# Specialization in the bargaining family

Raphaela Hyee & Julio R. Robledo*

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**Abstract**

We develop a two period family decision making model where spouses bargain over the contributions to a family public good (say, the raising of children) and the resulting private consumption levels. In contrast to most models in the literature, specialization arises as a consequence of the provision of the public good and not in anticipation of the public good provision. Binding agreements lead to efficient asymmetric allocations: due to learning by doing in market work, at least one spouse is completely specialized. If no commitment is possible, inefficiencies arise as the public good provision level is too low because investment in market productivity is too high.

*Keywords:* Family bargaining, specialization, private provision of public goods

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*Department of Economics, University of Vienna, Hohenstaufengasse 9, 1010 Vienna, Austria, e-mail: raphaela.hyee@reflex.at & julio.robledo@univie.ac.at.We thank Ana Ania, Thomas Gaube, and Christine Zulehner for helpful comments. All errors and omissions are our own.

# 1 Introduction

Economics used to treat the household as a black box that determines labor supply and demand for consumption goods, without asking how household members achieve to aggregate the preferences of its members. Gary Becker was the first to propose an explicit model of family decision making.[1] In Becker's "unitary" model, the altruistic head of the household determines the intrafamily allocation, and the family can thus be treated as if it possessed one common utility function (the altruist's). This does not allow to explicitly model how decisions are taken within the family. More modern formulations in the spirit of Chiappori (1988) assume a collective model where family decision making leads to efficient outcomes. Again, no decision making process is specified.

In order to allow for a conflict of interests within the household, Manser and Brown (1980) and Mc Elroy and Horney (1981) propose Nash bargaining models where the spouses bargain over the allocation of goods and time within marriage. By construction, the Nash bargaining solution is efficient.[2] The players bargain over the surplus that can be obtained by cooperation. The threat point of the players crucially determines the distribution of cooperation gains. In the models of Manser and Brown (1980) and Mc Elroy and Horney (1981), the threat points of the spouses are given by the divorce outside option (spouses live as singles). Alternatively, some authors have analyzed the possibility of non-cooperative family models where both spouses contribute privately to a family public good (see, e. g., Lundberg and Pollak (1993), Lundberg and Pollak (1994), and Konrad and Lommerud (1995)).

Depending on the specification, the spouses have different incentives to specialize in household work or in labor market work. In a cooperative Nash bargaining setting, specialization is usually efficient. In a non-cooperative setting, being more productive changes the strategic incentives to contribute to the public good (Buchholz and Konrad (1995)). Since specialization involves taking a long-term decision, it is natural to analyze these decisions in a dynamic model with several stages, where each stage represents a longer period in one's lifetime.

In Konrad and Lommerud (2000) spouses invest non-cooperatively in education before marriage. Then they marry and in this second period they may behave non-cooperatively

[1]Among the many contributions of Becker to the theory of the family, see e. g. Becker (1965), Becker (1981).

[2]See Nash (1950) and for a modern treatment Muthoo (1999).

or they may cooperate with the non-cooperative equilibrium as threat point. Both spouses have an incentive to inefficiently overinvest in education (i. e., their productivity in the market), because a higher wage rate improves their position in the second stage (whether directly in the private provision game or indirectly via the fall-back utility in the Nash bargaining game). Vagstad (2001) proposes a similar model where the spouses may invest not in outside education, but in household skills. Besides, asymmetric household productivity is assumed.

In all these models, specialization predates marriage, cooperation and/or non-cooperation. While it is certainly true that career choices taken when young influence future outcomes and options, those models neglect the effect of marriage and of the behavior within marriage on the specialization within the couple. The present paper seeks to fill this gap and to analyze if and how marriage and cooperation lead to specialization within the household.

Our paper is related to Lundberg (2002), who also considers a model with learning-by-doing in the labor market. But her focus is on family policy effects and she does not model explicitly the decision making within the household: household utility is a weighted average of individual utilities. In a related way, Gugl (2005) analyzes the effects of the taxation of couples on labor supply and intrafamily distribution when there is learning-by-doing in the labor market.

