Chapter 3

THE FORMATION AND DISSOLUTION OF FAMILIES: WHY MARRY? WHO MARRIES WHOM? AND WHAT HAPPENS UPON DIVORCE

YORAM WEISS*

Tel-Aviv University

Contents

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1. Introduction

This survey summarizes the main ideas that economists bring to the analysis of marriage and divorce. It is fair to say that most of the work on these issues has been done outside economics. The new perspective of economists is that marriage, when viewed as a voluntary union of rational individuals, is subject to the same tools of analysis as other economic phenomena. In particular, economists rely heavily on the similarity between the job market, where workers and firms combine to produce marketable goods, and the marriage market where husbands and wives combine to produce nonmarketable household goods. In both cases the forces of competition determine the assignment and the associated division of the proceeds between the partners.

As usual, analogies can be extremely helpful or totally misplaced. In this survey applications of simple economic analysis are presented. The intention is to illustrate how economists think about the issues of marriage and divorce. However, economic considerations do not dominate the picture. A successful theory which is capable of explaining the data on marriage and divorce must incorporate ideas from sociology biology and other fields. Yet, an understanding of the economic point of view can be helpful in the construction of a unified approach.

This survey does not enumerate individual contributions and does not provide an exhaustive list of empirical facts. Instead, the reader is exposed to the main ideas in an integrated fashion, using simple models. Empirical findings are mentioned, briefly, only to the extent that they bear on these ideas. Such a presentation of the literature can be useful to students and researchers who are curious about what can economics say on "noneconomic" subjects such as marriage and divorce (Becker, 1991). Mortensen (1988) provides an excellent survey of part of the material. A recent survey with similar objectives but somewhat different coverage than the present one is Cigno (1991). Several aspects of the interactions between the labor and marriage markets are discussed by Grossbard-Shechtman (1993).

2. Economic reasons for marriage

From an economic point of view, marriage is a partnership for the purpose of joint production and joint consumption. The production and rearing of children is the most commonly recognized role of the family. But there are other important functions:

(1) Division of labor to exploit comparative advantage or increasing returns. For instance, one partner works at home and the other works in the market.
(2) Extending credit and coordination of investment activities. For example, one partner works when the other is in school.
(3) Sharing of collective (nonrival) goods. For instance, both partners enjoy the same child and share the same home or the same information.

(4) Risk pooling. For example, one partner works when the other is sick or unemployed.

None of the above must really happen within families. If all goods and work activities are marketable, there is no need to form marriages to enjoy increasing returns or to pool risks. In fact, the role of the family varies depending on market conditions and vice versa. For instance, with good medical or unemployment insurance one does not need to rely on one's spouse. Sex and even children can be obtained commercially. Nevertheless, household production persists because it economizes on search, transaction costs and monitoring. However, to fully exploit these advantages requires a durable relationship. This shifts attention to the question which types of partnerships are likely to last.

Gains from human partnerships need not be confined to a couple of the opposite sex. One also observes "extended families" of varying structures which coordinate the activities of their members and provide self-insurance. The prevalence of male–female partnerships has to do with sexual attraction which triggers some initial amount of blind trust. (The Bible is quite right in puzzling over why "shall a man leave his father and mother and cleave unto his wife".) Equally important is a strong preference for own (self-produced) children. These emotional and biological considerations are sufficient to bring into the family domain some activities that could be purchased in the market. Then, the accumulation of specific "marital capital" in the form of children, shared experience and personal information increases the costs of separation and creates incentives for a lasting relationship. In this sense, there is an accumulative effect where economic considerations and investments reinforce the natural attachment. Other glues, derived from cultural and social norms also support lasting relationships. But in each case customs interact with economic considerations. The weaker the market, the more useful is the extended family, and social norms (commands) are added to the natural glue.

Some simple examples are provided which illustrate the potential gains from marriage.

2.1. *Increasing returns*

There is a household production function where purchased goods, x, and time spent at home, t, are combined to produce a commodity, z, which can be consumed and transferred within the household but cannot be sold. Since it takes about the same time to produce a meal for two as for one, using twice the materials, we shall use a production function of the form

$$z = xt. \tag{2.1}$$

This production function displays increasing returns to scale in the sense that doubling all inputs raises output by a factor of four. However, increasing returns do not cause indeterminacy of household actions because household time cannot be bought directly. The only way to get more household time is to work less in the market. Therefore, it is not feasible to increase both x and t.

For a single person we can assume, without loss of generality, that utility is measured by total output. His objective, therefore, is to maximize z. If we use the budget constraint

$$x = wh, \tag{2.2}$$

and the time constraint

$$t + h = 1, \tag{2.3}$$

we see that a single person will choose $t = h = 1/2$, resulting in optimal output $z^* = w/4$.

Now consider a marriage between two people a and b with wages w_a and w_b, respectively. Assume that each person's utility is simply his share, z_i in total family output. In this case, the household's objective will be to maximize the joint output

$$z = [(w_a(1 - t_a) + w_b\,(1 - t_b)](t_a + t_b). \tag{2.4}$$

Observe that total output is determined by the aggregate time spent at home by both partners and the total amount of goods purchased by the family in the market. This expression is maximized by setting the home time of the high-wage person to zero and the home time of the low-wage person to one, yielding a joint output

$$z^* = \mathrm{Max}[w_a, w_b]. \tag{2.5}$$

Comparing the results for a single person household and a couple, we see that there is always a positive gain from marriage. If the two wages are equal, $w_a = w_b = w$, the gain from marriage, $w/2$, is purely due to increasing returns. If $w_a \neq w_b$ the gain is even larger, reflecting the added gains from specialization according to comparative advantage.

As emphasized by Becker (1991: Ch. 2), even in the absence of ex-ante differences between the partners, comparative advantage can be developed via differential investments. Whether at the market or at home, human capital is more useful if it is used more intensely. Within marriage each party can use his capital to a larger extent. For instance, a wife can specialize in household capital and a husband in building a career.

There is ample evidence for division of labor within the household. Married men work longer hours in the market and have substantially higher wages than unmarried men. Married women have lower wages and work more at home than unmarried women (see Gronau, 1986; Daniel, 1992; Korenman and Neumark, 1992).

2.2. *Imperfect credit market*

Consider two potential partners denoted by a and b. Each person lives for two periods which we denote by 1 and 2. Utility in each period is derived from consumption only

$$u_{it} = U(c_{it}). \tag{2.6}$$

Each person has a given earning capacity which he can augment by schooling:

$$y_{i2} = y_{i1}\ (1 + \gamma\lambda_{i1}), \tag{2.7}$$

where γ is a parameter indicating learning capacity, $\gamma > 1$, and λ is the rate of investment, $0 \leq \lambda \leq 1$. Investment at a rate λ implies a loss of potential earnings λy and a direct cost λd, where d denotes the per period tuition costs. The gain in future earnings is given by $y\gamma\lambda$. Thus, the rate of return for investment in human capital is

$$\rho_i = \gamma y_{i1}/(y_{i1} + d) - 1. \tag{2.8}$$

Because of the linear technology, the rate of return is independent of the level of investment. Because of the presence of direct costs, a person with higher earning capacity (higher y_{i1}) will have a higher rate of return for investment in human capital.

Consider first a perfect capital market where each person can borrow and lend freely at a fixed interest rate, r. Under a perfect capital market, production and consumption decisions can be separated. Schooling is chosen to maximize wealth. Each person will specialize in schooling in the first period if $\rho_i > r$ and invest nothing if $\rho_i < r$. This simple investment rule holds whether or not a marriage occurs. Consider now an imperfect capital market where a person can save (at a real interest rate of r) but cannot borrow against his future labor income. In this case, consumption and production cannot be separated and the investment rule will depend on marital status. In particular, person i in isolation cannot invest more than $y_{1i}/(d + y_{1i})$ since this would imply negative consumption. However, if two people facing a borrowing constraint marry, they can transfer consumption good within the family and support an optimal investment policy.

To illustrate, let us simplify further assuming a linear utility function, $U_i(c_{it}) = c_{it}$, and setting $r = 0$. In this case, a single person with initial earning capacity y_{i1} obtains a life time utility (consumption) given by

$$u_i = y_{i1} + y_{i1}\,\mathrm{Max}[1, \gamma y_{i1}/(y_{i1} + d)]. \tag{2.9}$$

A family consisting of two individuals with initial incomes y_a and y_b, such that $0 \leq y_a, y_b \leq d$, can obtain

$$u_{ab} = y + y\,\mathrm{Max}[1, \gamma y_a/(y_a + d), \gamma y_b/(y_b + d)], \tag{2.10}$$

where $y = y_a + y_b$. That is, the family invests only in the schooling of the person with the higher rate of return, i.e. the person with the higher earning capacity. The other person works in the market and finances this investment. At a lower cost of schooling, where $y_a, y_b \geq d$, it may be profitable to send both partners to school, but again most of the resources will be invested in the person with the higher earning capacity. In any case, because of the substitution within marriage towards the person with higher earning capacity we must have $u_{ab} \geq (u_a + u_b)$. In this model, there is no gain from marriage for partners with equal earning capacity. More generally, if individuals vary in their ability as investors for reasons which are unrelated to earning capacity (i.e. have different γ) there would be gains from marriage even if incomes are equal.

Evidence of implicit credit arrangements within marriage is sometimes revealed at the time of divorce, when the wife claims a share of her ex-husband's earnings on the grounds that she supported him in school (see Borenstein and Courant, 1989).

2.3. Sharing collective goods

Some of the consumption goods of a family are nonrival and both partners can share them. Expenditures on children or housing are clear examples. If all goods within marriage are collective goods, the gains from marriage are obvious. If a person with income y_i lives alone, his utility is $U_i(y_i)$, $i = a,b$. If two such persons marry, each member i of the union will have a utility $U_i(y_a + y_b)$, which exceeds his utility in the single state.

There is no need to assume that all family income is spent on public goods. In fact, the presence of any amount of collective goods generates gains from marriage. To see that, let

$$u = U_i(c_i, q_i), \tag{2.11}$$

where c_i is private consumption and q_i expenditure on a sharable good. When each partner is single, q is treated like a private good and the budget constraint is

$$c_i + q_i = y_i. \tag{2.12}$$

Each person alone will maximize his utility subject to his budget constraint. Let us denote the optimal choices by c_i^*, q_i^* and the resulting utility by u_i^*.

Now consider a marriage between two individuals a and b. Without loss of generality, assume that $q_b^* \geq q_a^*$. Consider the maximization

$$\text{Max } U_a(c_a, q), \tag{2.13}$$

subject to

$$c_a + c_b + q \leq y_a + y_b \tag{2.14}$$

and

$$U_b(c_b, q) \geq u_b^*. \tag{2.15}$$

Observe that in this maximization, the same quantity q appears in both utilities. This reflects the public good aspect of q. The allocation $c_a = c_a^*$, $c_b = c_b^*$ and $q = q_b^*$ satisfy Eq. (2.15) as an equality and Eq. (2.14) as an inequality. It also makes person a at least as well off as in the original single state. Therefore, by increasing consumptions to the point where Eq. (2.14) is binding, person a can be made strictly better off, while person b is as well off as in the his single state. Implicit in this proof is the assumption that an increase in the marginal utility from the public good is positive for both partners. Clearly, there is a loss from marriage if one of the partners views q as a nuisance, and would not have consumed it on his own.

