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Self-enforcing family rules, marriage and the (non)neutrality of public intervention*

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Abstract

We demonstrate the existence of self-enforcing, renegotiation-proof family rules requiring adults to provide attention for their elderly parents in a model where individuals marry, and Nash-bargain the allocation of domestic resources with their partners. We show that public policy is neutralized by private action in some cases, but not in general

1 Introduction

In an influential article, Bernheim and Bagwell (1988) argue that, if everybody were altruistically linked to everybody else by blood or marriage, any public action (no matter whether distortionary or non- distortionary) would be neutralized by a private reaction. As government policy is plainly nonneutral in practice, the same authors take their result as a symptom that private actions, in particular those that affect the wellbeing of others, cannot be entirely explained by altruism. Becker (1974), Bernheim et al. (1985), Bruce and Waldman (1990), Zhang and Zhang (1995), Cremer and Pestieau (1996), Chiappori and Weiss (2007), Pezzin et al. (2007, 2009) and several others introduce elements of strategic self-interest in altruistic models. Cremer and Roeder (2016) dispense with altruism altogether. But none of these authors addresses the neutrality question.

An assumption underlying this sub-literature, as indeed most microeconomics, is that individual optimization is constrained only by the law of the land (in particular by contract law, and by the legislation

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governing marital relations and parental responsibilities). But, sociological research and mere introspection suggest that individual behaviour is conditioned also by unwritten and often unspoken norms. Empirical economists usually take these extra-legal norms as exogenously given, and account for them by including control variables such as marital status, religion or ethnic group in their regressions. Some theoretical economists have tried to endogenize them. Cigno (1993) demonstrates that a family norm ordering adult family members to support young children and elderly parents yields a subgame-perfect Nash-equilibrium under fairly unrestrictive conditions. Caillaud and Cohen (2000) show that the same applies to society-level norms. Cigno (2006a) further demonstrates that, again under fairly bland conditions, a family norm can be renegotiation-proof in the sense that, out of all possible family norms that can be supported by a subgame-perfect Nash-equilibrium, there is one that it is not in any generation's interest to amend. Such a rule is the family-level equivalent of the political constitution that restricts a parliament's legislative powers (in particular, its power to pass legislation detrimental to future generations).[1] The basic family constitution model has been extended in a number of directions to accommodate uncertainty, descending altruism and imperfect substitutability of market or government-provided services for the personal services of one's own near and dear.[2] Thus extended, the model appears to be consistent with the evidence.[3]

Like purely altruistic models, "constitutional" models with or without altruism assume rationality. In the former, however, individuals respond rationally to a given economic and legal environment. In the latter, by contrast, some individuals respond rationally to a rule that is itself a collectively rational response to the environment. Constitutions

[1] At the political level, making sure that a piece of legislation conforms with the country's constitution is the job of a constitutional or high court, and amending the costititution is made difficult by the requirement of a qualified majority. In some countries, any amendement must be approved more than once or confirmed by referendum. At the family level, where these devices are not available, a norm will be obeyed if it is in the interest of the present adults to do so, and will not be amended if it is not in any generation's interest to do so.

[2] See Chang and Zijun (2015), Cigno and Rosati (2000), Cigno (2006a) and Rosati (1996).

[3] For descriptive evidence concerning material support for and personal care of infants and the elderly on the part of adult relatives, see among others Crimmins and Ingegneri (1990), and Cigno and Rosati (2000). For macro-econometric evidence, see Cigno et al. (2003a), Cigno and Rosati (1992, 1996, 1997), Zhang and Zhang (1995). For micro-econometric evidence, see Cigno et al. (2006), and Galasso et al. (2009). For a comprehensive survey, see Arrondel and Masson (2006).

bear similarities, but are not to be confused with relational contracts.[4] The latter are in fact negotiated by the interested parties, and differ from legally enforceable contracts only in that they require mutual trust (because they concern actions or outcomes that can be observed but not verified). The former, by contrast, are not negotiated. A constitution comes about at the instance of a person, couple or generation, and remains in place after its initiators are gone because it is not in their successors' interest to disobey or change it. Put more formally, relational contracts belong in repeated games where the players are always the same, constitutions arise in repeated games where the players change at each round. The policy implications of models where related individuals are linked by the common observance of a given norm differ from those of models where individuals are linked by altruism only. Such differences have been exploited to test the former against the latter.[5]

A limitation of the family constitution models developed to this date is that they abstract from sex differentiation, sexual reproduction and marriage. What if individuals divide into men and women, and a woman must team-up with ("marry") a man if she is to have a child? Whose family rules will apply then, his, hers or both? The problem does not arise in traditional societies where a party (usually the woman, but in some cases possibly the man)[6] "marries into" the other party's family, and becomes automatically subject to the rules governing it. It does arise, however, in modern societies where both parties retain (or do not retain, as the case may be) their links with their families of origin. The present paper extends the basic constitutional model to take account of these complications, and addresses the question whether the existence of family constitutions affects policy outcomes. Section 2 sets out the assumptions and identifies a benchmark. Sections 3 and 4 deal with marriage in the absence and in the presence of family constitutions. Section 5 addresses preference heterogeneity. Section 6 carries out a number of policy experiments showing how family rules affect policy outcomes. Section 7 concludes.

2 Assumptions

There is a large number of persons of both sexes. Each of them lives three periods, labelled $0, 1$ and 2. A person is an infant in period 0, an adult in period 1, old in period 2. Adults can work and marry. Infants and the old can do neither of these things. Adults know their own wage

[4] See Bull (1987), MacLeod and Malcomson (1989), and Levin (2003).

[5] See Cigno and Rosati (1992, 1996), and Cigno et al. (2003a).

[6] For example, in Japan at least until the Meji revolution, and in India still today, if the bride's family has no male heirs, her parents may effectively adopt the groom.

rates before they decide whether and whom to marry, but not the future wage rate of any child they might have. Unmarried individuals do not have children. If a person chooses to remain single, her or his utility is given by

$$U = \beta \ln c_0 + \phi \ln g + c_1 + \ln c_2, \;\; 0 < (\beta, \phi) < 1,$$

where c_p is this person's consumption in period $p = 0, 1, 2$, and g is the amount of parental attention he or she received in period 0. Given that this person's decisions are taken in period 1, c_0 and g are given constants. The budget constraints facing him or her are

$$c_1 + s = w$$

and

$$c_2 = sr,$$

where s is this person's savings in period 1, and r is the interest factor. Given that capitalized savings are this person's only source of old-age consumption, s will be chosen strictly positive. The pay-off of singlehood is thus

$$R = \max_s \left(w - s + \ln sr \right) = w - 1 + \ln r.$$

If a couple is formed ("marries"), they have two children, one male and the other female. Parents derive utility not only from consumption, but also from giving attention, material goods and education to their children in period 1, and from giving them money and receiving attention from them in period 2. They do not derive utility from giving money or attention to their parents. The last assumption is somewhat extreme, but nothing of substance changes if we allow for the possibility that adults derive utility from making presents to their parents also, as long as this utility is not as large as the one they get from making presents to their children. As we are primarily concerned with developed societies, where adults have ample opportunities to make provision for old age via the market or the public sector, we further assume that the old are not interested in receiving material support from their grown-up children, but appreciate their attention, because that type of service has no perfect market or government-provided substitute.[7] Whether they will get this attention is another matter.

Take the couple formed by a particular woman f, and a particular man m. We assume that couples are sorted by their maximized utility

[7] Evidence that what the elderly receive from their grown-up children in developed countries is primarily personal services is reported by, among others, Crimmins and Ingegneri (1990), and Cigno and Rosati (2000).

as singles, so that

$$R_f = R_m = R. \tag{1}$$

If everybody has the same preferences as we will assume in the next two sections, (1) implies that f and m have the same wage rate,

$$w_f = w_m = w,$$

as in Lam (1988). The implications of preference heterogeneity will be discussed in Section 4.