For the sake of simplicity and to concentrate on human capital decisions within marriage, we disregard specialization efforts before marriage, as analyzed by Konrad and Lommerud (2000) and Vagstad (2001). In our model, the first period is young marriage. It is at this stage where most couples raise children. This family public good represents not only a monetary cost, but also demands time and attention at the expense of other activities, e. g. market work. This period in one's career is also the stage where most market related human capital is accumulated, playing a crucial role in lifetime earnings and in later income patterns. We assume learning-by-doing in the labor market: the more a spouse works in the market, the more productive she/he becomes, i. e., the more time she/he devotes to the household public good, the more she/he forgoes at the labor market. Besides, we assume this effect to become weaker the more the spouse works in the labor market. Thus, the provision of the family public good leads to specialization, and not the other way round. In the second period, the children have left home, so we assume there is no need for household public good provision any more.

The spouses play a sequence of two Nash bargaining games. In the first period they bargain over the level of the contributions to the family public good and over private consumption. In the second and last period, they only bargain over private consumption, where the labor vs. household work choice in the first period determines the productivity in the second period and only market productivity (the wage rate) matters for intrafamily distribution. In applying the Nash bargaining solution we consider two possible threat point specifications: divorce and non-cooperative marriage. It turns out that different threat points "favor" different spouses.

We devote special attention to the specialization incentives within the couple. With commitment, the spouses efficiently specialize because individual earnings within marriage do not matter for intrafamily distribution - only earnings at the threat point matter. Without commitment, the efficient degree of specialization may not be a time-consistent strategy. Without commitment, there is an asymmetry between market work and household work: with learning-by-doing on the labor market, specializing in household production may not be a time consistent strategy - it does not have a very good threat potential in the second stage when compared to market skills.

The paper proceeds as follows. The next section describes the model, its main assumptions and presents the efficient Nash bargaining solution. Section 3 analyzes the time structure of the game and the determinants of the threat point utilities. The following sections 4 and 5 analyze the situation with and without commitment. Section 6 focuses on possible policy implications of our theoretical results. The final section summarizes the main results and concludes.

## 2 The Model

Consider a household consisting of two spouses, $i = f, m$. Each of them has a utility function

$$U^i = c_1^i + v(G) + c_2^i, \qquad i = f, m, \tag{1}$$

where $c_j^i$, $i = f, m$, $j = 1, 2$, denotes private consumption of spouse $i$ in period $j$ and $G$ is the provision level of the family public good (household keeping, raising children, etc.). The function $v(G)$ is continuous, monotonically increasing, concave and twice continuously differentiable. Utility is quasilinear and intertemporally linear.[3] For the sake of simplicity there is no leisure, no borrowing, no saving, no discounting.

The public good $G$ is produced in period 1 with linear technology $G = h^f g^f + h^m g^m$, where $g^i$, $i = f, m$ are her and his contributions to $G$.[4] In period 1, spouses $f$ and $m$ allocate their time $L$ between household work producing the family public good $G$ and market work leading to private consumption $c_1^i$, $i = f, m$ in period 1. In period 2, spouses devote all their time to market work, i. e., to private consumption $c_2^i$, $i = f, m$.

At the beginning, spouses earn the same market wage rate $w$. Market work leads to private consumption in period 1

$$c_1^i = w \cdot (L - g^i), \qquad i = f, m, \tag{2}$$

where $L - g^i$ is the time spent on market work. Contributing to $G$ in period 1 decreases market productivity according to the wage function $w(g^i)$. Thus, private consumption in period 2 is given by

$$c_2^j = w(g^i) \cdot L, \qquad i = f, m. \tag{3}$$

For the wage function we plausibly assume that market wage increases with learning-by-doing: $w'(g^i) < 0$. A more contentious matter is the fact whether household work reduces market productivity with diminishing or increasing effects, i. e., whether the wage function $w(g^i)$ is a convex or concave function, respectively. We postulate that the longer a spouse is outside the job market, the smaller the marginal productivity effect of her/his absence. In other words, whether someone is one or two years on leave makes a big difference, but whether this person stays away from the job market 7 or 8 years does not have a big impact. Thus $w(g^i)$ is a monotonic, convexly decreasing function, $w''(g^i) > 0$.[5]

[3] This special form of utility is quite restrictive, but it is commonplace in the literature to restrict the analysis to special utility functions for the sake of analytical tractability. Lundberg and Pollak (1993) assume a Stone-Geary utility function, Konrad and Lommerud (2000) work with a quasilinear "payoff" function and Vagstad (2001) analyzes the case of Cobb Douglas preferences with equal coefficients for the public and the private good. We chose this quasilinear formulation because in our Nash bargaining setting the utility possiblity frontier (the locus of all Pareto efficient utility allocation) is linear and utility is easily transferable between the spouses, which greatly simplifies the formal analysis, see Bergstrom (1997).

