} = \frac{\mu_{it-1}}{1-\mu_{it-1}}$.

The approximation of the first-order condition for K_{it} is trickier as it involves both partners' marginal utilities. Applying logs on both sides at time t and $t-1$ and subtracting the latter from the former yields $\Delta\ln\left(\mu_{i,t}U_{1,K}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it}) + (1-\mu_{it})U_{2,K}(\widetilde{K}_{it}, \widetilde{C}_{2it}, \widetilde{H}_{2it})\right) = \Delta\ln\lambda_{it}$. I approximate $\ln\left(\mu_{it}U_{1,K}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it}) + (1-\mu_{it})U_{2,K}(\widetilde{K}_{it}, \widetilde{C}_{2it}, \widetilde{H}_{2it})\right)$ about $\left\{\widetilde{K}_{it-1},\ \widetilde{C}_{jit-1},\ \widetilde{H}_{jit-1}\right\}$:

$$\begin{aligned}
&\Delta\ln\left(\mu_{it}U_{1,K}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it}) + (1-\mu_{it})U_{2,K}(\widetilde{K}_{it}, \widetilde{C}_{2it}, \widetilde{H}_{2it})\right)\\
&\quad\approx (\mu_{it-1}U_{1,K} + (1-\mu_{it-1})U_{2,K})^{-1}\left(\Delta\big(\mu_{it}U_{1,K}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it})\big) + \Delta\big((1-\mu_{it})U_{2,K}(\widetilde{K}_{it}, \widetilde{C}_{2it}, \widetilde{H}_{2it})\big)\right)\\
&\quad\approx \nu_{it-1}\left(\mu_{it-1}U_{1,K}\right)^{-1}\Delta\big(\mu_{it}U_{1,K}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it})\big)\\
&\qquad + (1-\nu_{it-1})\left((1-\mu_{it-1})U_{2,K}\right)^{-1}\Delta\big((1-\mu_{it})U_{2,K}(\widetilde{K}_{it}, \widetilde{C}_{2it}, \widetilde{H}_{2it})\big)\\
&\quad\approx \nu_{it-1}\left(\Delta\ln\mu_{it} + \Delta\ln U_{1,K}(\widetilde{K}_{it}, \widetilde{C}_{1it}, \widetilde{H}_{1it})\right)\\
&\qquad + (1-\nu_{it-1})\left(\Delta\ln(1-\mu_{it}) + \Delta\ln U_{2,K}(\widetilde{K}_{it}, \widetilde{C}_{2it}, \widetilde{H}_{2it})\right)
\end{aligned}$$

where $\nu_{it-1} = \mu_{it-1}U_{1,K}(\mu_{it-1}U_{1,K} + (1-\mu_{it-1})U_{2,K})^{-1}$ is a mixture of preferences (marginal utilities of the public good) and relative powers. If not explicitly stated otherwise, all partial derivatives are evaluated at $t-1$. Expanding $\Delta\ln U_{j,K}(\widetilde{K}_{it}, \widetilde{C}_{jit}, \widetilde{H}_{jit})$, $j=\{1,2\}$, follows the same logic as in (A.2). I approximate $\ln U_{j,K}(\widetilde{K}_{it}, \widetilde{C}_{jit}, \widetilde{H}_{jit})$ about $\{\widetilde{K}_{it-1}, \widetilde{C}_{jit-1}, \widetilde{H}_{jit-1}\}$ (full derivation omitted for brevity) and I combine the resulting expressions to get the approximation to the first order condition for K_{it};

[32] $\boldsymbol{\zeta}^{K}_{jt}$, $\boldsymbol{\zeta}^{C}_{jt}$, and $\boldsymbol{\zeta}^{H}_{jt}$ are the corresponding coefficients at t. Both family members' preference factors affect $\widetilde{K}_{it}$.

that is

$$\left(\nu_{it-1}\frac{U_{1,KK}}{U_{1,K}}+(1-\nu_{it-1})\frac{U_{2,KK}}{U_{2,K}}\right)\Delta\widetilde{K}_{it}+ \nu_{it-1}\left(\frac{U_{1,KC_1}}{U_{1,K}}\Delta\widetilde{C}_{1it}+\frac{U_{1,KH_1}}{U_{1,K}}\Delta\widetilde{H}_{1it}\right)+ (1-\nu_{it-1})\left(\frac{U_{2,KC_2}}{U_{2,K}}\Delta\widetilde{C}_{2it}+\frac{U_{2,KH_2}}{U_{2,K}}\Delta\widetilde{H}_{2it}\right)\approx\Delta\ln\lambda_{it}+\widetilde{\nu}_{it-1}\Delta\ln\mu_{it} \tag{A.7}$$

with $\widetilde{\nu}_{it}=(1-\nu_{it})\widetilde{\mu}_{it}-\nu_{it}$ (relabeled for convenience). Again all first and second order partial derivatives are evaluated at $t-1$.

I solve the system of equations (A.3)-(A.7) to get approximate closed-form expressions for the change in the choice variables in the model (5 equations in 5 choice variables) as functions of the changes in wages, the relative powers in the household, and the marginal utility of wealth:

$$\begin{pmatrix}\Delta\widetilde{K}_{it}\\ \Delta\widetilde{C}_{1it}\\ \Delta\widetilde{C}_{2it}\\ \Delta\widetilde{H}_{1it}\\ \Delta\widetilde{H}_{2it}\end{pmatrix}\approx\mathbf{M}^{w}_{5\times2}\begin{pmatrix}\Delta\ln W_{1it}\\ \Delta\ln W_{2it}\end{pmatrix}+\mathbf{M}^{\mu}_{5\times1}\Delta\ln\mu_{it}+\mathbf{M}^{\lambda}_{5\times1}\Delta\ln\lambda_{it}. \tag{A.8}$$

I have imposed that aggregate $\Delta\ln P_t=0$ (aggregate shocks will be captured by year dummies in the conditioning observables). $\mathbf{M}^{w}_{5\times2}$, $\mathbf{M}^{\mu}_{5\times1}$, and $\mathbf{M}^{\lambda}_{5\times1}$ are matrices of loading factors; as they are only intermediate products of the solution, I will not present their elements in detail.[33]