Let D denote the couple's daughter, and S the couple's son. We assume that k's wage rate, $k = D, S$, will be high, $w_k = w^H$, with probability π_k, and low, $w_k = w^L$, with probability $1 - \pi_k$, where

$$\pi_k = \pi\left(z_k\right),\ \pi'\left(z_k\right),\ \pi''\left(z_k\right) < 0,\ \pi(0) = 0,$$

and z_k is the amount of education that k receives from the couple. In period 1, the expected utility of parent $i = f, m$ is given by

$$\begin{aligned} EU_i = & \beta \ln c_{0i} + \phi \ln gi + c_{1i} + \ln c_{2i} \\ & + \delta\left\{\pi\left(z\right)\left(\ln t^H_{Di} + \ln t^H_{S\ i}\right) + \left[1 - \pi\left(z\right)\right]\left(\ln t^L_{Di} + \ln t^L_{S\ i}\right)\right\} \\ & + EW_D + EW_S, \end{aligned}$$

where δ is a taste for filial attention parameter, $0 < \delta < 1$, t^H_{ki} (t^L_{ki}) is the amount of attention that i receives from k if k's wage rate is w^H (w^L), and

$$EW_k = \alpha\left\{\phi \ln g_k + \ln b_k + \pi\left(z_k\right)\ln w^H + \left[1 - \pi\left(z_k\right)\right]\ln w^L\right\},\ 0 < \alpha < 1$$

is the pleasure that parent i expects to get from giving child k c_{0k} units of material goods, g_k units of attention and z_k units of education when k is an infant, and b_k units of money ("bequests") when k is an adult. As EW_k is not obtained maximizing k's utility conditional on (c_{0k}, g_k, b_k, z_k), the model is characterized by "warm-glow" giving in the sense of Andreoni (1990). Notice that the warm glow i gets from giving z units of education to k comes from the fact that this will improve k's earnings and marriage prospects. Notice also that $(EW_D + EW_S)$ has the nature of a local public good.

In general, both c_{0ik} and g_k will be chosen by k's parents, and g_k could be provided by either or both of them.[8] To simplify, however, we assume that c_{0ik} is a given constant (normalized to unity, so that $\ln c_{0k}$ is equal to zero), and that g_k is provided entirely by the mother (the same applies to c_{0i} and g_i). As a further simplification, we set $g_k = g$ and

[8] For a marriage model based on this idea, see Cigno (2014).

$z_k = z$, thus ruling out the possibility that parents might have gender preferences. We also assume that the mother buys z for, and the father pays b to, both children, but this does not involve any further loss of generality, because the mother may receive a compensatory payment T (positive, negative or zero) from the father, and the cost of the children may thus be effectively shared between the two. Along with most of the economics of marriage literature, we take it for granted that neither party can commit in period 1 to compensate the other in period 2,[9] and thus that T will have to be paid in period 1. As in a long series of contributions beginning with Manser and Brown (1980), we posit that the domestic allocation of resources conditional on marriage is Nash-bargained between f and m . The marriage will take place if and only if the pay-off is at least as large as R for both parties.

3 Marriage in the absence of family constitutions

Given our assumptions, adults may make presents to their children, but will not make presents to their parents. One way the old could get their children's attention is to buy it off them. Given that this good has no perfect market substitute, however, the children could form a cartel, and set the price so high that the entire surplus generated by the transaction would go to them. Bernheim et al. (1985) argue that, as an alternative to paying cash, parents could commit to bequeathing their entire fortune either to the child who has given them the most attention or, if that attention falls below a certain minimum, to a third party. According to this argument, the surplus would go to the parents, rather than to the children. Cigno (1991, 2006b) remarks, however, that the children could counter their parents' strategy by drawing-up a perfectly legal contract committing only one of them to give the parents the minimum amount of attention required to inherit the lot, and then share the inheritance (minus a specified amount as compensation for the attention given to the parents) equally with the others. [10] That would give the entire surplus back to the children. In the present section, we assume that adults do

[9] In most of the literature, that is because the transactions cost of negotiating a legally enforceable contract is taken to be prohibitively high. Cigno (2012, 2014) shows that the man may be able to commit even in the absence of a legally enforceable contract if divorce court awards tend to compensate the disadvantaged party (but the allocation may be inefficient nonetheless).

[10] Other possible objections to Bernheim et al. (1985) are that (a) it may be difficult for the parents to commit to assigning the estate in the way described because testaments can be re-written at the last minute, and (b) certain legislations prescribe that at least a certain share of the estate has to go to the children.

not give attention to their elderly parents,

$$t_{ki}^H = t_{ki}^L = 0,\ k = D, S,\ i = f, m.$$

Having assumed that f and m give the same amount of attention, g, education, z, and money, b, to D and S, it then follows that

$$EW_k = EW,\ k = D, S.$$

The Nash-bargaining equilibrium maximizes

$$N = (EV_f - R)(EV_m - R), \tag{2}$$

where

$$EV_f = w(1 - 2g) - 2z - s_f + T + \ln(rs_f) + 2EW, \tag{3}$$

$$EV_m = w - s_m - T + \ln(rs_m - 2b) + 2EW \tag{4}$$

and

$$EW = \alpha\left\{\phi \ln g + \ln b + \pi(z)\ln w^H + [1 - \pi(z)]\ln w^L\right\},\ 0 < \alpha < 1. \tag{5}$$

In general, we might want to impose nonnegativity constraints on s_f and s_m. With the parametrization adopted, however, these constraints would never be binding.

Given that marriage expands the utility-possibility set because it generates a local public good, the optimization problem has a solution (in other words, the (R, R) point lies inside the utility-possibility frontier), and the couple will consequently marry. We show in the Appendix that

$$\begin{aligned} \hat{g} &= \frac{2\alpha\phi}{w} \\ \hat{b} &= 2\alpha r \\ \hat{s}_f &= 1,\ \hat{s}_m = 1 + 4\alpha \\ \hat{T} &= \hat{z} - 2\alpha(1 - \phi) \\ \pi'(\widehat{z}) &= \frac{1}{2\alpha\Delta w} \end{aligned} \tag{6}$$

where

$$\Delta w = \ln w^H - \ln w^L, \tag{7}$$

and an apex denotes the Nash-bargained value of the variable. Notice that $\hat{g}$ is decreasing in the couple's realized wage rate, and $\widehat{z}$ increasing in the ratio of high to low wage rate. The compensatory payment $\hat{T}$ is so determined, that $(EU_f - R) = (EU_m - R)$, and thus that

$$E\widehat{V}_f = E\widehat{V}_m = E\widehat{V},$$

where

$$E\widehat{V} = w - 2\alpha\phi - \widehat{z} - 1 - 2\alpha + \ln r \qquad (8)$$
$$+2\alpha\left\{\phi\ln\frac{2\alpha\phi}{w} + \ln 2\alpha r + \pi(\widehat{z})\ln w^H + [1-\pi(\widehat{z})]\ln w^L\right\}.$$

4 Marriage in the presence of family constitutions

We now investigate the possible existence of a norm requiring every adult female F (male M) to give a certain amount of attention to her (his) elderly parents, conditional on the receiver having done the same for her or his now defunct parents a period earlier.[11] To allow for the possibility that these requirements might be conditional on the givers' wage rates,[12] we write t_F^H (t_M^H) for the amount of attention that F (M) must give each of her (his) parents if her (his) own wage rate turns out to be high, and t_F^L (t_M^L) for the amount of attention that F (M) must give if her (his) wage rate turns out to be low. We will first characterize a Nash-bargaining equilibrium under the assumption that such requirements will be met, and that such an equilibrium exists given those requirements, and then look for specific values of these requirements such that the associated Nash-bargaining equilibrium is not Pareto-dominated by any of those associated with different values of the requirements. If such values exist, the norm prescribing them is renegotiation-proof in the sense of Bernheim and Ray (1989), and Maskin and Farrell (1989), meaning that it will not be in anybody's interest to modify it. Provided that obeying it yields at least the same utility as disobeying it, this norm may be regarded the family-level equivalent of a political constitution.

The (f,m) couple's fall-back position is now $\left(E\hat{U}, E\hat{U}\right)$. For any given $\left(t_F^H, t_M^H, t_F^L, t_M^L\right)$, the Nash-bargaining equilibrium is found maximizing

$$N = \left(EV_f - E\widehat{V}\right)\left(EU_m - E\widehat{V}\right), \qquad (9)$$

where

$$EV_f = [w(1-2g-2t_F) - 2z - s_f + T] + \ln(rs_f) \qquad (10)$$
$$+\,\delta\left\{\pi(z)\left(\ln t_F^H + \ln t_M^H\right) + [1-\pi(z)]\left(\ln t_F^L + \ln t_M^L\right)\right\}$$
$$+\,2EW$$

[11] In Cigno (1993, 2006a), the rule concerns material support rather attention, and a necessary condition for the rule to be obeyed is that the pay-off is at least as high as that of buying assets. This restriction does not apply here, because filial attention can be neither bought nor substituted with money.

[12] Recall that wage rates are the only source of uncertainty.

and

$$\begin{aligned} EV_m = {} & [w(1-2t_M) - s_m - T] + \ln(rs_m - 2b) \\ & + \delta \left\{ \pi(z) \left(\ln t_F^H + \ln t_M^H \right) + [1 - \pi(z)] \left(\ln t_F^L + \ln t_M^L \right) \right\} \\ & + 2EW. \end{aligned} \tag{11}$$

EW is still determined by (5). Given that f"s and m's common wage rate, w, is known (either $w = w^H$, or $w = w^L$) when the game is played, we have written t_i for the amount of attention that $i = f, m$ is required to give each of her or his elderly parents in that period.

