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The strategic aspect of female employment

A dynamic bargaining model and its econometric implementation

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Abstract

In this paper a dynamic bargaining model of intrafamily time allocation is presented with divorce as the threat point. Rational behavior leads to overinvestment in human capital and inefficient time allocation regarding housework and market work the latter of which is also supplied as an insurance against the loss of bargaining power within the household respectively the risk of divorce. For married women in the German Socio-Economic Panel a labor supply function for a model specification with "virtual conflict payoffs" is estimated: A duration model for marital stability is performed. Threat point estimates are obtained from sub-sample OLS conflict payoff estimations with separating spouses only. Predicted conflict payoffs together with conditional probabilities of divorce are then entered into the Probit estimation of female labor force participation. The empirical results support the bargaining argument of a strategic aspect of female employment.

***Keywords**: time use, female labor supply, intrafamily bargaining, divorce, hazard rate*

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1 Introduction

Over the past decades there has been an enormous increase in the labor force participation of married women. Whereas overall participation rates in Germany have been falling due to a reduction in life time work (later entry into the labor force as well as earlier retirement), married women's participation rates for age 25 to 50 have almost doubled from the 1960s up to the 1990s, going from 37% to 70% (Franz 1996 and Statistisches Bundesamt 1997). Over this same period divorce rates have continuously increased as well. The probability of divorce in 25 years of marriage has doubled from 15% for a couple that married in 1960 to 30% for a marriage entered in 1980 (Statistisches Bundesamt 1990). In view of these patterns, on the micro level we might assume diminishing marital stability to be related to the individual employment decision. Whether the increasing risk of divorce is caused by higher female labor force participation, as many studies suggest, or whether married women now supply more labor due to the higher risk of divorce, as other studies argue (see for instance Diekmann 1994), the decision to work certainly involves an aspect of insurance that has been missed by traditional models of household labor supply. It is this insurance aspect that will be incorporated in the theoretical modeling and econometric estimation of female labor supply in the present paper.

In the conventional common preference or unitary model of the household (Becker 1965, Gronau 1973 and 1977) time allocation decisions of family members involve neither human capital considerations of job experience nor strategic bargaining aspects of individual control over financial resources. Instead individual labor supply is derived from the maximization of a household utility function subject to budget and time constraints. Apart from the fact that it still remains to be clarified just how such a joint utility function can be developed, whether it be a social welfare function of the sort proposed by Paul Samuelson (1956), the utility function of an altruistic "head of the household" as Gary Becker suggested (in 1974) or some other aggregation of the individual utility functions of all family members, the traditional framework fails to fully explain the actual labor force participation of married women. In particular with respect to the opportunity costs of raising children, women are often observed to work for much less than what could possibly be the value of their home time.[1]

[1] This is true especially in light of the German tax system (Ehegattensplitting), where through the combination of progressive tax rates and joint taxation of married couples the second earner's market work is discouraged since (in most cases) her earnings are hit by high marginal tax rates.

Part of the discrepancy between observation and traditional economic theory was taken up by Lehrer and Nerlove (1981). In their human capital framework to model labor supply and fertility behavior of married women, the life cycle is divided into three stages distinguished by the presence and age of children or, interpreted somewhat differently, the demand for household production. A wife allocates her time between work in the labor force, work at home and leisure. She also chooses investment in her own human capital which affects her wage rate in subsequent periods. If the increase in future earnings is sufficiently large, she will work in the labor market even if her wage does not reach the shadow price of her time spent at home rearing children.

Besides the goal of maintaining their human capital and the fear of reducing future chances on the labor market after the child-rearing phase, many women state that they want to achieve some independence from their husbands' earnings[2]. Often this means working for a lower wage rate than predicted by the unitary model. Strategic behavior and its distributional aspect of control over financial resources thus seems to play some role in individual decision making within families. Empirical studies (e.g. the survey by Diekmann and Klein 1991) indicate that in the light of "fading family stability" and increasing divorce rates, labor force participation also serves as an insurance against the risk of economic losses as a result of divorce.

This strategic aspect of labor force participation was first taken into consideration by economists following a game theoretic approach. In their seminal contributions Marilyn Manser and Murray Brown (1980) as well as Marjorie McElroy and Mary Jean Horney (1981) applied Nash cooperative bargaining theory to household decision making. In these models the distribution of utility within households is determined by the feasible consumption set of the two partners and their outside options[3] to family bargaining which are the single-state utilities. Any change in the relative conflict payoffs, e.g. an increase in income of one of the partners, will affect the household utility distribution towards that spouse's favor.

An alternative Nash bargaining model with non-cooperative marriage reflecting traditional gender roles instead of divorce as the outside option was proposed by Lundberg and Pollak (1993)[4]. The separate-spheres model, in contrast to the divorce-threat model, also explains

[2] See e.g. Gaugler/Schach/Vollmer (1984).
[3] The terms outside option, threat point and conflict payoff are used synonymously. They all indicate a person's best alternative to the bargaining outcome.
[4] Woolley (1988) as well as Konrad/Lommerud (1996) also model intrafamily decision making as a Nash bargaining model with internal threat points.

different equilibrium distributions in existing marriages implied by transfer payments to either of the partners, even if these do not affect the single state utilities.

Notburga Ott (1992) has taken account of intertemporal dependencies of household decisions through a dynamic bargaining model with subgame consistency. In such a setting the partners' outside options are no longer exogenous, instead they are endogenously determined by the preceding period's time allocation. An individual's decision to supply labor is made allowing for the accompanying impact on his or her future conflict payoff. The partners' relative bargaining powers therefore directly depend on past time use decisions and the resulting human capital accumulation. Sequential non-cooperation means binding contracts between the periods are not possible. This framework seems to be most appropriate for explaining the labor force participation of many women, who not only regard current labor income but also the human capital dimension of job experience as well as their future bargaining power within the household when making their time allocation decisions.

This paper is divided into two parts: In the theoretical part a dynamic bargaining model of family time use is presented, in the empirical second part an econometric estimation of female labor supply will incorporate implications of the theoretical model.

In the following section a dynamic bargaining model is proposed that extends the work of Ott (1992). Time allocation is determined by intrafamily bargaining taking place within a three-period life cycle. Whereas in the first stage human capital investments are made non-cooperatively by each individual, in subsequent stages, i.e. the family phase, time allocation decisions (esp. housework vs. labor market activity) are determined through Nash bargaining between partners with separation as their threat point. In this model rational individuals not only tend to overinvest in human capital during the first period of life but also have an incentive to choose suboptimal time patterns at the beginning of the family phase should this improve their bargaining position in the following period. This result is due to an asymmetry of the learning effects from market work versus housework and to the asymmetry of the marketability of the different labor skills. Unless binding long-term contracts can be made between the partners, rational behavior always leads to inefficient outcomes with respect to time allocation and household production within the family. In this model labor supply decisions are also determined by strategic bargaining considerations, thereby extending the traditional framework.

In the econometric part of the study these strategic aspects are taken into account when estimating female labor supply using data from the German Socio-economic Panel. First the data set is introduced and a comparison of sample characteristics by incidence of future divorce is presented. The apparent interdependence between participation and marital stability suggests that labor supply might in fact be caused by the individual risk of divorce. A three-step estimation procedure is carried out for a model specification that includes "virtual conflict payoffs". A loglinear duration model on marital "survival" or stability is estimated. The resulting conditional probabilities of divorce serve as weights for the conflict payoffs obtained from sub-sample OLS conflict payoff equation estimates. The resulting expected conflict payoffs are then entered into probit estimation of labor force participation. By explicitly including the individual outside option, the resulting labor supply equation allows for strategic aspects of intrafamily time allocation.