Next, I apply a Taylor approximation to μ_{it}, given by (5), around μ_{it-1} assuming that the distribution factors $\mathbf{d}_{it}$ remain unchanged and I get $\Delta\ln\mu_{it}\approx\eta_{\mu,w_1,t}v_{1it}+\eta_{\mu,w_2,t}v_{2it}$. I replace $\Delta\ln\mu_{it}$ in (A.8) with its equivalent expression above; furthermore I replace individual hours of work with individual earnings Y_{jit} (whereby $Y_{jit}=W_{jit}H_{jit}$ I denote individual j's earnings at time t). I rewrite (A.8) as

$$\begin{pmatrix}\Delta k_{it}\\ \Delta c_{1it}\\ \Delta c_{2it}\\ \Delta y_{1it}\\ \Delta y_{2it}\end{pmatrix}\approx\begin{pmatrix}\alpha_{k,w_1}&\alpha_{k,w_2}\\ \alpha_{c_1,w_1}&\alpha_{c_1,w_2}\\ \alpha_{c_2,w_1}&\alpha_{c_2,w_2}\\ \alpha_{y_1,w_1}&\alpha_{y_1,w_2}\\ \alpha_{y_2,w_1}&\alpha_{y_2,w_2}\end{pmatrix}\begin{pmatrix}v_{1it}+\Delta u_{1it}\\ v_{2it}+\Delta u_{2it}\end{pmatrix}+\begin{pmatrix}\beta_{k,w_1}&\beta_{k,w_2}\\ \beta_{c_1,w_1}&\beta_{c_1,w_2}\\ \beta_{c_2,w_1}&\beta_{c_2,w_2}\\ \beta_{y_1,w_1}&\beta_{y_1,w_2}\\ \beta_{y_2,w_1}&\beta_{y_2,w_2}\end{pmatrix}\begin{pmatrix}v_{1it}\\ v_{2it}\end{pmatrix}+\begin{pmatrix}\alpha_{k,\lambda}\\ \alpha_{c_1,\lambda}\\ \alpha_{c_2,\lambda}\\ \alpha_{y_1,\lambda}\\ \alpha_{y_2,\lambda}\end{pmatrix}\Delta\ln\lambda_{it}. \tag{A.9}$$

All outcome variables are now net of observable characteristics; namely $\Delta k_{it}=\Delta\ln K_{it}-\sum_j\Delta(\mathbf{z}^{K\prime}_{jit}\boldsymbol{\zeta}^{K}_{jt})-\sum_j\Delta(\alpha_{k,w_j}\mathbf{x}^{W\prime}_{jit}\boldsymbol{\zeta}^{W}_{jt})$, $\Delta c_{jit}=\Delta\ln C_{jit}-\Delta(\mathbf{z}^{C\prime}_{jit}\boldsymbol{\zeta}^{C}_{jt})-\sum_j\Delta(\alpha_{c_j,w_j}\mathbf{x}^{W\prime}_{jit}\boldsymbol{\zeta}^{W}_{jt})$, and $\Delta y_{jit}=\Delta\ln Y_{jit}-\Delta(\mathbf{z}^{H\prime}_{jit}\boldsymbol{\zeta}^{H}_{jt})-\sum_j\Delta(\alpha_{y_j,w_j}\mathbf{x}^{W\prime}_{jit}\boldsymbol{\zeta}^{W}_{jt})-\Delta(\mathbf{x}^{W\prime}_{jit}\boldsymbol{\zeta}^{W}_{jt})$. The first 5×2 loading matrix captures the static effects induced by wage shocks on the outcome variables (both permanent and transitory shocks induce the same static effects by definition); the second 5×2 loading matrix captures the bargaining effects due to limited commitment induced by permanent shocks only. The last loading matrix transmits the dynamic effects induced by temporal revisions to the marginal utility of wealth. All loading factors are naturally i- and t-specific (notation removed here for simplicity) and are complicated functions of a large set of Frisch elasticities and intra-family power. Table 1 introduces the full set of individual-specific Frisch elasticities whereas appendix A.1 defines these elasticities analytically. I report the full list of loading factors in appendix A.4.

Equation (A.9) is still not very useful empirically as it involves $\Delta\ln\lambda_{it}$ that is unobserved and hard to characterize. To get around this problem I first apply a second order Taylor approximation to the Euler equation. Let $\exp(\rho)=\beta(1+r)$ for an appropriate ρ. I approximate the natural exponential

[33] They are available upon request though.

function $\exp(\cdot)$ evaluated at λ_{it+1} about the point $\ln\lambda_{it}+\rho$ and I get

$$\begin{aligned}\exp(\ln\lambda_{it+1}) &\approx \exp(\ln\lambda_{it}+\rho)+\exp(\ln\lambda_{it}+\rho)(\Delta\ln\lambda_{it+1}-\rho)+\exp(\ln\lambda_{it}+\rho)\frac{1}{2}(\Delta\ln\lambda_{it+1}-\rho)^2\\ &= \lambda_{it}\exp(\rho)[1+\Delta\ln\lambda_{it+1}-\rho+\frac{1}{2}(\Delta\ln\lambda_{it+1}-\rho)^2].\end{aligned}$$

Taking expectations at time t and noting that $\lambda_{it}=\exp(\rho)\mathbb{E}_t\lambda_{it+1}$ (the Euler equation) yields $\mathbb{E}_t\Delta\ln\lambda_{it+1}\approx\rho-\frac{1}{2}\mathbb{E}_t(\Delta\ln\lambda_{it+1}-\rho)^2$ which in turn can be written as

$$\Delta\ln\lambda_{it+1}\approx\omega_{it+1}+\epsilon_{it+1} \tag{A.10}$$

with $\omega_{it+1}=\rho-\frac{1}{2}\mathbb{E}_t(\Delta\ln\lambda_{it+1}-\rho)^2$. The last term ϵ_{it+1} is an expectations error with $\mathbb{E}_t\epsilon_{it+1}=0$. This expression will be used as an input to a Taylor approximation to the intertemporal budget constraint which is presented in appendix A.3.