In the last section, we assumed that a Nash-bargaining equilibrium exists because marriage gives f and m access to an otherwise unavailable local public good, and will thus unequivocally expand the utility-possibility set. Can we be sure that the existence of a family constitution will further expand the utility-possibility set, and thus that Nash-bargaining in the presence of such a constitution will lead to an equilibrium? The answer is no, because a constitution would give f and m access to an otherwise unavailable good (filial attention), but would also impose restrictions on the couple's choices. We show in the Appendix that, if the $\left(E\widehat{V}, E\widehat{V}\right)$ point lies inside the utility-possibility frontier, the Nash-bargaining equilibrium is

$$\begin{aligned} g^C &= \frac{2\alpha\phi}{w} \\ b^C &= 2\alpha r \\ s_f^C &= 1, \;\; s_m^M = 1 + 4\alpha \\ T^C &= w\left(t_F - t_M\right) + z^C - 2\alpha\left(1 - \phi\right) \\ \pi'\left(z^C\right) &= \frac{1}{2\alpha\Delta w + \delta\Delta t} \end{aligned} \tag{12}$$

where

$$\Delta t = \left(\ln t_F^H + \ln t_M^H\right) - \left(\ln t_F^L + \ln t_M^L\right), \tag{13}$$

and the C superscript denotes a variable's Nash-bargained value in the presence of a family constitution. T^C is so determined that $\left(EV_f - E\widehat{V}\right) = \left(EV_m - E\widehat{V}\right)$, and consequently that

$$EV_f^C = EV_m^C = EV^C.$$

This equilibrium differs from the one obtained in the absence of a family constitution in two respects. The first is that educational expenditure is now dependent on the ratio between the amount of attention i

receives from k if k's wage rate is high, and the amount of attention i receives from k if k's wage rate is low, as well as on the ratio of those wage rates, and that the choice reflects the parents' taste-for-filial-attention parameter δ, as well as the warm-glow parameter α. The second is that the compensatory payment from m to f takes account of the difference between the amount of attention each parent would get if her or his children's wage rate were high, and the amount each parent would get if her or his children's wage rate were low.

Our next step is to find a pair of functions, $t_F(w_F)$ and $t_M(w_M)$, such that a norm prescribing $t_F^H = t_F(w^H), t_M^H = t_M(w^H)$, $t_F^L = t_F(w^H)$ and $t_M^L = t_M(w^L)$ is renegotiation-proof. As this norm is supposed to apply not only to the (f, m) couple, but also to the two couples formed by f's and m's respective parents, the z chosen by each of the latter will be the same as the one chosen by the former. As the norm will have been formulated *before* f's and m's common wage rate is revealed – indeed before they were even born – we then look for the $(t_F^H, t_M^H, t_F^L, t_M^L)$ quadruplet that maximizes the expected value of EU given (12),

$$\begin{aligned}
E(EU) = {} & \pi(z^C)\left[\phi \ln \frac{2\alpha\phi}{w^H} + w^H(1 - t_F^H - t_M^H)\right] \\
& + \left[1 - \pi(z^C)\right]\left[\phi \ln \frac{2\alpha\phi}{w^L} + w^L(1 - t_F^L - t_M^L)\right] \\
& - 2\alpha(1+\phi) - 1 - z^C + \ln r \\
& + \delta\left\{\pi(z^C)\left[\ln t_F^H + \ln t_M^H\right] + \left[1 - \pi(z^C)\right]\left[\ln t_F^L + \ln t_M^L\right]\right\} \\
& + 2\alpha\{\ln 2\alpha r + \pi(z^C)\left(\phi \ln \frac{2\alpha\phi}{w^H} + \ln w^H\right) \\
& + \left[1 - \pi(z^C)\right]\left(\phi \ln \frac{2\alpha\phi}{w^H} + \ln w^L\right)\}
\end{aligned}$$

The solution (see Appendix) is

$$\begin{aligned}
t_F^H = t_M^H &= \frac{\delta}{w^H} \\
t_F^L = t_M^L &= \frac{\delta}{w^L}
\end{aligned} \tag{14}$$

Therefore, the norm requiring each adult to give each of her or his elderly parents the amounts of attention determined by (14) is a family constitution. Given this constitution, the condition determining z^C becomes

$$\pi'(z^C) = \frac{1}{2(\alpha - \delta)(\ln w^H - \ln w^L)}$$

This tells us that education is lower with than without the constitution,

$$z^C < \widehat{z},$$

and will be actually zero (corner solution) if δ is larger than α. The intuition is straightforward. Education raises the probability that a child's wage rate will be high, but reduces the expected amount of attention that this child will give her or his parents. Parents will then give a child an education if they take more pleasure in making presents to their children, than in receiving attention from them,

$$\alpha > \delta.$$

Otherwise, they will only give them money. Substituting (14) into the expression for T^C, we get

$$T^C = z^C - 2\alpha\,(1-\phi)\,.$$

Comparing this expression with the one for $\widehat{T}$, and knowing that $z^C < \widehat{z}$, reveals that the presence of a family constitution makes it more likely that it will be the mother to compensate the father, rather than the father to compensate the mother.

The expected utility of marrying under the constitution is

$$\begin{aligned}E\left(EU^C\right) = {} & \pi\left(z^C\right)w^H + \left[1-\pi\left(z^C\right)\right]w^L - 2\alpha\,(1+\phi) - 2\delta - z^C - 1 + \ln r \qquad (15)\\ & + 2\delta\left\{\pi\left(z^C\right)\ln\frac{\delta}{w^H} + \left[1-\pi\left(z^C\right)\right]\ln\frac{\delta}{w^L}\right\}\\ & + 2\alpha\{\pi(z^C)\left[\phi\ln\frac{2\alpha\phi}{w^H} + \ln w^H\right]\\ & + \left[1-\pi(z^C)\right]\left[\phi\ln\frac{2\alpha\phi}{w^L} + \ln w^L\right] + \ln 2\alpha r\}.\end{aligned}$$

We are now ready to answer the question whether Nash-bargaining in the presence of a constitution leads to an equilibrium, and a constitution thus exists. That is the same as asking whether the pay-off of marrying with the constitution, given by

$$\begin{aligned}EV^C = {} & w - 2\alpha\,(1+\phi) - 2\delta - z^C - 1 + \ln r \qquad (16)\\ & +2\delta\left\{\pi\left(z^C\right)\ln\frac{\delta}{w^H} + \left[1-\pi\left(z^C\right)\right]\ln\frac{\delta}{w^L}\right\}\\ & +2\alpha\{\phi\ln\frac{2\alpha\phi}{w} + \pi(z^C)\ln w^H\\ & + \left[1-\pi(z^C)\right]\ln w^L + \ln 2\alpha r\}, \qquad (17)\end{aligned}$$

is at least as large as the pay-off of marrying without one, given by (8). For that to be the case, it must be true that

$$2\delta\left\{\pi\left(z^{C}\right)\ln\frac{\delta}{w^{H}}+\left[1-\pi\left(z^{C}\right)\right]\ln\frac{\delta}{w^{L}}-1\right\} \\ \geq 2\alpha\left[\pi\left(\widehat{z}\right)-\pi\left(z^{C}\right)\right]\Delta w-\left(\widehat{z}-z^{C}\right) \tag{18}$$

The LHS of this inequality is the non-altruistic gain from having positive t_k^H and t_k^L. The RHS is the difference between the altruistic pleasure of giving children an education without and with a constitution. As both sides are positive, it is then not sufficient to say that a norm is not dominated by any other norm that also supports a Nash-bargaining equilibrium. For this norm to be a constitution, it must also be the case that the equilibrium with the norm is not dominated by the equilibrium without the norm. As this is not true in general, all we can say is then that a Nash-bargaining equilibrium with a constitution *may* exist. It all depends on preferences. Is that a problem? It would be if everybody had the same preferences, because either all couples would then be governed by a family constitution (the same for all couples), or none would. But not if different couples have different preferences.

5 Heterogeneous preferences

Let us then see what happens if different persons have different preferences. Suppose that having the same preferences (as well as the same realized wage rate) is the criterion for forming a couple. Take a couple whose common preferences satisfy (18). Will this couple abide by a constitution (14) reflecting their common preferences? Only if their ascendants and descendants have those preferences too. Have we any reason to expect that this will be the case?