To illustrate, let preferences be represented by

$$u_i = c_i q_i, \quad i = \text{a,b}. \tag{2.16}$$

Each person separately maximizes $u_i = (y_i - q)q$ with respect to q, yielding $q_i^* = y_i/2$ and $u_i^* = y_i^2/4$. Maximizing the utility of partner a subject to the family budget constraint (2.14) and the efficiency requirement $c_b q \geq y_b^2/4$ yields $q = y/2$ and $u_a^{**} = y^2/4 - y_b^2/4 > y_a^2/4$.

The share of public goods in family expenditures can be substantial. For instance, Lazear and Michael (1980) estimate that two single individuals can almost double their purchasing power by forming a union. Sometimes the partners can share productive inputs rather than consumption goods. It has been observed, for instance, that the wife's schooling enhances her husband's wages (see Benham, 1974).

2.4. *Risk sharing*

Consider two risk averse partners with uncertain incomes. Acting alone each partner will have an expected utility given by $E(U_i(y_i))$. Acting together they can trade consumption in different states of nature. To see the potential gains from trade, consider the maximization

$$\text{Max } \mathrm{E}(U_a(c_a)), \tag{2.17}$$

subject to

$$\mathrm{E}(U_b(y_a + y_b - c_a)) \geq \mathrm{E}(U_b(y_b)). \tag{2.18}$$

Clearly, setting in each state $c_a = y_a$ is a feasible solution which will imitate the allocations in the single state. However, the optimal risk sharing rule is

$$U'_a((c_a) = \lambda U'_b(c_b) \tag{2.19}$$

where λ is a positive constant. That is, the slope of the utility frontier (given by $-U'_a(c_a)/U'_b(c_b)$) is equalized across states. Otherwise, both partners can be made better off by transferring resources to a person in a state where his marginal utility of consumption is relatively high, taking resources away from him in another state where his marginal utility is relatively low. Following this optimal rule, both partners can be made strictly better off, provided that their incomes are not perfectly correlated.

Depending upon the particular risk, the potential gains from mutual insurance can be quite large. For instance, Kotlikoff and Spivak (1981) who consider the risk of uncertain life, in the absence of an annuity market, estimate that the gains that a single person can expect upon marriage are equivalent to 10–20% of his wealth. In a different application, Rosenzweig and Stark (1989) show that marriages in rural India are arranged between partners who are sufficiently distant to significantly reduce the correlation in rainfall, thereby generating gains from insurance.

Keeping these examples in mind, we can now return to the question which activities will be carried out within the family. One argument is that the family simply fills in gaps in the market system, arising from thin markets, or other market failures (see Locay, 1990). Another line of argument (see Pollak, 1985) is that the family has some intrinsic advantages in monitoring (due to proximity) and in enforcement (due to access to nonmonetary punishments and rewards). A related but somewhat different argument is that family members have already paid the (sunk) costs required to acquire information about each other (see Ben-Porath, 1980). Thus, credit for human capital investments may be supplied internally either because of a lack of lending institutions, or because a spouse recognizes the capacity of her partner to learn and is able to monitor the utilization of his human capital better than outsiders. Similarly, annuity insurance is provided internally, either because of lack of annuity markets or because married partners have a more precise information on their spouse's state of health than the market at large. It is clear that these three considerations interact with each other and cannot be easily separated. The main insight is that the gains from marriage depend on the state of the market and must be determined in a general equilibrium context.

3. How families solve their economic problems

The existence of potential gains from marriage is not sufficient to motivate marriage and to sustain it. Prospective mates need to form some notion as to whether families realize the potential gains and how they are divided. This section discusses mainly the implications of efficiency and altruism to the family's allocation problem. As a preliminary, the family's allocation problem is examined in the case of transferable utility, a simplifying assumption that plays a crucial role in the literature.

3.1. Transferable utility

In comparing alternative marriages it is useful to define an output measure that characterizes the marriage. In general, associated with each marriage, there is a set of feasible actions. Each action yields an outcome which is the utility values (payoffs) of the two partners. In a special case, the set of utility payoffs is characterized by a single number, which can be naturally defined as the output of the marriage. This substantial simplification occurs if there exists a commodity (usually called money) which, upon changing hands, shifts utilities between the partners at a fixed rate of exchange.

Formally, let X be a set of possible actions for the family. Let $x \in X$ be a particular action and let $U_a(x)$ and $U_b(x)$ represent the preferences of the two partners with respect to these actions. Suppose that preferences can be represented by

$$U_a(x) = \alpha x_1 g(x_2, x_3, \ldots, x_n) + V_a(x_2, x_3, \ldots, x_n) \tag{3.1}$$

and

$$U_b(x) = -\beta x_1 g(x_2, x_3, \ldots, x_n) + V_b(x_2, x_3, \ldots, x_n). \tag{3.2}$$

Note that for both partners the marginal utility of x_1 is independent of x_1. By assumption, the marginal utility is $\alpha g(x_2, x_3, \ldots, x_n)$ for one partner and $-\beta g(x_2, x_3, \ldots, x_n)$ for the other. In this sense, x_1 can be viewed as a tool for transferring utility between the partners.

Now consider any action x which is Pareto efficient. That is, for some feasible u_0, x solves the program

$$\text{Max } U_a(x), \tag{3.3}$$

subject to

$$U_b(x) \geq u_0.$$

It is easy to verify that the sub vector $(x_2^*, x_3^*, \ldots, x_n^*)$ which maximizes the weighted sum of the two utility functions, given by

$$f(x_2, x_3, \ldots, x_n) = \beta V_a(x_2, x_3, \ldots, x_n) + \alpha V_b(x_2, x_3, \ldots, x_n), \tag{3.4}$$

will be a component of any such solution. Hence, if we restrict attention to efficient outcomes, $(x_2^*, x_3^*, \ldots, x_n^*)$ will be adopted by the couple independently of the distribution of utilities within the family (i.e. independent of u_0). A change in u_0 will affect only x_1, the sole variable which regulates the distribution. We may define $z^* = f(x_2^*, x_3^*, \ldots, x_n^*)$ to be the output of the marriage. For any feasible action, the individual utility levels $u_a = U_a(x)$ and $u_b = U_b(x)$ satisfy

$$\beta u_a + \alpha u_b \leq z^*. \tag{3.5}$$

Eq. (3.5) defines a linear utility frontier with a slope of $-\beta/\alpha$.

The assumption of transferable utility serves two distinct purposes: (i) It simplifies the description of the family choices in the presence of conflict. In particular, it assures that a single commodity (e.g. money) is used to regulate the conflict between the two partners, while all other actions are chosen to maximize a common goal. The family decision process can be described as: choose an action which yields the highest utility frontier, then choose a point on the frontier to regulate the division. The assumptions on preferences ensure that these two steps are separable. (ii) The existence of an output measure allows each person to compare the gains from marriage that he may acquire with various potential mates. As we shall see, the distribution of outputs across marriages is sufficient information for the determination of the equilibrium outcome.

Some of the examples discussed in the previous section satisfy the requirements for transferable utility and the existence of an output measure. In the first example with household production the utility of each partner was assumed to be linear in terms of an abstract nonmarketable good. In the example with imperfect capital market, a family output measure exists when the utility of both partners is linear in the marketable consumption good. In this case, the family's objective is to maximize aggregate household consumption summed over partners and periods. A somewhat less standard case arises in the example with public goods where preferences are represented by $u_i = c_i q$ for $i = \text{a,b}$. Although utility is not strictly linear, the private consumption goods can be used to transfer utility across partners at a fixed rate of exchange. The couple will, therefore, maximize the utility sum $u_a + u_b = (y - q)q$ and choose $q = y/2$. Thus, $u_a + u_b = z^* = y^2/4$.

It should be noted that except for the function $g(x_2, x_3, \ldots, x_n)$, which is assumed to be comparable, it is generally not necessary to require comparability across members of the household. Thus, if we double the units of utility for person a, keeping the units for person b unaffected, the function $f(x_2, x_3, \ldots, x_n)$ defined in Eq. (3.4) will also double in order to keep the choice of $(x_2^*, x_3^*, \ldots, x_n^*)$ unaffected. Similarly, condition (3.5) will change to reflect the change in units. In particular, we can normalize α and β to unity.

One may question the empirical relevance of transferable utility. It is clear that the family relationship involves multiple exchanges and quid pro quo rather than the transfer of a mean of exchange. The main role of this assumption is to capture in a simple way the idea that each partner can be compensated for his actions or traits. The simplification is that such compensations can be made without affecting total resources.

3.2. The role of altruism

As stated in Section 2, sexual attraction is an important ingredient in explaining why human partnerships take a rather special form. By the same view, love or altruism helps married couples to solve their allocation problem, and is therefore conducive for a lasting relationship. Specifically, altruism diminishes the need for bargaining and facilitates efficient mechanism designs which rely on informal commitments.

Consider, first, the simple case of transferable utility where the two issues of efficiency and distribution can be separated. As we have seen, there is in this case a well-defined set of actions which maximizes joint output. How are those actions actually enforced? One possibility is that bargaining takes place at the outset of marriage, some sort of binding agreement is signed and then carried out. With perfect information, one may presume that the outcome of this bargaining is efficient in the sense that the partners will agree at the outset on the set of actions which maximize marital output. However, if the partners are altruistic towards each other, their feelings of love generate implicit commitments. This can be exploited in the design of mechanisms which implement an efficient outcome and are self-enforcing.

One such scheme (see Becker, 1991: Ch. 8) is to select a principal (a family head) who is given control over family resources and can make transfers as he sees fit. The only requirement is that the principal should care about all family members in the sense that their utility enters his own preferences as normal goods. Once this scheme is put in place, each person is allowed to choose his own actions selfishly. It had been observed by Becker that such a mechanism is efficient and each participant voluntarily acts in the interest of the group. The reason is that any productive action which increases total output is rewarded by an increased transfer from the principal. Conversely, any destructive action is punished by reduced transfers. In this way the interests of the group are internalized by every member. Note that it is immaterial who the principal is and that the gains from the transfer activities can be eliminated by a lump sum at the outset. The crucial aspect is that every partner should trust the principal to truly care about all family members and that he should be able to fully control the distribution of income (including negative transfers).

Even in the absence of transferable utility, altruism can reduce the range of disagreement. That is, the parties, if they had power to determine the outcome unilaterally, will choose actions which are relatively close. This factor also diminishes the incentives to bargain (Stark, 1993).

To illustrate these two general points, let us first define altruism or caring, as it is most commonly used. Consider a couple with interrelated preferences given by

$$U_a(x) = W_a(u_a(x_a), u_b(x_b)), \tag{3.6}$$

$$U_b(x) = W_b(u_a(x_a), u_b(x_b)). \tag{3.7}$$

Thus, the aggregate (social) utility of each partner is a function of the "person specific" (private) utility indices $u_a(x_a)$ and $u_b(x_b)$, where x_a and x_b denote the components of the family action which directly affect each spouse. (The vectors x_a and x_b may include some separate components such as consumption of private goods by the two partners and some common components, such as public goods.) Caring of a for b is represented by a positive impact of u_b in $W_a(.,.)$. Selfishness is represented by u_b having zero marginal effect in $W_a(.,.)$. One might also write a different formulation, where a cares about the social preferences of b rather than his private ones, in which case W_b would appear as an argument in a's social welfare function. That is, a takes into account that b cares for a who cares for b and so on. In this case, Eqs. (3.6) and (3.7) are the reduced form solutions of the infinite regress (see Bernheim and Stark, 1988). Operationally, the main restriction embedded in this system is that each partner is indifferent between all private actions that his spouse considers equivalent, and does not care how a given level of utility aggregate is obtained by his spouse. An immediate implication of this restriction is that a necessary condition for Pareto efficiency in terms of social preferences is Pareto efficiency in terms of private preferences. That is, to be socially efficient, the actions x_a and x_b must be such that $u_a(x_a)$ is maximized given $u_b(x_b)$.

