The family as the health producer — when spouses are Nash-bargainers

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Abstract

The Grossman model is extended to a situation in which the family is regarded as the producer of individual health and spouses are Nash-bargainers. The model has implications for the interaction between family structure, income and the stocks of health capital and the bargaining strength of different family members. The main insight is that the possibility of divorce affects the distribution of health capital between family members. We analyse, inter alia, the impact on the distribution of health (particularly regarding child health) of changes in family policies related to the dissolution of the family. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

In his seminal work Grossman (1972) argued that “good health” is a commodity which is produced by the individual. The commodity “good health” is treated as part of his or her human capital, and as such it determines the total amount of time the individual can spend on productive activities in market and non-market sectors. This provides the rationale for the individual to demand health capital up to the point where the costs of one additional unit of health capital is equal to the value of the additional time available for productive use plus the utility of being healthy per se that an additional unit of “good health” creates. Grossman (2000) provides a survey of the research in this field of economics.

Grossman’s model gave many insights, but it did not take into account that most people lead their lives within a family. The structure of a family may change over the lifecycle,
but the fact remains that other individuals with whom a person lives influence behaviour. Jacobson (2000) extends Grossman’s model in that she argues that the family — not the individual — produces “good health”. Following Becker (1973, 1974), Jacobson postulates a family-utility function that does not explicitly reflect the potentially conflicting preferences among family members; she analyses a model in which family members have common preferences. The most fundamental insight provided by Jacobson is that not only own income (or wealth) can be used in the production of health, but rather that it is the family’s joint resources that are important. Jacobson’s model implies, for example, that the family will not try to equalise the health capital of different family members. Instead the family will allocate the investments in health capital so that the marginal benefit equals the marginal net cost of health capital.

As pointed out by Manser and Brown (1980), Becker’s approach to the family’s allocation problem does not solve the problem of conflicting preferences. Accordingly, divergent preferences of man and wife are not analysed within Jacobson’s framework. Even in the case where man and wife value their own health identically and they both put the same value on the health of the spouse, they will not in general have identical preferences regarding the investments in the health capital. That is, the husband may prefer an amount of health capital which is different from the amount that the wife prefers her husband to hold. One reason for this is that investments made by one spouse in the health capital of the other spouse is an investment that cannot be utilised by the investor in the event of the family’s dissolution. Thus, the possibility of divorce and the fact that human capital is not shared between the spouses in case of divorce create differing incentives between the spouses to invest in the health capital of the other spouse.¹

Following Grossman’s tradition, this paper develops a basic dynamic model of the demand for the commodity “good health” in which the family is regarded as the producer of “good health” and in which the spouses bargain for the allocation of the family’s total resources. The innovating and distinguishing characteristics of our model is that it stresses the importance of conflicting interests of husband and wife (but not between parent(s) and child(ren)). The framework lends itself to an analysis of the distribution of investments in health capital between family members. Moreover, it is also possible to analyse the impact of outside opportunities on the distribution of investments in health capital within the family. For example, what is the effect on the distribution of investments in health capital within the family of the different opportunities in the labour market that face men and women? Opportunities in the labour market partly determine the bargaining strength of each spouse, and hence, will affect the allocation within the family.

Since children are dependent on their parents, the family perspective in the production of health is especially important when it comes to child health. Jacobson (2000) discusses the relationship between child health and the conditions under which the child was brought up and surveys the empirical literature. For an example, see Currie and Gruber (1996) who found that parents with college education are more likely to take their children to the doctor.

¹ This is similar to the conclusions in, for example, Landes (1978), King (1982) and Bolin (1994), that the possibility of divorce disturbs the investments in the human capital of the family members. Some sort of payment in case of divorce — spousal support — is needed to make the investments in the spouses’ human capital efficient.
They also found that children in divorced families have higher utilisation levels of medical care.

The model, presented in this paper, does not consider that life in many respects is uncertain. For example, divorce and bad health may be — at least to some extent — regarded as stochastic events. In the final section of the paper we discuss extensions of, or alternatives to, our basic model, aiming at incorporating uncertainty and strategic behaviour in the decisions to make investments in different family members’ health, both being important areas for future research. First, however, we present our model of the bargaining family, derive and interpret its optimality conditions and discuss the implications for the distribution of health capital in the family from changes in the bargaining strength of husband and wife.