If preferences are purely random, the probability that a child is born with the same preferences as her or his parents is very small. But suppose that the numerical values of a person's α, δ and ϕ are a linear combination of the α, δ and ϕ of that person's parents. Combined with the assumption that couples are matched by their preferences, this would ensure that children have the same preferences as their parents. Another possibility, suggested by Stark (1993, 1995), and Cox and Stark (2005), is that preferences are inculcated, rather than genetically inherited. Those authors advance the hypothesis that adults take care of their elderly parents in order to impress on their children that they should do the same, and bring evidence that couples with children are more likely to take care of elderly parents than singles or couples without children. the presence of children raises the probability that consistent with this hypothesis ("demonstration effect"). We do not need to go as far as saying that this happens because parents take deliberate action to shape their children preferences. It may be simply a case of imprinting. What matters for our present purposes is that individuals brought up in families where adults appear to enjoy making presents to their children, and the old appear to enjoy receiving attention from their children, are more likely to develop a taste for these particular goods, and to seek out marriage partners with similar upbringing, than individuals brought up in families of a different kind.

People who neither inherited that kind of preferences, nor had them inculcated or imprinted, may still marry. But we are not able to demonstrate that they will have a family constitution with which to comply. These people may even marry persons with preferences different from their own, but there is then no guarantee that a Nash-bargaining equilibrium will exist, because the utility-possibility frontier and thus the game will be asymmetrical. This conclusion has a certain intuitive appeal. In the next section, we inquire whether public policy affects the conditions for the existence of a family constitution, and thus the share of adults who are governed by one.

6 Policy analysis

We now compare the effects of a number of policies on the behaviour of couples who are and couples who are not constrained by a family constitution, and on the existence of such a constitution. The first policy we consider is the promise to pay a lump-sum subsidy τ to all members of a certain generation when they become old, financed by a lump-sum tax of the same size on all members of the next generation when they become adult. This is to be interpreted as a one-off move. If *every* generation were taxed a fixed amount in favour of the preceding one, there would be no public intergenerational transfer. An example of such one-off policy are the "inaugural gains" enjoyed by the first generation of pensioners when the government introduces a pay-as-you-go public pension system. Another is debt-financed public expenditure. This is the classical experiment carried out in the literature to establish whether a public transfer will be neutralized by a private transfer of the opposite sign. Barro (1974) shows that it will, because altruistic adults will perceive the subsidy as a tax on their children ("Ricardian equivalence"). In Barro's world, however, there is no strategic self-interest, no sexual differentiation, no marriage, and no bargaining between spouses. Does the same result apply in our realistically more complicated world?

Assuming that the policy is fully anticipated by f and m in period 1 of their life, we can simply add τ to rs_i in EV, and subtract it from

b in EW. For couples not governed by a family constitution, the Nash-bargaining equilibrium is now (see Appendix)

$$\begin{aligned}
\hat{g}(\tau) &= \frac{2\alpha\phi}{w} \\
\hat{b}(\tau) &= 2\alpha r + \tau \\
\hat{s}_f(\tau) &= 1 - \frac{\tau}{r},\ \hat{s}_m(\tau) = 1 + 4\alpha + \frac{\tau}{r} \\
\hat{T}(\tau) &= \hat{z} - 2\alpha(1-\phi) - \frac{\tau}{r} \\
\pi'(\widehat{z}(\tau)) &= \frac{1}{2\alpha\Delta w}.
\end{aligned}$$

For couples governed by a family constitution, the Nash-bargaining equilibrium becomes (see Appendix)

$$\begin{aligned}
g^C(\tau) &= \frac{2\alpha\phi}{w} \\
b^C(\tau) &= 2\alpha r + \tau \\
s_f^C(\tau) &= 1 - \frac{\tau}{r},\ s_m^M = 1 + 4\alpha + \frac{\tau}{r} \\
T^C(\tau) &= z^C - 2\alpha(1-\phi) - \frac{\tau}{r} \\
\pi'\left(z^C(\tau)\right) &= \frac{1}{2(\alpha-\delta)\Delta w}.
\end{aligned}$$

For these constitution-abiding couples, the rule determining t_F^H and t_M^L is the same as without the policy. With or without a constitution, the policy raises bequests by the amount of the subsidy, and lowers (raises) the woman's (man's) savings by the present value of the subsidy. The compensatory transfer from the man to the woman is similarly reduced by the present value of the subsidy, and could be negative. The effect on i's expected utility is zero. Therefore, Ricardian equivalence applies despite marriage and strategic self-interest. Family constitutions make a difference in that they induce parents to give their children less education (zero if $\alpha \leq \delta$) and more money than they otherwise would, but the amount of education given is the same with or without the policy. They also make it more likely that the mother will compensate the father, and not the other way round.

Our next experiment concerns the effects of a redistributive policy that systematically taxes high wages and subsidizes low ones. Unlike the previous one, this policy redistributes within rather than between generations, and it is permanent rather temporary. We will examine only the extreme case where the policy equalizes take-home wage rates, but the qualitative results extend to the less extreme case where take-home wage rate inequality is simply reduced. If parents did not respond to the policy, everybody would take home the same wage rate (which would lie somewhere between w^H and w^L). As the policy reduces the return to education to zero, however, parents will respond by spending nothing for their children's education. Recalling that $\pi(0) = 0$, everybody will then be paid w^L. The policy eliminates uncertainty.

For couples without a constitution, the Nash-bargaining equilibrium is now (see Appendix)

$$\begin{aligned} g(R) &= \frac{2\alpha\phi}{w^L} \\ b(R) &= 2\alpha r \\ s_f(R) &= 1, s_m(R) = 1 + 4\alpha \\ T(R) &= -2\alpha(1-\phi), \end{aligned} \tag{19}$$

where the R label signals that wage-rate redistribution is in action. Notice that $T(R)$ is definitely negative. With the present policy, it is definitely the mother who compensates the father (because the woman does not have to pay for the children's education). The two parties' common pay-off is now

$$\begin{aligned} \widehat{V}(R) = {} & w^L - 2\alpha(1+\phi) - 1 + \ln r \\ & +2\alpha\left[\phi \ln \frac{2\alpha\phi}{w^L} + \ln 2\alpha r + \ln w^L\right]. \end{aligned} \tag{20}$$

Comparing (8) with (20),[13] we notice that f and m will be at least as well-off without than with the policy if

$$w - w^L + 2\alpha\left[\phi\left(\ln w - \ln w^L\right) + \pi(\widehat{z})\Delta w\right] \geq \widehat{z}.$$

This condition is always satisfied as an inequality because $\left(w - w^L\right)$ and $\left(\ln w - \ln w^L\right)$ are nonnegative, and the return to education, $\pi(\widehat{z})\Delta w$, cannot be less than the cost, $\widehat{z}$ (otherwise, f and m would have chosen $z = 0$ even without the policy). Therefore, the policy is not neutral. It makes couples without a constitution worse-off.

If a constitution exists for some couples, it prescribes

$$t_F = t_M = \frac{\delta}{w^L} \tag{21}$$

The Nash-bargaining equilibrium is then the same as it would have been without the constitution, but the pay-off is now

[13] The comparison is legitimate, even though the former is certain and the latter is an expectation, because utility is linear in current income.

$$V^C(R) = w^L - 2\alpha(1+\phi) - 1 + \ln r + 2\delta\left(\ln\frac{\delta}{w^L} - 1\right) \qquad (22)$$
$$+2\alpha\left[\phi\ln\phi + (1+\phi)\ln 2\alpha + (1-\phi)\ln w^L + \ln r\right].$$

The difference between (22) and (20),

$$V^C(R) - \widehat{V}(R) = 2\delta\left(\ln\frac{\delta}{w^L} - 1\right)$$

is nonnegative for

$$\ln\frac{\delta}{w^L} \geq 1. \qquad (23)$$

This is the condition for the existence of a family constitution in the presence of the redistributive policy in question. This condition is less stringent than the one that would apply without the policy, because the LHS of (23) is larger than the LHS of (18), and the RHS of (23) is smaller than the RHS of (18). Therefore, the policy raises the share of the adult population that is governed by a family constitution.

Does the policy make constitution-abiding couples better or worse-off? The relevant comparison is between (22) and (16). The difference between the two is

$$V^C(R) - EV^C = -\left(w - w^L\right) - 2(\alpha - \delta)\pi(z^C)\Delta w + 2\alpha\phi\left(\ln w - \ln w^L\right).$$

As the first and second RHS terms of this expression are non-positive, and the third one is nonnegative, we cannot say how the policy will affect constitution-abiding couples in general. If their α happens to be no larger than their δ, however, these couples will choose z equal to zero. Their w will then be equal to w^L, and the difference between the two payoffs will be nil. Taking into account that the policy raises the share of the adult population who are governed by a family constitution, and that these couples are better-off with than without that constitution, the policy will make couples who would have otherwise gone without a constitution better-off. As those who are still without one could be worse-off, and those who would have had one anyway stay the same, the aggregate welfare effect is ambiguous.

