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"Family bargaining and the gender gap in informal care"

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Abstract

We study the optimal long-term care policy when informal care can be provided by children in exchange for monetary transfers by their elderly parents. We consider a bargaining model with single-child families. Daughters have a lower labor market wage and a lower bargaining power within the family with respect to sons. Consequently, they provide more informal care and have lower welfare in the laissez-faire (although not necessarily lower transfers). The first best involves redistribution from families with sons to families with daughters and can be implemented by a gender-specific schedule of public LTC benefits and transfers to working children. If the policy is restricted to be gender neutral, we find that the informal care provided by daughters should be distorted up to enhance redistribution from families with sons to families with daughters. Transfers within the family should be distorted in both types of families.
JEL classification: D13, H23, H31, I19

Keywords: Long-term care, informal care, strategic bequests, family bargaining, gender-neutrality.

1 Introduction

With an aging population and increased longevity, the provision of adequate long-term care (LTC) to the dependent elderly represents a major challenge faced by all developed countries. Elderly people affected by cognitive diseases, such as Alzheimer's or other forms of dementia, or by motor disorders due to amyotrophic lateral sclerosis (ALS) or Parkinson's disease, need assistance with their personal care and daily activities. These LTC needs fare in addition to their demand for medical services. Health care is typically covered by public or private insurance, albeit to a degree that differs across countries. LTC, by contrast is rarely or only minimally covered by social insurance. Private insurance markets are also very thin on the ground, even though the risk is substantial. This phenomenon is often referred to as the "LTC insurance puzzle", which can be explained by a variety of reasons, including adverse selection, myopia and avoiding the crowding out of informal care; see Cremer *et al.* (2012) for a detailed discussion and references.

Currently, informal care provided by family members represents a significant part of long-term care services; see Bonsang and Schoenmaeckers (2015) and Norton (2016, Section 3) for an overview of the relevant empirical studies. For instance, Bolin *et al.* (2008) use SHARE (Survey of Health, Aging, and Retirement in Europe) data and find that elderly individuals with at least one child are likely to receive some informal care. More recent and precise estimates of the contribution of informal care to total care hours across countries are provided by Barczyk and Kredler (2019). They show that informal care is indeed very important in most countries; in Europe informal care ranges from 22% in the Northern countries (Belgium, Denmark, the Netherlands and Sweden) to 81% in Southern countries (Italy and Spain), with approximately 43% the in Middle countries (Austria, France and Germany). In the US, it is estimated at 54%.

Casual observations suggest that women and daughters, in particular, are the main providers of informal LTC. This stylized fact is confirmed by the empirical literature; see, among many others, Dentinger and Clarkberg (2002), Schmid *et al.*, 2012). As Bott *et al.* (2017) states: "The best long-term care insurance is a conscientious daughter". Indeed, among adult children taking care of their old parents, daughters typically provide more informal care than sons (Arber and Ginn, 1990; Bracke *et al.*, 2008; Haberkern and Szydlik, 2010; Schmid *et al.*, 2012; Tolkacheva *et al.*, 2014).

While caregivers might enjoy providing some care to their relatives, informal care can be costly and may also impose an emotional and physical burden on caregivers.[1] Providing care often reduces labor supply so many women find that the "child penalty" is supplanted by a "good daughter penalty".[2]

In a fairy tale world, informal care would be motivated by altruism. However, in reality, other factors appear to be at work. Care may be "bought" through implicit exchanges or be "imposed" by social norms.[3] These three motives (altruism, implicit exchanges and social norms) have been shown to coexist, and their relative importance depends on the social and family context.[4] In this paper, we focus on exchange-based transfers. Informal care is compensated for by monetary transfers, gifts or bequests. While our paper is inspired by the strategic bequest approach,[5] we depart from the traditional model by considering a different and more cooperative representation of the exchanges between generations. In the original strategic bequest model, parents manage to extract all the surplus generated by the exchanges. This is a rather extreme assumption, which has already been challenged by Canta and Cremer (2019), who argue that uncertainty or asymmetric information may force parents to leave some surplus (rents) to children. Here we abstract from informational issues but assume that the terms of the care-for-transfer exchange are determined by bargaining. The procedure is cooperative so that the solution is on the family Pareto frontier and shares the surplus between parents and children depending on their respective bargaining weights. The underlying model of family exchanges is similar to Cremer and Pestieau (1993), who focus on educational choices and study neither policy design nor gender differences.

[1] On the impact of informal care on female labor supply, see also Pezzin and Steinberg (1999) and Wilson et al. (2007). Di Novi *et al.* (2005) analyze the impact of the provision of care on the health and quality of life of female informal caregivers using the Survey of Health, Ageing and Retirement in Europe (SHARE).

[2] For instance, Schmitz and Westphal (2017) study the long run consequences of informal care in Germany and show that female caregivers have a probability of working full-time 4 percentage points lower than non-caregivers (with a baseline probability of 35%).

[3] See, for instance, Canta and Pestieau (2013) or Klimaviciute *et al.* (2017).

[4] For a detailed survey of the empirical literature, see Arrondel and Masson (2006).

[5] See, for instance, Kotlikoff and Spivak (1981) and Bernheim *et al.* (1985).

We study the optimal long-term care policy when informal care can be provided by children in exchange for monetary transfers by their elderly parents. We consider a bargaining model with single-child families and focus on insurance and gender-related issues. Daughters have a lower labor market wage and a lower bargaining power within the family with respect to sons. Consequently, daughters provide more informal care and have a lower welfare in the laissez-faire (although not necessarily lower transfers). The *laissez-faire* solution then raises two types of issues which both justify a policy intervention. First, in spite of receiving informal care, parents are typically not fully insured against the dependency risk. Second, society might object to the gender inequality implied by this solution and include a redistributive dimension in the design of the LTC policy. In other words, since daughters tend to obtain less favorable terms in intra-family exchanges, the LTC policy may be used to eradicate (or at least mitigate) inequalities.

To assess solutions, we consider a simple utilitarian welfare function. In other words, all individuals are weighted equally irrespective of their position in the family (parent of child) and their gender. This introduces a paternalistic dimension because social welfare weights will, in general, differ from intra-family bargaining weights.

We show that the first best involves redistribution from families with sons to families with daughters and can be implemented by a gender-specific schedule of public LTC benefits and transfers to working children. All young parents pay the same "premium", but LTC benefits depend on the gender of their child. If the policy is restricted to be gender neutral, we find that the informal care provided by daughters should be distorted up to enhance redistribution from families with sons to families with daughters. Care provided by sons is not distorted and is the same as in the *laissez-faire.* Transfers within the family should be distorted in both types of families. To be more precise, while all individuals are fully insured (full redistribution across states of nature), marginal utilities are not equalized across generations. Finally, we show that the solution does not change when fair private insurance is available but that it adds a degree of freedom to the design of social transfers.

The literature on gender patterns of LTC provision is mostly empirical. We have provided a selection of references above and more can be found in Barigozzi *et al.* (2020). Their paper, like ours, presents a theoretical model but does not consider transfers as payment for care. In their model, care is driven by an endogenous social norm, which affects daughters and leads to an inefficient outcome, with daughters providing an excessive level of care. They show that this inefficiency can be corrected (or at least mitigated) by a subsidy on formal care.