2. The bargaining family

Let our family be constituted of a husband, h, a wife, w, and a child, c. Each spouse, i, derives utility from his or her stock of health capital, \( H^i_t \), as well as from the spouse’s stock of health capital, \( H^j_t \), child health, \( H^c_t \), and a consumption commodity, \( Z_t \). We assume, for simplicity, that the utility functions are identical, time additive and strictly and jointly concave in \( H_t \) and \( Z_t \).\(^2\) Child health and child consumption are public goods within the family, but there is no explicit utility function for the child.\(^3\),\(^4\) The utilities of husband and wife are

\[
U(H^h_t, H^c_t, Z^h_t, Z^c_t),
\]

and

\[
U(H^w_t, H^c_t, Z^w_t, Z^c_t).
\]

\(^2\) That is, the spouses have identical utility functions but may be different in other regards.

\(^3\) There is a rather extensive literature that examines the family under the assumption that a (large) part of what is consumed within the family are, in fact, public goods. For a comprehensive discussion of this, see Konrad and Lommerud (1995) and Bolin (1996).

\(^4\) Thus, in our model, the husband (wife) cares for his wife’s (her husband’s) health but not for her (his) consumption of other goods and services. Moreover, child health is treated quite differently from the two spouses’ health: (a) child health affects both spouses’ time available for productive use and (b) only the spouses invest in child health. These are simplifying assumptions in order not to complicate the analysis more than necessary. Our main argument — that external opportunities such as labour market conditions and family legislation (which affect the threat points of husband and wife) will be of utmost importance for the distribution of health within the family, especially regarding child health — will not be biased by these assumptions. One might say, for instance, that the child ceases to be a child when it is able to produce his or her own health, and then, this model is no longer valid. However, at the same time, the assumptions made impose limitations as to what kind of analyses which could be performed. By concentrating on the simple three-persons-case of husband, wife, and child, for instance, potential implications of the size of the family for conflicts between child(ren)—parents and among children or possible differences in preferences between parents in relation to investments in different children were not possible to analyse in this context. The implications of more complex family structures and of more complex preferences among family members may be an area for future research. On the other hand, many families do consist of two adults and one child (and increasingly so, for instance, in Sweden). Also, more and more couples seem to prefer not have any children at all or to postpone having children. Our model could easily be adapted to represent this latter case by dropping the arguments for child health and child consumption from the equations.
We assume that the marginal utility of the consumption good is increasing in “good health” of both spouses, i.e. \( \partial^2 U / (\partial H^i \partial H^j) > 0 \), and more utility of health the healthier your spouse and child is, i.e. \( \partial^2 U / (\partial H^i \partial H^j) > 0 \), \( i, j = h, w, c; \ i \neq j \).

The individual, although governed by the family, invests in the stock of health capital — these gross investments are denoted \( I_h, I_w \) and \( I_c \) — but these investments are partially offset by a natural depreciation — at rates \( \delta_h, \delta_w \) and \( \delta_c \) — of the existing stock of health capital. Following Grossman (1972), Muurinen (1982), Wagstaff (1986), Liljas (1998) and Jacobson (2000) we examine a model in which the rates of depreciation are time-dependent.

Thus, the equations for the motion of the stocks of health capital over time are for husband, wife and child, respectively:

\[
\dot{H}_i^t = I_i^t - \delta_i H_i^t, \quad i = h, w, c.
\] (3)

We assume that marginal costs of both gross investments in health and the consumption commodity are constant. The sum of the family’s return on financial capital, the spouses’ incomes, the cost of investments in health capital of the spouses and the cost of the consumption commodity must equal the rate of growth of the stock of financial capital. Hence, the marginal (and average) cost of the consumption commodity, \( Z \), denoted \( p_Z \), and the marginal (and average) cost of the gross investments in health, \( p_I \), and earned income, denoted \( y \), must follow the asset accumulation constraint

\[
\dot{W}_t = rW_t + y^h_t(H^h_t, H^c_t) + y^w_t(H^w_t, H^c_t) - p_I^h(t^h_t + I^w_t + I^c_t) - p_Z^h(Z^h_t + Z^w_t + Z^c_t),
\] (4)

where \( W \) is total assets and \( r \) is the rate of interest. We express market income as a function of health. Sick time and the nursing time supplied by spouse \( i \), \( \tau_s^i(H^i_t) \) and \( \tau_s^i(H^c_t) \), are functions of own health and child health, respectively, and hence, we have for each spouse

\[
y_i^t = \omega_t(\Omega - \tau_s^i(H^i_t) - \tau_s^{c,i}(H^c_t) - \tau_I^i - \tau_Z^i) = \omega_t \tau_M^i, \quad i = h, w.
\] (5)