A.3 Approximation To The Intertemporal Budget Constraint

Let $F(\boldsymbol{\psi})=\ln\sum_{s=0}^{S}\exp\psi_s$ with $\boldsymbol{\psi}=(\psi_0,\psi_1,\ldots,\psi_S)'$; a first order Taylor approximation of $F(\boldsymbol{\psi})$ around $\boldsymbol{\psi^0}$ yields

$$F(\boldsymbol{\psi})\approx\ln\sum_{s=0}^{S}\exp\psi_s^0+\sum_{s=0}^{S}\frac{\exp\psi_s^0}{\sum_{s=0}^{S}\exp\psi_s^0}\left(\psi_s-\psi_s^0\right).$$

Now consider the left hand side of the intertemporal budget constraint (BC) given by $A_{i0}+\mathbb{E}_0\sum_{t=0}^{T}\frac{W_{1it}H_{1it}}{(1+r)^t}+\mathbb{E}_0\sum_{t=0}^{T}\frac{W_{2it}H_{2it}}{(1+r)^t}$. The logarithm of this can be defined as

$$F(\boldsymbol{\psi})=\ln\left[\exp(\ln A_{i0})+\sum_{t=0}^{T}\exp\left(\ln\frac{W_{1it}H_{1it}}{(1+r)^t}\right)+\sum_{t=0}^{T}\exp\left(\ln\frac{W_{2it}H_{2it}}{(1+r)^t}\right)\right]$$

where $S=2T+2$ and

$$\psi_s=\begin{cases}\ln A_{is} & s=0\\ \ln W_{1is-1}H_{1is-1}-(s-1)\ln(1+r) & s=1,\ldots,T+1\\ \ln W_{2is-(T+2)}H_{2is-(T+2)}-(s-(T+2))\ln(1+r) & s=T+2,\ldots,2T+2\end{cases}$$

Also define

$$\begin{aligned}\psi_s^0&=\begin{cases}\mathbb{E}_{-1}\ln A_{is} & s=0\\ \mathbb{E}_{-1}\ln W_{1is-1}H_{1is-1}-(s-1)\ln(1+r) & s=1,\ldots,T+1\\ \mathbb{E}_{-1}\ln W_{2is-(T+2)}H_{2is-(T+2)}-(s-(T+2))\ln(1+r) & s=T+2,\ldots,2T+2\end{cases}\\ D_{i0}&=\exp(\mathbb{E}_{-1}\ln A_{i0})+\sum_{k=0}^{T}\exp\left(\mathbb{E}_{-1}\ln\frac{W_{1ik}H_{1ik}}{(1+r)^k}\right)+\sum_{k=0}^{T}\exp\left(\mathbb{E}_{-1}\ln\frac{W_{2ik}H_{2ik}}{(1+r)^k}\right)\\ \pi_{i0}&=\frac{\exp(\mathbb{E}_{-1}\ln A_{i0})}{D_{i0}}\\ s_{i0}&=\frac{\sum_{k=0}^{T}\exp(\mathbb{E}_{-1}\ln W_{1ik}H_{1ik}-k\ln(1+r))}{D_{i0}-\exp(\mathbb{E}_{-1}\ln A_{i0})}\\ \theta_{jit}&=\frac{\exp(\mathbb{E}_{-1}\ln W_{jit}H_{jit}-t\ln(1+r))}{\sum_{k=0}^{T}\exp(\mathbb{E}_{-1}\ln W_{jik}H_{jik}-k\ln(1+r))}\end{aligned}$$

where $\mathbb{E}_{-1}$ defines expectations at time -1 (the intertemporal budget constraint covers the periods 0 through T). Parameter π_{i0} is approximately the $(t=-1)$-expected ratio of financial wealth at $t=0$ over total human and financial wealth in the household over the lifetime $t=0,\ldots,T$.[34] s_{i0} is the $(t=-1)$-expected ratio of individual 1's lifetime human wealth over total lifetime human wealth in the household.

[34] With "lifetime human wealth" over $t=0,\ldots,T$ I mean expected lifetime earnings over $t=0,\ldots,T$.

θ_{jit}, $j = \{1,2\}$, is the $(t=-1)$-expected ratio of j's earnings at t over lifetime human wealth by the same person.

Expanding the left hand side of the intertemporal budget constraint around $\boldsymbol{\psi}^{\mathbf{0}}$, taking expectations conditional on an information set I, and changing the notation appropriately, I get

$$\begin{aligned}
\mathbb{E}_I F(\boldsymbol{\psi}) \approx \mathbb{E}_I F(\boldsymbol{\psi}^{\mathbf{0}}) &+ \frac{\exp(\mathbb{E}_{-1}\ln A_{i0})}{D_{i0}}(\mathbb{E}_I - \mathbb{E}_{-1})\ln A_{i0} \\
&+ \sum_{t=0}^{T} \frac{\exp(\mathbb{E}_{-1}\ln W_{1it}H_{1it} - t\ln(1+r))}{D_{i0}}(\mathbb{E}_I - \mathbb{E}_{-1})\ln W_{1it}H_{1it} \\
&+ \sum_{t=0}^{T} \frac{\exp(\mathbb{E}_{-1}\ln W_{2it}H_{2it} - t\ln(1+r))}{D_{i0}}(\mathbb{E}_I - \mathbb{E}_{-1})\ln W_{2it}H_{2it} \\
\mathbb{E}_I F(\boldsymbol{\psi}) \approx \mathbb{E}_I F(\boldsymbol{\psi}^{\mathbf{0}}) &+ \pi_{i0}(\mathbb{E}_I - \mathbb{E}_{-1})\ln A_{i0} \\
&+ (1-\pi_{i0})s_{i0}\sum_{t=0}^{T}\theta_{1it}(\mathbb{E}_I - \mathbb{E}_{-1})(\Delta\ln Y_{1it} + \ln Y_{1it-1}) \\
&+ (1-\pi_{i0})(1-s_{i0})\sum_{t=0}^{T}\theta_{2it}(\mathbb{E}_I - \mathbb{E}_{-1})(\Delta\ln Y_{1it} + \ln Y_{1it-1}).
\end{aligned}$$

To reach the last step I use $\ln W_{jit}H_{jit} = \Delta\ln Y_{jit} + \ln Y_{jit-1}$ where $\Delta\ln Y_{jit}$ is given by $\alpha_{y_j,w_1}(v_{1it} + \Delta u_{1it}) + \alpha_{y_j,w_2}(v_{2it} + \Delta u_{2it}) + \beta_{y_j,w_1}v_{1it} + \beta_{y_j,w_2}v_{2it} + \alpha_{y_j,\lambda}(\omega_{it} + \epsilon_{it})$ (see (A.9) and (A.10); essentially I replace $\Delta\ln Y_{jit}$ with Δy_{jit} because I assume that changes in observable characteristics are in the partners' information sets since $t=-1$ and are therefore irrelevant for the difference $\mathbb{E}_I - \mathbb{E}_{-1}$, $I = \{t \geq -1\}$). Finally, (a) assuming that current earnings are negligible compared to lifetime earnings for sufficiently young individuals,[35] and (b) placing ω_{it} in the individuals' information sets, I difference $\mathbb{E}_I F(\boldsymbol{\psi})$ across two information sets $I: t=0$ and $I: t=-1$ to get

$$\begin{aligned}
\mathbb{E}_0 F(\boldsymbol{\psi}) - \mathbb{E}_{-1}F(\boldsymbol{\psi}) \approx\ & (1-\pi_{i0})s_{i0}\big((\alpha_{y_1,w_1} + \beta_{y_1,w_1})v_{1i0} + (\alpha_{y_1,w_2} + \beta_{y_1,w_2})v_{2i0} + \alpha_{y_1,\lambda}\epsilon_{i0}\big) \\
&+ (1-\pi_{i0})(1-s_{i0})\big((\alpha_{y_2,w_1} + \beta_{y_2,w_1})v_{1i0} + (\alpha_{y_2,w_2} + \beta_{y_2,w_2})v_{2i0} + \alpha_{y_2,\lambda}\epsilon_{i0}\big).
\end{aligned} \tag{A.11}$$