2 Model and laissez-faire solution

Consider a generation of parents who are *ex ante* identical. They all have a single child who can be either a daughter or a son with identical probability. We denote the gender of the child by the subscript $i = b, g$ where b stands for sons (boys) and g stands for daughters (girls). When they are young, parents receive an exogenous income y and allocate it between consumption and savings k_i, which depends on the gender of the child. When old, parents are dependent with probability π and healthy with probability $(1 - \pi)$. We assume that the expected utility of a parent having a child of gender i is

$$V_i^P = U(y - k_i) + (1 - \pi) U(k_i) + \pi H(m_i),$$

where $m_i = k_i + \gamma(a_i) - \tau_i$ is consumption when old and dependent. This includes LTC, which can be bought on the market, or obtained informally from children. The monetary equivalent of a_i units of time devoted by children is given by $\gamma(a_i)$, which is a strictly increasing and concave function. In the case where parents are dependent, in addition to their savings, they receive care from their children, a, in exchange for a transfer τ_i. The healthy elderly simply consume their savings. We assume that $U' > 0$, $H' > 0$, $U'' < 0$, $H'' < 0$, and that both functions satisfy the Inada conditions. Furthermore, we assume that for all x, $U'(x) < H'(x)$. This ensures that there is a role for insurance against the risk of dependence.

When parents are healthy, children do not provide any care, and they consume their income w_i and their utility is $u(w_i)$. When parents are dependent, children devote part of their time (a_i) to helping their parents. Their utility is equal to

$$u(\tau_i + w_i(1 - a_i)). \tag{1}$$

Expected utility of children is thus

$$V_i^C = \pi u(\tau_i + w_i(1-a_i)) + (1-\pi)u(w_i).$$

We assume that daughters' wages are lower than the wages of sons, *i.e.*, $w_g \leq w_b$.

If the parent is dependent, the level of care and the family transfer is chosen collectively by parents and children. We denote by α_i the bargaining weight of the child, and assume that $\alpha_g \leq \alpha_b$.

The levels of care and transfers are chosen to maximize

$$\begin{aligned} W_i &= (1-\alpha_i)V_i^P + \alpha_i V_i^C \\ &= (1-\alpha_i)[U(y-k_i) + (1-\pi)\,U\,(k_i) + \pi H\,(k_i + \gamma(a_i) - \tau_i)] \\ &+ \alpha_i[\pi u(\tau_i + w_i(1-a_i)) + (1-\pi)u(w_i)]. \end{aligned} \tag{2}$$

At this point, savings, k_i, are given. Recall that they were chosen by parents when young.

The first order conditions with respect to a_i and τ_i are, respectively

$$(1-\alpha_i)H'(k_i + \gamma(a_i) - \tau_i)\gamma'(a_i) = \alpha_i u'(\tau_i + w_i(1-a_i))w_i \tag{3}$$

and

$$(1-\alpha_i)H'(k_i + \gamma(a_i) - \tau_i) = \alpha_i u'(\tau_i + w_i(1-a_i)). \tag{4}$$

Combining (3) and (4), we obtain

$$\gamma'(a_i) = w_i. \tag{5}$$

In words, the optimal level of informal care equalizes the marginal benefit and the marginal cost of care. It does not depend on the bargaining weights, but exclusively on the wage of the child. Since $w_d \leq w_s$, daughters provide more care than sons in the laissez-faire.

The optimal transfer satisfies

$$\frac{H'(k_i + \gamma(a_i) - \tau_i)}{u'(\tau_i + w_i(1-a_i))} = \frac{\alpha_i}{1-\alpha_i}. \tag{6}$$

Differentiating conditions (5) and (6) we obtain

$$\frac{\partial a_i}{\partial k_i} = 0$$

and

$$\frac{\partial \tau_i}{\partial k_i} = \frac{(1-\alpha)H''}{(1-\alpha_i)H'' + \alpha u''} \in (0,1).$$

Parental savings reduce the marginal cost of transferring resource to children. However, an increase in 1$ in savings increases intrafamily transfers by less than $1.

In the first period, the parents set the optimal level of savings, depending on whether they have a son or a daughter, and anticipating the level of informal care and transfers in case of dependence. Using the envelope theorem, the optimal savings satisfy the following first-order condition

$$-U'(y-k_i) + (1-\pi)U'(k_i) + \pi H'(k_i + \gamma(a_i) - \tau_i) = 0. \tag{7}$$

2.1 Comparative statics

The first-order condition with respect to a_i (3) implicitly defines a_i as a function of w_i: $a_i(w_i) = \gamma'^{-1}(w_i)$. The derivative with respect to w_i is

$$\frac{\partial a_i}{\partial w_i} = \frac{1}{\gamma''} < 0. \tag{8}$$

Substituting in $a_i(w)$ into the first order conditions with respect to τ_i and k_i, (4) and (7), we have

$$FOC\tau = -(1-\alpha_i)H'(k_i + \gamma(a_i(w_i)) - \tau_i) + \alpha_i u'(\tau_i + w_i(1-a_i(w_i))) = 0, \tag{9}$$

and

$$FOCk = -U'(y-k_i) + (1-\pi)U'(k_i) + \pi H'(k_i + \gamma(a_i(w_i)) - \tau_i) = 0. \tag{10}$$

The Hessian matrix is given by

$$H = \begin{bmatrix} (1-\alpha_i)H'' + \alpha_i u'' & -(1-\alpha_i)H'' \\ -\pi H'' & U_1'' + (1-\pi)U'' + \pi H'' \end{bmatrix} \tag{11}$$

with $|H| > 0$.

We have

$$\begin{bmatrix} \frac{\partial FOC\tau}{\partial w_i} \\ \frac{\partial FOCk}{\partial w_i} \end{bmatrix} = \begin{bmatrix} \alpha_i u''(1-a_i) - [(1-\alpha_i)H''\gamma\prime + \alpha_i u'' w_i]\frac{1}{\gamma''} \\ \pi H''\gamma\prime \frac{1}{\gamma''} \end{bmatrix}, \tag{12}$$

and

$$\begin{bmatrix} \frac{\partial FOC\tau}{\partial \alpha_i} \\ \frac{\partial FOCk}{\partial \alpha_i} \end{bmatrix} = \begin{bmatrix} H' + u' \\ 0 \end{bmatrix}. \tag{13}$$

Using Cramer's, rule we find

$$\frac{\partial \tau_i}{\partial w_i} = \frac{-\alpha_i u''[(1-a_i) - \frac{w_i}{\gamma''}][U_1'' + (1-\pi)U'' + \pi H''] + (1-\alpha_i)H''\frac{\gamma'}{\gamma''}[U_1'' + (1-\pi)U''(k_i)]}{|H|} < 0, \tag{14}$$

$$\frac{\partial k_i}{\partial w_i} = \frac{-\pi H'' \alpha_i u''(1-a_i)}{|H|} < 0, \tag{15}$$

$$\frac{\partial \tau_i}{\partial \alpha_i} = \frac{-[H' + u'][U''(y-k_i)(1-\pi)U''(k_i) + \pi H'']}{|H|} > 0, \tag{16}$$

$$\frac{\partial k_i}{\partial \alpha_i} = \frac{-\pi H''[H' + u']}{|H|} > 0. \tag{17}$$

Simple inspection of conditions (14)–(17) show that

$$\frac{\partial \tau_i}{\partial w_i} < \frac{\partial k_i}{\partial w_i} \quad \text{and} \quad \frac{\partial \tau_i}{\partial \alpha_i} > \frac{\partial k_i}{\partial \alpha_i},$$

implying that τ_i is more responsive to changes in wages and bargaining weight with respect to k_i, so that parents do not fully compensate an increase in τ_i with higher savings. This is not surprising, given that savings are also consumed in the healthy state of the world.

Finally, fully differentiating (2) and applying the envelope theorem, we get

$$\frac{\partial W_i}{\partial w_i} = \alpha_i[\pi u'(\tau_i - w_i(1-a_i))(1-a_i) + (1-\pi)u'(w_i)] > 0.$$

$$\frac{\partial W_i}{\partial \alpha_i} = -V_i^P + V_i^C > 0 \iff V_i^C > V_i^P.$$

To sum up, we show that $a_d > a_s$, but we also show that we cannot compare τ_s and τ_d since the effects of w and α go in opposite directions.