The paper concludes with a summary of the theoretical and empirical results from analyzing labor supply within a dynamic bargaining framework and proposes directions for further research.

2 A dynamic bargaining model

Consider a model in which an individual's life cycle is divided into three periods of differing length: In the first period decisions on human capital investment are made, that is, the available time has to be allocated between education activities K and leisure L. [5] At the beginning of the second period each individual is randomly matched to a partner with whom he or she forms a family in order to raise children[6]. The second and the third period constitute the family phase, when time is allocated among three competing activities: work in the labor force M, which yields market goods, work at home H, which yields home produced goods such as child services, and leisure L which yields direct utility. The two periods are distinguished by the children's age or their demand for care (i.e. household production), respectively. This takes a high value in period 2 when infants have to be looked after 24 hours

[5] This model extends the work of Ott (1992, 1995) by including these pre-family human capital decisions.

[6] In this model the term family generally describes a household in which two persons mutually agree on living together and where a substantial amount of household "jobs" have to be taken care of. These jobs do not necessarily have to be linked to the bearing and rearing of children, they could also include the nursing of relatives in need of care.

a day and, from a certain age on, diminishes steadily in the late family phase.[7] Whereas in the first period time allocation and consumption decisions are made independently by each individual, the family phase is characterized by a two-stage cooperative Nash bargaining game: the distribution of leisure and a composite consumption good within the household is, according to the axiomatic Nash solution of the game, determined by the maximum product of the individual cooperation gains in the two stages. Agreements made at the beginning of the family phase are only binding for one period. Human capital accumulation in one period does not take effect until the subsequent period. Hence, the outside options and the payoff space in the second and third period are determined by decisions made in the prevailing pre-period. Although each individual's utility function is intertemporally separable, the life periods are nonetheless interrelated through the determination of the conflict payoffs. Because of this interdependence the three-stage optimization problem has to be solved through backwards induction according to the idea of subgame consistency.

The optimization problem of spouse *a* is illustrated with the following overview:

life cycle: $U_1^a + U_2^a + U_3^a \rightarrow \left(U_2^a + U_3^a - C_2^a\right)\left(U_2^b + U_3^b - C_2^b\right) \rightarrow \left(U_3^a - C_3^a\right)\left(U_3^b - C_3^b\right)$

time use:

K, L_1	M_2, H_2, L_2	M_3, H_3, L_3

Backwards induction: $U_1^a + W^a \leftarrow \left(U_2^a + V^a - C^a\right)\left(U_2^b + V^b - C^b\right) \leftarrow \left(U_3^a - C_3^a\right)\left(U_3^b - C_3^b\right)$

Where $U_t^a\left(X_t^a, L_t^a\right)$ and $U_t^b\left(X_t^b, L_t^b\right)$ are individual utility functions depending on the level of private consumption X_t^i and the amount of leisure time L_t^i, with *i=a,b*. V^a, V^b, W^a and W^b are so-called "maximum-Nash-solution functions" of the partners a and b at time t. C^a and C^b are the corresponding conflict payoffs. The conflict payoff as the solution to the maximization of single-state utility represents the maximum utility that could be achieved

[7] The exact age of distinction between stage 2 and stage 3 depends on the institutional circumstances regarding the amount of child care services provided publicly. Whereas U.S.-American studies often differentiate between families with pre-school children and those with children of school age, German families with children reaching school age certainly do not enter the third stage as this means even less institutionally provided child care than in kindergarten; here, the distinguishing age level has to be assumed much higher.

outside the partnership[8]. In other words, it reflects the opportunity costs of family life that are determined by individual productivity factors, such as wage rate *w*, household productivity *z*, and non-labor income *I*: $C^i\left(w^i, z^i, I^i\right)$.

The solution to the three-period model is derived recursively as follows:

Period 3: $max \quad \left(U_3^a - C_3^a\right)\left(U_3^b - C_3^b\right) \quad \rightarrow V^a, V^b$

Period 2: $max \quad \left(U_2^a + V^a - C^a\right)\left(U_2^b + V^b - C^b\right) \quad \rightarrow W^a, W^b$

Period 1: $max \quad U_1^i + W^i \quad$ for $i = a, b$

First, the conditional bargaining solution for period 3 will yield "maximum-Nash-solution functions" V^a and V^b which depend on time allocation decisions made in the preceding period. Using these indirect utility functions the decision problem of the second period will be solved, again providing "maximum-Nash-solution functions" W^a and W^b for this period. The same procedure is then repeated for the first period.

Period 3

$$max \quad N_3 = \left(U_3^a\left(X_3^a, L_3^a\right) - C_3^a\right)\left(U_3^b\left(X_3^b, L_3^b\right) - C_3^b\right)$$
$$= \left(U^a - C^a\right)\left(U^b - C^b\right)$$

$$where \quad X^a + X^b = X = X_M + X_H \quad \text{and} \quad X_H = Z\left(H^a + H^b\right)$$

$$subject\ to \quad T = M^i + H^i + L^i \quad \text{for} \quad i = a, b$$

$$and \quad w^a M^a + w^b M^b - X^a - X^b + Z\left(H^a + H^b\right) + I^a + I^b = 0$$

In this last period a static Nash-bargaining game has to be solved. The product of the individual cooperation gains is maximized with regard to private consumption X^i and leisure L^i, subject to budget and time constraints. The private consumption goods of the two partners can either be produced at home $\left(X_H\right)$ according to the household production function Z or purchased on the market. The total amount of market goods X_M must not exceed pooled household income generated by labor income $w^a M^a + w^b M^b$ plus non-labor income $I^a + I^b$.[9]

[8] It is assumed that such important decisions concerning labor force participation and home work justify the use of the divorce-threat model as opposed to fall backs with non-cooperative behavior.

[9] The price of the market good is set to unity.

Optimal time allocation in this static setting is known from traditional results, i.e. in equilibrium time is allocated among market work and household production according to the equality between the prevailing productivity factors w^i and z^i (with $z^i = \frac{\partial Z}{\partial H^i}$) and the marginal utility of leisure relative to that of consumption:

$$\frac{U_L^i}{U_X^i} = z^i = w^i .$$

As in the Beckerian framework different wages for men and women lead to specialization of the partners according to their comparative advantages.

The main distinction between this static bargaining model and the traditional model lies in the distribution of utility within the family. Whereas in the common preference theory the question of intrafamily distribution is simply ignored, here it is conditioned on the relative bargaining positions of the partners. Thus, a rise in *a* 's conflict payoff, e.g. due to an increase in this spouse's non-labor income, results in an intrafamily redistribution favoring *a*.

$$\frac{U_X^a}{U_X^b} = \frac{U^a - C^a}{U^b - C^b}$$

and

$$\frac{U_L^a}{U_L^b} = \frac{w^a}{w^b}\left(\frac{U^a - C^a}{U^b - C^b}\right) = \frac{z^a}{z^b}\left(\frac{U^a - C^a}{U^b - C^b}\right)$$

Period 2

The optimization problem of the second period is solved using the "maximum-Nash-solution functions" $U_{N3}^{a*} = U_3^a\left(X_3^{a*}, L_3^{a*}\right)$ and $U_{N3}^{b*} = U_3^b\left(X_3^{b*}, L_3^{b*}\right)$ from the bargaining game above. With $U_{N3}^{i*} = V^i\left(w_3^a, w_3^b, z_3^a, z_3^b, I_3^a, I_3^b\right)$, V^i is determined by time allocation decisions made in period 2 since wage rates and household productivities depend on learning effects from the prevailing time uses. Second period's time allocation is then optimized according to:

$$\begin{aligned} max \quad N &= \left(U_2^a + U_3^a - C^a\right)\left(U_2^b + U_3^b - C^b\right) \\ &= \left(U^a + V^a - C^a\right)\left(U^b + V^b - C^b\right) \end{aligned}$$

subject to budget and time constraints as above.