Moving to the right hand side of the intertemporal budget constraint (BC) I set

$$F(\boldsymbol{\psi}) = \ln\left[\sum_{t=0}^{T}\exp\left(\ln\frac{K_{it}}{(1+r)^t}\right) + \sum_{t=0}^{T}\exp\left(\ln\frac{P_t C_{it}}{(1+r)^t}\right)\right]$$

$$\psi_s = \begin{cases} \ln K_{is} - s\ln(1+r) & s = 0,\dots,T \\ \ln P_{s-(T+1)}C_{is-(T+1)} - (s-(T+1))\ln(1+r) & s = T+1,\dots,2T+1 \end{cases}$$

and I follow the same procedure like before to get[36]

$$\begin{aligned}
\mathbb{E}_0 F(\boldsymbol{\psi}) - \mathbb{E}_{-1}F(\boldsymbol{\psi}) \approx\ & \xi_{i0}\big((\alpha_{k,w_1} + \beta_{k,w_1})v_{1i0} + (\alpha_{k,w_2} + \beta_{k,w_2})v_{2i0} + \alpha_{k,\lambda}\epsilon_{i0}\big) \\
&+ (1-\xi_{i0})\varphi_{i,-1}\big((\alpha_{c_1,w_1} + \beta_{c_1,w_1})v_{1i0} + (\alpha_{c_1,w_2} + \beta_{c_1,w_2})v_{2i0} + \alpha_{c_1,\lambda}\epsilon_{i0}\big) \\
&+ (1-\xi_{i0})(1-\varphi_{i,-1})\big((\alpha_{c_2,w_1} + \beta_{c_2,w_1})v_{1i0} + (\alpha_{c_2,w_2} + \beta_{c_2,w_2})v_{2i0} + \alpha_{c_2,\lambda}\epsilon_{i0}\big).
\end{aligned} \tag{A.12}$$

The notation is as follows: $\xi_{it} = \frac{\sum_{k=0}^{T}\exp(\mathbb{E}_{-1}\ln\frac{K_{ik}}{(1+r)^k})}{\sum_{k=0}^{T}\exp(\mathbb{E}_{-1}\ln\frac{K_{ik}}{(1+r)^k}) + \sum_{k=0}^{T}\exp(\mathbb{E}_{-1}\ln\frac{P_k C_{ik}}{(1+r)^k})}$ is the $(t=-1)$-expected share of the family's lifetime expenditure on the public good between $t=0$ and $t=T$ over total family lifetime expenditure on all goods between $t=0$ and $t=T$; $\varphi_{it} = \frac{C_{1it}}{C_{it}}$ is the share of individual 1's private consumption over total private consumption in the family at t. φ_{it} enters the approximation because $\Delta\ln C_{it} \approx \varphi_{it-1}\Delta\ln C_{1it} + (1-\varphi_{it-1})\Delta\ln C_{2it}$.

[35] This implies that $\theta_{jit} \approx 0$ and transitory shocks to current earnings do not shift the intertemporal budget constraint.

[36] The detailed derivations are available upon request.

Combining (A.11) and (A.12), ϵ_{i0} is given by

$$\epsilon_{i0} \approx \ell_{w_1,i,0} v_{1i0} + \ell_{w_2,i,0} v_{2i0} \tag{A.13}$$

where

$$\begin{aligned}
\ell_{w_1,i0} &= (1/\widetilde{\alpha}_{\lambda,i0})\Big(\xi_{i0}(\alpha_{k,w_1} + \beta_{k,w_1}) + (1-\xi_{i0})\big(\varphi_{i,-1}(\alpha_{c_1,w_1} + \beta_{c_1,w_1}) + (1-\varphi_{i,-1})(\alpha_{c_2,w_1} + \beta_{c_2,w_1})\big) \\
&\quad - (1-\pi_{i0})s_{i0}(\alpha_{y_1,w_1} + \beta_{y_1,w_1}) - (1-\pi_{i0})(1-s_{i0})(\alpha_{y_2,w_1} + \beta_{y_2,w_1})\Big) \\
\ell_{w_2,i0} &= (1/\widetilde{\alpha}_{\lambda,i0})\Big(\xi_{i0}(\alpha_{k,w_2} + \beta_{k,w_2}) + (1-\xi_{i0})\big(\varphi_{i,-1}(\alpha_{c_1,w_2} + \beta_{c_1,w_2}) + (1-\varphi_{i,-1})(\alpha_{c_2,w_2} + \beta_{c_2,w_2})\big) \\
&\quad - (1-\pi_{i0})s_{i0}(\alpha_{y_1,w_2} + \beta_{y_1,w_2}) - (1-\pi_{i0})(1-s_{i0})(\alpha_{y_2,w_2} + \beta_{y_2,w_2})\Big) \\
\widetilde{\alpha}_{\lambda,i0} &= (1-\pi_{i0})(s_{i0}\alpha_{y_1,\lambda} + (1-s_{i0})\alpha_{y_2,\lambda}) - \xi_{i0}\alpha_{k,\lambda} - (1-\xi_{i0})(\varphi_{i,-1}\alpha_{c_1,\lambda} + (1-\varphi_{i,-1})\alpha_{c_2,\lambda})
\end{aligned} \tag{A.14}$$

For a general time period t the mapping between ϵ_{it} and the permanent shocks v_{1it} and v_{2it} looks alike. One has to follow the same steps, the only difference being that the budget constraint must start counting at t (rather than 0) and the difference in expectations must be $\mathbb{E}_t - \mathbb{E}_{t-1}$.