Furthermore, we can show that daughters are always worse off than sons in the *laissez faire*; that is to say, $V_b^C > V_g^C$. To see this, first assume that the bargaining weight for sons is the same as for daughters so that $\alpha_b = \alpha_g$, while $w_g < w_b$. Equation (5) can be rewritten as

$$H'(k_i + \gamma(a_i) - \tau_i) = \frac{U'(y - k_i) - (1 - \pi)U'(k_i)}{\pi}. \tag{18}$$

Since k_i decreases in w_i according to (15), $k_g > k_b$. Evaluating the RHS of the equation above at k_g and k_b, we have that $H'(k_g + \gamma(a_g) - \tau_g) > H'(k_b + \gamma(a_b) - \tau_b)$. Using this inequality and the fact that $\alpha_b = \alpha_g$, it follows from (4) that $u'(\tau_g + w_g(1 - a_g)) > u'(\tau_b + w_b(1 - a_b))$, which proves that daughters are worse off if the bargaining weights are the same.

If the bargaining weight of the sons increases so that $\alpha_b > \alpha_g$ this will not affect a_b, but implies a higher transfer τ_b, which makes sons even better off.

The main results of this section are summarized in the following proposition

Proposition 1 *The laissez-faire solution has the following properties:*

(i) The level of care decreases with the child's wage w_i, but does not depend on the bargaining weights α_i;

(ii) The transfer received by children decreases with their wage and increases with their bargaining weight. Since sons have a higher wage but a lower bargaining weight (in their respective family) than daughters, the comparison between τ_b and τ_g is ambiguous;

(iii) Daughters are always worse off than sons. Even when they receive a higher transfer this does not fully compensate the opportunity cost of the higher level of care they provide.

3 First-best allocation

The first-best (FB) solution is defined as the allocation that maximizes a utilitarian social welfare function. In other words, the social objective weighs all individuals equally irrespective of their gender or the gender of their children. Consequently social welfare is "individual based" and does not reflect the family specific bargaining weights. This introduces a paternalistic dimension.

Formally, social welfare is defined as

$$SWF = \sum_{i=g,b} \frac{1}{2}[U(c_i^1) + (1-\pi)U(c_i^h) + \pi H(c_i^s)] + \frac{1}{2}[\pi u(d_i^s) + (1-\pi)u(d_i^h)], \quad (19)$$

where c_i^1, c_i^s and c_i^h are consumption levels of type $i = b, g$ parents respectively, when young, when old and dependent and when old and healthy. Similarly, d_i^s and d_i^h are consumption levels of type i children when their parents are dependent and when they are healthy. The resource constraint requires

$$\sum_{i=g,b} [c_i^1 + \pi(c_i^s + d_i^s) + (1-\pi)(c_i^h + d_i^h)] \leq \sum_{i=g,b} [w\overline{T} + \pi[w_i(1-a_i) + \gamma(a_i)] + (1-\pi)w_i]. \quad (20)$$

The social planner maximizes (19) subject to (20). The first order conditions with respect to consumption levels and informal care yield:

$$U'(c_i^1) = U'(c_i^h) = u'(d_i^h) = H'(c_i^s) = u'(d_i^s) \quad i = b, g \quad (21)$$

$$w_i = \gamma(a_i). \quad (22)$$

These define the optimal levels of consumption and informal care $c_i^{1*}, c_i^{h*}, c_i^{s*}, d_i^{h*}, d_i^{h*}, a_i^*$ for $i = b, g$. These expressions imply

$$c_g^{1*} = c_b^{1*} = c_g^{h*} = c_b^{h*} = c^*, c_g^{s*} = c_b^{s*}, d_g^{h*} = d_b^{h*} = d_g^{s*} = d_b^{s*}. \quad (23)$$

4 Implementation: nonlinear policy with tagging

We assume that both informal care (equivalently labor supplies) and the intra-family transfers are observable. The FB allocation can be implemented by a set of gender-specific transfers. The required instruments are a set of transfers $T_i^s(a_i, \tau_i)$, transfers to the children of non-dependent parents (those that do not get any family transfers), $L_i^h(a_i, \tau_i)$, and transfers to young parents, $T_i^1(a_i, \tau_i)$. As long as no restrictions are imposed on these functions, this is equivalent to a situation where the government can set a_i and τ_i, and impose lump sum transfers T_i^s, L_i^h, and T_i^1. We show below how the appropriate levels of a_i and τ_i can be induced by appropriately designing the transfer functions and particularly their derivatives with respect to a_i and τ_i. This is not the only way to implement the FB. In Appendix A we show that the FB can also be decentralized by linear instruments. We assume that savings, k_i, cannot be observed so that families can choose them freely and they cannot be taxed (or be an argument of the transfer functions).[6]

With these instruments, the family problem becomes

$$\begin{aligned}\max_{k_i} W_i &= (1-\alpha_i)V_i^P + \alpha_i V_i^C \\ &= (1-\alpha_i)[U(y-k_i+T_i^1) + (1-\pi)\,U\,(k_i) + \pi H\,(k_i+\gamma(a_i)-\tau_i) + T_i^s)] \\ &+ \alpha_i[\pi u(\tau_i + w_i(1-a_i)) + (1-\pi)u(w_i + L_i^h)]. \end{aligned} \tag{24}$$

The first-order condition is

$$-U'(y-k_i+T_i^1) + (1-\pi)U'(k_i) + \pi H'(k_i+\gamma(a_i)-\tau_i+T_i^s) = 0. \tag{25}$$

Denoting by $\widehat{k}_i$ the solution to this equation, the FB can be decentralized by setting inducing a level τ_i^* and setting the other transfers such that

$$H'(c^*) = u'(\tau_i^* + w_i(1-a_i^*)) \tag{26}$$

$$T_i^1 = 2c^* - y \tag{27}$$

$$T_i^s = c^{s*} - c^* - \gamma(a_i^*) + \tau_i^* \tag{28}$$

$$L_i^h = \tau_i^* - w_i a_i^* \tag{29}$$

With these transfers, (25) yields $\widehat{k}_i = c^*$. Note that a transfer to healthy parents T_i^h is not necessary. Furthermore equation (27) implies that $T_b^1 = T_g^1$ and that $\tau_g > \tau_b$.

From a LTC policy perspective, one can interpret T_i^1 as an insurance premium aid by young parents, while T_i^s represents the benefit received in case of dependency. Because $T_b^1 = T_g^1$ the premium is the same for all, but benefits T_i^s are gender specific—or more precisely, are conditioned on the gender of the child. While (28) shows that T_b^s and T_g^s will in general differ, their comparison appears to be ambiguous. In addition to this, $T_b^s - \tau_b^* > T_g^s - \tau_g^*$, since informal care provided by daughters is higher than that provided by sons. This may be surprising at first because to achieve gender equality, as stated by (21) and (23), we have to redistribute from families with sons towards families

[6] This assumption is intended to keep the informational requirements as small as possible. However, it will become clear below that nothing would change if k were observable.

with daughters. However, dependent parents of sons receive less informal care, and have to be compensated by a higher net transfer in order to get the same level of insurance (full) as the parents of daughters.

With the transfers considered here, the budget constraint of the government is

$$\sum_{i=g,b}[T_i^1 + \pi T_i^s + (1-\pi)L_i^h] \leq 0 \tag{30}$$

Using the expressions (27)–(29), this condition can be rewritten as

$$4c^* + 2(1-\pi)c^* + 2\pi c^{s*} + 2d^* \leq \sum_{i=g,b}[y + \pi\gamma(a_i^*) + w_i - \pi w_i a_i^*]$$

which, after simplification, yields equation (20) so that (30).