In our model, as in much of the post-information-revolution economics literature, education does not increase productivity. It just helps a person to get a better job (at best, it reveals a person's innate ability). What if education raises a person's human capital, and thus her or his productivity? Consider a simple variation on our model, namely

$$w = w^L + \gamma z, \; 0 < \gamma < 1.$$

In this model, there is no uncertainty. We show in the Appendix that, for couples without a family constitution, and provided that certain parametric restrictions are satisfied,[14] the Nash-bargaining equilibrium is

$$\begin{aligned} g(H) &= \frac{2\alpha\phi}{w}, \\ b(H) &= 2\alpha r \\ s(H) &= 1,\ \ s_m(H) = 1 + 4\alpha \\ T(H) &= 2\alpha\phi - \frac{w^L}{\gamma}, \end{aligned}$$

with the H there to remind us that we are in the model with human capital accumulation. Education and the wage rate are either

$$z(H) = 2\alpha - \frac{w^L}{\gamma}$$

and

$$w(H) = 2\alpha\gamma,$$

or

$$z(H) = 0$$

and

$$w(H) = w^L.$$

For $z(H) > 0$, the pay-off of marriage is

$$\begin{aligned} \widehat{V}(H) = {} & 2\alpha\gamma - 2\alpha(\phi + 2) + \frac{w^L}{\gamma} - 1 + \ln r \\ & + 2\alpha\left[\phi \ln \phi + 2\ln 2\alpha + \ln r + (1-\phi)\ln \gamma\right]. \end{aligned} \tag{24}$$

Where it exists, the family constitution prescribes (see Appendix)

$$t_F(H) = t_M(H) = \frac{\delta}{2\alpha\gamma}.$$

These prescriptions are unconditional because there is no uncertainty. The Nash-bargaining equilibrium and the equilibrium wage rate are the same as without the constitution, but the pay-off of marriage is now

$$\begin{aligned} V^C(H) = {} & 2\alpha\gamma + 2\delta\left(\ln\frac{\delta}{2\alpha\gamma} - 1\right) - 2\alpha(\phi + 2) + \frac{w^L}{\gamma} - 1 + \ln r \\ & + 2\alpha\left[\phi \ln \phi + 2\ln 2\alpha + \ln r + (1-\phi)\ln \gamma\right]. \end{aligned} \tag{25}$$

[14] As the utility function is linear in current consumption, the parameters must be such that this consumption is positive in the Nash-bargaining equilibrium.

The condition for the existence of a family constitution is

$$\ln \frac{\delta}{2\alpha\gamma} \geq 1. \tag{26}$$

This condition differs from (18) for two reasons. First, because the amount of attention adults must give their elderly parents is now certain, rather than conditional on the realization of the giver's wage rate as in the model without human capital accumulation. Second, because the equilibrium level of education, and thus the equilibrium wage rate, is now the same with or without a constitution.

What would be the effects of a one-off public intergenerational transfer in this model? With or without a family constitution, the Nash bargaining solution for the case where $z(HD) > 0$ would be (see Appendix)

$$\begin{aligned}
g\left(HD\right) &= \frac{\phi}{\gamma} \\
b\left(HD\right) &= 2\alpha r + \tau \\
s_f\left(HD\right) &= 1 - \frac{\tau}{r},\ s_m\left(H\right) = \gamma + 4\alpha + \frac{\tau}{r} \\
T\left(HD\right) &= 2\alpha\phi - \frac{w^L}{\gamma} - \frac{\tau}{r}. \\
z\left(HD\right) &= 2\alpha - \frac{w^L}{\gamma},
\end{aligned}$$

and the equilibrium wage rate consequently

$$w\left(HD\right) = 2\alpha\gamma,$$

where the D after the H signals the presence of a debt-financed policy. As in the model where education does not affect productivity, the policy would thus induce an increase in the private transfer to the next generation equal to the public transfer to the present generation. It would also reduce f's savings and m's compensatory payment to f by the present value of the public transfer, and raise m's savings by the same amount. The payoffs, the conditions for the existence of a family constitution, and the prescriptions that such a constitution would make if it did exist, would not be affected by the policy.

Next, let us see what wage redistribution would do in this model. Once again, we focus on the extreme case where the government equalizes take-home wage rates. As parents would respond to the policy by choosing $z = 0$, the equilibrium wage rate would fall to w^L as in the model where education does not affect productivity. For couples without a constitution, the Nash bargaining equilibrium would become

$$
\begin{aligned}
\hat{g}\,(HR) &= \frac{2\alpha\phi}{w^L} \\
\hat{b}\,(HR) &= 2\alpha r \\
\hat{s}_f\,(HR) &= 1, \hat{s}_m\,(HR) = 1 + 4\alpha \\
\hat{T}\,(HR) &= -2\alpha\,(1-\phi) \\
\hat{z}\,(HR) &= 0,
\end{aligned}
$$

where the R after the H signifies that the government is equalizing take-home wage rates. With the policy, the pay-off of marriage would be

$$
\begin{aligned}
\hat{V}\,(HR) = {} & w^L - 2\alpha\,(1+\phi) - 1 + \ln r \\
& +2\alpha\left[\phi \ln \phi + (1+\phi)\ln 2\alpha + \ln(r) + (1-\phi)\ln w^L\right],
\end{aligned}
$$

Comparing this with the pay-off in the absence of policy, given by (24), we obtain

$$
\hat{V}\,(HR) - \widehat{V}\,(H) = \left(2\alpha\gamma - w^L\right)\left(\frac{1}{\gamma} - 1\right) - 2\alpha\left[(1-\phi)\left(\ln 2\alpha\gamma - \ln w^L\right)\right],
$$

which is the difference between two positive terms. Therefore, the policy *may* raise the pay-off of marriage for couples not constrained by a family constitution.

For couples constrained by a family constitution, the Nash-bargaining equilibrium would be

$$
\begin{aligned}
g^C\,(HR) &= \frac{2\alpha}{w^L} \\
b^C\,(HR) &= 2\alpha r \\
s_f^C\,(HR) &= 1,\ s_m^C\,(HR) = 1 + 4\alpha \\
T^C\,(HR) &= w^L\,(t_F - t_M) + 2\alpha\,(\phi - 1) \\
z^C\,(HR) &= 0.
\end{aligned}
$$

Therefore, the policy would affects the equilibrium differently in couples with, and couples without a constitution. The constitutional prescriptions would be (21) as in the model without human capital accumulation, but the pay-off of marrying given those prescriptions would now be

$$
\begin{aligned}
V^C\,(HR) = {} & w^L + 2\delta\left(\ln\frac{\delta}{w^L} - 1\right) - 2\alpha\,(1+\phi) - 1 + \ln r \\
& +2\alpha\left[\phi\ln\phi + (1+\phi)\ln 2\alpha + \ln r + (1-\phi)\ln w^L\right].
\end{aligned} \tag{27}
$$

Comparing (27) with (25), we find that the difference between the two,

$$V^C(HR) - V^C(H) = w^L - 2\alpha\gamma + 2\alpha - \frac{w^L}{\gamma} + [2\delta - 2\alpha(1-\phi)]\left(\ln 2\alpha\gamma - \ln w^L\right)$$

is positive. Therefore, the policy would make constitution-abiding couples better-off. If $\widehat{z}$ were positive (i.e., for $2\alpha\gamma > w^L$), the policy would also relax the condition for the existence of a family constitution, and thus raise the share of the adult population that is governed by such an understanding, because $V^C(HR) - V^C(H)$ is nonnegative for

$$\ln \frac{\delta}{w^L} - 1 \geq 0,$$

and this condition is less stringent than (26). For $\widehat{z} = 0$, the policy would have no effect on the share of constitution-abiding couples in the adult population. In any case, the policy could raise aggregate welfare. It may seem curious that a policy discouraging education could enhance welfare, especially in a model where education raises individual productivity. But this is only because the policy induces parents abiding by a family constitution to substitute filial attention for income (the effect on couples without a family constitution is ambiguous). The possibility of a positive welfare effect can be ruled out only if education has a strongly positive external effect.

Judging by the policies considered, it would thus appear that neutrality is the exception rather than the rule. We found neutrality in the case of a one-off, lump-sum subsidy to the present generation paid for by a lump-sum tax on the next one. But other kinds of policy make some categories better-off, and other worse-off. We also found that lump-sum intergenerational redistribution does not affect family constitutions, but wage-rate redistribution does, and that it may also tighten or relax the condition for the existence of such a arrangement (hence, lower or raise the share of the adult population that is governed by one). In general, therefore, the effect on affect aggregate welfare may come not only from changes in the utility levels of couples who do and couples who do not abide by a family constitution, but also from a change in the relative weight of these two groups.

7 Conclusion

Our aim in this paper was to establish (a) whether the idea that individuals are constrained by tacit rules inherited from their parents can be extended from a world where people reproduce, so to speak, by cell separation, to one where reproduction is the outcome of the union of two person of different sex, and (b) whether the existence of such rules affects the proposition that, if everybody were altruistically linked to everybody else by blood or marriage, any public action would be neutralized by a private reaction.