[4] This household production technology where time inputs of husband and wife are perfect substitutes was proposed by Becker (1981), who argued that "at the beginning everyone is identical; differences in efficiency are not determined by biological or other intrinsic differences"(Becker, 1981, p.32)

[5] Actually, for our qualitative results we only need that $w(g^i)$ is convex over some relevant range, but for the sake of simplicity we assume convexity over the whole range.

The efficient outcome maximizes joint intertemporal utility $\widetilde{U}$

$$\begin{aligned} \widetilde{U}(g^f, g^m) &= \widetilde{U}^f(g^f, g^m) + \widetilde{U}^m(g^f, g^m) = \qquad (4) \\ &= \big(w \cdot (L - g^f) + v(h^f g^f + h^m g^m) + w(g^f) \cdot L\big) + \\ &\quad \big(w \cdot (L - g^m) + v(h^f g^f + h^m g^m) + w(g^m) \cdot L\big) \\ &= w \cdot (L - g^f) + w \cdot (L - g^m) + 2v(h^f g^f + h^m g^m) + w(g^f) \cdot L + w(g^m) \cdot L, \end{aligned}$$

subject to non-negativity constraints $g^f \geq 0$ and $g^m \geq 0$. The Kuhn-Tucker first order conditions are given by

$$\frac{\partial \widetilde{U}}{\partial g^f} = -w + 2v'(G)h^f + w'(g^f)L \leq 0, \quad \frac{\partial \widetilde{U}}{\partial g^f} \cdot g^f = 0, \quad g^f \geq 0, \qquad (5)$$

$$\frac{\partial \widetilde{U}}{\partial g^m} = -w + 2v'(G)h^m + w'(g^m)L \leq 0, \quad \frac{\partial \widetilde{U}}{\partial g^m} \cdot g^m = 0, \quad g^m \geq 0. \qquad (6)$$

Since $\widetilde{U}(g^f, g^m)$ contains both concave and convex elements, we have to be careful, since the Kuhn-Tucker conditions may not lead to a utility maximum (actually, the Hessian matrix is indefinite). Consider therefore first the utility maximization of a spouse

$$\widetilde{U}^f(g^f, g^m) = w \cdot (L - g^f) + v(h^f g^f + h^m g^m) + w(g^f) \cdot L. \qquad (7)$$

The first and second order conditions (FOC and SOC) for the wife's maximization problem when she is single, i. e., when $g^m = 0$, are

$$\frac{\partial \widetilde{U}^f}{\partial g^f} = -w + v'(h^f g^f)h^f + w'(g^f)L \leq 0, \quad \frac{\partial \widetilde{U}^f}{\partial g^f} \cdot g^f = 0, \quad g^f \geq 0, \qquad (8)$$

$$\frac{\partial \widetilde{U^f 2}}{\partial 2 g^f} = v''(h^f g^f)h^f 2 + w''(g^f)L < 0 \qquad \text{for a maximum.} \qquad (9)$$

In order to have an interesting problem, we assume in the following that the FOC (8) is fulfilled at an inner point, i. e., that $g^f > 0$, and that the SOC (9) is also fulfilled, i. e., that the solution of defined by (8) is a maximum. These assumptions imply that the solution to the joint maximization problem (4) involves a strictly positive provision level of the family public good $G > 0$. Let this efficient level be $\bar{G}$. We can express joint utility $\widetilde{U}$ as a function of $\bar{g}^f$ and $\bar{G} - g^f$ and write

$$\widetilde{U}(g^f, \bar{G}) = F(g^f, \bar{G}) + L \cdot \big(w(g^f) + w(\bar{G} - g^f)\big)\,, \qquad (10)$$