To achieve the desired levels a_i^* and τ_i^* it is sufficient to make T_i^s dependent on a and τ, and the marginal transfers must be designed as follows. The first order conditions with respect to τ_i and a_i are given by

$$(1-\alpha)\pi H'(\widehat{k}_i + \gamma(a_i) - \tau_i + T_i^s)\left[\frac{\partial T_i^s}{\partial \tau_i} - 1\right] + \alpha\pi u'(\tau_i + w_i(1-a_i)) \tag{31}$$

$$(1-\alpha)\pi H'(\widehat{k}_i + \gamma(a_i) - \tau_i + T_i^s)\left[\gamma'(a_i) + \frac{\partial T_i^s}{\partial a_i}\right] - \alpha\pi u'(\tau_i + w_i(1-a_i))w_i. \tag{32}$$

From (31) we must have

$$(1-\alpha_i)\left[1 - \frac{\partial T_i^s}{\partial \tau_i}\right] = \alpha_i$$

so that

$$\frac{\partial T_i^s}{\partial \tau_i} = \frac{1-2\alpha_i}{1-\alpha_i}. \tag{33}$$

Consequently, the marginal subsidy on transfers decreases with α_i and we have

$$\frac{\partial T_i^s}{\partial \tau_i} \lesseqgtr 0 \quad \Longleftrightarrow \quad \alpha_i \gtreqless \frac{1}{2}. \tag{34}$$

so that transfers should be subsidized (at the margin) and thus encouraged when the child has a lower bargaining weight than the parent, while they should be taxed and discouraged in the opposite case.

(32) requires

$$(1-\alpha_i)\left[\gamma'(a_i^*) + \frac{\partial T_i^s}{\partial a_i}\right] = \alpha_i w_i$$

or

$$\frac{w_i + \frac{\partial T_i^s}{\partial a_i}}{w_i} = \frac{\alpha}{1-\alpha}$$

which yields

$$\frac{\partial T_i^s}{\partial a_i} / w_i = \frac{2\alpha - 1}{1-\alpha} \tag{35}$$

which corresponds to the expressions we obtain in the linear case. The intuition behind this expression is the same as for (34), except that the sign is, of course, reversed. For instance, when children have a low bargaining weight, they provide more care than is socially optimal, so that informal care should be taxed (at the margin) and thus discouraged.

Our results pertaining to the FB solution are summarized in the following proposition

Proposition 2 *(i) The FB solution implies full insurance and full redistribution: marginal utilities are equalized across states of nature and generations;*

(ii) This allocation can be implemented by a system of transfers, where the gender specific transfer to dependent parents (which can be interpreted as a social long-term care benefit) is a nonlinear function of a and τ. Young parents are subject to a lump sum transfer, which can be interpreted as an insurance premium, and does not depend on the gender of the child;

(iii) When the child has a lower bargaining weight than the parent, transfers should be subsidized (at the margin) and thus encouraged, while informal care should be taxed (at the margin) and thus discouraged. When the child has the larger bargaining weight, the signs of these marginal transfers are reversed.

5 Gender-neutral solution

In the previous section, we show how the FB can be implemented by a (nonlinear) policy that is gender specific. More precisely, the transfer scheme offered to families depends on the gender of the child. In practice, such a gender specific policy may be hard to implement for mainly political reasons. Consequently, we shall now also study the optimal gender-neutral policy. Gender neutrality can be achieved by using a pooling policy; that is, by applying the same policy to all families. Alternatively, one can think of offering a menu of contracts that is self-selecting (incentive compatible). The policy is gender neutral in the sense that all families face the same choice (the same menu of transfer schemes), but which is designed such that families self-select and choose the policy designed for their gender. Indeed, it is likely that this brings us to a second-best world, unless the policy implementing the FB happens to be incentive compatible.

We continue to consider the same nonlinear instruments as in the previous section, which effectively means that we can impose the levels of transfers τ_b and τ_g and care, a_b and a_g. As in the FB implementation, this can be achieved by specifying the transfer to dependent parents T_i^s, that is the level of social LTC, as a function of τ and a. The problem of a family i reporting type j is then given by

$$\begin{aligned}\max_{k_{ij}} W_{ij} &= (1-\alpha_i)V_{ij}^P + \alpha_i V_{ij}^C \\ &= (1-\alpha_i)[U(y-k_{ij}+T_j^1) + (1-\pi)\,U\,(k_{ij}) + \pi H(k_{ij}+\gamma(a_j)-\tau_j+T_j^s)] \\ &\quad + \alpha_i[\pi u(\tau_j + w_i(1-a_j)) + (1-\pi)u(w_i+L_j^h)]. \end{aligned} \tag{36}$$

The only variable left to choose "freely" is k which is not observable. We can then define $\widehat{k}_{ij}$ as the solutions to this problem. The first-order condition with respect to $\widehat{k}_{ij}$ is similar to (25) and given by

$$-U'(y-k_{ij}+T_j^1) + (1-\pi)U'(k_{ij}) + \pi H'(k_{ij}+\gamma(a_j)-\tau_j+T_j^s) = 0. \tag{37}$$

Observe that this condition does not depend on w nor on α so that we have $\widehat{k}_{ij} = \widehat{k}_{jj} = \widehat{k}_{ii}$. For instance, we have $\widehat{k}_{bg} = \widehat{k}_{gg}$ so that families with sons who mimic families with girls save the same amount as families with daughters who truly report their type.[7]

Further define

$$\widehat{V}_{ij}^P(T_j^1, T_j^s, L_j^h, a_j, \tau_j) = U(y-\widehat{k}_{ij}+T_j^1) + (1-\pi)\,U\left(\widehat{k}_{ij}\right) + \pi H\left(\widehat{k}_{ij}+\gamma(a_j)-\tau_j+T_j^s\right), \tag{38}$$

$$\widehat{V}_{ij}^C(T_j^1, T_j^s, L_j^h, a_j, \tau_j) = \pi u(\tau_j + w_i(1-a_j)) + (1-\pi)u(w_i+L_j^h). \tag{39}$$

[7] This implies that nothing would be gained by distorting k if it were observable.

Because of the gender-neutrality requirement the maximization of social welfare is now subject to the following two incentive constraints

$$(1-\alpha_b)\widehat{V}_{bb}^P + \alpha_b \widehat{V}_{bb}^C \geq (1-\alpha_b)\widehat{V}_{bg}^P + \alpha_b \widehat{V}_{bg}^C, \tag{40}$$

$$(1-\alpha_g)\widehat{V}_{gg}^P + \alpha_g \widehat{V}_{gg}^C \geq (1-\alpha_g)\widehat{V}_{gb}^P + \alpha_g \widehat{V}_{gb}^C, \tag{41}$$

where $\widehat{V}_{ij}^P$ and $\widehat{V}_{ij}^C$ are defined by (38) and (39) so that subscripts bb and gg correspond to truthful reporting while bh and and hb to mimicking. In all cases, the first subscript represents the true type, while the second is the reported type. These conditions ensure that types self-select and pick the transfer scheme that is designed for them.

To obtain some insight into which of these constraints will be binding, we start by examining which condition (if any) is violated in the FB implementation considered in the previous section. Continuing to denote FB quantities by a $*$ we proceed in several steps. First, as already mentioned in the previous section, (27) implies that $T_b^1 = T_g^1$. Furthermore, since $c_g^{s*} = c_b^{s*}$, we have

$$T_g^s + \gamma(a_g^*) - \tau_g^* = T_b^s + \gamma(a_b^*) - \tau_b^*.$$

This, together with $\widehat{k}_{bg} = \widehat{k}_{gg}$, implies that, in case of dependence, the parents of sons are better off when choosing the policy designed for families with daughters. Using the fact that $d_g^{s*} = d_b^{s*}$, we have that $\tau_g^* + w_g(1-a_g^*) = \tau_b^* + w_b(1-a_b^*)$, which implies that $\tau_g^* = \tau_b^* + w_b(1-a_b^*) - w_g(1-a_g^*)$. Then, in case of dependence, the son of a family choosing the transfers designed for families with daughters obtains $\tau_g^* + w_b(1-a_g^*) = \tau_b^* + w_b(1-a_b^*) - w_g(1-a_g^*) + w_b(1-a_g^*)$, which is greater than $\tau_b^* + w_b(1-a_b^*)$. Finally, since $d_b^{h*} = d_g^{h*}$ it follows that $L_g^h > L_b^h$ because $w_g < w_b$. Substituting these expressions into (40)–(41) while using definitions (38) and (39) shows that (40) is violated in the FB so that families with sons are better off with the transfer scheme designed for families with daughters.