For the optimal level of M_2^a the following condition must be satisfied:

(1) $$\frac{U_L^a}{U_X^a} = z^a = w^a + \frac{1}{U_X^a}\left| \frac{\partial V^a}{\partial M_2^a} + \frac{\partial V^a}{\partial C^a}\frac{dC^a}{M_2^a} \right| + \frac{1}{U_X^b}\left(\frac{\partial V^b}{\partial M_2^a} + \frac{\partial V^b}{\partial C^a}\frac{dC^a}{M_2^a} \right|$$

If equality holds, time will be allocated among market work, work at home and leisure according to the marginal outputs of these time uses[10]. In contrast to the traditional framework the marginal output of labor is not confined to the hourly wage rate but also includes the impact of current labor force participation on next period's utility.

If the individual wage rate is positively related to the human capital accumulated, hence a function of the form $w_t = w\left(K, \quad {}_{t=1}^{t-1}M_t\right)$ with $\frac{\partial w}{\partial K} > 0$, $\frac{\partial^2 w}{\partial^2 K} < 0$, $\frac{\partial w}{\partial M_t} > 0$ and $\frac{\partial^2 w}{\partial^2 M_t} < 0$, the decision to work will have differing long-run effects: Due to a higher wage level an enlargement of the feasible consumption set, that is an outward shift of the utility possibility frontier, will result. Let us call this the pure frontier effect. At the same time a change of the conflict payoff will lead to a distributional bargaining effect. Both frontier effect and distributional bargaining effect arise from the impact of market work on own and spouse's future utility weighted by the reciprocals of the respective marginal utilities of consumption $\frac{1}{U_X^a}$ and $\frac{1}{U_X^b}$, respectively. Since time spent in the labor market typically has the described positive impact on future utility through a shift of the utility possibility frontier as well as an improved bargaining position, time is allocated to market work even at a wage rate much below household productivity. Hence, in comparison with traditional theory relatively more time will be dedicated to market work and less to household production. Even at $z = w$ a specialization in market work takes place. This is due to the asymmetry between the accompanying learning effects resulting from the lower marketability of household abilities. Or, in other words, the differing effects from investments in market-specific human capital and investments in family-specific human capital on bargaining power counter-effect the advantages of specialization.

Considering the long-run effects of time use, i.e. the marginal output of time spent in market production as opposed to time spent in household production, even different wage structures of men and women do not necessarily lead to complete specialization as would be the case in

[10] For simplicity the marginal benefit of household work is restricted to the actual household productivity *z* while paid labor also yields human capital effects. A consideration of human capital accumulation in household production, however, would not alter the results qualitatively as long as the human capital gained from specialization in the household is less marketable than the human capital accumulated in market work.

traditional theory. Instead, the interior solution of both partner's time being allocated to all different time uses, to paid as well as unpaid work in particular, that one observes in reality can now be explained.

Labor supply in the early family phase can be described as a function of both spouses' wages, household productivities, nonlabor incomes and outside options to family life:

$$M^i_2 = M^i\left(w^a, w^b, z^a, z^b, I^a, I^b, C^a, C^b\right) \quad \text{for } i=a,b.$$

Period 1

The optimization problem of the first period is solved using the "maximum-Nash-solution functions" $U^{a*}_{N2} = U_{a2}\left(X^{a*}_2, L^{a*}_2\right)$ and $U^{b*}_{N2} = U_{b2}\left(X^{b*}_2, L^{b*}_2\right)$ from the bargaining game above. With $U^{i*}_{N2} = W^i\left(w^a_2, w^b_2, z^a_2, z^b_3, I^a_2, I^b_2\right)$, W^i is determined by time allocation decisions made in period 1. Although partners have not met yet, they know that their expected utility will also be determined by their future partner's human capital investments in the first period where all potential matching partners are simply assumed to be equal. Now, first period's time use is optimized according to:

$$\begin{aligned} &\max U^i_1 + U^i_2 + U^i_3 \\ &\quad = U^i + W^i \\ \textit{subject to} \quad & T = M^i + K^i + L^i \\ \textit{and} \quad & w^i M^i + I^i - X^i \geq 0 \quad \textit{for} \quad i = a,b \end{aligned}$$

Since in the pre-family stage decisions on time use are made independently, individual maximization is now subject to individual budget constraints.

Optimal time allocation decisions have to meet the first order condition:

$$\frac{U^i_L}{U^i_X} = \frac{1}{U^i_X}\left| \frac{\partial W^i}{\partial K^i} + \frac{\partial W^i}{\partial C^i}\frac{dC^i}{dK^i} \right| \tag{2}$$

The amount of educational investment should be chosen so as to equalize the shadow price of time and the marginal benefit associated with an additional unit of schooling. Since human capital investment takes effect on future wage rates, the marginal output of education has two components: The first is the direct impact of education on utility possibilities, the frontier effect, the second is the distributional bargaining effect that arises from a change of the

individual conflict payoff. More human capital leads to higher returns from market work and thus improves the financial situation of the household as a whole. At the same time it strengthens the individual bargaining power through an improvement of the single state utility.

Due to these long-run effects of time use more human capital investment will typically result in comparison with traditional theory or even compared with the dynamic model of Lehrer and Nerlove which explicitly considers human capital accumulation.

2.1 Implications

Since in the family phase the distribution of utility within the household is uniquely determined by the utility possibility frontier of the two partners as well as their outside options, all decisions that affect these parameters are of great importance for the intrafamily allocation of time. The amount of human capital investment chosen by each individual in the first period of life will set the base for the family bargaining game in the following periods with regard to the origin of the feasible payoff space and the conflict payoff. Likewise, intrafamily time allocation in the second period has implications not only for that period's outcome but decisively determines the partner's bargaining positions in the next family phase (3rd period).

Pre-family human capital investment

There are two effects resulting from any change in human capital investment: a shift of the utility possibility frontier and an altered division of resources between the partners. Starting from a given optimal education level, i.e. for efficient choices in the pre-family stage, the frontier effect of an extra unit of schooling (see equation (2)) has to be zero. The distributional bargaining effect, however, induces a move along the efficiency frontier favoring a so that a has an incentive to overinvest in human capital compared to the household-efficient level K^{a*}. Overinvestment occurs as long as

$$\frac{dC^a}{dK^a} > \frac{\partial U^a}{\partial L^a} \tag{3}$$

that is, as long as, by accumulating an extra unit of human capital exceeding the efficient level, the improvement of a's bargaining position is higher than her utility loss from reduced

leisure time in period 1. This condition holds if optimal human capital investment as single is higher than within a family[11].

In traditional models no incentive for overinvestment exists. Since the outside option is neglected, the total effect of an extra unit of education would be zero[12]. The traditional result could therefore be considered as a special case of the bargaining approach where optimal human capital investment as single equals that within a family. Hence, education exceeding the optimal level would have no effect on the individual bargaining position.

As opposed to the human capital model by Lehrer and Nerlove (1981) where the optimal level of investment in human capital is a function of the extent to which this capital is utilized in the subsequent stages of life, here the human capital endowment serves for improving the individual bargaining position regardless of its actual utilization. In other words, the human capital endowment is employed rather implicitly than explicitly in the time allocation decision. It serves as a strategic variable in the family decision-making process.