where $F(g^f, \bar{G}) := w \cdot (L - g^f) + w \cdot (L - (\bar{G} - g^f)) + 2v(h^f g^f + h^m g^m)$. If household productivities are equal $h^f = h^m$, the contributions $g^f$ and $g^m$ in the term $F(\cdot)$ are perfect substitutes and thus it does not matter which spouse contributes, as long as the sum of the contributions equals $\bar{G}$. For a given $\bar{G}$, $U(g^f, \bar{G})$ is maximized whenever the sum $w(g^f) + w(\bar{G} - g^f)$ is maximized. Since $w$ is convex function, this sum is maximized when the values $g^f$ and $g^m = \bar{G} - g^f$ are on the border of the interval at a corner solution where $g^f = \bar{G}$ and $g^m = 0$ or, alternatively, $g^m = \bar{G}$ and $g^f = 0$. Suppose now that one spouse has a higher household productivity, without loss of generality assume $h^f \geq h^m$. Then the same argument as above applies concerning the maximization of joint utility (10), with the additional restriction that due to the different household productivities a unique corner solution obtains, namely $g^f = \bar{G}$ and $g^m = 0$. We have proved

**Proposition 1 (Nash bargaining solution)**
*The efficient, cooperative Nash bargaining solution involves full specialization by the spouses,i. e., at least one spouse devotes his/her full working time to market work and the family public good is fully provided by the other spouse. If one spouse has a higher household productivity, the other spouse specializes in market work. If both spouses have equal productivities in the market and in the household, any spouse can specialize.*

The Pareto efficient utility possibility frontier defined by the maximization of (4) is linear and spouses bargain over the partition of a "gains from marriage cake" of fixed size, $U^m = \widetilde{U} - U^f$. Let $T^f$ and $T^m$ denote the threat point utilities of the wife and the husband, respectively. If there are gains to distribute, i. e. if $T^f + T^m < \widetilde{U}$, there are points $U^f$ and $U^m$ such that the utility pairs $(T^f, U^m)$ and $(U^f, T^m)$ lie on the Pareto frontier. The following lemma characterizes the Nash bargaining solution in our setting:

**Lemma 1 (Split-the-difference-Rule)**
*For any bargaining problem, such that the utility possibility frontier is of the form* $U^f = \widetilde{U} - U^m$ *and there are points* $U^m$ *and* $U^f$ *such that the utility pairs* $(U^f, T^m)$ *and* $(T^f, U^m)$ *lie on the utility possibility frontier, the Nash bargaining solution* $(U^{f*}, U^{m*})$ *is*

$$U^{f*} = T^f + \frac{\widetilde{U} - T^f - T^m}{2} \quad \textit{and} \quad U^{m*} = T^m + \frac{\widetilde{U} - T^f - T^m}{2}.$$

Proof. See Muthoo (1999).

Thus, if the bargaining problem is of this form, spouses guarantee themselves their threat point utility, and then split the remaining gain equally among them. For the remainder of the paper, it makes sense to assume that one partner may have a higher household productivity. Without loss of generality and following empirical observation, we make therefore the realistic assumption $h^f \geq h^m$. Notice that this involves the case of equal household skills as a border case. In the following section we will analyze the time structure of the game and the determinants of the threat point utilities.

# 3 Time structure and threat point utilities

We consider a two period game with the following structure.

1. A couple marries, a family public good has to be provided. Since marriage involves day-by-day cooperation, we assume that Nash bargaining determines the allocation of goods within marriage. Spouses have two possible threat points when bargaining:

   (a) Non-cooperative marriage as threat point: Spouses contribute privately to the family public good.

   (b) Divorce as threat point. Spouses evaluate their utilities as being life-time singles.

   The husband and the wife choose their contribution to the public good which also determines, as a residual of the time budget, the time they devote to market work. This determines, via learning-by-doing on the labour market, spouses' second period wages.

2. In the second period there is no public good to be provided and both spouses devote all their time to market work, i. e., to private consumption.