To avoid repetition, we skip the proof, but not surprisingly, the same arguments show that (41) always holds in the FB. Intuitively, the fact that (40) is violated implies that the FB implies redistribution from families with sons to families with daughters. Consequently, it is not surprising that families with daughters cannot gain by mimicking families with sons.

To sum up, the FB solution cannot be implemented under gender neutrality, and we can thus expect that the binding incentive constraint is (40).

The optimal gender-neutral solution then solves the following problem

$$
\begin{aligned}
\max_{T_i^1, T_i^s, L_i^h, L_i^s, \tau_i, a_i} \sum_{i=g,b} & \left(\widehat{V}_{ii}^P + \widehat{V}_{ii}^C\right) \\
\text{s.t. } & (1-\alpha_b)\widehat{V}_{bb}^P + \alpha_b \widehat{V}_{bb}^C - \\
& [(1-\alpha_b)\widehat{V}_{bg}^P + \alpha_b \widehat{V}_{bg}^C] = 0, \\
& \sum_{i=g,b} [T_i^1 + \pi(T_i^s) + (1-\pi)L_i^h] = 0.
\end{aligned} \tag{42}
$$

In words, we maximize the utilitarian welfare subject to b's incentive constraint and the government budget constraint. Let λ denote the Lagrange multiplier associated with the incentive constraint and μ the one associated with the budget constraint. Differentiating the Lagrangrian expression $\mathcal{L}$ then yields the first-order conditions as provided in Appendix B.

Combining (A18), (A20), (A22), and (A24), and rearranging we obtain

$$U'(y - \widehat{k}_{bb} + T_b^1) = H'\left(\widehat{k}_{bb} + \gamma(a_b) - \tau_b + T_b^s\right) = \frac{\mu}{1 + \lambda(1-\alpha_b)}, \tag{43}$$

and

$$u'(\tau_b + w_b(1-a_b) + L_b^s) = u'^s(w_b - L_b^h) = \frac{\mu}{1 + \lambda\alpha_b}. \tag{44}$$

These expressions show that for families with sons, the marginal utilities of consumption are equalized across states of the world and across periods for parents, but not across parents and children. In other words, there is full insurance but the distribution across generations is distorted. The marginal utility of consumption should be greater for parents if their weight is lower than 1/2. Formally, equations (37), (43) and (44) imply

$$U'(c_b^1) = U'(c_b^h) = H'(c_b^s) \gtreqless u'(d_b^s) = u'(d_b^h) \quad \Longleftrightarrow \quad \alpha_b \gtreqless 1/2. \tag{45}$$

Consequently, the traditional "no-distortion at the top" property is violated unless $\alpha_b = 1/2$; that is, when paternalistic considerations are not relevant for b families. A distortion is optimal even for the top family (whom the other does not want to mimic) because the parent's and children's consumption levels are weighted differently in the incentive constraint than in the social objective. This opens the door for relaxing incentive constraints by not restoring a FB tradeoff for this family. Specifically, when children have a higher weight ($\alpha_b > 1/2$), parents will receive a lower share of the surplus than in the FB to strike a compromise between paternalism and incentives.

Turning to families with daughters, combining (A19), (A23) and (A25) along with the property that $\widehat{k}_{bg} = \widehat{k}_{gg}$ yields

$$U'(y - \widehat{k}_{gg} + T_g^1) = H'\left(\widehat{k}_{gg} + \gamma(a_g) - \tau_g + T_g^s\right) = \frac{\mu}{1 - \lambda(1 - \alpha_b)}, \tag{46}$$

and

$$u'(\tau_g + w_g(1 - a_g) + L_g^s) = u'^s(w_g - L_g^h) = \frac{\mu}{1 - \lambda\alpha_b}. \tag{47}$$

These expressions are similar to (43) and (47), except that the sign preceding the second term in the denominator is reversed. Consequently, we again have full insurance but the marginal utilities across generations are not equalized unless $\alpha_b = 1/2$. The extent of the distortion increases again as α_b moves away from 1/2 but the impact of α_b is reversed. The marginal utility of consumption should now be greater for parents if their weight is larger than 1/2. Formally, we have

$$U'(c_g^1) = U'(c_g^h) = H'(c_g^s) \gtreqqless u'(d_g^s) = u'(d_g^h) \quad \Longleftrightarrow \quad \alpha_b \lesseqqgtr 1/2.$$

As in the case for sons this distortion strikes a compromise between paternalism and incentives. The sign however is reversed, implying that daughters get a lower share of the surplus with respect to the FB when the bargaining weight of sons is higher than the one of their parents ($\alpha_b > 1/2$). This is desirable in order to make the daughter's family consumption bundle less attractive to families with sons.

The distortions discussed so far are associated with paternalism as they arise because welfare weights and family weights differ. We now turn to the tradeoff determining the levels of care, which as we will see, involves more standard properties. Starting with sons, combining equations (A24) and (A26) yields

$$\gamma'(a_b) = w_b, \tag{48}$$

which implies that the informal care for a family with sons is not distorted. Consequently, as far as a_b is concerned, we do have the traditional no distortion at the top property.

Turning to families with daughters, we can rewrite (A27) as

$$H'_{gg}\gamma'(a_g) - u'_{gg}w_g - \lambda\left[(1-\alpha_b)H'_{bg}\gamma'(a_g) - \alpha_b u'_{bg}w_g\right] - \lambda\alpha_b u'_{bg}(w_g - w_b) = 0,$$

where $H'_{gg} \equiv H'\left(\widehat{k}_{gg} + \gamma(a_g) - \tau_g + T^s_g\right)$, $H'_{bg} \equiv H'\left(\widehat{k}_{bg} + \gamma(a_g) - \tau_g + T^s_g\right)$, $u'_{gg} \equiv u'(\tau_g + w_g(1-a_g) + L^s_g)$, and $u'_{bg} \equiv u'(\tau_g + w_b(1-a_g) + L^s_g)$. Using (A21) and (A23) we get

$$\mu(\gamma'(a_g) - w_g) - \lambda\alpha_b u'_{bg}(w_g - w_b) = 0$$

so that

$$(\gamma'(a_g) - w_g) = \lambda\alpha_b u'_{bg}(w_g - w_b)/\mu < 0.$$

Consequently, care provided by daughters, a_g, is distorted upwards. This is in line with the usual intuition that a distortion is desirable if it relaxes an otherwise binding incentive constraint. This is exactly what increasing a_g above the FB level does because care is more costly for the mimicker (sons) than for the mimicked (daughters) because their wage is higher.

The results concerning the gender-neutral solution are summarized in the following proposition.

Proposition 3 *The FB solution cannot be implemented by a gender-neutral policy. If the policy cannot be conditioned on the gender of the child, families with sons would prefer the transfer schedule designed for families with daughters to their own schedule. The second-best, gender-neutral solution, with the binding incentive constraint of families with sons is such that:*

(i) Informal care is not distorted and at its FB level for sons (the "top family"), while it is distorted upwards for families with daughters;

(ii) There is full insurance as in the FB, but the allocation across generations is distorted in both families including the "top" one, as long as children and parents have different bargaining weights. This distortion strikes a compromise between paternalism and incentives.