Intrafamily labor supply

Rational individuals not only tend to overinvest in human capital at the pre-family stage but also have an incentive to choose suboptimal time patterns at the beginning of the family phase if this will improve their bargaining position in the following period[13]. Again, there are two effects arising from a change in second period's labor supply on the bargaining set of the late family phase: a shift of the utility possibility frontier and an altered division of resources between the spouses. Since for efficient choices the frontier effect equals zero, an additional unit spent in the labor force does not change the utility space but induces a move on the efficiency frontier towards a higher utility level for a. As we can see from equation (1) an oversupply of market work in the second period will occur if, starting from given optimal time allocation, an increase of one partner's labor force participation will raise his or her next-

[11] This implication corresponds with the results of Konrad and Lommerud's two-stage game of marriage (1996) where the wage rate is chosen non-cooperatively in the first stage and a Nash bargaining game between the partners is solved in the second stage.

[12] A question that also deserved empirical investigation would be: If, as it is not modeled here, investments in human capital also occur because children benefit from a higher educational level of their parents, do mothers and fathers invest differently in that kind of human capital that can be transmitted to children, such as e.g. humanities versus technical skills?

[13] This suboptimal time allocation in the early family phase or the underprovision of household production is comparable to the hold-up problem in industrial economics (see Grossman/Hart 1986 and Hart/Moore 1990). There firms hesitate to make relationship-specific investments due to the threat of expropriation.

period's conflict payoff (4) and if the distributional bargaining effect favoring his or her own future utility exceeds that of the spouse (5):

(4) $$\frac{\partial C_2^a}{\partial M_2^a} > 0$$

(5) $$\left| \frac{1}{\partial U_X^a} \frac{\partial V^a}{\partial C_3^a} \right| > \left| \frac{1}{\partial U_X^b} \frac{\partial V^b}{\partial C_3^a} \right|$$

The first condition holds if optimal labor supply as single is higher than within a family. In the traditional framework no incentive for oversupply exists. Since the outside option is neglected, the total effect of an extra unit of market work would be zero. The traditional result could therefore be considered as a special case of the bargaining approach where optimal time allocation as single equals that within a family. Hence, labor supply exceeding the optimal level would have no effect on the individual bargaining position. This would also be the case for a setting with binding long-term contracts between the partners, where the individual bargaining powers are assumed to remain unchanged regardless of the chosen time allocation in period 2. Thus the lack of distributional incentives would sustain an optimal level of labor supply. Unless binding long-term contracts can be made between the partners bargaining outcomes will be suboptimal with respect to time allocation and household production[14].

Due to intrafamily bargaining, individual optimization is not exclusively focussed on the maximization of family outcome but also on one's own share of that outcome. Since utility within a household is distributed according to the partner's external alternatives, time allocation decisions have to be made in the light of their effects on these external alternatives. Even though with the presence of small children in the early family phase more time devoted to household production, particularly a specialization of the partners, would be efficient in the short run, none of the partners will be willing to weaken his or her future bargaining position. As a result, not all production possibilities in the household can be exhausted. On account of educational overinvestment before and suboptimal time allocation within the early family phase the gains from specialization within the household will be less than those technically feasible. In the dynamic bargaining model with endogenously determined conflict payoffs paid labor serves as a strategic variable for intrafamily utility distribution.

[14] On a discussion concerning the enforcement of intrafamily agreements see Ott (1993).

2.2 Discussion of the theoretical results

In the model presented rational individuals tend to overinvest in human capital in the pre-family period. At the beginning of the family phase they also have an incentive to choose an amount of labor supply exceeding the optimal level or an amount of household production falling short of the optimal level, respectively, should this improve their bargaining position in the following period. Unless binding long-term contracts can be made between the partners, rational behavior always leads to inefficient outcomes with respect to time allocation and household production within the family.

One major implication of intrafamily bargaining concerns the estimation of labor supply. For the reasons just described, the decision to participate in the labor market in the dynamic bargaining approach is not only determined by productivity indicators, such as wage rates and household productivities, but also includes human capital accumulation as well as strategic aspects regarding the individual bargaining position. Allowing for strategic aspects in econometric specification will therefore lead to more satisfactory estimates of individual labor supply.

With its assumption about the time structure of life, this model admittedly describes an extreme case of family formation. Human capital investments are made before partners in life randomly meet and begin to raise families. Another extreme case of lifestyle would be the single state. Reality must lie somewhere in between these two cases. If a probability is assigned to each extreme, then an individual's expected lifetime utility takes some value weighted by the likeliness of these two lifestyles. As for the investment in education, if the probability of staying single is greater than zero and if the sufficient conditions for overinvestment hold, i.e. optimal human capital investments as single are higher than within marriage, even greater overinvestment will result. This is because no one can be sure that he or she will meet "Ms. or Mr. Right" and be able to take advantage from a cooperation surplus, especially that share generated by intrahousehold specialization. Thus, the finding of inefficient educational decisions remains, even in a more general version of the model.

3 Empirical implementation

In this section the strategic aspect of family time use decisions is implemented to estimate female labor supply, taking into account marital stability and the outside option to marriage as

determinants of female labor force participation[15]. The empirical implementation is thus focused on the impact of bargaining positions on time allocation in the early family phase taking human capital investments prior to family formation as given.

A number of studies investigated how divorce probabilities influence female labor supply decisions[16]. William R. Johnson and Jonathan Skinner (1986) accounted for the effect of marital stability on labor force participation in estimating a simultaneous model of future divorce probability and current labor supply for married women. Using 1972 data from the Panel Study of Income Dynamics (PSID) for couples who were married in that year and some of whom separated in the following 6 years, Johnson/Skinner's results support the hypothesis that subjective divorce probabilities increase labor supply. In a cross-national comparison Barbara Butrica (1998) finds large differences between the United States and Germany. Her estimates, based on the 1986 samples of the PSID and the German Socio-Economic Panel (GSOEP), suggest that the probability of divorce has no significant impact on labor supply or hours decisions of women in the U.S. whereas Germany very much resembles the Johnson-Skinner results from the U.S. in the 1970s. Kristian Bolin (1996) adopted a similar approach with Swedish data. He also included the risk of divorce as an additional regressor in his labor supply equation. Whereas Johnson/Skinner and Butrica estimated labor supply within marriage, Bolin was interested in labor supply at the time of marriage. His results also convey a significant impact of predicted divorce risks on female labor force participation.

It was McElroy (1990) who first suggested including "extrahousehold environmental parameters" (EEPs) in a nested testing of the Nash bargaining and the traditional household model. EEPs as indices of the control over resources outside the family (e.g. social networks or chances on the remarriage market) are determinants of the threat points. In other words, they serve as shifters of the threat points and as such help to explain time allocation in general and labor supply in particular. Since in the unitary model the opportunity costs of being married are not relevant, a statistical link between EEPs and intrahousehold allocation would provide evidence to reject its restrictions. Examples of EEPs include a country's legal structure governing marriage and divorce or the conditioning of governmental transfers on

[15] Theoretically, male labor supply is subject to these strategic considerations just as well. Practically, however, men's working hours show much less variation than women's. Since the model proposed has in any case initially been chosen to motivate the observation of married mothers' labor force participation, the empirical analysis will be restricted to women only.

[16] See Bolin 1997, Butrica 1998, Gray 1998, Haurin 1989, Johnson and Skinner 1986, Parkman 1992, Peters 1986.

marital status. As a consequence, a considerable extent of research has been focussed on the impact of divorce laws and marital-property laws on household behavior.