## 3.1 Non-cooperative marriage as threat point

Non-cooperative marriage as the threat point means that both wife and husband maximize their individual utility as given by (7) for a given choice of the other player (Nash behavior). The FOCs implicitly describing the best-response reaction functions are

$$v'(h^f g^{f*} + \overline{h^m g^m}) = \frac{1}{h^f}(w - w'(g^{f*})L), \tag{11}$$

$$v'(\overline{h^f g^f} + h^m g^{m*}) = \frac{1}{h^m}(w - w'(g^{m*})L). \tag{12}$$

Since we have assumed equal utility functions for the wife and the husband and $v$ is the utility contribution of the public good, the LHS of both conditions is equal. If $h^f = h^m$, the RHS also have to be equal so we obtain equal and symmetric contributions $g^{f*} = g^{m*}$. If $h^f > h^m$, both spouses cannot be in an interior solution, since the conditions cannot hold simultaneously. Either the husband, or the wife, or both must be in a corner solution. We assume that, due to her higher household productivity, the wife is in an interior solution, so she works both in the household and in the market. The husband's marginal condition is therefore not binding, and he free-rides on the public good provision of his wife. He works all his time on the market in the first period as well.

## 3.2 Divorce as threat point

If one is single, the public good is also a private good, and there are no monetary transfers. The wife maximizes

$$U^f(g^f) = w \cdot (L - g^f) + v(h^f g^f) + w(g^f) \cdot L. \tag{13}$$

Her first order condition reads

$$v'(h^f g^{f*}) = \frac{1}{h^f}(w - w'(g^{f*})L). \tag{14}$$

The left hand side (LHS) is the marginal utility of an additional unit of time devoted to the public good, while the right hand side (RHS) represents the marginal cost of that unit in forgone units of private consumption. She takes not only the direct cost of her home time into account ($wL$ on the RHS), but also the lower wage rate a marginal unit of household work has as a consequence in the second period ($w'(g^f)L$ on the RHS). Exchanging superscripts gives the condition for her husband.

## 3.3 Comparison of threat points

In the case of divorce threat bargaining, the wife is at least as well off as the husband, because her total income is equal or higher than his, since she is equally productive in market work, but equally or more productive at home. In non-cooperative marriage, the husband is at least as well off as the wife, because he can free-ride on her public good provision, and so more time is left for him to work for private consumption.

If the wife is the sole provider of the public good in the non-cooperative setting, she has exactly the same utility in divorce as she has in non-cooperative marriage and her FOCs (14) and (11) coincide. But in the Nash bargaining solution, *relative* threat point utility levels determine the distribution of cooperation gains among the players. Therefore, since her husband has a higher utility in non-cooperative marriage than in divorce threat bargaining, given the option of choosing between the two threat points, she would prefer divorce, while he would opt for non-cooperative marriage.

## 4 Efficiency with binding agreements

If spouses can make a binding contract over the allocation of time and consumption in both periods at the beginning of marriage, efficiency will obtain in a Nash bargaining setting. Both spouses have an interest to maximize the "cake", regardless of the threat point specification. Still, the distribution of gains will depend on the threat points as described in the preceding section. This efficient outcome can be implemented with transfer payments.

This bargaining regime is efficient because in bargaining over life time utility, spouses cannot influence their threat points by their labor supply within marriage, since their threat point utilities are evaluated before their time allocation choices. Threat point utilities are independent of labor supply within marriage, and therefore strategic behavior is not possible. Because spouses know that they will receive half of the gains from cooperation $\widetilde{U} - T^f - T^m$ at the bargaining outcome regardless of the threat point specification, it is in their interest to maximize total utility in choosing their labor supply in the first period. In the following, let $\Delta^T$ be the difference between the threat point utilities of husband and wife, which we will also call the wife's *utility edge* at the threat point.

$$\Delta^T = T^f - T^m. \tag{15}$$

As shown in section 2 there is specialization at the bargaining outcome. The wife's maximization problem involves maximizing joint utility as given by equation (4) and the efficiency condition for the wife's household contribution is the inner solution of the FOC (5):

$$2v'(h^f g^f) = 2v'(G) = \frac{1}{h^f}(w - w'(g^f) \cdot L). \tag{16}$$

All household production is done by one spouse, here the wife, which is efficient since it minimizes the social cost in terms of second period consumption.