To illustrate the working of the "head mechanism", let each spouse have two private actions: consumption and work. Time not spent at work is used to produce a household good which is a public good (e.g. child quality). Let us assume transferable utility and write the person specific utility as $u_i(x_i) = qc_i = \varphi(t_a, t_b)c_i$ and let the budget constraint be $c_a + c_b = (1 - t_a)w_a + (1 - t_b)w_b$, where c_i denotes consumption, t_i denotes time at home, and w_i is the wage, i = a,b. Applying the results on transferable utility, it is easy to verify that any Pareto efficient allocation must maximize the "pie" [(1 −

$t_a)w_a + (1 - t_b)w_b]\varphi(t_a, t_b)$. To show that this is an equilibrium outcome of the "head mechanism", we solve the problem backwards. In the last stage, the levels of t_a and t_b are given and so is total family income. Given family resources, the head chooses transfers (i.e. consumption levels) for each partner in order to maximize his social welfare function. Because of transferable utility, this problem of the head translates into a choice of utility levels for each spouse given a linear constraint $u_a + u_b \leq z$, where z is the size of the pie. Assuming that private utilities enter $W_a(.,.)$ as normal goods, he will increase (decrease) the person specific utilities whenever total resources at his disposal increase (decrease). Anticipating that, each person (including the head himself) will select the actions in the first stage to maximize the pie.

It has been shown by Bergstrom (1989) that, in the presence of public goods, transferable utility is necessary to obtain efficiency. If all goods are private goods and preferences are altruistic as in Eqs. (3.6) and (3.7) then there are many efficient mechanisms, even in the absence of transferable utility. For instance, let each person decide on his work and use the proceeds to purchase his own consumption.

To illustrate the narrowing of the bargaining range, let us take an even simpler case with only one consumption good for each spouse. Assume diminishing marginal utility (i.e. the person specific utilities $u_i(c_i)$ are strictly concave). In this simple case, the family has only two decisions to make, c_a and c_b. Using the family budget constraint to eliminate c_b and substituting into Eqs. (3.6) and (3.7), we can write the social welfare functions of the two partners as function of a single variable, c_a:

$$U_a(x) = W_a(u_a(c_a), u_b(y - c_a)), \tag{3.8}$$

$$U_b(x) = W_b(u_a(c_a), u_b(y - c_a)). \tag{3.9}$$

Now consider the allocation $c_a = y$, $c_b = 0$. This allocation would be efficient if both partners are selfish. However, under altruism a small increase in c_b will make both partners better off. The reason is that b has at this point a relatively high marginal utility of consumption and a who cares about b will be more than compensated for the reduction in his private utility. By the same argument, the allocation $c_a = 0$, $c_b = y$, which is efficient under selfishness, will be inefficient if b cares about a. In general, the higher the degree of caring, the narrower will be the range of conflict. That is, both partners will agree to delete extremely unequal distributions from the family's choice set.

Note, however, that in some cases altruism may increase conflicts. Consider, for instance, the following model:

$$U_a(x) = qc_a + \beta c_b, \tag{3.10}$$

$$U_b(x) = qc_b + \beta c_a, \tag{3.11}$$

where c_a and c_b are husband's and wife's consumptions and q is a public good. The parameter β, $0 < \beta < 1$, may be interpreted as a measure of altruism, but in this case each partner cares only about a particular good that his partner consumes not his total utility. Such goods are called "merit goods". In this example, the consumption goods have been chosen to be the merit goods. Although these merit goods are formally indistinguishable from public goods, the source of interdependence is different. The public good aspect arises from the technology of consumption (both a and b can consume the same good), the merit good aspect arises from the structure of preferences. It is easy to show that, in this case, an increase in β will reduce the expenditure on the public good q and will, therefore, increase the range of conflict in terms of consumption goods.

3.3. *Modes of family decision-making*

We may distinguish three general modes of family decision-making. The first mode arises when the family has no internal conflict, the second mode arises when a conflict exists but the partners manage to cooperate (i.e., they reach a binding agreement), the third mode arises when the conflict is resolved by a self-enforcing set of actions where no one wishes to deviate unilaterally (an equilibrium). Let us first describe these three modes for a household with two decisions for each member, consumption and work. To maintain a general framework, let us assume that each partner may care about all of the family decision variables.

3.3.1. *A common objective*

The traditional approach to the analysis of household decisions, such as labor supply of family members, was to describe the family as maximizing a "family utility function". A prototype formulation is

$$\text{P1:} \quad \text{Max } V(c_a, c_b, l_a, l_b),$$

s.t.

$$c_a + c_b = w_a(1 - l_a) + w_b(1 - l_b) + y_a + y_b,$$

where, c_i, l_i, w_i and y_i denote, respectively, consumption, leisure, wage and nonwage income of partner i, i = a,b.

Throughout the survey, we viewed a marriage as a union of two independent decision makers who may or may not cooperate. This raises the question: what is the source of the common utility function $V(\cdot)$ imposed in P1? One possible interpretation is that it relies on some (unobserved) private good to transfer utility, so that there is no real conflict in terms of observable actions. Alternatively, one may think of $V(\cdot)$ as representing the preferences of the altruistic head who, by agreement, or by custom, obtained the power to pool resources and who via transfers or other means, is capable of manipulating the actions of all family members.

3.3.2. Cooperation

Consistent with our general approach, let us endow the two partners with separate utility functions and assume that via bargaining, or otherwise, they reach a Pareto efficient allocation. In this case, family decisions solve the problem P2:

$$\text{P2:} \quad \text{Max } U_{\rm a}(c_{\rm a}, c_{\rm b}, l_{\rm a}, l_{\rm b}),$$

s.t.

$$c_{\rm a} + c_{\rm b} = w_{\rm a}(1 - l_{\rm a}) + w_{\rm b}(1 - l_{\rm b}) + y_{\rm a} + y_{\rm b},$$

$$U_{\rm b}(c_{\rm a}, c_{\rm b}, l_{\rm a}, l_{\rm b}) \geq u_{\rm b}(w_{\rm a}, w_{\rm b}, y_{\rm a}, y_{\rm b}).$$

Here, $U_i(x)$ represent the preferences of partner i over possible family actions, i = a,b. Each of the utility indicators depends on all family decisions since we allow for any sort altruism. By allowing $u_{\rm b}$ to depend on w_1, y_1, w_2 and y_2 we can apply explicit bargaining mechanisms to select the point on the utility frontier. For instance, $u_{\rm b}$ is likely to increase in $w_{\rm b}$ since a higher wage for b may improve her opportunities outside marriage and, therefore, increase her share within marriage (see Manser and Brown, 1988). The crucial assumption of the cooperative model is that, whatever the mechanism for selecting the point on the efficiency frontier, the partners can always agree on and enforce an efficient outcome.

3.3.3. Noncooperation

One can think of family members as being linked via externalities but acting noncooperatively. That is, each person determines the variables under his control unilaterally, taking the decisions of his spouse as given. In the single period framework discussed here, the equilibrium to this "game" satisfies

$$\text{P3:} \quad c_{\rm a}, l_{\rm a} \in \underset{c,l}{\text{Argmax}}\, U(c, c_{\rm b}, l, l_{\rm b}),$$

s.t.

$$c = w_{\rm a}(1 - l) + y_{\rm a},$$

and

$$c_{\mathrm{b}}, l_{\mathrm{b}} \in \operatorname*{Argmax}_{c,l} U_{\mathrm{b}}(c_{\mathrm{a}}, c, l_{\mathrm{a}}, l),$$

s.t.

$$c = w_{\mathrm{b}}(1 - l) + y_{\mathrm{b}}.$$

The crucial feature of the equilibrium outcome is that it is self-enforcing. However, in contrast to the cooperative outcome, the solution need not be efficient (see Lundberg and Pollak, 1993).

3.4. *Tests of the family's modes of behavior*

Each mode of family behavior is not merely an analytic tool but a testable hypothesis. In standard demand theory one can derive restrictions on the demand function based on the assumption that the consumer maximizes some utility function subject to a budget constraint. Moreover, given information on choices at different price–income situations, one may recover the preference structure of the consumer. Similarly, in the theory of the household, one may obtain restrictions on observed demand based solely on the assumption that the allocation is efficient or self-enforcing, which hold for any pair of utility functions. Again, given data on the resources of family members, the prices they face and their consumption of private and collective goods, we may, under some conditions, recover the preferences of the partners.

In general, the fact that two individuals are linked imposes some cross-equation restrictions on their demand functions. The nature of the restrictions vary according to the particular mode of family decision-making.

With a common objective function, the demand functions solving P1 are

$$x_j = D_j(w_{\mathrm{a}}, w_{\mathrm{b}}, y) \tag{3.12}$$

where x_j denotes one of the four decision variables $(c_{\mathrm{a}}, c_{\mathrm{b}}, l_{\mathrm{a}}, l_{\mathrm{b}})$, and $y = y_{\mathrm{a}} + y_{\mathrm{b}}$ is nonwage family income. The cross-equation restrictions are embodied in the requirement that the matrix of substitution effects must be symmetric and negative semi-definite (the Slutzky conditions). For instance, the labor supply functions, derived from P1, must satisfy the symmetry condition

$$\partial h_1/\partial w_2 - h_2 \partial h_1/\partial y = \partial h_2/\partial w_1 - h_1 \partial h_2/\partial y. \tag{3.13}$$

Under cooperation, we can write the demand functions in the form

$$x_j = D_j(w_{\mathrm{a}}, w_{\mathrm{b}}, y, \mu(w_{\mathrm{a}}, y_{\mathrm{a}}, w_{\mathrm{b}}, y_{\mathrm{b}})), \tag{3.14}$$

where μ is the Lagrange multiplier associated with the efficiency constraint in P2. Holding μ constant, one obtains the same demand functions as in the common objective case. Indeed, μ is constant if there is transferable utility or if one of the partners is a dictator. In general, μ varies with prices and individual incomes and the Slutzky conditions fail to hold (see McElroy, 1990). However, efficiency is indicated by the presence of the common (unknown) function which appears in all demands. Exploiting this common factor one can obtain the appropriate cross equation constraints. Consider, for instance, the demands for consumption and leisure by person a. Holding y constant and differentiating with respect to the private incomes y_a and y_b, one obtains

$$\left(\frac{\partial l_a / \partial y_a}{\partial c_a / \partial y_a}\right) = \left(\frac{\partial l_a / \partial y_b}{\partial c_a / \partial y_b}\right). \tag{3.15}$$

That is, the ratios of the marginal propensity to consume of the two goods are independent of the source of income (see Browning et al., 1994).

In the noncooperative case, demands will be of the form

$$x_{ja} = D_{ja}(w_a, y_a, f_b(w_b, y_b)) \tag{3.16}$$

and

$$x_{jb} = D_{jb}(w_b, y_b, f_a(w_a, y_a)), \tag{3.17}$$

where x_{ji} denotes one of the two actions (consumption or leisure) for person i, i = a,b. The restrictions arise because, in the solution of P3, variations which do not affect b's behavior do not influence a's behavior and vice versa.