Carlin (1991) investigated the effect of EEP variations on U.S.-American couples' time use decisions. Interestingly, women living in states with more generous divorce settlements were found to invest more in their human capital by increasing education and working time at the expense of home production and leisure. Using 1979 U.S.-data the articles by H. Elizabeth Peters (1986) and Allen M. Parkman (1992) both conclude that the introduction of unilateral divorce has increased the labor force participation rate of married women. But whereas Peters attributes this response to the lack of compensation for marriage-specific investment at divorce that creates an incentive for married women to increase their marketable capital, Parkman brings up the lack of compensation for married women's reduced human capital. He finds a greater effect of unilateral divorce on the labor supply of younger and better educated women who would experience larger reductions in their future earning capacity should they reduce their participation in the labor force. Although Parkman implicitly considers the dynamic effects of human capital loss for married women, overall the cited studies restrict their analysis to the relationship between labor supply and the risk of divorce as such rather than the impact of the external alternative or outside option to family decision making, i.e. the impact of the underlying bargaining power.

Jeffrey S. Gray (1998) accounts for the relevance of the wife's bargaining position when investigating U.S. married women's labor supply behavior with a change in marital property laws. A state's adoption of unilateral divorce can be interpreted as an exogenous and unexpected shift of the EEPs of family life. In contrast to Peters and Parkman he finds that unilateral divorce as opposed to mutual-consent divorce has no impact on married women's labor force participation unless the underlying marital-property laws in each state are also considered (1998: 629). By analyzing exogenous changes of EEPs, Gray concludes that the wife's labor supply is an increasing function of her bargaining position within marriage.

In this study the empirical application of bargaining power in family decision making is further developed: Women's expected outside options are estimated and their impact on female labor supply are investigated to directly test the theoretical relationship derived in the dynamic bargaining model above, using the concept of a "virtual conflict payoff".

3.1 The virtual conflict payoff

The concept of the "virtual conflict payoff" accounts for the endogeneity of individual bargaining power with regard to time use decisions, particularly labor force participation. It is due to the fact that everybody has some outside option to family bargaining regardless of whether it will ever be realized or not. Whereas for separating couples we are able to observe their economic performance after a break-up and, thus, a realization of their outside options to family life, for intact partnerships we do not observe anything about the spouses' conflict payoffs. The basic idea here is to apply whatever can be observed for separating spouses to the non-separating ones in order to generate that may be called a "virtual conflict payoff" for each person no matter whether a household dissolution will actually take place or not. The impact of the virtual or expected conflict payoff on individual time allocation can then be examined. In other words, the strategic aspect to female employment that has been derived in the theoretical model can be investigated empirically. Allowing for human capital and other individual endowment factors, the individual outside option is chosen as an additional determinant of the supply of labor. In this way we extend the conventional estimation of female labor supply by a strategic element[17].

3.2 Data set and sample characteristics

To explore the relationship between female labor supply and marital stability in Germany data from the German Socio-Economic Panel (GSOEP)[18] has been used. As an individual household micro-data panel the GSOEP is a rich data source for analyzing labor force participation by means of various individual as well as household characteristics. The empirical results to be presented here are based on data from the West German sub-sample of the GSOEP covering the years from 1985 to 1997. Making use of the panel structure of the data, the long-term impact of the risk of divorce on current labor supply is accounted for: a cross-section sample of couples that have been married in 1985 (2nd wave of the GSOEP) is analyzed having additional information on their marital status as well as their economic status

[17] The simultaneous modeling of time allocation decisions and household dissolution characterizes an extension of the conventional estimation procedures for female labor supply (for an overview of the empirical literature see e.g. Layard/Barton/Zabalza 1980, Killingsworth 1983, Killingsworth/Heckman 1986, Mroz 1987 and Blundell/MaCurdy 1998).

[18] For more information on the GSOEP see Wagner/Burkhauser/Behringer (1993) and Projektgruppe Sozio-oekonomisches Panel (1995).

in the twelve subsequent years until 1997. To maximize the number of observations we use an unbalanced panel, taking account of data censoring.

The analysis is restricted to German couples with the wife not younger than 20 and not older than 45 years of age (to roughly cover the early-family-phase age) and the husband between 20 and 55 years (to prevent the results from being excessively affected by retirement behavior). It is further restricted to couples where both spouses have completed their schooling or apprenticeship in 1985, in order to confine the analysis to time allocation decisions made in the second period when (according to the theoretical model) human capital investments in education have already been completed. As we are interested in the labor force participation of dependent employees only, all self-employed are dropped as well as all those working in the farming sector. Observations with missing data on any of the explaining variables have also been removed. The final sample consists of 751 couples, 94 of whom separated or divorced in one of the subsequent years[19], 432 of whom remained married during the following 12-year period (balanced panel) and 225 of whom dropped out of the sample eventually (unbalanced panel).

In Table 1 the summary statistics of the two sub-samples, based on women with high marital stability versus separating women, are listed. The two groups reveal great differences in their human capital endowment, their current labor force participation and in personal characteristics regarding marital background variables. The average non-separating couple is older than a separating couple[20] and it got married at a slightly older age. Also the share of first marriages is substantially higher with stable partnerships.

Non-separating women are on average less educated (i.e. less years of schooling), have less work experience in full-time and part-time employment during marriage and their current labor force participation and monthly work hours are lower than those of divorcing women. Their husbands, on the contrary, have more work experience and are currently working to a higher extent than their separating counterparts. The presence and the age of children do not

[19] The sample is not limited to "complete" couples, though. In other words it partly consists of women whose husbands have left the panel at some stage and it includes men whose wives did not participate in the interviews during the whole time period. To be precise, information on 432 women living in stable marriages and 94 separating women is used together with the observations of 427 non-separating and 86 separating men.

[20] Of course, this pattern is a rather mechanical one: In a given population the average age of a couple to be separated is always lower than the overall age mean of couples, since the proportion of unstable marriages decreases over time.

make a big difference as we are comparing couples' characteristics at year 1985 when separation might still be a number of years ahead.

Table 1: Sample characteristics in 1985

	Non-separating Sample		Separating Sample	
	Mean	(Standard deviation)	Mean	(Standard deviation)
Age wife	33.28	(6.42)	30.69	(6.63)
Age husband	35.90	(5.96)	33.57	(6.92)
Years of schooling wife	10.96	(1.81)	10.96	(1.96)
Years of schooling husband	11.77	(2.51)	11.08	(2.14)
Current labor force participation wife (%)	0.44	(0.50)	0.49	(0.50)
Current labor force participation husband (%)	0.88	(0.32)	0.83	(0.38)
Hours of work wife	13.3	(16.66)	15.87	(17.03)
Hours of work husband	38.04	(9.00)	36.55	(12.13)
Work experience while married, wife (%)	0,56	(0,37)	0.61	(0.38)
Work experience while married, husband (%)	0,88	(0,22)	0.89	(0.22)
Dummy First marriage	0.92	(0.27)	0.89	(0.31)
Years married	10.74	(6.27)	8.66	(6.23)
Age at marriage wife	22.51	(3.90)	22.03	(4.38)
Age at marriage husband	25.13	(3.98)	24.91	(4.62)
Dummy Child < 16 years	0.77	(0.42)	0.79	(0.41)
Age of youngest child (<16 years)	6.58	(5.01)	5.45	(4.51)
n	432		94	

Data source: German Socio-Economic Panel 1985-1997.

Overall we can say that differences with regard to human capital endowment and labor force status are smaller among separating spouses. Female and male education, work experiences, current labor force participation and hours of work are generally more equated in the separating subgroup. These complementarities within "stable" couples might be an indication for the Beckerian argument of comparative advantages. That is, with diminishing gender differences the returns from specialization within the household are losing importance. For the separating sub-sample the gains from staying married will turn out to be lower on average.

As a first finding we may note that the descriptive statistics provide a weak support of the insurance aspect to female employment derived above.