**Non-cooperative Marriage.** If the relevant threat point is non-cooperative marriage, we can explicitly solve for the spouses' utilities, and therefore for the transfers of private consumption, because public good consumption at the threat point cancels out. In the Nash bargaining solution only the difference between the threat point utilities counts. By inspection of (15) we need to bother only about the difference in private consumption, because in non-cooperative marriage both spouses necessarily consume the same amount of the public good. The wife receives half of the gains from marriage. Since the public good at the bargaining outcome need not be divided, we can concentrate on private consumption.

The wife's provision level of the public good at the non cooperative threat point $g^{f*}$ is determined by (11), the husband's contribution is zero, since he can free ride on his wife's contribution. The calculation of the wife's utility edge yields

$$\Delta^T = (w(g^{f*} - w(0)) \cdot L - w \cdot g^{f*} \tag{17}$$

where$g^f$ is her contribution at the bargaining outcome determined by (16), which is negative. Applying Lemma 1, the wife's utility level at the threat point can be obtained. At the bargaining outcome, the wife earns $w \cdot (L - g^f)$ in the first period and $w(g^f)$ in the second. Subtracting this from the wife's utility level at the bargaining outcome, and noticing that there is no borrowing and no saving, first and second period transfers can be calculated. This yields a first period transfer from husband to wife of $\frac{1}{2}w \cdot (g^f - g^{f*})$. In the second period, she gets the transfer $\frac{1}{2}w(g^f - g^{f*}) \cdot L$. In the first period, her husband compensates her for half of the time she worked more in the cooperative outcome than she would have done in the absence of an agreement, and in the second period he compensates her for half of her associated wage loss. The outcome is not "fair" in the sense that spouses share equally in the provision of the public good. This is because the husband knows that, if he paid her nothing, she would nevertheless contribute something to the public good. Therefore, he does not have to compensate her for that contribution.

**Divorce.** Consider now the case of divorce as the threat point, the wife's utility edge $\Delta^T$ is given by

$$\Delta^T = \underbrace{w \cdot (g^{m*} - g^{f*}) + (w(g^{f*}) - w(g^{m*})) \cdot L}_{?} + \underbrace{[v(h^f g^{f*}) - v(h^m g^{m*})]}_{>0}, \tag{18}$$

where $g^{i*}$ is spouse $i$'s time allocated to household work if single as given by (14). The sign of the first term depends on whether $(g^{m*} - g^{f*})$ is positive or negative. With the assumptions we made about $v(G)$ and $h^f/h^m$, we can not say a priori if the husband or the wife works more at the divorce threat point. The sign of the first term is therefore undetermined.

The second term is positive, since the wife consumes more of the public good than the husband at the divorce threat point. To see why, recall that in the divorce threat point condition (14) holds for both spouses. $\frac{1}{h^m}(w - w'(g^{m*}) \cdot L) > \frac{1}{h^f}(w - w'(g^{f*}) \cdot L)$ if $h^f > h^m$. So $v'(h^m g^{m*}) > v'(h^f g^{f*})$, which implies that the wife consumes more of the public good at the divorce threat point than the husband, given that $v(G)$ is concave. Although we cannot determine the sign of $(g^{m*} - g^{f*})$, the wife's utility edge $\Delta^T$ is strictly positive, because she is better endowed than the husband.

If divorce is taken to be the threat point, the husband makes a transfer of $\frac{1}{2}[w(g^f - g^{f*} + g^{m*}) + v(h^f g^{f*}) - v(h^m g^{m*})]$ to the wife. This is clearly more than she would receive if non-cooperative marriage were the threat point in bargaining. In this case, she is better off than the husband. Since she would enjoy more of the public good if divorced than he would, she gets the difference in cash. Moreover, since her husband cannot free-ride on her public good provision, he must compensate her for more of her forgone earnings in comparison to the non-cooperative marriage threat point.

In the second period, she gets a transfer of $w(g^f + g^{m*} - g^{f*}) \cdot L$. This transfer is clearly higher than the transfer in the case of non-cooperative marriage as the threat point. But if she consumes more than the husband in the second period is undetermined and depends on who works more at home if single.