An interesting special case arises when the links across partners depend only on the sum of their consumption levels. That is,

$$U_i(x) = U_i(c, l_i), \tag{3.18}$$

where $c = c_1 + c_2$. In this example, the sum of the consumptions constitute a public good and l_i are private goods. In this case, as long as both partners consume at a positive level, the demand curves induced by the Nash equilibrium will depend only on the sum of the incomes of the two partners. That is,

$$x_{ji} = D_{ji}(w_b, w_a, y_a + y_b). \tag{3.19}$$

This result emerges because the effective constraint on the levels of the public good and private good chosen by each individual is

$$c = w_i(1 - l_i) + y_i + c_j, \quad i \neq j. \tag{3.20}$$

Note that person i influences c through his private contribution c_i, taking the contribution of j as given. There is, therefore, an additional constraint facing i, namely $c > c_j$ which we assume not to bind. Thus, if a dollar is transferred from b to a and c_b is reduced by a dollar, then a, facing the same budget constraint, will choose the same level of public good, c. But this means that he raises his own contribution by a dollar and, therefore, person b will be in fact satisfied with reducing his contribution by a dollar. Hence, after the redistribution all demands will be unaffected (see Bergstrom et al., 1986).

Recently, there have been attempts to test some of these restrictions. Special attention has been given to the restrictions implied by income pooling. A household with a joint objective would be influenced only by total family income. As we have seen, the same restriction also holds, in some circumstances, if the partners act noncooperatively. This prediction seems to be rejected by findings that husbands and wife's (nonwage) income have different effects on the allocation of family resources (see Horney and McElroy, 1988; Schultz, 1990; Thomas, 1994). The separate role of individual incomes is consistent with both cooperation and noncooperation. However, cooperation severely restricts the role of independent incomes as all appear through the common factor μ. Browning et al. (1994) who analyze the effects of husband's and wife's (labor) income on spending on women's clothes find that pooling is rejected but efficiency is not.

In the context of uncertainty, efficiency has some further implications. Since the ratio of marginal utilities from consumption of the two partners are equalized across states of nature (see Eq. (2.19)), the consumption levels of the two partners are tied together. In particular, if there is only one consumption good and utilities are state independent then, holding aggregate consumption constant, the consumption of partner i is independent of idiosyncratic shocks such as fall into unemployment or bad health. Stated differently, with risk sharing, all individuals in the household are affected by a random shock to any individual income and all consumptions move together. Testing for efficient insurance within the household is complicated by the problems in assigning family consumption to individual members. Therefore, most often the tests involve coinsurance across larger units such as villages (Townsend, 1994) or extended families (Altonji et al., 1992). Not surprisingly, the data reject efficient risk sharing at this level of aggregation. Shocks to individual households do matter.

One may well argue that efficiency or lack of it is not the main issue which separates the three modes of behavior. For example, if we restrict attention to altruistic utility functions of the form

$$U_i(x) = W_i(u_a(c_a, l_a), u_b(c_b, l_b)), \quad i = \mathrm{a,b}, \tag{3.21}$$

then, because of separability, each of the three modes of behavior can be reduced to a single principle; divide family incomes between the two partners and let them select their own level of consumption and leisure. Efficiency, in this case, simply means that each person maximizes his specific utility, given the budget allotted to him, yielding

$$w_i U^i_c(c_i, l_i) = U^i_l(c_i, l_i), \quad i = \text{a,b}. \tag{3.22}$$

These efficiency conditions will be satisfied in all the three cases discussed above, however, they will hold at different allocations of family resources and the comparative statics with respect to changes in incomes and wages will differ. In this case, it is mainly, the division of family resources which is influenced by the mode of family decision-making (see Chiappori, 1988, 1993).

The most easily observed aspect of within family allocation is the labor supply of the two partners. Lundberg (1988) reports that in families with no young children, labor supplies are independent of their spouse wage, which is consistent with non-cooperation under separable preferences. On the other hand, among families with children, an increase in husband's wage or nonwage income reduces her hours of work. These results are consistent with either cooperation or joint maximization. As one would expect, the presence of children creates scope for division of labor and enhances cooperation. In some cases one might assign some goods to a particular partner. Browning et al. (1994) assume that women's clothes, which women presumably like, do not affect husbands directly (i.e. they are not merit goods or public goods). With this assumption one can derive the sharing rule of total family income only from observations on incomes and expenditures on clothes. They find that an increase in the wife's share in family income increases her share in total family expenditures. Similarly, Thomas (1994) reports that health outcomes for daughters and sons depend on educational differences among parents. When the wife is relatively more educated than her husband, more resources are transferred to daughters relative to sons. These findings seem to suggest that an increase in earning power increases the wife's bargaining power and her share in family resources.

4. The marriage market

Individuals in society have many potential partners. This situation creates competition over the potential gains from marriage. In modern societies, explicit price mechanisms are not observed. Nevertheless, the assignment of partners and the sharing of the gains from marriage can be analyzed within a market framework. The main insight of this approach is that the decision to form and maintain a particular union depends on the whole range of opportunities and not only on the merits of the specific match.

4.1. Stable matching

Marriage can be viewed as a voluntary assignment of males to females. We can say that an assignment is stable if:
(i) there is no married person who would rather be single;
(ii) there are no two (married or unmarried) persons who prefer to form a new union.

The interest in stable marriage assignments arises from the presumption that an assignment which fails to satisfy (i) and (ii) either will not form or will not survive.

It is relatively easy to apply the criteria for stability in the case of transferable utility, where a unique "output" measure can be associated with each marriage. In this case, a stable assignment must maximize total output over all possible assignments. To understand this result, consider the simplest possible case. Let there be two people of each sex. We use the indices i and j to refer to a particular male or female, $i, j = 1,2$. Assuming that marriage dominates the single state (i.e. if any two remain unattached they can gain by forming a union), there are two possible assignments: man 1 is married to woman 1 and man 2 is married to woman 2, or man 1 is married to woman 2 and man 2 is married to woman 1. These assignments can be presented by matrices with zero or one entries, depending upon whether or not male i is married to female j. We wish to determine which of these assignments is stable.

An output matrix with entries z_{ij} which specifies the total output of each marriage provides all the information required for the determination of stable outcomes. However, to show this result we need to consider the possible divisions of the gains from marriage. Let v_{ij} be the share of total output that male i receives if he marries woman j. The woman's share in this marriage is $u_{ij} = z_{ij} - v_{ij}$. In testing for stability we treat the totals as given and the divisions as variables. Suppose that the matrix with ones on the opposite diagonal represents a stable assignment. Then, the following inequalities must hold:

$$v_{21} + u_{12} \geq z_{22}, \tag{4.1}$$

$$z_{12} - u_{12} + z_{21} - v_{21} \geq z_{11}. \tag{4.2}$$

If the first inequality does not hold then man 2 and woman 2, who are presently not married to each other, can form a union and reassign utilities so as to improve over any possible values of v_{21} and u_{12}. If the second inequality fails to hold then male 1 and female 1, who are currently not married to each other, can form a union with an assignment of utilities which will improve upon any possible values of v_{12} and u_{21}. Adding conditions (4.1) and (4.2), we obtain

$$z_{12} + z_{21} \geq z_{11} + z_{22}. \tag{4.3}$$

By a similar argument an assignment along the main diagonal will be stable only if (4.3) is reversed.

Condition (4.3) is not only necessary but also sufficient for stability of the off diagonal assignment. For, if it is satisfied, we can find values of u_{12} and v_{21} such that (4.1) and (4.2) hold. Such imputations support the stability of the assignment since it is then impossible for both partners to gain from reassignment.

Our main interest lies in the following question. Suppose each male is endowed with a single characteristic, m, and each female is endowed with a single characteristic, f, which positively affects the family's output (gains from marriage), would a stable assignment associate males with a high marital endowment to females with high marital endowment or, to the contrary, associate highly endowed males with lowly endowed females? The answer follows immediately from the observation that a stable assignment must maximize total output. Let

$$z_{ij} = Z(m_i, f_j). \tag{4.4}$$

Let us rank males and females by their marital endowment (i.e. $m_2 > m_1$ and $f_2 > f_1$). Then Eq. (4.3) can be rewritten as

$$Z(m_1, f_2) - Z(m_1, f_1) \geq Z(m_2, f_2) - Z(m_2, f_1). \tag{4.5}$$

That is, the contribution to output of the female's attribute is diminishing with the male's attribute. By a similar rearrangement, the impact of the male's attribute diminishes in the female's attribute. In other words, there is a negative interaction between the two sex-specific traits. We conclude that a negative (positive) interaction in the production of marital output leads to a negative (positive) assortative mating. Thus, if m stands for money and f stands for beauty then, with a negative interaction, the wealthy male will not marry the pretty woman, since, whichever way they divide their gains from marriage, either he is bid away by the less pretty woman or she is bid away by the poorer man.

Associated with a stable matching is a division of the gains from marriage. Thus the quantity u_{ij} can be interpreted as the implicit wage or the bride-price that women j receives for marrying man i. Similarly, v_{ij} may be interpreted as the implicit wage or the dowry that man i receives if he marries woman j. Eqs. (4.1) and (4.2) restrict these prices but, in general, do not determine them uniquely. In some cases, however, the within marriage division is uniquely determined by market forces. For instance, suppose that both men have the same endowment, $m_1 = m_2$, but women differ and $f_1 < f_2$. Since both men can produce more with woman 2, one would expect that competition will bid her share up and she will get a higher share within marriage than woman 1. Indeed, it is easily verified that, for this example, Eqs. (4.1)–(4.3) hold as equalities, that is, both diagonals are a stable matching, and in each matching woman 2 receives the whole marital output, while woman 1 receives nothing. Alternatively, if all females have the same endowment of the marital characteristic, f, and if the number of women exceeds the number of men, then a matching in which any woman gets more than the (common) value of being single cannot be stable. Even if the division within marriage is not fully determined, some qualitative properties of the division can be derived from information on the joint distribution of male and female characteristics together with a specification of household production function (Eq. (4.4)) (see Parsons, 1980).

4.1.1. Examples

(1) Consider the example in Section 2.1 where division of labor leads to a total output $Z(w_i, w_j) = \text{Max}[w_i, w_j]$. Since a high-wage person is more useful to a low-wage person, we generally get negative sorting. The assignment also depends on the location of the income distribution for each gender. If the two distributions are identical, then, in the 2 by 2 case, the maximal output is obtained on the opposite diagonal, where a low-wage person is matched to a high-wage person. If there are more couples, the opposite diagonal is still a solution but other solutions which are close to the diagonal exist too. If the distributions differ, there might be substantial departures from negative sorting. As an extreme case, let the worst woman have a higher wage than the best man. Then in all marriages the female wage determines the outcome and all assignments are equally good.

(2) Consider the example in Section 2.2 where, because of imperfect capital market, one partner finances the schooling investment of the other. In this case, marital output as a function of earning capacities is given by $Z(y_i, y_j) = y + y\ \text{Max}[1, \gamma y_i/(y_j + d), \gamma y_j/(y_j + d)]$, implying a positive interaction, except in the region where the two partners have similar earning capacity. Since the family invests in the schooling of the person with high earning capacity, it is most efficient to match the investor with a spouse who is most productive among the less productive than the investor himself, in order to permit the maximal investment at the highest rate of return. On the whole, one would expect, therefore, to obtain positive sorting. For the case of symmetric income distributions by gender, since the gains from marriage exist only among unequals, the assignment cannot be on the main diagonal. However, as the number of couples increases, the stable assignment approaches the diagonal. If the distributions are displaced (e.g., by a translation) the assignment on the diagonal is stable.