3.3 Female labor force participation with virtual conflict payoffs

The labor supply function to be estimated is specified according to the following equation:

$$M_i = X_i' \beta + C_i^{*\prime} \gamma + \varepsilon_i \quad i = 1,..,N$$

where X_i is a vector of variables commonly used as regressors in an estimation of labor supply (consisting of education, age, previous work experience, children, household nonlabor income and husband's earnings). According to the model the bargaining position is included as a vector C_i* containing a set of (latent) bargaining variables. The effects of omitted variables are represented by the random error term ε_i.

3.4 Bargaining variables

In the theoretical model presented above family partners bargain over the distribution of utility according to their relative bargaining positions. But how is this bargaining power determined empirically, in every day life so to speak? Presumably there is nobody explicitly computing his or her conflict payoff to be realized in the case of a divorce. In a more subtle way, however, every person becomes aware of conflict payoff measures when observing friends, relatives or neighbors who separate. One might argue that each individual applies such a bargaining measure to his or her own situation, given individual human capital endowment, household characteristics and extra-household environmental parameters (EEP). In other words, it is the perceived bargaining power drawn from personal observations and expectations that we suspect to affect intrafamily decision making. Next those bargaining variables will be introduced that are assumed to characterize the perceived bargaining power and used as explanatory variables in the final labor supply estimation.

1) The probability of divorce

Since the empirical studies cited above and the descriptive statistics above suggest that a wife's probability of divorce is related to her labor supply decision, we will include the individual probability of divorce in the estimation of female labor force participation. A duration model for marital stability will be estimated to provide individual hazards for divorce conditional on the tenure of marriage. The cumulative divorce probability for the subsequent ten-year period will be used as one of the explaining variables representing perceived bargaining power in the labor supply equation.

2) The conflict payoff measure

In order to consider the individual outside option in the labor supply equation, expected conflict payoffs have to be generated for those spouses who do not separate within the sample period and hence do not yield any information on their fall back position explicitly. Consider a payoff equation for the latent conflict payoff c_i* of the form

$$c_i^* = \tau \cdot Z_i + u_i \quad i = 1,..,N$$

where Z_i is a vector of variables observed for all divorced men and women, including the tenure of marriage, human capital and other socio-demographic and household variables, and u_i is a mean zero normally distributed random error term representing the effects of unobserved factors. Since c_i* is only known for the separating subgroup (d=1), one observes:

$$c_i = c_i^* \qquad if \ d = 1$$
$$c_i = 0 \qquad if \ d = 0$$

The conflict payoff actually drawn from the separating group is computed as the monthly adjusted equivalent income in the second year after break-up according to inc_e=hhinc/(hhsize)$^{0.5}$. Hence, household income is divided by the square root of the number of household members to roughly allow for economies of scale in household consumption. Since during the twelve months following a separation entitlements to transfer payments have in most cases not been settled yet, reported incomes turn out to be subject to heavy variation. Therefore the second year's financial status (after separation) is used as a more robust measure of a spouse's conflict payoff[21].

Since the group of separated respondents might differ from the group of still married spouses on account of unobserved variables, the problem of sample selection bias should be carefully considered when assigning conflict payoffs to non-separating wives and husbands. Otherwise the use of predicted conflict payoffs obtained from an Ordinary Least Squares (OLS) estimation based on separating respondents only, might result in inconsistent parameter estimates due to sample selectivity problems. Therefore, the Heckman procedure for selectivity bias-corrected estimations (Heckman 1979, 1980) should be applied to the

[21] It could be argued that a woman's individual income rather than her share of the household income represents her conflict payoff in case of a divorce. On the other hand, the measure used should account for the possibility of a new partnership and the accommodating financial resources that are part of the EEPs.

estimation of consistent conflict payoffs. When applying the two-stage Heckman procedure to the estimation of conflict payoffs, however, no robust estimation results could be obtained due to collinearity problems and the very small sample size of separating couples (n=94 or 86, respectively). As simulation studies show (Puhani 1997, Rendtel 1992), in those cases sub-sample OLS still turns out to be the most robust estimator. As a consequence, we estimate conflict payoffs using the sub-sample of separating couples. Once the payoff estimation coefficients have been obtained, virtual conflict payoffs can be predicted for the whole sample and for every subsequent year, based on the respondents' socio-demographic characteristics. This virtual conflict payoff, averaged over the ten-year period with the weights according to the conditional divorce probabilities, is then used within the set of explaining variables for perceived bargaining power in the labor supply equation.

3) Relative bargaining power

Relative bargaining power within the household as a determinant of the strategic supply of labor can enter the estimation equation in various ways. In the theoretical model it is the relative bargaining coefficient, reflected by one partner's gain from bargaining divided by that of the other spouse, which conditions the individual time use decision. In the empirical analysis we therefore also use a relative measure of individual bargaining power, namely the ratio of the wife's and the husband's average predicted conflict payoffs to capture strategic behavior within the household.

This way the wife's bargaining position enters her labor force participation equation in a two-folded manner, with an absolute term reflecting the *absolute level* of her bargaining position and with a relative term reflecting her *comparative* bargaining position within the household.

3.5 Estimation procedure

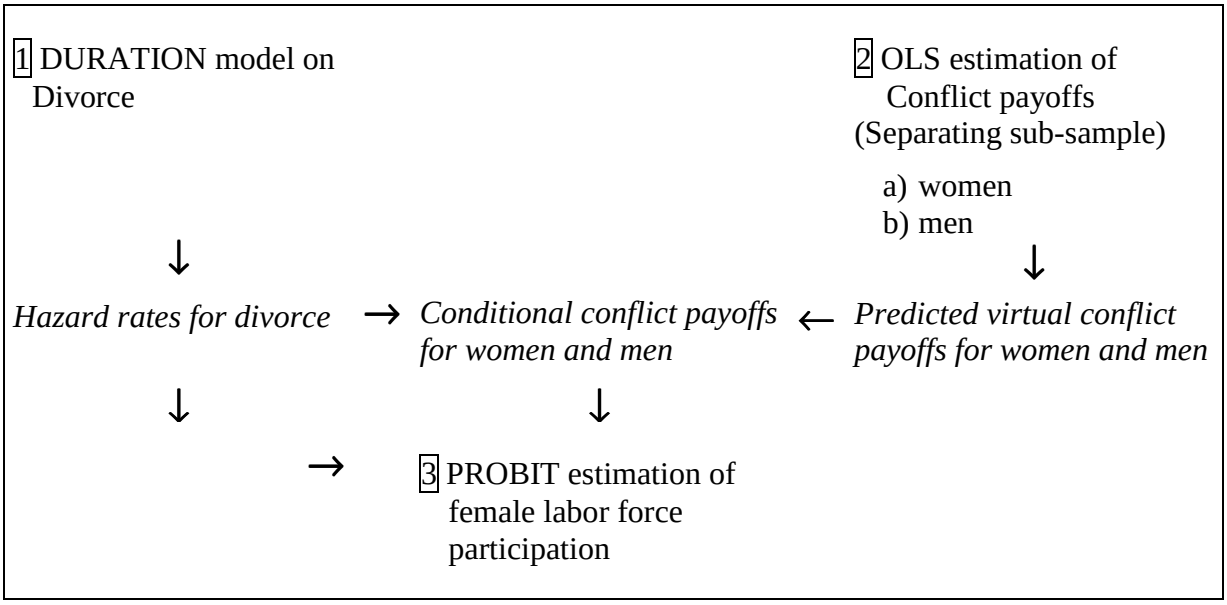
The resulting three-step estimation procedure is performed as displayed in Figure 1: In the first step a loglinear duration model (Weibull model) on marital "survival" or stability is estimated for the full unbalanced sample of all married couples. The effect of a set of exogenous variables y_i on the hazard function can be formalized by writing (Diekman and Mitter 1984, Greene 1993):

$$r(t) = \lambda p \cdot (\lambda t)^{p-1}$$

with $\lambda = e^{-\beta' y_i}$.