The answer to (a) is positive if the criterion for forming a union is that the parties have the same realized wage rate, and the same preferences. The same-wage condition is only a reflection of the particular model used, where child care is the woman's exclusive province, and the man fully compensates her for this burden. In a model where child care is allocated between the parties according to their personal comparative advantages, however, we could well find couples with complementary traits, where one party has a high wage, and the other a high ability to raise children. The condition that the two should have the same preferences is more restrictive. Evidence that a substantial share of the adult population behaves as if something like a family rule were in operation suggests that, at least for some, having the same preferences is the basis for forming a union. It is a mute point whether a person's preferences happen to be the way they are, or were inculcated.

The answer to (b) is negative. A non-distortionary policy like a one-off public transfer from one generation to the other will be neutralized by a private transfer of opposite sign, but a distortionary policy like wage-rate redistribution will affect the well-being of couples and individuals, and change the share of the adult population that is governed by a family constitution.

8 Appendix

8.1 Nash-bargaining in the absence of a family constitution

The FOCs for the maximization of (2) are

$$\frac{\partial N}{\partial T} = (EV_f - R) - (EV_m - R) = 0$$
$$\frac{\partial N}{\partial g} = -2w\,(EV_m - R) + \frac{2\alpha\phi}{g}\,(EV_f - R + EV_m - R) = 0$$
$$\frac{\partial N}{\partial z} = -2\,(EV_m - R) + 2\alpha\pi'(z)\left(\ln w^H - \ln w^L\right)(EV_f + EV_m - 2R) = 0$$
$$\frac{\partial N}{\partial s_f} = \left(-1 + \frac{r}{rs_f}\right)(EV_m - R) = 0$$
$$\frac{\partial N}{\partial s_m} = \left(-1 + \frac{r}{rs_m - 2b}\right)(EV_f - R) = 0$$
$$\frac{\partial N}{\partial b} = \left(\frac{-2}{rs_m - 2b}\right)(EV_f - R) + \frac{2\alpha}{b}\,(EV_f - R + EV_m - R)$$

Using the first of these equations, the conditions on g, z and s_f yield

$$\hat{g} = \frac{2\alpha\phi}{w},$$

$$\pi'(\hat{z}) = \frac{1}{2\alpha\left(\ln w^H - \ln w^L\right)}$$

and

$$\hat{s}_f = 1.$$

The condition on s_m can then be re-written as

$$\frac{1}{rs_m - 2b} = \frac{1}{r},$$

which substituted back into the conditions for b, s_m and T yields

$$\hat{b} = 2\alpha r,$$

$$\hat{s}_m = 1 + 4\alpha$$

and

$$\hat{T} = 2\alpha\phi + \hat{z} - 2\alpha.$$

8.2 Nash-bargaining in the presence of a family constitution

The FOCs for the maximization of (9) are

$$
\begin{aligned}
\frac{\partial N}{\partial T} &= \left(EV_f - E\hat{V}_f\right) - \left(EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial g} &= -2w\left(EV_m - E\hat{V}_m\right) + \frac{2\alpha\phi}{g}\left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial z} &= -2\left(EV_m - E\hat{V}_m\right) + \delta\pi'(z)\left[\left(\ln t_f^H + \ln t_m^H\right) - \left(\ln t_f^L + \ln t_m^L\right)\right] \\
&\quad * \left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) \\
&\quad + 2\alpha\pi'(z)\left(\ln w^H - \ln w^L\right)\left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f}\right)\left(EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b}\right)\left(EV_f - E\hat{V}_f\right) = 0 \\
\frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b}\right)\left(EV_f - E\hat{V}_f\right) + \frac{2\alpha}{b}\left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) = 0.
\end{aligned}
$$

Following the same procedure as in the case without the constitution, we find

$$
\begin{gathered}
g^C = \frac{2\alpha\phi}{w}, \\
\pi'(z^C) = \frac{1}{\delta\left[\left(\ln t_F^H + \ln t_M^H\right) - \left(\ln t_F^L + \ln t_M^L\right)\right] + \alpha\left(\ln w^H - \ln w^L\right)}, \\
s_f^C = 1, \\
b^C = 2\alpha r, \\
s_m^C = 1 + 4\alpha, \\
T^C = w\left(t_F - t_M\right) + 2\alpha\phi + z^C - 2\alpha.
\end{gathered}
$$

Substituting for g^C, b^C, s_f^C and T^C in the expressions for EU_f^C or EU_m^C, and setting

$$t_f^j = t_D^J = t_F^j,\ t_m^j = t_S^j = t_M^j,\ j = H, L,$$

the value of EU expected at the time when the norm was enunciated is

$$\begin{aligned}E\left(EU\right) = &\pi\left(z^C\right)w^H(1-t_F^H-t_M^H)+\left[1-\pi\left(z^C\right)\right]w^L(1-t_F^L-t_M^L)+\\&-z^C-2\alpha\phi-1-2\alpha+\ln\left[r\right]\\&+\delta\left\{\pi\left(z^C\right)\left(\ln t_F^H+\ln t_M^H\right)+\left[1-\pi\left(z\right)\right]\left(\ln t_F^L+\ln t_M^L\right)\right\}\\&+2\alpha\left[\pi\left(z^C\right)\phi\ln\frac{2\alpha\phi}{w^H}+\left[1-\pi\left(z^C\right)\right]\phi\ln\frac{2\alpha\phi}{w^L}\right]\\&+2\alpha\left\{\ln\left(2\alpha r\right)+\pi(z^C)\ln w^H+\left[1-\pi(z^C)\right]\ln w^L\right\}.\end{aligned}$$

The FOCs for the maximization of $E\left(EU\right)$,

$$\frac{\partial E\left(EU\right)}{\partial t_k^j}=-w^j+\frac{\delta}{t_k^j}=0,\ \ j=H,L,\ \ k=F,M,$$

yield

$$t_F^j=t_M^j=\frac{\delta}{w^j}.$$

8.3 One-off public transfer from children to parents

In the presence of a policy that transfers τ from the children to the parents, the expressions for EV_f and EV_m in the Nash bargaining problem (9) become

$$\begin{aligned}EV_f = &w(1-2g-2t_F)-2z-s_f+T+\ln\left(rs_f+\tau\right)\\&+\delta\left\{\pi\left(z\right)\left(\ln t_f^H+\ln t_m^H\right)+\left[1-\pi\left(z\right)\right]\left(\ln t_f^L+\ln t_m^L\right)\right\}\\&+2\alpha\left\{\phi\ln g+\ln\left(b-\tau\right)+\pi(z)\ln w^H+\left[1-\pi(z)\right]\ln w^L\right\}\end{aligned}$$

and

$$\begin{aligned}EV_m = &w\left(1-2t_M\right)-s_m-T+\ln\left(rs_m-2b+\tau\right)\\&+\delta\left\{\pi\left(z\right)\left(\ln t_f^H+\ln t_m^H\right)+\left[1-\pi\left(z\right)\right]\left(\ln t_f^L+\ln t_m^L\right)\right\}\\&+2\alpha\left\{\phi\ln g+\ln\left(b-\tau\right)+\pi(z)\ln w^H+\left[1-\pi(z)\right]\ln w^L\right\}.\end{aligned}$$

The FOCs are

$$
\begin{aligned}
\frac{\partial N}{\partial T} &= \left(EV_f - E\hat{V}_f\right) - \left(EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial g} &= -2w\left(EV_m - E\hat{V}_m\right) + \frac{2\alpha\phi}{g}\left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial z} &= -2\left(EV_m - E\hat{V}_m\right) + \delta\pi'(z)\left[\left(\ln t_f^H + \ln t_m^H\right) - \left(\ln t_f^L + \ln t_m^L\right)\right] \\
&\quad * \left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) \\
&\quad + 2\alpha\pi'(z)\left(\ln w^H - \ln w^L\right)\left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f - \tau}\right)\left(EV_m - E\hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b - \tau}\right)\left(EV_f - E\hat{V}_f\right) = 0 \\
\frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b - \tau}\right)\left(EV_f - E\hat{V}_f\right) + \frac{2\alpha}{b - \tau}\left(EV_f - E\hat{V}_f + EV_m - E\hat{V}_m\right) = 0
\end{aligned}
$$

The case without a constitution is obtained by setting $t_F = t_M = \delta = 0$.