(3) Consider, finally, the example in Section 2.3 where the partners share public goods and $Z(y_i, y_j) = (y_i + y_j)^2/4$. In this case, there is a positive interaction everywhere leading to positive sorting.

Generally speaking, one would expect negative sorting on wages and positive sorting on nonwage income (see Becker, 1991: pp. 130–134). Empirical findings suggest positive sorting on both wage and nonwage income. In particular, there is a substantial correlation in the schooling achievements of partners to marriage. In the US about half of the couples have the same level of schooling for both partners (see Mare, 1991). It is possible to rationalize such findings by combining together elements of household production and joint consumption (see Lam, 1988). For instance, similarity in schooling may lead to similarity in tastes and facilitate the allocation of public goods.

4.2. Nontransferable utility and the Gale–Shapley algorithm

In some cases there is no commodity which the couple can transfer within marriage. In this case a marriage generates an outcome for each partner which is fully determined by the individual traits of the partners. This outcome cannot be modified by one partner compensating the other for his deficient traits. However, an undesired marriage can be avoided or replaced by a better one. Although there is no scope for trade within marriage, there is margin for trade across couples.

Consider again a model with equal number of females and males. Each man has a preference ranking over all women and vice versa. Such rankings can be represented by a matrix with two utility entries in each cell. A column u_j describes the preference ordering of woman j over all feasible males. A row v_i describes the preference ordering of man i over all feasible women. We may incorporate the rankings of the single state by adding a column and a row to the matrix. In contrast to the previous analysis the entries u_{ij} and v_{ij} are datum for the analysis (of course, they are only unique up to monotone transformations). Given the preferences, the problem is to identify stable assignments in such a matrix.

Gale and Shapley (1992) suggested the following algorithm: To start, each man proposes marriage to his most favored woman. A woman rejects any offer which is worse than the single state, and if she gets more than one offer she rejects all the dominated offers and keeps all the undominated offers. The nonrejected proposals are put on hold (engagement). In the second round each rejected man proposes to the best of the women who did not reject him. Women will reject all dominated offers, including the ones on hold. The process stops when no male is rejected. Convergence is ensured by the demand that no woman is approached more than once by the same man. The process must yield a stable assignment because women can hold all previous offers. So if there is some pair not married to each other it is only because either the man did not propose or that he did and was rejected. A different stable assignment is obtained if women make the offers and men can reject or store them. It can be shown that the stable matching obtained when men make the proposal is weakly preferred by all men to the stable matching that is obtained when women propose first.

Example. Recall the example in Section 2.3 and suppose that all goods within the family are public, implying $u_{ij} = U_j(y_i + y_j)$ and $v_{ij} = U_i(y_i + y_j)$. That is, the utility of each partner from the marriage is determined by the sum of the incomes of the two partners. In this case, there is no mean for transferring utility. Thus, for all women the ranking of men is the same, the higher his income the better. Similarly all men rank women in the same order. In this special case, there is a unique stable marriage assignment which is independent of whether men or women propose first. The only stable assignment is to associate people in a positive assortative matching along the main diagonal. To see that, suppose that men propose first. In the first round all men will propose to the woman with the highest income and she will reject all offers but the one from the best man. In the second round all remaining men will propose to the second best woman and she will reject all but the second best man and so on. The situation when women propose first is identical.

In addition to the identification of stable assignments, one can use the Gale–Shapley algorithm to obtain simple comparative static results. Allowing for unequal number of man and women, it can be shown that a change in the sex ratio has the anticipated effect. An increase in the number of women increases the welfare of men and harms some women. The same result holds in many to one assignments (polygamy). The model can be further extended to allow transfers in which case transferable utility is just a special case. Thus, if X_{ij} is some feasible set of actions and x is a member of this set we can define $u_{ij}(x)$ and $v_{ij}(x)$ as the utility of members i and j, respectively, if they marry each other and action $x \in X_{ij}$ is taken. A particular action is for i to transfer consumption goods to j. If marginal utilities are constant we are back to the case of transferable utility. In this more general framework stability is defined with respect to an assignment together with a specified action for each couple. Such an outcome is stable if no pair who is currently not married can marry and choose an action which yields a result which is better for both than their lot under the existing assignment and associated set of actions. Observe that the assignment and the actions are simultaneously restricted by this definition. (It is only under transferable utility that the two aspects can be separated). The comparative static results concerning the addition of player hold in this more general case (see Roth and Sotomayor, 1990: Ch. 6; Crawford, 1991).

4.3. Search

The process of matching in real life is characterized by scarcity of information about potential matches. The participants in the process must spend time and money to locate their best options. The realized distribution of matches and the division of the gains from each marriage are therefore determined in an equilibrium which is influenced by the costs of search and the search policies of other participants.

The main ingredients of the search model are as follows. There is a random process which creates meetings between members of society of the opposite sex. When a meeting occurs, the partners compare their characteristics and evaluate their potential gains from marriage. Each partner anticipates his share in the joint marital output. If the gains for both partners from forming the union exceed their expected gain from continued search, then these partners marry. Otherwise, they depart and wait for the next meeting to occur.

Meetings occur according to a Poisson process. That is, the waiting times between successive meetings are i.i.d. exponential variables with mean $1/\lambda$. Within a short period h, there is a probability of a meeting given by $\lambda h + o(h)$ and a probability of no meeting given by $1 - \lambda h + o(h)$, where, $o(h)/h$ converges to zero as h approaches zero. The arrival rate λ is influenced by the actions of the participants in the marriage market. Specifically, imagine an equal number of identical males and females, say N, searching for a mate. Let s_{im} denote the "search intensity" (i.e. number of meetings per period) initiated by a particular male. If all females search at the same intensity s_f they will generate Ns_f contacts per period distributed randomly across all males. In this case, the probability that male i will make a contact with some female, during a short interval, h, is $(s_{im} + s_f)h$. If all males search at a rate s_m and all females at a rate s_f then the rate of meetings between agents of opposite sex is

$$\lambda = s_m + s_f. \tag{4.6}$$

The key aspect in Eq. (4.6) is that activities on both side of the market determine the occurrence of meetings. A limitation of the linear meeting technology is that the number of searchers, N, has no effect on the arrival rate λ (see Diamond and Maskin, 1979, 1981).

Each participant who searches actively and initiates meetings must bear a monetary search cost given by $c_i(s)$, $i = $ m,f where we allow the costs of search to differ by sex. The total and the marginal costs of search increase as search intensity increases. (Specifically, $c(0) = c'(0) = 0$, $c'(s) > 0$ for $s > 0$ and $c''(s) > 0$.)

When a meeting occurs the marital output (quality of match) that the partners can generate together is a random variable, z, drawn from some fixed distribution, $F(z)$. Having observed z, the couple decides whether or not to marry. With transferable utility, the decision to marry is based on the total output that can be generated by the couple within marriage relative to the expected total output if search continues. Hence, a marriage occurs if and only if

$$z \geq v_m + v_f, \tag{4.7}$$

where v_m and v_f denote the value of continued search for the male and female partners, respectively. These values depend, in equilibrium, on the search intensity that will be chosen if the marriage does not take place. Specifically, for $i, j = $ m,f,

$$rv_i = \text{Max}\{(s + s_j)\int_{v_m+v_f}^{\infty}(w_i(z) - v_i)\, \mathrm{d}f(z) - c_i(s)\}, \quad i \neq j, \tag{4.8}$$

where $w_i(z)$ denote the share of the gains of marital output that male and female partners expect. By definition,

$$w_{\mathrm{m}}(z) + w_{\mathrm{f}}(z) = z. \tag{4.9}$$

Eq. (4.8) states that the value of being an unattached player arises from the option to sample from offers which arrive at a rate $s + s_j$ and are accepted only if Eq. (4.7) holds. Each accepted offer yields a surplus of $w_i(z) - v_i$ for partner i and integrating over all acceptable offers, weighting by $\mathrm{d}F(z)$ (or the density $f(z)$ if it exists), we obtain the expected gain from search. Since each participant controls his own intensity of search he will choose the level of s which maximizes his value in the unattached state. Therefore, with identical males and females,

$$\int_{v_{\mathrm{m}}+v_{\mathrm{f}}}^{\infty} (w_i(z) - v_i)\,\mathrm{d}F(z) = c'_i(s_i), \quad i = \mathrm{m,f}. \tag{4.10}$$

The marginal benefits from a search, the left-hand side of Eq. (4.10), depend on the share that a person of type i expects in prospective marriages. As $w_i(z)$ rises, holding z constant, he or she searches more intensely. Hence, the equilibrium outcome depends on the sharing rules that are adopted.

The literature examined two types of sharing rules. One class of sharing rules relies on Nash's axioms and stipulates

$$w_i(z) = v_i + \theta_i(z - v_{\mathrm{m}} - v_{\mathrm{f}}), \tag{4.11}$$

where $\theta_i > 0$ and $\theta_{\mathrm{m}} + \theta_{\mathrm{f}} = 1$, $i = \mathrm{m,f}$.

The parameter θ_i allows for asymmetry in the bilateral bargaining between the sexes due to preferences or social norms. The crucial aspect of this assumption, however, is that outside options, reflected in the market determined values of v_{m} and v_{f}, influence the shares within marriage. Wolinsky (1987) points out that a threat to walk out on a potentially profitable partnership is not credible. Rather than walking away, the partners exchange offers. When an offer is rejected, the partners search for an outside opportunity that would provide more than the expected gains from an agreement within the current marriage. Hence, during the bargaining process each partner search at an intensity given by

$$\int_{y}^{\infty} (w_i(z) - w_i(y))\,\mathrm{d}(F(z) = c'_i(s_i), \quad i = \mathrm{m,f}, \tag{4.12}$$

where y is the quality of the current marriage and $w_i(y)$ is the expected share in the current marriage if an agreement is reached. Since $y \geq v_{\mathrm{m}} + v_{\mathrm{f}}$ and $w_i(y) \geq v_i$, a person who searches for better alternatives during a bargaining process will search less intensely and can expect lower gains than an unattached person. The threat of each partner is now influenced by two factors: the value of his outside opportunities (i.e., the value of being single), which enters only through the possibility that the other partner will get a better offer and leave; the value of continued search during the bargaining process, including the option of leaving when an outside offer (whose value exceeds the value of potential agreement) arrives. Therefore, the threat points, v_i, in Eq. (4.11) must be replaced by a weighted average of the value of remaining without a partner and the value of continued search during the bargaining (the weights are the probabilities of these events). Given these modified threat points, the parameter θ_i which determines the shares depends on the respective discount rates of the partners and the probabilities of their exit from the bargaining process. The logic behind this type of formula, due to Rubinstein (1982), is that each person must be indifferent between accepting the current offer of his partner or rejecting it, searching for a better offer and, if none is received, return to make a counter offer that the partner will accept.