The resulting hazard rates yield probabilities of divorce conditional on the tenure of the marriage. Hence, divorce probabilities can be predicted for each spouse for each year of his or her (average) remaining lifetime.

Figure 1: Three-step estimation procedure



In the second step male and female OLS conflict payoff equations are estimated using the separating sub-sample only. Average expected conflict payoffs are then computed for all men and women weighted by the hazards of divorce. Together with the cumulative individual probability of a separation within the next ten-year period these conditional conflict payoffs are in the third step entered as imputed variables into the Probit estimation of labor force participation.

3.6 Empirical findings

The estimation of the loglinear duration model reveals that marital stability is significantly higher the greater the difference in husband's and wife's educational backgrounds. It is also higher for first marriages (Table 2).

Table 2: Step 1 - Duration model for marital stability

Weibull model (n_w=1065)	Coefficient estimate	Standard error
Years of schooling wife	-0.003	0.569
Difference in years of schooling husband-wife	**0.125**	0.040
Age at marriage wife	0.019	0.019
Difference in age at marriage husband-wife	0.023	0.018
First marriage - dummy	**0.715**	0.263
σ	**0.660**	0.073
Constant	**3.322**	0.564
- Log Likelihood	418	

Shaded coefficients are significant at the 10%-level, bold coefficients at the 5%-level.
Data source: German Socio-Economic Panel 1985-1997.

The level of schooling and the spouses' age difference, in comparison, are not statistically significantly related to separation in this model. The coefficient estimate for $\sigma = 1/p < 1$ indicates that the hazard function of divorce is monotonically increasing with the years of marriage[22]. Since $p \neq 1$, the Weibull model does not collapse to the exponential model with a constant hazard rate. Given the estimated coefficients we can now compute conditional probabilities for each individual to have a divorce in any of the subsequent years and derive a cumulative divorce probability for the following ten-year period.

The second-step coefficient estimates for the conflict payoff equation are listed in Table 3. For illustrative purposes, the results presented here are based on a more extensive specification of the conflict payoff. The predicted values for the full sample will be derived from a subset of these explanatory variables to reduce multi-collinearity problems in the preceding steps.

Here the conflict payoff measure has been regressed on human capital variables and household characteristics. Equations for women and men have been estimated separately to take account of gender differences. Indeed, the conflict payoff determination of women and men turns out to differ substantially as can be seen with the coefficient estimates. Whereas the outside option for married men is positively related to their own work experience at the year

[22] To illustrate, an average couple faces a *conditional* probability to have a divorce in the next year (i.e. 1986) of 0.1%, the conditional probability for a divorce in the tenth year (1995) is 1%, for the 30st year it amounts to 1.7%.

preceding separation and inversely related to the years already married, women's conflict payoffs are higher if their partners have worked part-time, with a better household's financial status and if they are re-married to a new partner after divorce.

Table 3: Step 2 - OLS estimation of the conflict payoff

OLS (n_w=94/ n_h=86)	**Conflict payoff**			
	Wife		**Husband**	
	Coeff.estimate	Standard error	Coeff.estimate	Standard error
Age	-7.67	16.99	-32.17	31.94
Education	51.39	39.64	**118.19**	66.42
Work experience full-time	-4.08	17.54	**64.88**	33.65
Work experience part-time	-10.35	19.62	**652.85**	172.87
Work experience full-time, partner	13.33	39.21	49.21	28.84
Work experience part-time, partner	**242.24**	77.66	-4.62	31.77
Total household income	**161.67**	56.05	171.13	103.20
# of household members	-125.40	70.48	-31.68	112.84
Years married	11.32	41.18	**-3.82**	1.29
New partner after separation	**650.47**	179.47	-176.75	385.04
Constant	708.60	608.89	672.97	1007.4
Adjusted R^2	0.24		0.33	

Data source: German Socio-Economic Panel 1985-1997.
Note: Shaded coefficients are significant at the 10%-level, bold coefficients at the 5%-level.
The conflict payoff is computed as monthly equivalent income in the second year after separation.

Separating couples might still differ from non-separating in a systematic way that is not independent of conflict payoffs. As mentioned above, data constraints prevent us from using the Heckman procedure to correct for a potential selection bias. The last variable, indicating whether the divorcee is living with a new partner, has been included to capture at least part of this selection rule that cannot be explained by the human capital variables used.

In order to compute the expected conflict payoff, those characteristics that are strictly monotonically increasing over time, such as age and the tenure of marriage, are appropriately adjusted, whereas variables such as total household income and number of household members are set constant (static expectations). Work experience is also reassessed according to the present (i.e. 1985) labor force status. The final conflict payoff measure is then computed as the weighted average of expected future conflict payoffs, with the weights according to individual divorce probabilities in all years. To predict conflict payoffs for the

non-separating sample a subset specification is used to minimize multi-collinearity problems later on[23].

Table 4: Step 3 - Female labor force participation

PROBIT (n_w=751)	**Labor force participation – marginal effects**			
	Model I	Model II	Model III	Model IV
Constant	-0.1143 (0.1923)	-0.1090 (0.1923)	-0.2001 (0.1971)	0.2814 (0.2256)
Human capital variables				
Years of schooling	0.042 (0.0119)	0.0364 (0.0124)	0.0208 (0.01305)	0.0086 (0.0135)
Job experience (hypothetical)	0.0406 (0.0165)	0.0397 (0.0165)	0.03311 (0.0168)	0.0165 (0.0173)
Job experience squared (hypoth.)	-0.0012 (0.0005)	-0.0013 (0.0005)	-0.0011 (0.0005)	-0.0009 (0.0005)
Household characteristics				
Household nonlabor income/1000	-0.0483 (0.0314)	-0.0429 (0.0315)	-0.0347 (0.0313)	-0.0669 (0.0323)
Husband's labor income/1000	-0.1045 (0.0232)	-0.0951 (0.0239)	-0.1735 (0.0302)	-0.1494 (0.0304)
Dummy child<16 years	-0.3093 (0.0724)	-0.3178 (0.0726)	-0.3006 (0.0735)	-0.2678 (0.0746)
# children <6 years	-0.2308 (0.0410)	-0.2280 (0.0411)	-0.1713 (0.0427)	-0.2052 (0.0437)
# children 6-16 years	-0.0648 (0.0351)	-0.0684 (0.0353)	-0.0364 (0.0364)	-0.0372 (0.0364)
Bargaining variables				
Probability of divorce		0.5954 (0.3585)	0.6015 (0.3617)	0.9004 (0.3715)
Conflict payoff /1000			0.3145 (0.0679)	0.4760 (0.0762)
Relative bargaining power				-0.8788 (0.1939)
- Log Likelihood	423.24	421.89	411.12	400.52

Data source: German Socio-Economic Panel 1985-1997.
Note: Standard errors in parentheses. [24]

The nested Probit estimation of female labor force participation in the third step (see Table 4) reveals that the decision to work is significantly positively related to the probability of divorce

[23] For the final conflict payoff equation (for men) age, years of schooling, years in fulltime employment, wife's work experience in fulltime and part-time and the number of household members are included as explanatory variables (R^2=0.36). For women age, years of schooling, husband's work experience in part-time, total household income, the number of household members and a dummy for a new partner are used (R^2=0.27).

as well as to the absolute size of the wife's expected conflict payoff and it is inversely related to her relative bargaining power even when controlling for variables indicating her own and her husband's human capital endowment, the opportunity costs of market work (measured by the presence and age of children) and household non-labor income.