where \( \omega_t \) is the wage rate and \( \Omega \) is the total time. \( \tau_I^i \) is time allocated to the production of the consumption commodity, \( \tau_Z^i \) is time allocated to the production of investments in health capital and \( \tau_M^i \) is time allocated to the labour market. Time available for market work increases as the stock of health capital increases. This is manifested through the amount of time spent at being sick being inversely related to the stock of health capital, i.e. \( \partial \tau_s^i / \partial H^i_t < 0 \). We assume that each spouse’s nursing time is a strictly decreasing function of child health, i.e. \( \partial \tau_s^{c,i} / \partial H^c_t < 0 \). It is significant to see the connection between, on the one hand, the amount of time available in the future for allocation to the market, and, on the other hand, health investments, \( H_t, \text{today} \), as it is this trade-off that makes investments in health profitable. The connection between the health stock and earned income is \( \partial y / \partial H_t = -\omega_t(\partial \tau_s^i / \partial H^i_t) > 0 \).

2.1. The family’s control problem

The intertemporal problem that faces the family is to choose the time paths of the health capital (and the consumption commodity) of its members so that the lifecycle utility of
the family is maximised. At each point in time, \( t \), the spouses act as if a Nash-bargaining process with a non-empty bargaining set governed them. The threat points at time \( t \) of the Nash-bargaining process are the maximum utility that each spouse would enjoy if cooperation breaks down at that same point in time. In this case the levels of utilities are settled as a non-cooperative game in which each spouse supplies child health. We assume that the non-cooperative outcome is divorce and that the utilities at divorce are settled without remarriage. That is, at each point in time decisions are made in such a way that the product of each spouse’s extra utility accruing from being a family member, \( V^h = U(H^h_t, H^w_t, H^c_t, Z^h_t, Z^c_t) - U^h_d(H^h_t, 0, H^c_t, Z^h_d, Z^c_d) \), for the husband, and \( V^w = U(H^w_t, H^h_t, H^c_t, Z^w_t, Z^c_t) - U^w_d(H^w_t, 0, H^c_t, Z^w_d, Z^c_d) \), for the wife, is maximised. \( U^h_d \) and \( U^w_d \) denote utilities in the case of divorce. It follows from the Nash-bargaining problem that, at time \( t \), the family’s objective function is

\[
V^h V^w.
\]

As the health capital at time \( t \) is decided by the family’s decisions before time \( t \), the amount of health capital at time \( t \) is independent of whether or not the family dissolves. The production of the consumption commodity, however, is affected as it is produced and consumed at the same point in time. Outside the family, spouses cannot enjoy the benefits which arise from specialisation according to comparative advantages. Therefore, \( Z^h_{it} < Z^h_i \) and \( Z^w_{it} < Z^w_i \). Utilities at divorce affect the family’s allocation of health capital and the consumption commodity among its members through the relative bargaining strength of the spouses. Formally, this can be seen in the fact that it is not the product of the utilities but rather the product of the deviations of each spouse’s utility from what he or she would have enjoyed as divorced. As the threat points change, the conditions of the bargaining process will evolve through time.

We are now ready to formally state the maximisation problem that faces the family. Assume that the planning horizon is \( t = T \) and that the family discounts future utility at the rate \( \rho \). The family acts as to solve the following:

\[
\max \int_0^T e^{-\rho t} \{ U(H^h_t, H^w_t, H^c_t, Z^h_t, Z^c_t) - U^h_d \} \{ U(H^w_t, H^h_t, H^c_t, Z^w_t, Z^c_t) - U^w_d \} \, dt
\]

5 The choice of the Nash-bargaining process can be justified by it being the only solution to the cooperative bargaining problem that satisfies the four requirements: Pareto optimality, symmetry, independence of irrelevant alternatives and independence of affine transformations in the utility scales. Manser and Brown (1980) applied the Nash-bargaining solution to the family’s problem of allocating resources.

6 A non-empty bargaining set implies that there is at least one point which offers both spouses a reward for acting cooperatively. It also means, since the model contains no uncertainty, that the only way in which the threat points can be realised is if cooperation breaks down.

7 See Bolin et al. (2000), for an analysis of the case where spouses act strategically.

8 In order to make the notation as simple as possible, the arguments in the utility functions denoting divorce are left out in the following.