**Proposition 2 (Binding agreements feasible)**
*With feasible binding agreements, there is full specialization. Efficiency is reached via monetary transfers whose size depend on the threat point specification.*

# 5 No binding agreements

Suppose now in a more realistic way that binding agreements across periods are not feasible. In the second period there is no household public good (e. g., because the children have already left home) and no gains from specialization, so there is no surplus to be divided. The threat points divorce and non-cooperative marriage coincide, because in both cases each spouse has only his or her private income. Clearly, if the second period transfer cannot be legally enforced, the husband has no reason to share with his (potentially low) income spouse in the second period. He has a threat point utility that exceeds his utility at the bargaining outcome negotiated in the former period, and therefore an incentive to renegotiate the marriage contract and/or to leave the relationship. So the wife will not trust in her husband honoring the contract in the first place, but anticipate that there will be no transfers in the second period.

In the first period spouses take into account the effects of their actions on the outcome in the second period (which is influenced by their threat points). Their first period threat points are given, as they are already determined at the beginning of marriage and cannot be manipulated during marriage. Binding agreements across periods are not possible, so time allocation and distribution are renegotiated in the second period.

Note that now we cannot apply the Nash bargaining solution concept any more, because we relaxed the assumption of Pareto efficiency, allowing for strategic actions in the first period. The model we consider is what Ott (1992, p.98) calls a "composite game", a sequence of subgames, where each subgame is a Nash bargaining game. The link between the subgames is that the threat points of later periods are influenced by the outcomes of earlier stages of the game. Because of the learning-by-doing effect, the wife's second period utility decreases in the time allocated to household work in the first period. If there are no binding agreements, she will take that into account when choosing her labor supply, which is the source of inefficiency. The wife still maximizes the sum of first period utilities, knowing that she will get half of it, but takes into account her wage loss in the second period. Her problem is to maximize:

$$U^f = \frac{1}{2}[\widetilde{U_1}(g^f) - T_1^m + T_1^f + \widetilde{U_2}(g^f) - T_2^m + T_2^f(g^f)], \tag{19}$$

where as before $T_i^j$, $(i = f, m, j = 1, 2)$ denotes the threat point utility of spouse $j$ in period $i$.

$\widetilde{U_k}(g^f)$ is the sum of individual utilities in period $k$. The difference to condition (4) clearly is her second period utility $T_2^f(g^f)$. Her first order condition for her home time in period one changes from condition (16) to

$$2v'(h^f g^f + \overline{h^m g^m}) = \frac{1}{h^f}(w - w'(g^f) \cdot 2L). \tag{20}$$

The husband remains in a corner solution free-riding on his wife's supply of the public good, but the wife provides an inefficiently low level of $G$, because she is not compensated for her wage loss in the second period. The first period transfers described in the last section do not change qualitatively, but are smaller, since total utility decreased, due to the inefficiency in public good provision.

Although the husband would wish to do so in the first period, he cannot credibly commit to a transfer in the second period. Assuming that the husband is not able to raise sufficient funds on the capital market to pay his wife in advance, allocation within marriage will be inefficient. This result is so pronounced in this case, because the wife's specialization in household production only enlarges the first period household utility possibility set. Specialization could also increase the second period utility possibility set sufficiently such that a lower share of a larger cake makes the Pareto efficient time allocation desirable for the wife (Ott, 1992). But in general this need not be the case.

Note that the threat point specification is irrelevant for the inefficiency of the bargaining outcome. Since in the second period, the non-cooperative marriage threat point and the divorce threat point coincide, and the first period threat point is determined at the beginning of marriage, the same inefficiency arises regardless of the threat point specification. We summarize our results:

**Proposition 3 (No binding agreements)**
*If no binding agreements are feasible across periods, there is full specialization. The spouse providing the public good supplies an inefficiently low level of it because she has to bear all wage loss associated with household production. Total utility decreases and first period transfers decrease, too.*

# 6 Policy implications

In our model, the provision of the family public good reduces time spent on an outside job which reduces the investment in human capital by the spouse doing the household work. Since in the second period household skills are less valuable than market skills (in the extreme case where household skills are child-related, those skills are almost worthless once the couple grows older and the children leave home), the spouse who provides the household public good faces a double burden: the direct burden of providing the public good and the indirect future burden of having accumulated less human capital at the marketplace.