Introducing the cumulative probability of having a divorce within the next ten years in Model II, leaves the coefficient estimates of the standard participation model (Model I) substantively unchanged. The divorce probability alone, however, has hardly any effect on female employment. If one accepts a standard error that amounts to 0.6 of the coefficient estimate, the likeliness of a separation is positively related with women's decision to take up gainful employment. Economically speaking women with unstable marriages are more likely to be working (out of insurance considerations) than women who are living in stable relationships. If the probability of divorce is raised by ten percentage points, labor force participation will increase by 6%.

When in addition the wife's expected conflict payoff, averaged over a period of ten years, is included (Model III), we see that, while the coefficient for divorce probability remains unchanged, female employment becomes more likely the greater the size of the outside option to marriage. A 100-German-Marks rise of the conflict payoff is associated with a 3% higher probability to supply labor to the market. Interpreting this result in accordance with the dynamic model would imply that married women supply labor in order to enhance their future conflict payoff as well as their bargaining power within the household.

As can be seen from the sizes of the standard errors, one might suspect the presence of multi-collinearity between the conflict payoff measure and education as well as one of the children variables, though. The estimates for the variable counting the number of children aged 6-16 in the household suggest that, where children have a negative impact on mothers' employment, strategic considerations lead to an ever higher participation probability of these women.

Including all bargaining variables as explanatory variables in the last model reveals the great impact of a woman's perceived bargaining power on her labor force participation decision. The relation between participation and the ratio of wife's and husband's conflict payoffs is a statistically negative one, i.e. women with weak bargaining positions in comparison to their

[24] Due to the introduction of imputed variables the standard errors of the probit-estimates have to be interpreted very carefully. Therefore I will not refer to the T-statistics since they might not provide reliable values in order to reject the H_0-hypotheses accurately.

partners seek to keep their human capital (or bargaining power) from depreciating. Labor force participation gives them the opportunity to reach a certain level of conflict payoff and thereby insures against the risk of divorce or the risk of a renegotiation of utility distribution in the late family phase.[25]

In summary, these results indicate that female labor supply can be, at least partly, led back to strategic considerations regarding the individual future bargaining position. The more unequal a couples' (future) bargaining powers the higher is the wife's incentive to improve her relative bargaining position by staying in the labor market. That is, a woman's relative bargaining position, i.e. the expected relative attractiveness of her own external alternative with respect to that of her partner, significantly determines her employment decision. As predicted by the dynamic bargaining model, the impact of the conflict payoff results in higher labor force participation due to a lower reservation wage level. The insurance aspect is most important for women with poor bargaining positions.

4 Conclusions

In the theoretical model presented, rational individuals would be expected to overinvest in human capital in the pre-family period. At the beginning of the family phase they have an incentive to choose an amount of labor supply exceeding the optimal level or an amount of household production falling short of the optimal level, respectively, should this improve their bargaining position in the following period. Unless binding long-term contracts can be made between the partners, rational behavior always leads to inefficient outcomes with respect to time allocation and household production within the family. By taking into account the dynamic implications of different time uses, it turns out that market labor can also be supplied out of strategic reasons. It serves as an insurance against the loss of bargaining power or the risk of divorce.

The empirical results confirm the hypotheses derived for the early family phase: according to the theoretical model, a woman's relative bargaining power, measured as the ratio of her own and her husband's virtual conflict payoffs, is negatively related and the size of her conflict payoff as well as her individual probability of divorce are positively related to her labor force

[25] The schooling variable, however, seems to reflect an endogeneity problem and so does job experience in Model IV: the interdependencies between the human capital variables and an endogenously determined

participation. It seems that by staying in the labor market married women intend to keep their human capital and, thus, their bargaining power from depreciating. Labor force participation gives them the opportunity to reach a certain level of conflict payoff. Thus the estimation of labor supply with fitted conflict payoffs derived from payoff equation estimates supports the bargaining argument of a strategic aspect to female employment. As Gray (1998) stated for the U.S., this paper leads to the conclusion that wives' labor supply is an increasing function of their (expected) bargaining position within marriage, if measured in absolute terms. The relative bargaining position has an inverse effect on labor supply, meaning that women with weak bargaining power are more likely to enter employment (as an insurance) even when controlling for other household income.

Public policy could be usefully aimed at reducing any asymmetries in bargaining positions of women and men. As these asymmetries are mainly caused by different accumulations of human capital a possible policy measure would be to grant both spouses joint property rights not only to financial capital but also to *human capital* accumulated during marriage. In case of a divorce the partner with the higher marketable human capital endowment would have to share in the returns to that stock. Such an alimony regulation would help to compensate the asymmetric effects of specialization within the household.

Another starting point would be to prevent the uneven development of relative bargaining positions in the first place. That is to prevent asymmetric loss of human capital associated with raising a family. Effective family policy should provide conditions and incentives that allow both father and mother to combine family work and a job career. Subsidized or free child care services as well as flexible work hours would encourage couples to choose more symmetric time uses.

It could now be argued that what has been interpreted as strategic behavior within the household might in fact simply be strategic behavior versus the labor market, that women seek to maintain a certain level of human capital regardless of any "strategy" versus their partners. Indeed, the positive relation between female labor supply and the absolute conflict measure does not allow us to distinguish a wife's insurance against divorce from an insurance against human capital depreciation in general. The ratio of conflict payoffs, however, solely reflects a wife's bargaining position relative to that of her husband and thus unambiguously provides an indication of strategic behavior *within* the household.

conflict payoff might therefore result in biased coefficient estimates.

It might further be argued that in face of the German legal structures for marriage and divorce and the primary earner's obligation to pay maintenance to the former spouse after a separation, women do not need an additional insurance against the risk of divorce. There are two ways to reply to this point. First, the size of the maintenance payment is related to the former husband's earnings, whereas the extent of the woman's human capital depreciation is totally neglected. The ex-wife receives a certain fraction of his earnings but she is not compensated for the loss in marketable human capital that resulted from her staying home and that has a long-reaching impact on her future income potential. Second, maintenance payments in Germany are subject to the employment status of the wife prior to divorce. Entitlements are much more favorable if the wife has been working at least some hours than if she has not worked (for pay) at all. This regulation even suggests another strategic element for supplying labor within marriage.

5 Further research

In this paper on female employment a first step towards an econometric implementation of a dynamic bargaining model of family decision making has been presented. There are several directions in which this line of research could be profitably extended.

First, joint estimation of both the participation equation and an hours worked equation is desirable. One might attempt a procedure that controls for the selectivity bias of participation: From the probit estimates the inverse Mills ratio λ of participation could be computed and added to an OLS wage equation for workers only. Fitted values for wage rates derived from the selectivity bias-corrected wage equation estimates (step 4) together with the predicted conflict payoffs would be included in an additional step: an OLS regression on hours worked, again based on the restricted sample of employed women only (step 5). Thus the final labor supply estimation would then use two (sets of) imputed variables, the virtual wage rate and the virtual conflict payoff. However, preliminary results from an application of this procedure revealed severe multi-collinearity problems when using fitted conflict payoffs together with fitted wage rates as explaining variables in the hours equation. Further research should be dedicated to better empirical modeling of the participation decision to get around the collinearity problems.

Second, better estimates of the divorce probability are needed to be able to derive reliable selectivity corrections for the estimation of conflict payoffs. This is a problem of data constraints. A more detailed variable set including a wide range of questions on this subject would enable us to estimate labor supply with both selectivity corrected wage rates and selectivity corrected conflict payoffs. The selection rules of participation and divorce could then be controlled for.

Finally the results could be confirmed (or possibly rejected) by applying panel econometric techniques. In a panel estimation with fixed or random individual-specific effects one could test whether bargaining positions still matter for the employment decision once individual heterogeneity is controlled for.

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