Following the same procedure as without the policy, we find

$$
\begin{aligned}
\widehat{g} &= \frac{2\alpha\phi}{w}, \\
\pi'(\widehat{z}) &= \frac{1}{\alpha\left(\ln w^H - \ln w^L\right)}, \\
\widehat{s}_f &= 1 - \frac{\tau}{r}, \\
\widehat{b} &= 2\alpha r + \tau, \\
\widehat{s}_m &= 1 + 4\alpha + \frac{\tau}{r}, \\
\widehat{T} &= 2\alpha\phi + \widehat{z} - 2\alpha - \frac{\tau}{r}.
\end{aligned}
$$

in the absence of a constitution, and

$$g^C = \frac{2\alpha\phi}{w},$$
$$\pi'(z^C) = \frac{1}{\delta\left[\left(\ln t_F^H + \ln t_M^H\right) - \left(\ln t_F^L + \ln t_M^L\right)\right] + \alpha\left(\ln w^H - \ln w^L\right)},$$
$$s_f^C = 1 - \frac{\tau}{r},$$
$$b^C = 2\alpha r + \tau,$$
$$s_m^C = 1 + 4\alpha + \frac{\tau}{r},$$
$$T^C = w\left(t_F - t_M\right) + 2\alpha\phi + z^C - 2\alpha - \frac{\tau}{r}.$$

if a constitution is in place.

The constitution is found maximizing either

$$\begin{aligned} E\left(EU_f\right) = {} & \pi\left(z^C\right)\left[w^H(1 - 2g^{CH} - 2t_F^H) + T^{CH}\right] \\ & + \left[1 - \pi\left(z^C\right)\right]\left[w^L(1 - 2g^{CL} - 2t_F^L) + T^{CL}\right] \\ & -2z^C - s_f^C + \ln\left(rs_f^C + \tau\right) \\ & +\delta\left\{\pi\left(z^C\right)\left(\ln t_F^H + \ln t_M^H\right) + \left[1 - \pi\left(z^C\right)\right]\left(\ln t_F^L + \ln t_M^L\right)\right\} \\ & +2\alpha\left[\pi\left(z^C\right)\phi\ln g^{CH} + \left[1 - \pi\left(z^C\right)\right]\phi\ln g^{CL}\right] \\ & +2\alpha\left\{\ln\left(b^C - \tau\right) + \pi(z)\ln w^H + \left[1 - \pi(z^C)\right]\ln w^L\right\} \end{aligned}$$

or

$$\begin{aligned} E\left(EU_m\right) = {} & \pi\left(z^C\right)\left\{w^H(1 - 2t_M^H) - s_m^C - T^{CH} + \ln\left(rs_m^C + \tau - 2b^C\right)\right\} \\ & + \left[1 - \pi\left(z^C\right)\right]\left\{w^L(1 - 2t_M^L) - s_m^C - T^{CL} + \ln\left(rs_m^C - 2b^C\right)\right\} \\ & +\delta\left\{\pi\left(z^C\right)\left[\ln t_F^H + \ln t_M^H\right] + \left[1 - \pi\left(z^C\right)\right]\left[\ln t_F^L + \ln t_M^L\right]\right\} \\ & +2\alpha\left[\pi\left(z^C\right)\phi\ln g^{CH} + \left[1 - \pi\left(z^C\right)\right]\phi\ln g^{CL}\right] \\ & +2\alpha\left\{\ln\left(b^C - \tau\right) + \pi(z^C)\ln w^H + \left[1 - \pi(z^C)\right]\ln w^L\right\} \end{aligned}$$

with respect to t_F and t_M.

Substituting the expressions for g^C, b^C, s_f^C and T^C obtained with and without the policy into the expression for $E\left(EU_i\right)$, we obtain the same expression, with and without the policy, for $i = f, m$. Consequently, the FOCs are the same in either case, and the renegotiation-proof values of $\left(t_F^H, t_M^H, t_F^L, t_M^L\right)$ are

$$t_k^j = \frac{\delta}{w^j},\ j = H, L,\ k = F, M.$$

Moreover, the common value of $E\left(EU_f\right)$ and $E(EU_m)$ is the same with or without the policy.

8.4 Net-wage equalization

The maximand is still

$$N = \left(EU_f - E\hat{U}_f\right)\left(EU_m - E\hat{U}_m\right).$$

As z is zero, however, we have

$$\begin{aligned} EU_f = {} & w^L(1-2g-2t_F) - s_f + T + \ln(rs_f) \\ & +\delta\left\{\left(\ln t_f^L + \ln t_m^L\right)\right\} + 2\alpha\left\{\phi\ln g + \ln b + \ln w^L\right\} \end{aligned}$$

and

$$\begin{aligned} EU_m = {} & w^L(1-2t_M) - s_m - T + \ln(rs_m - 2b) \\ & +\delta\left\{\left(\ln t_f^L + \ln t_m^L\right)\right\} + 2\alpha\left\{\phi\ln g + \ln b + \ln w^L\right\} \end{aligned}$$

in the presence of a family constitution, and the same with $t_F = t_M = \delta = 0$ in the absence of a family constitution.

The FOCs are in either case

$$\begin{aligned} \frac{\partial N}{\partial T} &= \left(EU_f - E\hat{U}_f\right) - \left(EU_m - E\hat{U}_m\right) = 0 \\ \frac{\partial N}{\partial g} &= -2w\left(EU_m - E\hat{U}_m\right) + \frac{2\alpha\phi}{g}\left(EU_f - E\hat{U}_f + EU_m - E\hat{U}_m\right) = 0 \\ \frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f}\right)\left(EU_m - E\hat{U}_m\right) = 0 \\ \frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b}\right)\left(EU_f - E\hat{U}_f\right) = 0 \\ \frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b}\right)\left(EU_f - E\hat{U}_f\right) + \frac{2\alpha}{b}\left(EU_f - E\hat{U}_f + EU_m - E\hat{U}_m\right) = 0. \end{aligned}$$

From the FOCs on T and g, we find

$$g(R) = \frac{2\alpha\phi}{w^L}$$

From the FOC on s_f, we get

$$s_f(R) = 1.$$

Using the FOCs on s_f and b, we also find

$$b(R) = 2\alpha r$$

and

$$s_m(R) = 1 + 4\alpha$$

Finally, using the FOC on T, we find

$$T(R) = w(t_F - t_M) - 2\alpha(1-\phi).$$

Substituting the Nash-bargaining equilibrium into the expected life-time utility of either f or m, and maximizing with respect to t_F^L and t_M^L, we obtain

$$t_k^L = \frac{\delta}{[1-\pi(z^C)]\,w^L},\ \ k = F, M$$

8.5 Human capital model: Nash-bargaining in the absence of a family constitution

For

$$w = w^L + \gamma z,\ \ 0 < \gamma < 1,$$

the Nash-bargaining equilibrium without a family constitution is found maximizing

$$N = (V_f - R)(V_m - R),$$

where

$$\begin{aligned} V_f = {} & w(1-2g) - 2z - s_f + T + \ln(rs_f) \\ & +2\alpha\left[\phi \ln g + \ln b + \ln\left(w^L + \gamma z\right)\right] \end{aligned}$$

and

$$\begin{aligned} V_m = {} & w - s_m - T + \ln(rs_m - 2b) \\ & +2\alpha\left[\phi \ln g + \ln b + \ln\left(w^L + \gamma z\right)\right], \end{aligned}$$

The FOCs are now

$$\begin{aligned} \frac{\partial N}{\partial T} &= (V_f - R) - (V_m - R) = 0 \\ \frac{\partial N}{\partial g} &= -2w(V_m - R) + \frac{2\alpha\phi}{g}(V_f - R + V_m - R) = 0 \\ \frac{\partial N}{\partial z} &= -2(V_m - R) + 2\alpha\left(\frac{\gamma}{w^L + \gamma z}\right)(V_f - R + V_m - R) = 0 \\ \frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f}\right)(V_m - R) = 0 \\ \frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b}\right)(V_f - R) = 0 \\ \frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b}\right)(V_f - R) + \frac{2\alpha}{b}(V_f - R + V_m - R) = 0, \end{aligned}$$

whence

$$\begin{aligned}
\hat{g}(H) &= \frac{2\alpha\phi}{w}, \\
\hat{z}(H) &= 2\alpha - \frac{w^L}{\gamma}, \\
\hat{b} &= 2\alpha r, \\
\hat{s}_f(H) &= 1, \\
\hat{s}_m &= 1 + 4\alpha, \\
\hat{T} &= 2\alpha\phi - \frac{w^L}{\gamma}.
\end{aligned}$$

8.6 Human capital model: Nash-bargaining in the presence of a family constitution

In the presence of a family constitution, the Nash-bargaining equilibrium maximizes

$$N = \left(V_f - \hat{V}_f\right)\left(V_m - \hat{V}_m\right).$$

The FOCs are now

$$\begin{aligned}
\frac{\partial N}{\partial T} &= \left(V_f - \hat{V}_f\right) - \left(V_m - \hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial g} &= -2w\left(V_m - \hat{V}_m\right) + \frac{2\alpha\phi}{g}\left(V_f - \hat{V}_f + V_m - \hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial z} &= -2\left(V_m - \hat{V}_m\right) + 2\alpha\left(\frac{\gamma}{w^L + \gamma z}\right)\left(V_f - \hat{V}_f + V_m - \hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f}\right)\left(V_m - \hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b}\right)\left(V_f - \hat{V}_f\right) = 0 \\
\frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b}\right)\left(V_f - \hat{V}_f\right) + \frac{2\alpha}{b}\left(V_f - \hat{V}_f + V_m - \hat{V}_m\right) = 0.
\end{aligned}$$