Similar arguments can be used to show that an approximation to single j's intertemporal budget constraint (11) results in the following mapping between ϵ_{jis} (the innovation to the single's marginal utility of wealth at time s) and the permanent shock v_{jis}

$$\epsilon_{jis} = \frac{\xi_{jis}\eta_{j,k,w} + (1-\xi_{jis})\eta_{j,c,w} - (1-\pi_{jis})(1+\eta_{j,h,w})}{(1-\pi_{jis})\sum\eta_{j,h} - \xi_{jis}\sum\eta_{j,k} - (1-\xi_{jis})\sum\eta_{j,c}} v_{jis} \tag{A.15}$$

The notation is as follows: $\sum\eta_{j,k} = \eta_{j,k,p^k} + \eta_{j,k,p^c} + \eta_{j,k,w}$; $\sum\eta_{j,c} = \eta_{j,c,p^k} + \eta_{j,c,p^c} + \eta_{j,c,w}$; $\sum\eta_{j,h} = \eta_{j,h,p^k} + \eta_{j,h,p^c} + \eta_{j,h,w}$; ξ_{jis} is j's ratio of public to total expected expenditure over his/her singlehood; and $\pi_{jis} \approx \text{Assets}_{jis}/(\text{Assets}_{jis} + \text{Earnings over Singlehood}_{jis})$ captures j's financial wealth relative to his/her total financial and human wealth over singlehood combined.

A.4 Transmission Parameters

In this section I report the analytical expressions for the transmission parameters in $\mathbf{T}_{it4\times4}$ in the system of equations (7). This system can be written (less compactly) as

$$\begin{pmatrix}\Delta k_{it}\\ \Delta c_{1it}\\ \Delta c_{2it}\\ \Delta y_{1it}\\ \Delta y_{2it}\end{pmatrix} \approx \begin{pmatrix}\alpha_{k,w_1} & \alpha_{k,w_2}\\ \alpha_{c_1,w_1} & \alpha_{c_1,w_2}\\ \alpha_{c_2,w_1} & \alpha_{c_2,w_2}\\ \alpha_{y_1,w_1} & \alpha_{y_1,w_2}\\ \alpha_{y_2,w_1} & \alpha_{y_2,w_2}\end{pmatrix}\begin{pmatrix}v_{1it} + \Delta u_{1it}\\ v_{2it} + \Delta u_{2it}\end{pmatrix} + \begin{pmatrix}\beta_{k,w_1} & \beta_{k,w_2}\\ \beta_{c_1,w_1} & \beta_{c_1,w_2}\\ \beta_{c_2,w_1} & \beta_{c_2,w_2}\\ \beta_{y_1,w_1} & \beta_{y_1,w_2}\\ \beta_{y_2,w_1} & \beta_{y_2,w_2}\end{pmatrix}\begin{pmatrix}v_{1it}\\ v_{2it}\end{pmatrix} + \begin{pmatrix}\gamma_{k,w_1} & \gamma_{k,w_2}\\ \gamma_{c_1,w_1} & \gamma_{c_1,w_2}\\ \gamma_{c_2,w_1} & \gamma_{c_2,w_2}\\ \gamma_{y_1,w_1} & \gamma_{y_1,w_2}\\ \gamma_{y_2,w_1} & \gamma_{y_2,w_2}\end{pmatrix}\begin{pmatrix}v_{1it}\\ v_{2it}\end{pmatrix}$$

where the first 5×2 matrix (the α's) is the matrix of static effects induced by both permanent and transitory shocks, the second 5×2 matrix (the β's) is the matrix of bargaining effects due to limited commitment induced only by permanent shocks, and the last 5×2 matrix (the γ's) is the matrix of dynamic income-wealth effects induced by permanent shocks. $\mathbf{T}_{it4\times4}$ is essentially the sum of these 3 matrices after collapsing Δc_{1it} and Δc_{2it} (reported here) to Δc_{it} using the approximation $\Delta\ln C_{it} \approx \varphi_{it-1}\Delta\ln C_{1it} + (1-\varphi_{it-1})\Delta\ln C_{2it}$.

Static effects

$$\begin{aligned}
\text{On } \Delta k_{it} \quad &: \quad \alpha_{k,w_1} = \nu_{it-1}\eta_{2,k,p^k}\eta_{1,k,w}(1/\bar{\eta}_{k,p^k}) \\
&: \quad \alpha_{k,w_2} = (1-\nu_{it-1})\eta_{1,k,p^k}\eta_{2,k,w}(1/\bar{\eta}_{k,p^k})
\end{aligned}$$

$$
\begin{aligned}
\text{On } \Delta c_{1it} &: \quad \alpha_{c_1,w_1} = \eta_{1,c,w} - (1-\nu_{it-1})\eta_{1,c,p^k}\eta_{1,k,w}(1/\bar{\eta}_{k,p^k}) \\
&: \quad \alpha_{c_1,w_2} = (1-\nu_{it-1})\eta_{1,c,p^k}\eta_{2,k,w}(1/\bar{\eta}_{k,p^k}) \\
\text{On } \Delta c_{2it} &: \quad \alpha_{c_2,w_1} = \nu_{it-1}\eta_{2,c,p^k}\eta_{1,k,w}(1/\bar{\eta}_{k,p^k}) \\
&: \quad \alpha_{c_2,w_2} = \eta_{2,c,w} - \nu_{it-1}\eta_{2,c,p^k}\eta_{2,k,w}(1/\bar{\eta}_{k,p^k}) \\
\text{On } \Delta y_{1it} &: \quad \alpha_{y_1,w_1} = 1 + \eta_{1,h,w} - (1-\nu_{it-1})\eta_{1,h,p^k}\eta_{1,k,w}(1/\bar{\eta}_{k,p^k}) \\
&: \quad \alpha_{y_1,w_2} = (1-\nu_{it-1})\eta_{1,h,p^k}\eta_{2,k,w}(1/\bar{\eta}_{k,p^k}) \\
\text{On } \Delta y_{2it} &: \quad \alpha_{y_2,w_1} = \nu_{it-1}\eta_{2,h,p^k}\eta_{1,k,w}(1/\bar{\eta}_{k,p^k}) \\
&: \quad \alpha_{y_2,w_2} = 1 + \eta_{2,h,w} - \nu_{it-1}\eta_{2,h,p^k}\eta_{2,k,w}(1/\bar{\eta}_{k,p^k})
\end{aligned}
$$