6 Private LTC insurance

So far, we have assumed that private LTC insurance was not available. Social insurance, then addresses several issues: it provides full LTC insurance and redistributes across generations and genders. Suppose now that actuarially fair long-term care insurance is available. It provides a transfer I to dependent parents in exchange for a premium πI paid by parents when they are young. The expected utility of parents of type i becomes

$$V_i^P = U(y - k_i - \pi I_i) + (1 - \pi) U(k_i) + \pi H(k_i + \gamma(a_i) - \tau_i + I_i).$$

In the absence of any policy, the first-order condition of parents with respect to insurance is given by

$$U'(y - k_i - \pi I_i) = H'(k_i + \gamma(a_i) - \tau_i + I_i).$$

We assume that the choice of I is not publicly observable. This is the more interesting case. When I is observable and can be controlled by the government though nonlinear instruments, the only role that it plays is to provide an extra degree of freedom for the implementation of the solution. All that matters for the parents and the caregivers is the total (positive or negative) transfer they receive in the different states of nature. The solutions described in the previous sections can still be implemented exactly as described, and by setting $I = 0$. But one can still also set I to a positive level and adjust the transfers accordingly. To sum up, when private insurance is publicly observable, it does not change the outcome. Consequently, it is not needed but could also be set to provide full insurance against dependence. In this case social insurance would merely take care of redistribution across generations and genders.

By contrast, when I is not observable, we can no longer rule out from the outset that it might affect the solution, particularly for the gender-neutral policy where private insurance might affect the incentive constraints. Next, we analyze the tagging and gender-neutral policy separately.

6.1 Tagging

The family problem becomes

$$\max_{k_i,I_i} W_i = (1-\alpha_i)V_i^P + \alpha_i V_i^C$$
$$= (1-\alpha_i)[U(y-k_i+T_i^1-\pi I_i) + (1-\pi)\,U\,(k_i) + \pi H\,(k_i+\gamma(a_i)-\tau_i) + T_i^s + I_i)]$$
$$+ \alpha_i[\pi u(\tau_i + w_i(1-a_i)) + (1-\pi)u(w_i + L_i^h)].$$

The first-order conditions are

$$-U'(y-k_i+T_i^1) + (1-\pi)U'(k_i) + \pi H'(k_i+\gamma(a_i)-\tau_i+T_i^s) = 0,$$

and

$$U'(y-k_i-\pi I_i+T_i^1) = H'\left(k_i+\gamma(a_i)-\tau_i+I_i+T_i^s\right).$$

Denote the solutions to these equation $\hat{k}_i$ and $\hat{I}_i$. The second condition implies that, for any T_i^1 and T_i^s, $U'(.) = H'(.)$, which is the FB trade-off.

The FB can be decentralized by setting inducing a level τ_i^* and setting the other transfers such that

$$\begin{aligned} H'(c^*) &= u'(\tau_i^* + w_i(1-a_i^*)) \\ T_i^1 &= 2c^* - y + \pi\hat{I}_i \\ T_i^s &= c^{s*} - c^* - \gamma(a_i^*) + \tau_i^* - \hat{I}_i \\ L_i^h &= \tau_i^* - w_i a_i^* \end{aligned} \tag{49}$$

Since private insurance is set optimally by individuals, any $T_i^1 \in [0, 2c^*-y]$ decentralizes the FB. Since $T_i^1 - \pi\hat{I}_i$ is constant, as T_i^1 increases from 0 to $2c^*-y$, insurance coverage $\hat{I}_i$ decreases from $(2c^*-y)\pi$ to 0. Then, with insurance, T_i^1 becomes a redundant instrument. We can set for instance T_i^1 and let private insurance take care of the risk of dependence, while T_i^s and L_i^h are set to equalize utilities across generations and genders. Alternatively, the social planner can set $T_i^1 = (2c^*-y)\pi$ so that private insurance is fully crowded out and we return to the implementation described in Proposition 2. Either way, even when private insurance is not observable, it does not affect the solution.

6.2 Gender-neutral policy

In this scenario, individuals choose k and I, which are assumed not to be publicly observable. Define $\widehat{k}_{ij}$ and $\widehat{I}_{ij}$ the solutions to the individual's problem, implicitly given by the first order conditions

$$-U'(y-k_{ij}+T_j^1-\pi\widehat{I}_{ij})+(1-\pi)U'(k_{ij})+\pi H'(k_{ij}+\gamma(a_j)-\tau_j+T_j^s+\widehat{I}_{ij})=0.$$

and

$$-U'(y-k_{ij}+T_j^1-\pi\widehat{I}_{ij})+H'(k_{ij}+\gamma(a_j)-\tau_j+T_j^s+\widehat{I}_{ij})=0. \tag{50}$$

These conditions depend on neither w nor on α so that we have $\widehat{k}_{ij}=\widehat{k}_{jj}$ and $\widehat{I}_{ij}=\widehat{I}_{jj}$.

If individuals can purchase insurance coverage, we can also show that the IC constraint violated in the FB implementation is that of families with sons. First, as mentioned in the previous section, (49) implies that $T_b^1-\pi\hat{I}_b=T_g^1-\pi\hat{I}_g$. Furthermore, since $c_g^{s*}=c_b^{s*}$, we have

$$T_g^s+\gamma(a_g^*)-\tau_g^*+\widehat{I}_b=T_b^s+\gamma(a_b^*)-\tau_b^*+\widehat{I}_g.$$

This, together with $\widehat{k}_{bg}=\widehat{k}_{gg}$, implies that, in case of dependence, the parents of sons are better off when choosing the policy designed for families with daughters. To show that the sons are also better off when choosing the policy designed for daughters, we can proceed exactly as in the previous section.

The first-order conditions of the government problem (42) with private insurance are given in Appendix C. Comparing these expressions to their counterparts in the absence of insurance given in Appendix B shows that the trade-offs are exactly the same as before,so that the solution is not affected by private insurance. To be more precise, the equilibrium *allocation* remains the same but the transfers change. Indeed, a simple inspection of the first-order conditions in the two cases shows that we have $(i=g,b)$

$$T_i^{1N}=T_i^{1I}-\pi\widehat{I}_{ii} \tag{51}$$

$$T_i^{sN}=T_i^{sI}+\widehat{I}_{ii} \tag{52}$$

where the second superscripts N and I refer to the solution without and with private insurance, and where the $\widehat{I}_{ii}$ is endogenous and defined by (50). In words, $\widehat{I}_{ii}$ depends on T is adjusted to yield full insurance.

Consequently, private insurance provides the government with one extra degree of freedom. It can implement the same solution as without insurance and totally crowd out insurance. Alternatively, it can set lower levels of T and let individuals supplement by private insurance. Combining (51) and (52), we obtain that it sufficient to set the transfers so that for all $i = g, b$

$$T_i^{1N} + \pi T_i^{sN} = T_i^{1I} + \pi T_i^{sI}.$$

In words, the net transfer (benefit minus premium) to each type of family must remain the same as when there is no private insurance. However, the level of social insurance (premium and benefit) can be lower, and the difference is made up by private insurance. Consequently, the two issues addressed by social insurance absent private insurance can now be addressed by separate instruments. Insurance against the dependence risk can be provided privately while social insurance concentrates on redistribution across families.

7 Conclusion

We study the optimal long-term care policy when informal care can be provided by children in exchange for monetary transfers by their elderly parents. We consider a bargaining model with single-child families. Daughters have a lower labor market wage and a lower bargaining power within the family than sons. Consequently, they provide more informal care and have a lower welfare in the laissez-faire, although not necessarily lower transfers. The *laissez-faire* solution then raises two types of issues. First, despite receiving informal care, parents are typically not fully insured against the dependency risk. Second, society might object to the gender inequality implied by this solution and include a redistributive dimension in the design of the LTC policy. In other words, since daughters tend to obtain less favorable terms in intra-family exchanges, LTC policies may be used to eradicate (or at least mitigate) inequalities.