9 We assume that the Nash product is jointly concave in all its arguments. Since neither the difference between nor the product of two concave functions is necessarily concave, this is not guaranteed by assumptions made up to this point.
subject to\(^{10}\)

\[
\dot{H}_i = I_i - \delta_i H_i, \quad i = h, w, c,
\]

\[
\dot{W}_i = rW_i + y_i(H_i^h, H_i^w, H_i^c) + \gamma_i^w(H_i^w, H_i^c) - p_i^1(I_i^h + I_i^w + I_i^c) - p_i^7(Z_i^h + Z_i^w + Z_i^c),
\]

\[
\Omega = \omega_s^h + \omega_s^{c,h} + \omega_s^{M,h} + \omega_s^{I,h} + \omega_s^{Z,h} + \omega_s^{M,w},
\]

\[
H_i^h = \hat{H}_i^h, \quad H_i^w = \hat{H}_i^w, \quad H_i^c = \hat{H}_i^c \quad \text{and} \quad \dot{W}_0 = \dot{W},
\]

\[
H_T^h \leq H_{\min}^h, \quad H_T^w \leq H_{\min}^w \quad \text{and} \quad H_T^c \leq H_{\min}^c \quad \text{and} \quad W_T \geq 0.
\]

Our model stands in contrast to previous models of the demand for health. The most important differences in relation to earlier models are, first, that we now have two individuals with explicitly expressed preferences and, second, that utilities at divorce are allowed to affect allocations within the family through the threat points. The threat points may change over time, which reflects the fact that opportunities change inter alia as a consequence of investments in human capital (not only health capital) and the depreciation of that same human capital. As pointed out by Grossman (1972), health capital differs from other forms of human capital since other forms of human capital affect the productivity (market and non-market), while health capital is directly related to the total amount of time that can be used for welfare enhancing activities. This feature of health capital is incorporated in our model. However, since our goal is to study implications of the impact of health being produced by a family, we want to make our model as simple as possible in other regards, and hence, we do not treat the household production functions explicitly.

2.2. Equilibrium and changes in threat-points

The solution to the maximisation problem is achieved by applying optimal control theory. The maximum principle gives necessary and sufficient conditions for the optimal control of \(I_i\) (and \(Z_i\)), given the time path of the state variables \(H_i^h, H_i^w\) and \(H_i^c\). We will derive the solution only for the time path of \(H_i^h\) (the solutions for \(H_i^w\) and \(H_i^c\) can be derived in the same manner). The Hamilton function for the maximisation problem is

\[
H = e^{-\rho t}(U(H_i^h, H_i^w, H_i^c, Z_i^h, Z_i^w, Z_i^c) - U_0)(U(H_i^h, H_i^w, H_i^c, Z_i^h, Z_i^w, Z_i^c) - U_0)
+ \lambda_i^h(I_i^h - \delta_i^h H_i^h) + \lambda_i^w(I_i^w - \delta_i^w H_i^w) + \lambda_i^c(I_i^c - \delta_i^c H_i^c)
+ \lambda_i^w(W^i + \nu_i^h(H_i^h, H_i^c) + \nu_i^w(H_i^w, H_i^c) - p_i^1(I_i^h + I_i^w + I_i^c)
- p_i^7(Z_i^h + Z_i^w + Z_i^c)).
\]

(8)

The Lagrangian, \(L\), is

\[
L = H + \lambda_i^2(\Omega - \omega_s^h - \omega_s^{c,h} - \omega_s^{M,h})
+ \lambda_i^M(\Omega - \omega_s^{s,w} - \omega_s^{s,c,w} - \omega_s^{s,M,w}) - \tau_T^h + \tau_T^w + \tau_T^c.
\]

(9)

\(^{10}\)This outline of the model assumes that the family stops acting as a family at time \(t = T\), e.g. as a consequence of the death of one of the spouses. The rationale for assuming this is that we are here only interested in the family’s decision-making problem and the family will cease to function as a decision-unit at some point in time.
The maximum principle yields the following equations of motion. First, for the husband’s health capital we have

\[
\dot{\lambda}_H = -\frac{\partial L}{\partial H_i} = -e^{-\rho t} \left( \left( U(H_i^w, H_i^h, H_i^c, Z_i^w, Z_i^c) - U_d \right) \frac{\partial(U_h - U_d)}{\partial H_i^h} + \left( U(H_i^h, H_i^w, H_i^c, Z_i^h, Z_i^c) - U_d \right) \frac{\partial U_w}{\partial H_i^h} \right) + \lambda_H \delta_i^h + \lambda_W \frac{\partial \tau_{s,h}}{\partial H_i^h} + \lambda_O \frac{\partial \tau_{s,h}}{\partial H_i^h}.
\]

We also have the equation of motion for total assets:

\[
\dot{\lambda}_W = -\frac{\partial L}{\partial W_t} = -\lambda_W r.
\]

Finally, we have the first-order conditions for the control variables. Notice that the control set is unconstrained, i.e. the family can actually choose any values for \(I_t\) and \(Z_t\) — within the limits of the budget — so the solution will be interior. (We assume that the lifecycle utility of the family is increasing in both control variables when they are zero.) The first-order condition for investments in the husband’s health is

\[
\frac{\partial L}{\partial I_t^h} = \lambda_H - \lambda_W p_I^t = 0.
\]