Bargaining effects

$$
\begin{aligned}
\text{On } \Delta k_{it} &: \quad \beta_{k,w_1} = \eta_{\mu,w_1}\beta_k \\
&: \quad \beta_{k,w_2} = \eta_{\mu,w_2}\beta_k \\
&: \quad \beta_k = \widetilde{\nu}_{it-1}\eta_{1,k,p^k}\eta_{2,k,p^k}(1/\bar{\eta}_{k,p^k}) \\
&\qquad -\nu_{it-1}\eta_{2,k,p^k}(1/\bar{\eta}_{k,p^k})(\eta_{1,k,p^c}+\eta_{1,k,w}) + \widetilde{\mu}_{it-1}(1-\nu_{it-1})\eta_{1,k,p^k}(1/\bar{\eta}_{k,p^k})(\eta_{2,k,p^c}+\eta_{2,k,w}) \\
\text{On } \Delta c_{1it} &: \quad \beta_{c_1,w_1} = \eta_{\mu,w_1}\beta_{c_1} \\
&: \quad \beta_{c_1,w_2} = \eta_{\mu,w_2}\beta_{c_1} \\
&: \quad \beta_{c_1} = \widetilde{\nu}_{it-1}\eta_{1,c,p^k}\eta_{2,k,p^k}(1/\bar{\eta}_{k,p^k}) - \eta_{1,c,p^c} - \eta_{1,c,w} \\
&\qquad +(1-\nu_{it-1})\eta_{1,c,p^k}(1/\bar{\eta}_{k,p^k})(\eta_{1,k,p^c} + \widetilde{\mu}_{it-1}\eta_{2,k,p^c} + \eta_{1,k,w} + \widetilde{\mu}_{it-1}\eta_{2,k,w}) \\
\text{On } \Delta c_{2it} &: \quad \beta_{c_2,w_1} = \eta_{\mu,w_1}\beta_{c_2} \\
&: \quad \beta_{c_2,w_2} = \eta_{\mu,w_2}\beta_{c_2} \\
&: \quad \beta_{c_2} = \widetilde{\nu}_{it-1}\eta_{2,c,p^k}\eta_{1,k,p^k}(1/\bar{\eta}_{k,p^k}) + \widetilde{\mu}_{it-1}\eta_{2,c,p^c} + \widetilde{\mu}_{it-1}\eta_{2,c,w} \\
&\qquad -\nu_{it-1}\eta_{2,c,p^k}(1/\bar{\eta}_{k,p^k})(\eta_{1,k,p^c} + \widetilde{\mu}_{it-1}\eta_{2,k,p^c} + \eta_{1,k,w} + \widetilde{\mu}_{it-1}\eta_{2,k,w}) \\
\text{On } \Delta y_{1it} &: \quad \beta_{y_1,w_1} = \eta_{\mu,w_1}\beta_{y_1} \\
&: \quad \beta_{y_1,w_2} = \eta_{\mu,w_2}\beta_{y_1} \\
&: \quad \beta_{y_1} = \widetilde{\nu}_{it-1}\eta_{1,h,p^k}\eta_{2,k,p^k}(1/\bar{\eta}_{k,p^k}) - \eta_{1,h,w} - \eta_{1,h,p^c} \\
&\qquad +(1-\nu_{it-1})\eta_{1,h,p^k}(1/\bar{\eta}_{k,p^k})(\eta_{1,k,p^c} + \widetilde{\mu}_{it-1}\eta_{2,k,p^c} + \eta_{1,k,w} + \widetilde{\mu}_{it-1}\eta_{2,k,w}) \\
\text{On } \Delta y_{2it} &: \quad \beta_{y_2,w_1} = \eta_{\mu,w_1}\beta_{y_2} \\
&: \quad \beta_{y_2,w_2} = \eta_{\mu,w_2}\beta_{y_2} \\
&: \quad \beta_{y_2} = \widetilde{\nu}_{it-1}\eta_{2,h,p^k}\eta_{1,k,p^k}(1/\bar{\eta}_{k,p^k}) + \widetilde{\mu}_{it-1}\eta_{2,h,w} + \widetilde{\mu}_{it-1}\eta_{2,h,p^c} \\
&\qquad -\nu_{it-1}\eta_{2,h,p^k}(1/\bar{\eta}_{k,p^k})(\eta_{1,k,p^c} + \widetilde{\mu}_{it-1}\eta_{2,k,p^c} + \eta_{1,k,w} + \widetilde{\mu}_{it-1}\eta_{2,k,w})
\end{aligned}
$$

where $\bar{\eta}_{k,p^k} \equiv \bar{\eta}_{k,p^k,it-1} = (1-\nu_{it-1})\eta_{1,k,p^k} + \nu_{it-1}\eta_{2,k,p^k}$ is a weighted average of the partners' elasticities of the public good with respect to its price (subscripts i and $t-1$ implied but omitted for brevity). All transmission parameters α and β are i- and t-specific through their dependence on ν, $\widetilde{\nu}$, $\widetilde{\mu}$, and $\bar{\eta}_{k,p^k}$. I drop these subscripts to ease the notation.

Dynamic (wealth) effects

$$
\begin{aligned}
\text{On } \Delta k_{it} &: \quad \gamma_{k,w_1} = \alpha_{k,\lambda}\ell_{w_1,it} \\
&: \quad \gamma_{k,w_2} = \alpha_{k,\lambda}\ell_{w_2,it} \\
\text{On } \Delta c_{1it} &: \quad \gamma_{c_1,w_1} = \alpha_{c_1,\lambda}\ell_{w_1,it} \\
&: \quad \gamma_{c_1,w_2} = \alpha_{c_1,\lambda}\ell_{w_2,it} \\
\text{On } \Delta c_{2it} &: \quad \gamma_{c_2,w_1} = \alpha_{c_2,\lambda}\ell_{w_1,it} \\
&: \quad \gamma_{c_2,w_2} = \alpha_{c_2,\lambda}\ell_{w_2,it} \\
\text{On } \Delta y_{1it} &: \quad \gamma_{y_1,w_1} = \alpha_{y_1,\lambda}\ell_{w_1,it}
\end{aligned}
$$

$$
\begin{aligned}
& : \quad \gamma_{y_1,w_2} = \alpha_{y_1,\lambda}\ell_{w_2,it} \\
\text{On } \Delta y_{2it} \quad & : \quad \gamma_{y_2,w_1} = \alpha_{y_2,\lambda}\ell_{w_1,it} \\
& : \quad \gamma_{y_2,w_2} = \alpha_{y_2,\lambda}\ell_{w_2,it}
\end{aligned}
$$