Following the usual procedure, we then find

$$g^{C}\left(H\right)=\frac{2\alpha\phi}{w},$$
$$z^{C}\left(H\right)=2\alpha-\frac{w^{L}}{\gamma},$$
$$s_{f}^{C}\left(H\right)=1,$$
$$b^{C}\left(H\right)=2\alpha r,$$
$$s_{m}^{C}\left(H\right)=1+4\alpha,$$
$$T^{C}\left(H\right)=w\left(t_{F}-t_{M}\right)+2\alpha\phi-\frac{w^{L}}{\gamma}.$$

Substituting $\left(g^{C},b^{C},s_{f}^{C},T^{C}\right)$ into either f's or m's lifetime utility function, which is now certain because the wage rate is not a random variable as in the model without human capital accumulation, setting

$$t_{f}=t_{D}=t_{F}\text{ and }t_{m}=t_{S}=\ t_{M},$$

and maximizing with respect to t_F and t_M, we get the FOCs

$$\frac{\partial U}{\partial t_{k}}=-2\alpha\gamma+\frac{\delta}{t_{k}}=0,\ \ k=F,M,$$

whence

$$t_{F}\left(H\right)=t_{M}\left(H\right)=\frac{\delta}{2\alpha\gamma}.$$

8.7 One-off public transfer from children to parents in the human capital model

In the absence of a family constitution, the Nash-bargaining equilibrium maximizes

$$N=\left(V_{f}-R\right)\left(V_{m}-R\right),$$

where

$$\begin{aligned}V_{f}=&\,w(1-2g)-2z-s_{f}+T+\ln\left(rs_{f}+\tau\right)\\&+2\alpha\left[\phi\ln g+\ln\left(b-\tau\right)+\ln\left(w^{L}+\gamma z\right)\right]\end{aligned}$$

and

$$\begin{aligned}V_{m}=&\,w-s_{m}-T+\ln\left(rs_{m}-2b+\tau\right)\\&+2\alpha\left[\phi\ln g+\ln\left(b-\tau\right)+\ln\left(w^{L}+\gamma z\right)\right],\end{aligned}$$

The FOCs are

$$\begin{aligned}
\frac{\partial N}{\partial T} &= (V_f - R) - (V_m - R) = 0 \\
\frac{\partial N}{\partial g} &= -2w\,(V_m - R) + \frac{2\alpha\phi}{g}\,(V_f - R + V_m - R) = 0 \\
\frac{\partial N}{\partial z} &= -2\,(V_m - R) + 2\alpha\left(\frac{\gamma}{w^L + \gamma z}\right)(V_f - R + V_m - R) = 0 \\
\frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f + \tau}\right)(V_m - R) = 0 \\
\frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b + \tau}\right)(V_f - R) = 0 \\
\frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b + \tau}\right)(V_f - R) + \frac{2\alpha}{b - \tau}\,(V_f - R + V_m - R) = 0,
\end{aligned}$$

whence

$$\begin{aligned}
\hat{g}\,(HD) &= \frac{2\alpha\phi}{w} = \frac{\phi}{\gamma} \\
\hat{z}\,(HD) &= 2\alpha - \frac{w^L}{\gamma} \\
\hat{b}\,(HD) &= 2\alpha r + \tau \\
\hat{s}_f\,(HD) &= 1 - \frac{\tau}{r} \\
\hat{s}_m\,(HD) &= 1 + 4\alpha + \frac{\tau}{r} \\
\hat{T}\,(HD) &= 2\alpha\phi - \frac{w^L}{\gamma} - \frac{\tau}{r}
\end{aligned}$$

and

$$w = w^L + \gamma\left(2\alpha - \frac{w^L}{\gamma}\right) = 2\alpha\gamma.$$

In the presence of a family constitution, the equilibrium maximizes

$$N = \left[V_f - \hat{V}_f\,(H)\right]\left[V_m - \hat{V}_m\,(H)\right].$$

From the FOCs, we find

$$\begin{aligned}
g^C(HD) &= \frac{2\alpha\phi}{2\alpha\gamma} = \frac{\phi}{\gamma}, \\
z^C(HD) &= 2\alpha - \frac{w^L}{\gamma}, \\
s_f^C(HD) &= 1 - \frac{\tau}{r}, \\
b^C(HD) &= 2\alpha r + \tau, \\
s_m^C(HD) &= 1 + 4\alpha + \frac{\tau}{r}, \\
T^C(HD) &= 2\alpha\gamma\left[t_F(HD) - t_M(HD)\right] + 2\alpha\phi - \frac{w^L}{\gamma} - \frac{\tau}{r}
\end{aligned}$$

Substituting these equilibrium values into the two parties' lifetime utility functions, we get a common expression that, maximized with respect to t_k, $k = F, M$, yields

$$t_F(HD) = t_M(HD) = \frac{\delta}{2\alpha\gamma}.$$

8.8 Net-wage equalization in the human capital model

In the absence of a family constitution, the Nash-bargaining equilibrium maximizes

$$N = (V_f - R)(V_m - R),$$

where

$$\begin{aligned}
V_f = {} & w^L(1-2g) - 2z - s_f + T + \ln(rs_f) \\
& +2\alpha\left[\phi\ln g + \ln b + \ln w^L\right]
\end{aligned}$$

and

$$\begin{aligned}
V_m = {} & w^L - s_m - T + \ln(rs_m - 2b) \\
& +2\alpha\left[\phi\ln g + \ln b + \ln w^L\right],
\end{aligned}$$

The FOCs are

$$\begin{aligned}
\frac{\partial N}{\partial T} &= (V_f - R) - (V_m - R) = 0 \\
\frac{\partial N}{\partial g} &= -2w^L (V_m - R) + \frac{2\alpha\phi}{g} (V_f - R + V_m - R) = 0 \\
\frac{\partial N}{\partial z} &= -2 (V_m - R) < 0 \\
\frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f}\right) (V_m - R) = 0 \\
\frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b}\right) (V_f - R) = 0 \\
\frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b}\right) (V_f - R) + \frac{2\alpha}{b} (V_f - R + V_m - R) = 0.
\end{aligned}$$

Rearranging terms, we find the Nash-bargaining equilibrium

$$\begin{aligned}
\hat{g}(HR) &= \frac{2\alpha\phi}{w^L}, \\
\hat{z}(HR) &= 0, \\
\hat{b}(HR) &= 2\alpha r, \\
\hat{s}_f(HR) &= 1, \\
\hat{s}_m(HR) &= 1 + 4\alpha, \\
\hat{T}(HR) &= -2\alpha(1 - \phi).
\end{aligned}$$

In the presence of a family constitution,

$$N = \left(V_f - \hat{V}_f\right)\left(V_m - \hat{V}_m\right).$$

The FOCs are now

$$\begin{aligned}
\frac{\partial N}{\partial T} &= \left(V_f - \hat{V}_f\right) - \left(V_m - \hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial g} &= -2w^L \left(V_m - \hat{V}_m\right) + \frac{2\alpha\phi}{g} (V_f - R + V_m - R) = 0 \\
\frac{\partial N}{\partial z} &= -2 \left(V_m - \hat{V}_m\right) < 0 \\
\frac{\partial N}{\partial s_f} &= \left(-1 + \frac{r}{rs_f}\right) \left(V_m - \hat{V}_m\right) = 0 \\
\frac{\partial N}{\partial s_m} &= \left(-1 + \frac{r}{rs_m - 2b}\right) \left(V_f - \hat{V}_f\right) = 0 \\
\frac{\partial N}{\partial b} &= \left(\frac{-2}{rs_m - 2b}\right) \left(V_f - \hat{V}_f\right) + \frac{2\alpha}{b} \left(V_f - \hat{V}_f + V_m - \hat{V}_m\right) = 0,
\end{aligned}$$

and the Nash-bargaining equilibrium is

$$g^C(HR) = \frac{2\alpha\phi}{w^L},$$
$$z^C(HR) = 0,$$
$$s_f^C(HR) = 1,$$
$$b^C(HR) = 2\alpha r,$$
$$s_m^C(HR) = 1 + 4\alpha,$$
$$T^C(HR) = w^L(t_F - t_M) - 2\alpha(1-\phi).$$

Following the usual procedure, we then find

$$t_F(HR) = t_M(HR) = \frac{\delta}{w^L}.$$

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