To assess the solutions, we consider a simple utilitarian welfare function. In other words, all individuals are weighted equally irrespective of their position in the family (parent of child) and their gender. This introduces a paternalistic dimension because social welfare weights will, in general, differ from intra-family bargaining weights.

We demonstrate that the FB involves redistribution from families with sons to families with daughters and can be implemented by a gender-specific schedule of public LTC benefits and transfers to working children. All young parents pay the same "premium", but LTC benefits depend on the gender of their child. If the policy is restricted to be gender neutral, we find that the informal care provided by daughters should be distorted up to enhance redistribution from families with sons to families with daughters. Care provided by sons is not distorted and its level is the same as in the *laissez-faire.* Transfers within the family should be distorted in both types of families. Specifically, while all individuals are fully insured (full redistribution across states of nature), marginal utilities are not equalized across generations.

Finally, we show that *fair* private insurance does not change the solutions (tagging and gender-neutral), irrespective of whether or not it is publicly observable. The design of social insurance then involves an extra degree of freedom so that social insurance can concentrate on redistribution while leaving dependency insurance to private markets.

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Appendix

A Implementation of the FB with linear instruments

The FB allocation can be implemented by a set of gender-specific linear taxes on intrafamily transfers τ_i at rate t_i and on children's informal care a_i at rate θ_i. In addition, we need state and gender specific transfers to dependent parents, T_i^s, transfers to children of non-dependent parents (the ones that do not get any family transfers), L_i^h, and transfers to young parents, T_i^1. With these instruments the family problem becomes

$$\begin{aligned}\max_{k_i,a_i,\tau_i} W_i &= (1-\alpha_i)V_i^P + \alpha_i V_i^C \\ &= (1-\alpha_i)[U(y-k_i+T_i^1) + (1-\pi)\,U\,(k_i) + \pi H\,(k_i+\gamma(a_i)-\theta_i a_i - \tau_i(1+t_i)) + T_i^s] \\ &+ \alpha_i[\pi u(\tau_i + w_i(1-a_i)) + (1-\pi)u(w_i + L_i^h)]. \qquad \text{(A1)}\end{aligned}$$

The first-order conditions of the family problem, under this system of taxes and transfers are

$$(1-\alpha_i)H'(k_i+\gamma(a_i)-\theta_i a_i-\tau_i(1+t_i)+T_i^s)(\gamma'(a_i)-\theta_i) = \alpha_i u'(\tau_i+w_i(1-a_i))w_i, \quad \text{(A2)}$$

$$(1-\alpha_i)(1+t_i)H'(k_i+\gamma(a_i)-\theta_i a_i-(1+t_i)\tau_i+T_i^s) = \alpha_i u'(\tau_i+w_i(1-a_i)), \quad \text{(A3)}$$

$$-U'(y-k_i+T_i^1)+(1-\pi)U'(k_i)+\pi H'(k_i+\gamma(a_i)-\theta_i a_i-\tau_i(1+t_i)+T_i^s) = 0. \quad \text{(A4)}$$

In the FB we must have $w_i = \gamma(a_i)$, and $H'(c_i^s) = u'(d_i^s)$. Using these equations we can solve (A2) and (A3) to obtain

$$t_i = \frac{2\alpha-1}{1-\alpha} \quad \text{and} \quad \theta_i/w_i = \frac{1-2\alpha}{1-\alpha},$$

which corresponds to the negative of the marginal subsidies obtained in the nonlinear case.

Furthermore, in order to implement the FB consumptions, one needs to set T_i^s such that

$$T_i^s = c_i^{s*} - c_i^{h*} - \gamma(a_i^*) + \tau_i^*(1 + t_i) + \theta a_i^*, \tag{A5}$$

and

$$T_i^1 = c_i^{1*} + c_i^{h*} - y, \tag{A6}$$

Where τ_i^* is the solution to (A3). Then, the solution of (25) is $k_i = c_i^{h*}$.

Finally, L_i^h should be set so that $d_i^s = d_i^h = w_i + L_i^h = w_i(1 - a_i^*) + \tau_i^*$, which implies that

$$L_i^h = \tau_i^* - w_i a_i^*. \tag{A7}$$

The budget constraint is

$$\sum_{i=g,b} [T_i^1 + \pi(T_i^s - t_i\tau_i^* - \theta_i a_i) + (1 - \pi)L_i^h] \leq 0$$

Using (A5), (A6), and (A7), this condition rewrites

$$\sum_{i=g,b} [c_i^1 + \pi c_i^s + (1 - \pi)c_i^h + d_i^s] \leq \sum_{i=g,b} [y + \pi\gamma(a_i^*) + w_i - \pi w_i a_i^*]$$

which is satisfied by FB consumptions and informal care levels.

B First-order conditions of problem 42

Differentiating the Lagrangian expression with respect to the instruments yields

$$\frac{\partial \mathcal{L}}{\partial T_b^1} = \frac{\partial \widehat{V}_{bb}^P}{\partial T_b^1} + \frac{\partial \widehat{V}_{bb}^C}{\partial T_b^1} - \mu + \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bb}^P}{\partial T_b^1} + \alpha_b \frac{\partial \widehat{V}_b^C}{\partial T_b^1} \right] = 0, \tag{A8}$$

$$\frac{\partial \mathcal{L}}{\partial T_g^1} = \frac{\partial \widehat{V}_{gg}^P}{\partial T_g^1} + \frac{\partial \widehat{V}_{gg}^C}{\partial T_g^1} - \mu - \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bg}^P}{\partial T_g^1} + \alpha_b \frac{\partial \widehat{V}_{bg}^C}{\partial T_g^1} \right] = 0, \tag{A9}$$

$$\frac{\partial \mathcal{L}}{\partial T_b^s} = \frac{\partial \widehat{V}_{bb}^P}{\partial T_b^s} + \frac{\partial \widehat{V}_{bb}^C}{\partial T_b^s} - \pi\mu + \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bb}^P}{\partial T_b^s} + \alpha_b \frac{\partial \widehat{V}_{bb}^C}{\partial T_b^s} \right] = 0, \tag{A10}$$

$$\frac{\partial \mathcal{L}}{\partial T_g^s} = \frac{\partial \widehat{V}_{gg}^P}{\partial T_g^s} + \frac{\partial \widehat{V}_{gg}^C}{\partial T_g^s} - \pi\mu - \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bg}^P}{\partial T_g^s} + \alpha_b \frac{\partial \widehat{V}_{bg}^C}{\partial T_g^s} \right] = 0, \tag{A11}$$

$$\frac{\partial \mathcal{L}}{\partial L_b^h} = \frac{\partial \widehat{V}_{bb}^P}{\partial L_b^h} + \frac{\partial \widehat{V}_{bb}^C}{\partial L_b^h} - \mu(1-\pi) + \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bb}^P}{\partial L_b^h} + \alpha_b \frac{\partial \widehat{V}_{bb}^C}{\partial L_b^h} \right] = 0, \tag{A12}$$

$$\frac{\partial \mathcal{L}}{\partial L_g^h} = \frac{\partial \widehat{V}_{gg}^P}{\partial L_g^h} + \frac{\partial \widehat{V}_{gg}^C}{\partial L_g^h} - \mu(1-\pi) - \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bg}^P}{\partial L_g^h} + \alpha_b \frac{\partial \widehat{V}_{bg}^C}{\partial L_g^h} \right] = 0, \tag{A13}$$

$$\frac{\partial \mathcal{L}}{\partial \tau_b} = \frac{\partial \widehat{V}_{bb}^P}{\partial \tau_b} + \frac{\partial \widehat{V}_{bb}^C}{\partial \tau_b} + \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bb}^P}{\partial \tau_b} + \alpha_b \frac{\partial \widehat{V}_{bb}^C}{\partial \tau_b} \right] = 0, \tag{A14}$$

$$\frac{\partial \mathcal{L}}{\partial \tau_g} = \frac{\partial \widehat{V}_{gg}^P}{\partial \tau_g} + \frac{\partial \widehat{V}_{gg}^C}{\partial \tau_g} - \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bg}^P}{\partial \tau_g} + \alpha_b \frac{\partial \widehat{V}_{bg}^C}{\partial \tau_g} \right] = 0, \tag{A15}$$

$$\frac{\partial \mathcal{L}}{\partial a_b} = \frac{\partial \widehat{V}_{bb}^P}{\partial a_b} + \frac{\partial \widehat{V}_{bb}^C}{\partial a_b} + \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bb}^P}{\partial a_b} + \alpha_b \frac{\partial \widehat{V}_{bb}^C}{\partial a_b} \right] = 0, \tag{A16}$$

$$\frac{\partial \mathcal{L}}{\partial a_g} = \frac{\partial \widehat{V}_{gg}^P}{\partial a_g} + \frac{\partial \widehat{V}_{gg}^C}{\partial a_g} - \lambda \left[(1-\alpha_b) \frac{\partial \widehat{V}_{bg}^P}{\partial a_g} + \alpha_b \frac{\partial \widehat{V}_{bg}^C}{\partial a_g} \right] = 0, \tag{A17}$$