where

$$
\begin{aligned}
\alpha_{k,\lambda} &= (1/\bar{\eta}_{k,p^k})\left(\eta_{1,k,p^k}\eta_{2,k,p^k} + \nu_{it-1}\eta_{2,k,p^k}(\eta_{1,k,p^c} + \eta_{1,k,w}) + (1-\nu_{it-1})\eta_{1,k,p^k}(\eta_{2,k,p^c} + \eta_{2,k,w})\right) \\
\alpha_{c_1,\lambda} &= \eta_{1,c,p^c} + \eta_{1,c,w} + (1/\bar{\eta}_{k,p^k})\left(\eta_{1,c,p^k}\eta_{2,k,p^k} + (1-\nu_{it-1})\eta_{1,c,p^k}(-\eta_{1,k,p^c} + \eta_{2,k,p^c} - \eta_{1,k,w} + \eta_{2,k,w})\right) \\
\alpha_{c_2,\lambda} &= \eta_{2,c,p^c} + \eta_{2,c,w} + (1/\bar{\eta}_{k,p^k})\left(\eta_{2,c,p^k}\eta_{1,k,p^k} - \nu_{it-1}\eta_{2,c,p^k}(-\eta_{1,k,p^c} + \eta_{2,k,p^c} - \eta_{1,k,w} + \eta_{2,k,w})\right) \\
\alpha_{y_1,\lambda} &= \eta_{1,h,w} + \eta_{1,h,p^c} + (1/\bar{\eta}_{k,p^k})\left(\eta_{1,h,p^k}\eta_{2,k,p^k} + (1-\nu_{it-1})\eta_{1,h,p^k}(-\eta_{1,k,p^c} + \eta_{2,k,p^c} - \eta_{1,k,w} + \eta_{2,k,w})\right) \\
\alpha_{y_2,\lambda} &= \eta_{2,h,w} + \eta_{2,h,p^c} + (1/\bar{\eta}_{k,p^k})\left(\eta_{2,h,p^k}\eta_{1,k,p^k} - \nu_{it-1}\eta_{2,h,p^k}(-\eta_{1,k,p^c} + \eta_{2,k,p^c} - \eta_{1,k,w} + \eta_{2,k,w})\right).
\end{aligned}
$$

$\ell_{w_1,it}$ and $\ell_{w_2,it}$ are given by (A.14). Like before, transmission parameters γ are i- and t- specific but I have removed these subscripts for notational ease.

A.5 Identification

A.5.1 Identification With General Preferences And External Information

Suppose that $\eta_{j,c,w}$, $\eta_{j,k,w}$, $\eta_{j,c,p^c} + \eta_{j,c,p^k}$, and $\eta_{j,k,p^c} + \eta_{j,k,p^k}$, $j = \{1,2\}$, are all available from when the partners are observed as singles (see section 3 for detailed arguments). Identification proceeds sequentially and uses the transmission equations presented in appendix A.4.

1. Given $\eta_{j,k,w}$, earnings, and expenditure of single individual j, the symmetry of the matrix of substitution effects can identify η_{j,h,p^k} (j's labor supply response to the price of the public good): $\eta_{j,h,p^k} = -\eta_{j,k,w}\frac{P^k K}{W_j H_j}$. Similarly, and given $\eta_{j,c,w}$, j's labor supply response to the price of the private good is identified as $\eta_{j,h,p^c} = -\eta_{j,c,w}\frac{P^c C_j}{W_j H_j}$.
2. Conditional on $\eta_{j,k,w}$ and η_{j,h,p^k}, α_{y_1,w_2} and α_{y_2,w_1} identify ν_{it-1} (assumed cross-sectionally invariant) and $\bar{\eta}_{k,p^k} \equiv \bar{\eta}_{k,p^k,it-1} = (1-\nu_{it-1})\eta_{1,k,p^k} + \nu_{it-1}\eta_{2,k,p^k}$. The latter is a weighted average of the partners' elasticities of the public good with respect to its price.
3. Given $\eta_{j,k,w}$, η_{j,h,p^k}, ν_{it-1}, and $\bar{\eta}_{k,p^k}$, the transmission of transitory wage shocks to own earnings (given by α_{y_1,w_1} and α_{y_2,w_2}) identifies the own-wage labor supply elasticities $\eta_{j,h,w}$.
4. Given $\eta_{j,k,w}$, ν_{it-1}, and $\bar{\eta}_{k,p^k}$, the transmission of transitory shocks into public consumption α_{k,w_1} and α_{k,w_2} identifies the own-price public consumption elasticities η_{j,k,p^k}
5. Conditional on η_{j,k,p^k}, the sum $\eta_{j,k,p^c} + \eta_{j,k,p^k}$, assumed known, trivially identifies the public consumption elasticities with respect to the price of the private good η_{j,k,p^c}. Given η_{j,k,p^c}, and public and private expenditure of single individual j, symmetry of the matrix of substitution effects implies $\eta_{j,c,p^k} = \eta_{j,k,p^c}\frac{P^k K}{P^k C_j}$. Conditional on η_{j,c,p^k}, the sum $\eta_{j,c,p^c} + \eta_{j,c,p^k}$, assumed known, identifies the own-price private consumption elasticities η_{j,c,p^c}
6. The transmission of transitory wage shocks into total private consumption $\bar{\alpha}_{c,w_j} \equiv \varphi_{it-1}\alpha_{c_1,w_j} + (1-\varphi_{it-1})\alpha_{c_2,w_j}$ (over-) identifies the allocation of private consumption between partners.
7. Identification of the bargaining effects is more complicated. Consider for now the bargaining effects $(\beta_{k,w_1}, \beta_{c,w_1}, \beta_{y_1,w_1}, \beta_{y_2,w_1})'$ induced by the fist partner's permanent shock (identification of the

bargaining effects due to second partner's permanent shock follows the same logic). I can write

$$\begin{pmatrix} \beta_{k,w_1} + \gamma_{k,w_1} \\ \beta_{c,w_1} + \gamma_{c,w_1} \\ \beta_{y_1,w_1} + \gamma_{y_1,w_1} \\ \beta_{y_2,w_1} + \gamma_{y_2,w_1} \end{pmatrix} = \begin{pmatrix} \varpi_{k,w_1} \\ \varpi_{c,w_1} \\ \varpi_{y_1,w_1} \\ \varpi_{y_2,w_1} \end{pmatrix}$$

where $(\varpi_{k,w_1}, \varpi_{c,w_1}, \varpi_{y_1,w_1}, \varpi_{y_2,w_1})' \neq \mathbf{0}_{4\times 1}$ is the difference between the impacts of a permanent and a transitory shock on the outcome variables. The γ's are all linear functions of β_{k,w_1}, β_{c,w_1}, β_{y_1,w_1}, and β_{y_2,w_1} given that the α's (of which they are functions too) are already identified above. Manipulating this system appropriately, I can write

$$\mathbf{M}_{it4\times 4} \begin{pmatrix} \beta_{k,w_1} \\ \beta_{c,w_1} \\ \beta_{y_1,w_1} \\ \beta_{y_2,w_1} \end{pmatrix} = \mathbf{m}_{it4\times 1}.$$