Given a specification of the share formulae, one can solve for the equilibrium levels of search intensities and the values of being unattached. For instance, if the shares are determined by Eq. (4.11) and θ_i is known, then Eqs. (4.8) and (4.10) determine unique values for s_{m}, s_{f}, v_{m} and v_{f}. Because of the linear meeting technology, these equilibrium values are independent of the number of searchers. Observe that although the share formulae depends on institutional considerations the actual share of marital output that each partner receives depends on market forces and is determined endogenously in equilibrium.

We can close the model by solving for the equilibrium number of unattached participants relative to the population. Suppose that each period a new flow of unattached persons is added to the population. To maintain a steady state, this flow must equal the flow of new attachments which were formed from the current stock of unattached. The rate of transition into marriage is given by the product of the meeting rate λ and the acceptance rate $1 - F(z_0)$, where z_0 is the reservation quality of match. Using Eqs. (4.6) and (4.7), we obtain

$$u(s_{\mathrm{m}} + s_{\mathrm{f}})(1 - F(v_{\mathrm{m}} + v_{\mathrm{f}})) = e, \tag{4.13}$$

where u is the endogenous, steady state, rate of nonattachment and e is the exogenous constant rate of entry.

The meeting technology considered thus far has the unsatisfactory feature that attached persons "do not participate in the game". A possible extension is to allow matched persons to consider offers from chance meetings initiated by the unattached, while maintaining the assumption that married people do not search. In this case divorce becomes an additional option. If an unattached person finds a married person who belongs to a marriage of quality z and together they can form a marriage of quality y then a divorce will be triggered if $y > z$. The search strategies will now depend on the relative numbers of attached and unattached persons. Specifically, Eq. (4.8) is replaced by

$$rv_i = \mathrm{Max}\{u(s+s_j)\int_{v_m+v_f}^{\infty}(w_i(z)-v_i)\,\mathrm{d}F(z) + (1-u)s\int_{v_m+v_f}^{\infty}\int_t^{\infty}(w_i(z)-v_i)\,\mathrm{d}F(y)\,\mathrm{d}G(z) - c_i(s)\}, \quad i,j = \mathrm{m,f} \text{ and } i \neq j, \tag{4.14}$$

where $G(z)$ is the distribution of quality of matched couples. Observe that the expected returns from meeting an attached person are lower than those of meeting with an unmarried one. Therefore, the higher is the aggregate rate of nonattachment the higher are the private returns for search.

Assuming that partners are ex-ante identical, the search models outlined above do not address the question who shall marry whom. Instead, they shift attention to the fact that, in the process of searching for a mate, there is always a segment of the population which remains unmatched, not because they prefer the single state but because matching takes time. A natural follow up to this observation is the question whether or not there is "too much" search. Clearly, the mere existence of waiting time for marriage does not imply inefficiency since time is used productively to find superior matches. However, the informational structure causes externalities which may lead to inefficiency. One type of externality arises because, in deciding on search intensity, participants ignore the higher chance for meetings that others enjoy. This suggests that search is deficient. However, in the extended model which allows for divorce there is an additional externality operating in the opposite direction. When two unattached individuals reject a match opportunity with $z \leq v_m + v_f$ they ignore the benefits that arise to other couples from a higher nonattachment rate. Thus, as in a related literature on unemployment, it is not possible to determine whether there is too much or too little nonattachment.

An important aspect of Eq. (4.14) is the two-way feedback between individual decisions and market outcomes. The larger is the proportion of the unattached the more profitable is search and each unattached person will be more choosy, further increasing the number of unattached. As emphasized by Diamond (1981) such reinforcing feedbacks can lead to multiplicity of equilibria. For, instance, the higher is the aggregate divorce rate the more likely it is that each couple will divorce. Therefore, some societies can be locked into an equilibrium with a low aggregate divorce rate while others will settle on a high divorce rate.

There are some additional features which characterize the search for a mate and can be incorporated into the analysis. First, as noted by Mortensen (1988), the quality of marriage is revealed only gradually. Moreover, each partner may have private information which is useful for predicting the future match quality (see Bergstrom and Bagnoli, 1993). Second, as noted by Oppenheimer (1988), the offer distribution of potential matches varies systematically with age, as the number and quality of available matches changes, and the information about a person's suitability for marriage sharpens. Finally, meetings are not really random. Unattached individuals select jobs, schools and leisure activities in order to affect the chances of meeting a qualified person of the opposite sex (see Goldin, 1992).

4.4. The division of the gains from marriage

The marriage market influences not only the assignment of partners but also the division of resources and activities within the family. At a given market situation, one would expect that a partner with more marketable traits will command a higher share of the gains from marriage. As market conditions change and a shortage of suitable partners of a particular kind is created, such partners will receive a larger share of the gains from marriage.

In traditional societies the transfer takes the form of an up-front payment in the form of a dowry or bride-price, with a possible reversed payment in the event of divorce. The data on dowries in such societies provide some evidence on the working of market forces. Grossbard (1978) brings evidence that polygamy, which raises the demand for women, tends to increase the bride-price. Rao (1993) shows that an increase in the demand for men created by faster population growth, combined with the tendency of men to marry younger women (a marriage squeeze), has led to an increase of dowries in rural India.

In modern societies, up-front payments are rare, so that the effects of market forces are mostly revealed by the division of labor within families. Grossbard-Shechtman (1993: Ch. 6) finds that a low ratio of males to females tends to increase labor force participation of married women and interprets this as a reduction in the female share in the gains from marriage. Examining recent trends in patterns of time use, Juster and Stafford (1991) observe that women reduced their total work (in the market and at home) more than men, while shifting hours from household chores to the market. In the same time, the marriage premium for males has declined (see Blackburn and Korenman, 1994). It has been argued that these shifts indicate, in part, an increase in the female share in gains from marriage. One can link the redistribution of shares to more liberal divorce laws (see Carlin, 1991) and other forms of government intervention, such as child allowances. Of course, legal changes and policy changes are to a large extent an outcome rather than a cause of market changes. Becker (1991: Ch. 2) argues that the main driving force is the higher earning capacity of women associated with modernization and changing industrial structure.

Additional information on the (expected) gains from marriage is contained in the decisions to enter marriage and to stay married. One might argue that a party who expects higher gains from marriage will decide to marry earlier and will be less likely to divorce. Keeley (1977) finds that a high wage induces men to have an early marriage while it induces women to postpone their marriages. This seems to be consistent with the view that, given the usual division of labor within the household where men work mostly in the market and women at home, high-wage men and low-wage women stand to gain more from marriage. Similarly, Weiss and Willis (1996) find that high expected earning capacity of males stabilizes the marriage, while high earning capacity of females is destabilizing. Brien (1991) finds evidence that local sex ratios (at the county level) influence the decisions to enter marriage and to have children out of wedlock. In particular, he finds support to Wilson's (1987) claim that an imbalance in the marriage market, i.e. a shortage of eligible black males in the US is a major reason for the lower rates of entry into marriage of black females relative to white females.

5. Divorce and its economic consequences

5.1. Determinants of divorce

As we have seen in the previous section, the search model allows for divorce in quite a natural way. Since couples meet randomly, a matched person can find a better match than his current match. Another important cause for divorce is uncertainty about the quality of the match and other marriage related characteristics of the partners. In this section a simple framework for a dynamic analysis of the marriage relationship is presented which incorporates the acquisition of new information. At the time of marriage, the two spouses have only limited information on the determinants of the gains from marriage. As time passes, new information on the success of their joint venture and on the outside options of each partner is accumulated and the couple decides whether to dissolve the partnership or to continue the marriage. Divorce occurs endogenously whenever the couple cannot find an allocation within marriage that dominates the divorce allocation.

The gains from marriage can be specified with the aid of a household production function. Household production in each period depends on the characteristics of the two partners (e.g., family background, schooling and earning capacity), the quality of their match (which is usually unobserved), and the accumulation of marital capital (e.g., children and common property). Some of these variables may vary as the marriage evolves. Denote the time since the marriage was formed by t, $t = 1, 2, \ldots, T$; the spouses' personal characteristics by x_{it}, $i =$ h,w; the quality of match by θ_t; and marital capital by k_t. The household production function is written as

$$g_t = G(x_{\mathrm{h}t}, x_{\mathrm{w}t}, k_{\mathrm{f}}, \theta_t). \tag{5.1}$$

Although household production is also influenced by the allocation of time and goods within the household, we only consider the outcome after these activities are "maximized out", the production function only in terms of the current state variables. (Such a two-stage procedure is only valid if time allocation has no impact on future states; investment activities are introduced in the subsequent section). In general, one expects the gains of marriage to be a nonlinear function of the partners' characteristics. This nonlinearity reflects variety of potential interactions between the spouses characteristics. For instance, it was shown in Section 2 that if the partners pool their incomes and share in a public good, their incomes will be complements in the household's production function.

Each partner has alternatives outside their particular marriage, as a single person. The value of being in the single state includes the option value of becoming remarried. It is assumed that the value of these outside alternatives can be described as a linear function of the characteristics of each partner:

$$A_{it} = \zeta_i' x_{it} + v_{it}. \tag{5.2}$$

Once a marriage is formed, dissolving it is costly. First, there are legal costs associated with the divorce process and the division of property. Secondly, marriage-specific capital such as information about the preferences of one's spouse is lost. Thirdly, if the couple has children, separation can lead to an inefficiently low level of child care expenditures. This is because the custodial parent does not internalize the preferences of his or her ex-spouse for expenditure on children (see Weiss and Willis, 1985). The extent of these costs depends on the nature of the divorce settlement and on the assignment of custody. For instance, if the husband fails to pay child support to the custodial mother, there will tend to be under provision of child expenditures and, assuming that both value the children's welfare, both partners will suffer. Let C_t denote the costs of divorce. Then

$$C_t = \gamma' k_t + \eta' s_t + \omega_t, \tag{5.3}$$

where s_t represents the various components of the divorce settlement (e.g., child support and alimony).

Each of the exogenous variables, $x_{\mathrm{h}t}$, $x_{\mathrm{w}t}$, k_t, θ_t, is governed by a stochastic difference equation. Let us indicate the "state" at time t by the vector $y = (x_{\mathrm{h}t}, x_{\mathrm{w}t}, k_t, \theta_t)$ then

$$y_t' = B y_{t-1}' + \mu_t, \tag{5.4}$$

where B is a matrix of coefficients and μ_t is a vector of unanticipated shocks.

In this dynamic framework the decision whether to marry and whether to stay married are characterized with the aid of the "value function". Let $V_t(y_t)$ denote the expected gain from being married in period t, conditioned on the current state y_t and on behaving optimally from t all the way to T (the end of the horizon). The value function is defined recursively by

$$V_t(y_t) = G(y_t) + \beta \mathrm{E}_t \operatorname{Max}[V_{t+1}(y_{t+1}), A_{\mathrm{w},t+1} + A_{\mathrm{h},t+1} - C_{t+1}] \tag{5.5}$$

where β is a discount factor, $\beta < 1$, and the expectation is taken over all possible realizations of the unanticipated shocks μ_{t+1}.

A couple will stay married at time t if the value of marriage exceeds the sum of outside opportunities at the time of marriage,

$$V_t(x_{ht}, x_{wt}, k_t, \theta_t) \geq A_{wt} + A_{ht} - C_t, \tag{5.6}$$

and divorce otherwise. Observe that divorce occurs whenever the value of marriage falls below the sum of the husband's and wife's outside opportunities. That is, divorce occurs endogenously whenever the couple cannot find an allocation within marriage that dominates the divorce allocation. This rule for "efficient divorce" holds as long as utility is transferable across spouses whether or not mutual consent of the couple is required by law (see Becker, 1991: Ch. 10; Mortensen, 1988).