The full specialization leading to an asymmetric outcome occurs in the manner of a chicken game, even when starting from a symmetric situation where, as Becker (1981) postulates, both spouses have identical household and market skills. In the following we will analyze several family policies and their effect on the specialization within the couple.

**Lump-sum transfers**. By lump-sum transfers we mean all sort of public (government) monetary transfers to the couple (or to one spouse or to the spouse providing the family public good) and not redistribution transfers *within* the couple, which, as we have seen, play a crucial role to achieve the efficient outcome within a Nash bargaining setting when binding agreements are feasible. It is well known from natural field experiments that monetary transfers and the targeting of them change utility and power within the couple (Lundberg et al. (1997)). In the present paper, we do not model explicitly non-wage income since the spouses allocate their time budget to market and household work. Having an additional source of income (which translates in private consumption) will certainly expand the utility possibility frontier of the couple, but it will not affect our qualitative results nor will this transfer solve the inefficient provision of the family public good and the disadvantage incurred by the spouse who provides it. This is because in our model the provision level of the public good provision is uniquely determined by its price, since income effects are ruled out by our assumption of quasilinear preferences.

**Taxation of couples**. The role of taxation is similar to the role of monetary public transfers (for a detailed analysis see, among others, Wrede (2003) and Gugl (2005)). Of course, taxation changes the relative productivity by reducing the market wage. But, in the same spirit as our comments on lump-sum transfers, taxing wages or subsidizing child support will not affect the driving force of our model, namely the non-accumulation of human capital for the spouse who provides the family public good, as long as the tax function does not change the convexity of the wage function as, for example, a progressive tax system does.

**Parental leave**. Laws about (mandated) parental leave have great influence on future income but they will also not change the specialization incentives within the couple (see, e .g., Phipps et al. (2001)). If the parental leave is taken by the spouse who would have supplied the family public good anyway, they have no effect. If the mandated parental leave has to be taken by the spouse who would otherwise have accumulated human capital in the market place, mandate parental leave can lead to inefficient allocations (for instance, new German parental leave law requires that the husband also takes some period of parental leave). This may change if firm specific human capital is considered (see, e .g., Waldfogel (1998)).

**Public child care**. There are startling differences in fertility and woman labor market participation among countries: While in France and Sweden both are high, both rates tend to be low in countries like Germany and Austria. Cultural and income differences cannot explain this pattern. In France and Sweden child support is provided in kind, which in effect means that the family public good is provided publicly by the government. This public provision eliminates the need for full specialization, avoids the disadvantage for the spouse who is not able to accumulate human capital (usually the wife) and thus contributes to a higher labor market participation by women and to a higher fertility, since the opportunity costs of having children are reduced. Thus, public child support in kind contributes to mitigate the specialization inefficiencies in our setting.

**Binding agreements - divorce law**. Finally, our specialization and provision inefficiencies also arise because signing binding contracts is not feasible or, alternatively, such contracts can be renegotiated (as in the divorce case). The divorce monetary transfers, which are compulsory in most countries, can be interpreted in the light or our model as trying to mitigate the costs of the break-up of marriage to the spouse who has specialized in household skills, who is usually the wife and who in most circumstances has the highest income loss from divorce.

# 7 Conclusions

In our model, specialization arises as a consequence of the provision of the public good and not in anticipation of the public good, as in most models in the literature. Under sensible assumptions about the effect of specialization in household work and market productivity we obtain an asymmetric corner solution, where the whole household work is provided by a single spouse (who will usually be the wife). This is valid even for a "symmetric" couple with equal market and household productivity.

If spouses cannot commit to intertemporal compensation payments, inefficiencies can arise as specialization in household production and market work are unlikely to lead to equal increases in bargaining power. The threat point specification does, in our model, make a distributional difference. The divorce threat point is more advantageous to the spouse with the comparative advantage in household production, while in non-cooperative marriage, she can be worse off than her partner although she is more productive overall.

Among the many family policies designed to support children, direct child support in kind is able to help to solve the inefficiencies in our setting.

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