$\mathbf{M}_{it4\times 4}$ is a data-dependent matrix which is unlikely to be singular. $\mathbf{m}_{it4\times 1}$ is also unlikely to be the zero vector. There is a unique solution for $(\beta_{k,w_1}, \beta_{c,w_1}, \beta_{y_1,w_1}, \beta_{y_2,w_1})'$ which is given by $\mathbf{M}_{it4\times 4}^{-1}\mathbf{m}_{i,t4\times 1}$. This completes the proof ($\mathbf{M}_{it4\times 4}$ and $\mathbf{m}_{it4\times 1}$ are available upon request).

The above is not the unique identification routine; other routines rely less on singles' expenditure information and may therefore be more desirable. All routines deliver the same identification output.

A.5.2 Identification With Separable Preferences

When the public good is additively separable from private consumption and leisure, the transmission parameters of wage shocks into choice variables are given by simpler expressions (compared to those in appendix A.4). To obtain the simpler expressions one needs to plug $\eta_{j,h,p^k} = \eta_{j,c,p^k} = \eta_{j,k,w} = \eta_{j,k,p^c} = 0$, $j = \{1, 2\}$, in the expressions of appendix A.4. Identification proceeds sequentially.

1. The response of one's earnings to their transitory shock α_{y_j,w_j} identifies the own-wage labor supply elasticities $\eta_{j,h,w}$.
2. The response of family private consumption to transitory shocks identifies $\eta_{j,c,w}$ up to scale (j's private consumption elasticity with respect to wage), where the scale is j's share of private consumption. Specifically, $\varphi_{it-1}\alpha_{c_1,w_1} + (1-\varphi_{it-1})\alpha_{c_2,w_1}$ identifies $\varphi_{it-1}\eta_{1,c,w}$ and $\varphi_{it-1}\alpha_{c_1,w_2} + (1-\varphi_{it-1})\alpha_{c_2,w_2}$ identifies $(1-\varphi_{it-1})\eta_{2,c,w}$.
3. The wealth effects can now identify all remaining parameters. Absent of bargaining effects, the average wealth effects (8 in total) are identified by the difference between the impacts of a permanent and a transitory shock on the outcome variables.

   The wealth effects vary cross-sectionally because of cross-sectional variability in ξ_{it}, s_{it} and π_{it}. If there exists a group of couples with similar values for ξ_{it}, s_{it} and π_{it} then these wealth effects are given by

$$\begin{aligned}
\gamma_{k,w_1} &= \alpha_{k,\lambda}(1/\widetilde{\alpha}_\lambda)\left((1-\xi)\varphi\alpha_{c_1,w_1} - (1-\pi)s\alpha_{y_1,w_1}\right) \\
\gamma_{c,w_1} &= (\varphi\alpha_{c_1,\lambda} + (1-\varphi)\alpha_{c_2,\lambda})(1/\widetilde{\alpha}_\lambda)\left((1-\xi)\varphi\alpha_{c_1,w_1} - (1-\pi)s\alpha_{y_1,w_1}\right) \\
\gamma_{y_1,w_1} &= \alpha_{y_1,\lambda}(1/\widetilde{\alpha}_\lambda)\left((1-\xi)\varphi\alpha_{c_1,w_1} - (1-\pi)s\alpha_{y_1,w_1}\right) \\
\gamma_{y_2,w_1} &= \alpha_{y_2,\lambda}(1/\widetilde{\alpha}_\lambda)\left((1-\xi)\varphi\alpha_{c_1,w_1} - (1-\pi)s\alpha_{y_1,w_1}\right)
\end{aligned} \tag{A.16}$$

   (where subscripts i and t have been removed for simplicity of the notation). Similar expressions describe the wealth effects from the second earner's wage shock.

Given ξ, s and π that are obtained directly from the data and $\eta_{1,h,w}$, $\eta_{2,h,w}$, $\varphi\alpha_{c_1,w_1}$ and $(1-\varphi)\alpha_{c_2,w_2}$ that have been identified above, (A.16) is a linear system of 4 equations in 4 unknown parameters: η_{1,h,p^c} and η_{2,h,p^c} (labor supply elasticities with respect to the price of private consumption), $\varphi\eta_{1,c,p^c} + (1-\varphi)\eta_{2,c,p^c}$ (the collective elasticity of *total* private consumption at the household with respect to its price), and $\eta_{1,k,p^k}\eta_{2,k,p^k}/\bar{\eta}_{k,p^k}$ (the collective elasticity of public consumption at the household with respect to its price). This system has a unique solution if the determinant of the matrix of coefficients is non-zero; this determinant is given by $1+\gamma_k\xi+\gamma_c(1-\xi)-(1-\pi)(s\gamma_{y_1}+(1-s)\gamma_{y_2})$ where $\gamma_\chi = \gamma_{\chi,w_1}/\left((1-\xi)\varphi\alpha_{c_1,w_1} - (1-\pi)s\alpha_{y_1,w_1}\right)$ for $\chi = \{k, c, y_1, y_2\}$. There may be some points in the data space for which the above determinant is zero but I expect the probability to run into these points to be very close to 0. For efficiency, I impose symmetry of the matrix of substitution effects (A.1) for each household member.

B Data & Estimation Appendix

B.1 Measurement Error

Table 10 – Variance of Consumption Measurement Error

	(1) nonseparable	(2) separable
In couples' c_{it}	0.1018	0.0985
	(0.0055)	(0.0056)
In couples' k_{it}	0.0525	0.0494
	(0.0050)	(0.0039)
In single males' c_{1it}	0.1227	
	(0.0213)	
In single males' k_{1it}	0.1091	
	(0.0158)	
In single females' c_{2it}	0.1850	
	(0.0256)	
In single females' k_{2it}	0.0673	
	(0.0085)	

Notes: The table presents the GMM estimates of the variance of the measurement error in private and public consumption. Column (1) presents the estimates when preferences are nonseparable; column (2) presents the estimates when preferences are separable.