Solving for $V_t(\cdot)$ by backward recursion, one can find the divorce rule. In general, it will depend on the realized values of x_{ht}, x_{wt}, s_t, k_t and θ_t. The quality of match, θ_t, is observed only by the couple and therefore, the researcher can only predict the probability of divorce, conditioned on observable characteristics of the partners. This type of reasoning leads to estimable models in which the researchers explain the probability of divorce or marriage in the sample.

The model outlined above yields several testable implications:

(1) It is the unanticipated changes in the characteristics of the partners or the quality of match which trigger divorce. It is clear that a reduction in θ, that is, falling out of love can cause divorce. It is less obvious how an unanticipated change in personal attributes, such as earning capacity, influence divorce. An increase (decrease) in earning capacity of a spouse influences both his/her contribution to the current marriage and his/her outside opportunities. Due to interactions in household production, the impact within marriage depends on the attributes of the current partner. Since the partners were matched based on their (predicted) earning capacity at the time of marriage, any surprise leading to an unanticipated rise or decline in earning capacity, can cause divorce (see Becker et al., 1977).

(2) If the gains from marriage are substantial, small shocks will not lead to divorce. Therefore, the probability of divorce will be lower amongst couples who are well matched. Anticipating that, couples sort into marriage according to characteristics which are likely to enhance the stability of the marriage.

(3) The costs of divorce, due to loss of specific marital capital, and the costs of searching for a mate are two sources of friction which mitigate the impact of unanticipated shocks on marital dissolution.

Several authors have attempted to test these implications. Weiss and Willis (1996) use data on a single cohort which finished high school in 1972 (age 18) and was subsequently followed up to 1986 (age 32). They report that unexpected changes in earning capacity strongly influence the probability of divorce. Specifically, an unexpected increase in the husband's earning capacity reduces the divorce hazard while an unexpected increase in the wife's earning capacity raises the divorce hazard. However, expectations of earning capacity which are formed at the time of marriage do not influence divorce. Thus, surprises concerning the earning capacity of the partners are more important than the differences in gains from marriage resulting from initial sorting based on expected earning capacity. Becker et al. (1977) report a cross-section relationship where the husband's income first reduces then increases the divorce hazard. Their interpretation of this finding is that unexpectedly high as well as unexpectedly low male earnings trigger divorce. Additional support to the claim that positive surprises can trigger divorce is provided by finding that unexpected subsidy (through a negative income experiment) increased the divorce hazard among the recipients (see Groenenveld et al., 1980; Cain and Wissoker, 1990).

There is ample evidence for a strong influence of sorting based on educational attainment. Couples with similar schooling attainments at the time of marriage are less likely to divorce and individuals are more likely to marry if they have a similar amount of schooling (the correlation in schooling attainments of the two spouses at the time of marriage is about 0.6). Likewise, similarity in religion and ethnicity, reduces the probability of divorce and a large proportion of all marriages are to individuals of the same ethnicity or religion. The finding that initial predictions of earning capacity do not influence subsequent divorce rates is consistent with the absence of sorting based on these predictions. (The correlation between the predicted earning capacities of husband and wife at the time of marriage is only 0.2 (see Weiss and Willis, 1996).)

The important roles of search and costs of divorce is indicated by the findings that higher age at marriage has a stabilizing effect, the divorce hazard is initially increasing with the duration of marriage, the presence of children and high levels of property stabilize the marriage (see Becker et al., 1977; Lillard and Waite, 1993; Weiss and Willis, 1993).

Somewhat more controversial is the role of divorce laws, in particular whether the legal possibility to unilaterally walk away from a marriage increases the divorce rate. The compensation principle implicit in the rule of efficient divorce suggests that such legal changes should only affect the shares in the gains from marriage but not the decision to separate. However, to the extent that legal rules affect the joint cost of divorce either in legal fees or through the impact on the expenditure on children, the legal environment may be relevant. There is weak evidence suggesting that divorce rates are higher in states where "fault" is not a prerequisite for divorce (see Allen, 1992; Peters, 1992; Weiss and Willis, 1996).

5.2. *Divorce transfers*

The presence of uncertainty together with risk aversion raises the issue of risk sharing. In the absence of appropriate mechanisms for risk sharing, divorce can have a substantial effect on the welfare of the partners. It has been observed that divorced husbands, even if relatively well-to-do, fail to support their ex-wives and their children at the standard to which they were accustomed during marriage. Consequently, divorced women and children in their custody seem to suffer a large decline in economic well-being (see Hoffman and Duncan, 1988). There are three possible explanations for this phenomenon. One is the lack of binding marriage contracts. The second is the inability of noncustodial parents to monitor expenditures by the custodian. Finally, fathers who live apart from their children may lose interest in them.

Following Weiss and Willis (1985), consider a simple two-period framework, where the only role of time is the resolution of uncertainty. The marriage is formed and children are born at time zero when the partners are still uncertain of the quality of their match. In the second period the quality of match is realized, the partners re-evaluate their original decision and decide whether or not to stay married. To abstract from issues of search, assume that remarriage is not an option.

If the marriage continues, the utility of each partner is given by

$$u_i = u_i(q, c_i) + \theta, \quad i = \mathrm{h,w}, \tag{5.7}$$

where q is the expenditure on children, c_i is the consumption level of partner i and θ is the quality of the match. If divorce occurs, the utility of each partner is given by Eq. (5.7) with θ set to zero. Observe that the same quantity q appears in both utilities, reflecting the assumption that child quality is a collective good for their parents.

When the partners meet they will form a union if the expected quality of the match is positive. Later on, having observed θ, the partners must decide whether or not to divorce. If the partners could cooperate in the divorce state then the marriage would break if and only if the partners can jointly produce more in the divorce state than in the marriage state, i.e. if and only if $\theta < 0$. However, if divorce also detracts from the efficiency of the allocation of family resources, then the marriage may continue even if $\theta < 0$. This is due to the presence of children whose maintenance is a collective good for the parents. We may assume that, within marriage, the allocation on the public good is determined in a cooperative fashion, while if they live apart the allocation will be determined noncooperatively.

A common arrangement in the event of divorce is that one partner is selected as custodian who determines the expenditure on the public good. The noncustodian can transfer resources to the custodian but cannot monitor the allocation of expenditures. If the wife is the custodian, the allocation is determined by

$$\operatorname*{Max}_{s \geq 0} u_{\mathrm{h}}(q^{-}, y_{\mathrm{h}} - s), \tag{5.8}$$

subject to

$$q^{-} = \operatorname*{Argmax}_{q} u_{\mathrm{w}}(q, y_{\mathrm{w}} + s - q). \tag{5.9}$$

Another possibility is that both partners contribute independently to the child. In this case

$$q_i = \operatorname*{Argmax}_{q \geq 0} u_i(q + q_j, y_i - q), \quad i, j = \mathrm{h,w} \text{ and } i \neq j. \tag{5.10}$$

The Stackelberg model, given by Eqs. (5.8) and (5.9), is probably more appropriate when the husband transfers money to his wife who then serves as an agent in transferring resources to the child. The Cournot model, described by Eq. (5.10), may be more appropriate if the partners can transfer directly to their child, as in the case of college education or other child-specific expenses.

Common to both models is an ex-post inefficiency in the allocation of family resources. If the wife controls the expenditure on children (i.e., she is the custodian) then, most likely, she will not take account of the impact of her choices on the welfare of her ex-husband. In the Stackelberg model, this can interpreted as an agency problem. Out of every dollar transferred to the custodial wife with the intention of raising the welfare of the child, she uses part for her own consumption. The father is thus facing a price for child quality which exceeds the true resource cost. Hence, he will reduce his transfer and under provision of child care arises. In the Cournot case, the problem can be viewed as a free rider problem. Here, both partners underpay hoping to shift the load to the other partner. Thus, in both cases, the quality of children falls short of the efficient level given by the Samuelson condition for an efficient allocation of collective goods,

$$\left(\frac{\partial u_{\mathrm{h}} / \partial q}{\partial u_{\mathrm{h}} / \partial c_{\mathrm{h}}}\right)+\left(\frac{\partial u_{\mathrm{w}} / \partial q}{\partial u_{\mathrm{w}} / \partial c_{\mathrm{w}}}\right)=1. \tag{5.11}$$

In addition to being inefficient ex-post, the self-enforcing transfer is inefficient from an ex-ante point of view. It does not share risks optimally. To simplify the presentation of ex-ante efficiency, assume now that the quality of the match θ obtains only two values: θ^+ with probability p and θ^- with probability $1-p$. Suppose that the husband cannot monitor the expenditure on children in the divorce state but can make a binding contract to pay the wife a certain amount, s^- in the event of divorce. Suppose further, that for any s^-, if the event $\theta=\theta^-$ occurs then there is no distribution within marriage which is preferable to both partners so that divorce is imminent. In this case, the ex-ante efficient allocation is determined from

$$\text{Max E}(u_{\mathrm{h}}) = (1-p)u_{\mathrm{h}}(q^-, y_{\mathrm{h}}-s^-) + p[u_{\mathrm{h}}(q^+, y_{\mathrm{h}}-s^+) + \theta^+], \tag{5.12}$$

subject to the constraints

$$\mathrm{E}(u_{\mathrm{w}}) = (1-p)u_{\mathrm{w}}(q^-, y_{\mathrm{w}}+s^- - q^-) + p[u_{\mathrm{w}}(q^+, y_{\mathrm{w}}+s^+ - q^+) + \theta^+] \geq u^*, \tag{5.13}$$

$$u_{\mathrm{w}}(q^+, y_{\mathrm{w}}+s^+ - q^+) + \theta^+ \geq u_{\mathrm{w}}(q^-, y_{\mathrm{w}}+s^- - q^-), \tag{5.14}$$

$$u_{\mathrm{h}}(q^+, y_{\mathrm{h}}-s^+) + \theta^+ \geq u_{\mathrm{h}}(q^-, y_{\mathrm{h}}-s^-), \tag{5.15}$$

$$q^{-} = \underset{q}{\operatorname{Argmax}}\, u_{\mathrm{w}}(q, y_{\mathrm{w}} + s^{-} - q). \tag{5.16}$$

Instead of the consumption levels, we view the within-family transfers as the decision variables for the maximization above. We denote the transfer from the husband to the wife by s^j, and the transfers to the child by q^j, $j = +,-$. We denote by y_i the income of partner i, $i = \mathrm{h,w}$, and total family income, $y_{\mathrm{h}} + y_{\mathrm{w}}$, is denoted by y.

The participation constraint, Eq. (5.13) states that the wife is willing to join the partnership when it is formed only if her expected gains from marriage exceed her next best alternative, u^*. More generally, u^* is any feasible level of expected utility that the wife obtains through bargaining at the time of marriage. The incentive compatibility constraints, Eqs. (5.14) and (5.15), require that, given the promised divorce and marriage transfers, the wife or the husband do not wish to walk out of the marriage if the realization is θ^+. The constraint, Eq. (5.16), reflects the assumption that in the event of divorce the wife becomes the custodian.