Using equation (37) thesese conditions can rearranged as follows

$$\frac{\partial \mathcal{L}}{\partial T_b^1} = (1+\lambda-\lambda\alpha_b)U'(y-\widehat{k}_{bb}+T_b^1) - \mu = 0, \tag{A18}$$

$$\frac{\partial \mathcal{L}}{\partial T_g^1} = U'(y-\widehat{k}_{gg}+T_g^1) - \mu - \lambda(1-\alpha_b)U'(y-\widehat{k}_{bg}+T_g^1) = 0, \tag{A19}$$

$$\frac{\partial \mathcal{L}}{\partial T_b^s} = (1+\lambda-\lambda\alpha_b)H'\left(\widehat{k}_{bb}+\gamma(a_b)-\tau_b+T_b^s\right) - \mu = 0, \tag{A20}$$

$$\frac{\partial \mathcal{L}}{\partial T_g^s} = H'\left(\widehat{k}_{gg}+\gamma(a_g)-\tau_g+T_g^s\right) - \mu - \lambda(1-\alpha_b)H'\left(\widehat{k}_{bg}+\gamma(a_g)-\tau_g+T_g^s\right) = 0, \tag{A21}$$

$$\frac{\partial \mathcal{L}}{\partial L_b^h} = (1+\lambda\alpha_b)u'(w_b - L_b^h) - \mu = 0, \tag{A22}$$

$$\frac{\partial \mathcal{L}}{\partial L_g^h} = u'(w_g - L_g^h) - \mu - \lambda\alpha_b u'(w_b - L_g^h) = 0, \tag{A23}$$

$$\frac{\partial \mathcal{L}}{\partial \tau_b} = -(1+\lambda-\lambda\alpha_b)H'\left(\widehat{k}_{bb} + \gamma(a_b) - \tau_b + T_b^s\right) + (1+\lambda\alpha_b)u'(\tau_b + w_b(1-a_b)) = 0, \tag{A24}$$

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial \tau_g} &= -H'\left(\widehat{k}_{gg} + \gamma(a_g) - \tau_g + T_g^s\right) + u'(\tau_g + w_g(1-a_g)) \\ &- \lambda\left[-(1-\alpha_b)H'\left(\widehat{k}_{gb} + \gamma(a_g) - \tau_g + T_g^s\right) + \alpha_b u'(\tau_g + w_b(1-a_g))\right] = 0,\end{aligned} \tag{A25}$$

$$\frac{\partial \mathcal{L}}{\partial a_b} = (1+\lambda-\lambda\alpha_b)H'\left(\widehat{k}_{bb} + \gamma(a_b) - \tau_b + T_b^s\right)\gamma'(a_b) - (1+\lambda\alpha_b)u'(\tau_b + w_b(1-a_b))w_b = 0, \tag{A26}$$

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial a_g} &= H'\left(\widehat{k}_{gg} + \gamma(a_g) - \tau_g + T_g^s\right)\gamma'(a_g) - u'(\tau_g + w_g(1-a_g))w_g \\ &- \lambda\left[(1-\alpha_b)H'\left(\widehat{k}_{gb} + \gamma(a_g) - \tau_g + T_g^s\right)\gamma'(a_g) - \alpha_b u'(\tau_g + w_b(1-a_g))w_b\right] = 0.\end{aligned} \tag{A27}$$

C First-order conditions of problem (42) with private insurance

We omit the conditions with respect to the transfers L since they continue to be given by (A22) and (A23)). The other conditions are given by

$$\frac{\partial \mathcal{L}}{\partial T_b^1} = (1+\lambda-\lambda\alpha_b)U'(y - \widehat{k}_{bb} + T_b^1 - \pi\widehat{I}_{bb}) - \mu = 0, \tag{A28}$$

$$\frac{\partial \mathcal{L}}{\partial T_g^1} = U'(y - \widehat{k}_{gg} + T_g^1 - \pi\widehat{I}_{gg}) - \mu - \lambda(1-\alpha_b)U'(y - \widehat{k}_{bg} + T_g^1 - \pi\widehat{I}_{bg}) = 0, \tag{A29}$$

$$\frac{\partial \mathcal{L}}{\partial T_b^s} = (1+\lambda-\lambda\alpha_b)H'\left(\widehat{k}_{bb} + \gamma(a_b) - \tau_b + T_b^s + \widehat{I}_{bb}\right) - \mu = 0, \tag{A30}$$

$$\frac{\partial \mathcal{L}}{\partial T_g^s} = H'\left(\widehat{k}_{gg} + \gamma(a_g) - \tau_g + T_g^s + \widehat{I}_{gg}\right) - \mu - \lambda(1-\alpha_b)H'\left(\widehat{k}_{bg} + \gamma(a_g) - \tau_g + T_g^s + \widehat{I}_{bg}\right) = 0, \tag{A31}$$

$$\frac{\partial \mathcal{L}}{\partial \tau_b} = -(1+\lambda-\lambda\alpha_b)H'\left(\widehat{k}_{bb}+\gamma(a_b)-\tau_b+T_b^s+\widehat{I}_{bb}\right)+(1+\lambda\alpha_b)u'(\tau_b+w_b(1-a_b))=0, \tag{A32}$$

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial \tau_g} &= -H'\left(\widehat{k}_{gg}+\gamma(a_g)-\tau_g+T_g^s+\widehat{I}_{gg}\right)+u'(\tau_g+w_g(1-a_g)) \\ &-\lambda\left[-(1-\alpha_b)H'\left(\widehat{k}_{bg}+\gamma(a_g)-\tau_g+T_g^s+\widehat{I}_{bg}\right)+\alpha_b u'(\tau_g+w_b(1-a_g))\right]=0,\end{aligned} \tag{A33}$$

$$\frac{\partial \mathcal{L}}{\partial a_b} = (1+\lambda-\lambda\alpha_b)H'\left(\widehat{k}_{bb}+\gamma(a_b)-\tau_b+T_b^s+\widehat{I}_{bb}\right)\gamma'(a_b)-(1+\lambda\alpha_b)u'(\tau_b+w_b(1-a_b))w_b=0,$$

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial a_g} &= H'\left(\widehat{k}_{gg}+\gamma(a_g)-\tau_g+T_g^s+\widehat{I}_{gg}\right)\gamma'(a_g)-u'(\tau_g+w_g(1-a_g))w_g \\ &-\lambda\left[(1-\alpha_b)H'\left(\widehat{k}_{bg}+\gamma(a_g)-\tau_g+T_g^s+\widehat{I}_{bg}\right)\gamma'(a_g)-\alpha_b u'(\tau_g+w_b(1-a_g))w_b\right]=0.\end{aligned} \tag{A34}$$