If θ^+ is sufficiently large to make the constraints (5.14) and (5.15) nonbinding, then the first-order conditions for the maximization imply that the slopes of the utility frontiers are equated in the divorce and marriage states. Thus, the main feature of ex-ante efficiency is that it ties the divorce transfer to the wife to the standard of living to which she and the child were accustomed within the marriage. We refer to these ties as the insurance motive in divorce settlements. In contrast, the ex-post transfers determined by Eqs. (5.8) and (5.9) or by (5.10) pay no attention to the options within marriage and therefore do not share risks optimally.

The inherent problem of the ex-ante marriage contract is that it is not self-enforcing. Intervention by the court is required to maintain efficiency. However, in most countries the law does not intervene in within-marriage allocations and its intervention in post-marriage allocations is limited to some general guidelines or formulae relating to child support, alimony and property division to the partners' incomes and to considerations such as the needs of children, investments in the marriage, and the accustomed standard of living. While this form of intervention certainly affects the bargaining power of the two partners and the post-divorce allocation (see Mnookin and Kornhouser, 1979), the upshot of this legal situation is that divorce can cause a substantial reduction in economic welfare. The amount that husbands transfer to their ex-wives falls short of the efficient level (see Weiss and Willis, 1993). The transfers would be larger if ex-ante contracts would be enforced, but legal intervention cannot resolve the ex-post inefficiency due to difficulties in monitoring the within household allocation. The problem of underprovision is exacerbated by the apparent loss of altruism towards the child by the noncustodian father. Seltzer (1991) reports a reduction in contacts between father and son following divorce. In addition, she found a clear association between child support payments and frequency of contacts.

5.3. Defensive investments

With deficient transfer mechanisms, the partners must prepare for the event of divorce. One important instrument is the allocation of time within marriage. By investing in human capital each partner can be less dependent on transfers in the event of divorce. However, such investments may detract from marital output. For instance, a wife who works is better defended against divorce but has less time to spend on children. Indeed, it appears that women tend to increase their investment in market work in anticipation of divorce (see Johnson-Skinner, 1986). Thus, lack of enforcement of divorce transfers reduces the welfare of children not only in the divorce state but also within marriage.

To analyze this phenomenon, let us use a slight variation on the previous model and assume that child quality is produced at home rather then purchased in the market. Specifically, in each period j, $j = 1,2$, child quality q_j is determined by the household production function

$$q_j = (\alpha t_{\mathrm{h}j} + \beta t_{\mathrm{w}j})^{\gamma}\, e_j^{1-\gamma}, \tag{5.17}$$

where t_{ij} is time spent at home by partner i, $i = \mathrm{h,w}$, and e_j are market goods devoted to home production. Let us assume transferable utility, where, for each partner

$$u_{ij} = q_j c_{ij} + \theta_j. \tag{5.18}$$

The quality of match θ_j is set to zero if the partners are not married. Time now plays two roles; as time passes, information is gathered and investments mature. When the partners marry in period 1, the initial wages w_{ij} are given and θ_1 is known (without loss of generality, let $\theta_1 = 0$). In the second period, a new value for θ is realized and new wages are determined according to

$$w_{i2} = W_{i2}(h_{i1}), \tag{5.19}$$

where h_{i1} is time spent at work by partner i in the first period and $W_{i2}\,(h_{i1})$ is a monotone increasing function of h_{i1}. This relationship represents a process of learning by doing where current work in the market affects future wages. Let the wife have the comparative advantage in home production, $\beta/w_{\mathrm{w}j} > \alpha/w_{\mathrm{h}j}$ for $j = 1,2$. To simplify further, assume that saving and borrowing is not an option. Otherwise, all previous assumptions are maintained including the assumption that the wife is the custodian in the case of divorce.

We solve the family's problem backwards, starting in the second (and last) period. Having observed θ_2 and given the new wages, there are two possible states. Either the partners remain married or they decide to separate. If the partners remain married then the husband will specialize in market work and the wife will spend part of her time working at home. This division of labor reflects her comparative advantage in home production. (The wife will specialize in home production if her wage is sufficiently low relative to the husband, i.e. if $w_{h2}/w_{w2} > (2-\gamma)/\gamma$, but it is assumed that the difference in wages is such that the wife is in an interior solution.) The total family utility is given by

$$u_{h2} + u_{w2} = \kappa w_{w2}^{-\gamma}(w_{h2} + w_{w2})^2 + 2\theta_2, \tag{5.20}$$

where κ is a constant which depends on the parameters. Note that an increase in the wife's wage has a positive income effect and a negative substitution effect on child quality. This is reflected in the opposing effects for w_{w2} in Eq. (5.20). However, the total effect of an increase in w_w on family utility is positive.

If the partners divorce, then the wife will obtain custody and the outcome will be determined by Eqs. (5.8) and (5.9). Specifically, the wife will spend time on her children according to $w_{w2}t_{w2} = \gamma(w_{w2} + s)/2$, and other expenditures according to $e_2 = (1-\gamma)(w_{w2} + s)/2$, where s is the payment that she gets from her husband. Taking this reaction function s as given, the husband will choose s to maximize his own utility, implying $s = (w_{h2} - w_{w2})/2$. The implied utilities are $u_{i2} = \kappa_i w_{w2}^{-\gamma}(w_{h2} + w_{w2})^2$, where κ_i are constants that depend on the parameters. It is easily verified that $\kappa_w + \kappa_h < \kappa$ and $\kappa_h > \kappa_w$. That is, the wife obtains a lower utility than her husband in the divorce state and aggregate utility in the divorce state is lower than the utility in the marriage state, with $\theta = 0$. These outcomes reflect the loss of efficiency in the allocation of the public good and the under payment by the husband resulting from the lack of control on the wife's expenditures.

The divorce rule which emerges from the results above is that the couple will remain married for realizations of θ_2 satisfying

$$\theta_2 \geq w_{w2}^{-\gamma}(w_{h2} + w_{w2})^2[\kappa_h + \kappa_w - \kappa]/2 \tag{5.21}$$

and divorce otherwise. Note that the partners remain married for some negative values of θ_2. That is, to avoid the loss of efficiency, the partners will stay married despite the "failure" of their marriage, provided, of course, that the negative shock is not too large. The higher is the wife's or the husband's wage in the second period, the lower is the probability of divorce. This happens because the loss in efficiency is larger at higher wages.

Anticipating the possibility of divorce, the partners need to decide on their respective work effort in the market (and at home) in the first period, when the future value of θ is still unknown. If the partners can coordinate their work activities, they will maximize the sum of their expected utilities,

$$\sum_i \mathrm{E}\sum_j u_{ij} = (\beta t_{\mathrm{w1}})^{\gamma} e_1^{1-\gamma}(w_{\mathrm{h1}} + w_{\mathrm{w1}}(1-t_{\mathrm{w1}}) - e_1) +$$

$$+[(1-F(\theta^*))\kappa + F(\theta^*)(\kappa_{\mathrm{h}} + \kappa_{\mathrm{w}})]w_{\mathrm{w2}}^{-\gamma}(w_{\mathrm{h2}} + w_{\mathrm{w2}})^2 + 2\int_{\theta^*}^{\infty} \theta \,\mathrm{d}F(\theta), \tag{5.22}$$

where θ^* is the reservation value of θ_2 at which Eq. (5.21) holds as an equality, $F(\theta)$ is the distribution of θ, and we exploit the assumption on the husband's comparative advantage and set his work at home to zero. Recall that, by Eq. (5.19), the second-period wages are positively affected by current work in the market. Therefore, the wife's work at home (market) in the first period will be set below (above) the level that maximizes the current family utility. We may refer to this adjustment as the investment effect on labor supply. The risk of divorce, and the associated loss of utility affect the incentives for investment. In particular, if divorce does not cause a loss of efficiency ($\kappa = \kappa_{\mathrm{h}} + \kappa_{\mathrm{w}}$), there will be a higher probability of divorce, and less work at home than in the case with costly divorce ($\kappa > \kappa_{\mathrm{h}} + \kappa_{\mathrm{w}}$). In this sense, the anticipation of a higher divorce probability is associated with more market work by the wife in the initial period of the marriage.

This analysis can be extended to the choice of the number of children. The larger the number of children, the higher will be the costs of divorce and the anticipation of divorce will reduce fertility. The analysis suggests that changes in the divorce law that would enforce transfers and make divorce less costly may increase the amount spent on children within marriage. However, changes in the law which facilitate divorce, but do not enforce transfers may have the opposite effect. Indeed, some studies find a positive impact of no-fault divorce laws on female participation in the labor force and the amount of work at home (see Peters, 1986; Carlin, 1991).

The analysis in this section was substantially simplified by the assumption of transferable utility which implies that the partners have a mutual interest to coordinate their work activities if they stay married. It was shown that defensive actions will be taken even in this case, simply because both partners anticipate the difficulties which would arise if divorce becomes imminent. Clearly, the problem of defensive investments will be exacerbated if the partners cannot cooperate in the marriage state (see Cohen, 1987). In any case, the main insight is that the developments in employment fertility and divorce are interrelated. An exogenous change which reduces the incentive to specialize in the household will increase divorce and reduce fertility. Similarly, an exogenous change which increases the divorce risk will increase labor market participation and reduce fertility (see Grossbard-Shechtman, 1984, 1993: Ch. 10; Ermisch, 1994).

6. The future of the family

The oldest of all Societies, and the only natural one, is that of the family; yet children remain tied to their father by nature only as long as they need him for their preservation. As soon as this need ends, the natural bond is dissolved. Once the children are freed from the obedience they owe their father, and the father is freed from his responsibilities towards them, both parties equally gain their independence. If they continue to remain united, it is no longer nature, but their own choice, which unites them; and the family as such is kept in being only by agreement.

Jean-Jacques Rousseau, The Social Contract, Ch. 2.

Despite its firm roots in nature and its antiquity in human society, the future of the family institution has been recently put into question. The recent trends of declining marriage rates, declining fertility, higher divorce rates and the rise in alternative arrangements such as cohabitation, single-person households and single-mother families, are common to many western societies. The economist can wisely relate these trends with the changes in the market place, in particular increased participation of female workers, and in the nature of government intervention in the form of taxes and subsidies and in the laws regulating marriage and divorce. The demographer can relate the weakening of the family to changes in the technology of producing children, in particular, lower mortality rates and more effective birth control. The sociologist may point to the relation with the erosion of religious and political authority and the rise of individual freedom (see Lesthaeghe, 1983; Bumpass, 1990; Goldscheider and Waite, 1991; Espenshade, 1985). From a casual reading of the literature, there is a sense that social scientists in each of these disciplines agree that gains can be made by the interweaving of social economic and demographic considerations. However, no single discipline seems capable of providing such a synthesis.

Examining the economic contributions, the main obstacle is the scarcity of equilibrium models which carefully tie the individual behavior with market constraints and outcomes. Consequently, we do not yet have a convincing model which would explain the aggregate changes in family formation and dissolution (see Michael, 1988). In a broad sense, this research agenda has a long tradition in economics, dating back to Malthus. For instance, Easterlin (1987) argues that if the offsprings' cohort is large relative to the parents' cohort (e.g. the baby boomers), then economic pressures, combined with a desire to imitate their parents consumption standards, will force the youngsters to postpone marriage and have smaller families. This line of argument suggests that the current pressures on the family are cyclical in nature and will diminish as fertility declines. A weakness of this model, however, is its failure to address the apparent increase in the wife's share in the gains from marriage. For this purpose, one needs to introduce additional feedbacks from the labor and marriage markets to family decision-making (see Becker, 1992). Hopefully, the ideas and models summarized in this survey may help to establish such links, but much remains to be done.

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