Start by solving the differential equation (11). The solution is

\[
\lambda_W = \lambda_0 W e^{-rt}.
\]

Next, take the total time-derivatives of Eq. (12), which yields

\[
\dot{\lambda}_H^h = \dot{\lambda}_W p_I^t + \dot{\lambda}_W p_I^t.
\]

Substitute Eqs. (11’), (12) and (12’) in Eq. (10). Rearranging yields the condition for the optimal time-path of the husband’s health capital:

\[
\frac{e^{-(\rho - r)t}}{\lambda_0 W} \left( \left( U(H_i^w, H_i^h, H_i^c, Z_i^w, Z_i^c) - U_d \right) \frac{\partial(U_h - U_d)}{\partial H_i^h} + \left( U(H_i^h, H_i^w, H_i^c, Z_i^h, Z_i^c) - U_d \right) \frac{\partial U_w}{\partial H_i^h} \right) - \omega_h^h \frac{\partial \tau_{s,h}}{\partial H_i^h} - \lambda_O \frac{\partial \tau_{s,h}}{\partial H_i^h} = \left( r + \delta_i^h - \frac{\rho I^t}{p_I^t} \right) p_{I_t^t}.
\]

The condition for the optimal time-path of the wife’s health capital can be derived in the same manner and is given by
The optimal time-path of child health can also be derived in the same manner and is given by

\[
\frac{e^{-(\rho-r)t}}{\lambda_W^t} \left( \left( U(H_t^H, H_t^W, H_t^c, Z_t^H, Z_t^c) - U_{t}^H \right) \frac{\partial (U^H - U_t^h)}{\partial H_t^W} + \left( U(H_t^W, H_t^H, H_t^c, Z_t^W, Z_t^c) - U_{t}^W \right) \frac{\partial (U^W - U_t^w)}{\partial H_t^W} \right)
\]

\[
- \lambda_W^t \lambda_{\tau_t^s} \frac{\partial \tau_{s,t}^c}{\partial H_t^c} - \lambda_W^t \lambda_{\tau_t^s} \frac{\partial \tau_{s,t}^w}{\partial H_t^c} = \left( r + \frac{\dot{p}_{t}^I}{p_{t}^I} \right) p_{t}^I.
\]

(14)

The conditions of an optimal allocation that are given by our model are similar to those given by Jacobson (2000). For example, Jacobson's result that the family will invest in the health of each family member until the marginal consumption benefits equals the marginal net costs of health capital is also implied by our model. The main difference between the model presented in this paper and Jacobson's model is that the utility function in Jacobson's model has been replaced with the family's objective function (6), which explicitly includes each spouse's utility. Theories of marriage and divorce presuppose individual utility functions, since both the decision to marry and the decision to divorce reflect individual choice. In Jacobson (2000), a fixed internal distribution, which is independent of outside external
options, is implicitly assumed. In contrast, our model allows for external options to affect the distribution within the family through the threat points of husband and wife.

So then, the fundamental insight given by our model is that outside opportunities affect the allocation of health (and consumption) within the family. That is, the factors that determine utilities at divorce will also influence the family’s allocations. Utilities at divorce are established by individual health stocks, child health, earning capacities and the legal institutions that regulate the consequences of divorce. This means that the relative bargaining strength of the spouses is influenced both by private decisions, taken by the family, and by decisions taken by policy makers. The relationship between threat-points and marital utilities is illustrated in Fig. 1.

A change in the threat-points affects the allocation of health capital in the following way. Assume that the husband’s threat-point increases in relation to the wife’s threat-point. Then, the Nash-bargaining process will reallocate time and other resources so as to increase the husband’s utility and decrease the wife’s utility within marriage. The implications for the allocation of health capital are given by Eqs. (13)–(15). A change in threat-points will affect the family’s marginal consumption gains from investing in health capital, i.e. the first terms on the left-hand sides of Eqs. (13)–(15). In general, without restrictive assumptions on

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11 It is a mathematical fact of the Nash-bargaining solution that if the threat point of one party improves in relation to the threat point of the other party, the first party will improve his/her outcome and the other party will be worse off.
the utility functions, the comparative dynamic effects are inconclusive. However, for given levels of child health, $H_{ct}^c$, and the consumption commodity, $Z_t^{i*}$, $i = h, w, c$, it is possible to make some conclusions regarding the effect on the allocation of health capital between husband and wife of a change in the threat-points. Start with the condition for optimal health for the wife, Eq. (14). Increasing the husband’s threat-point will only affect the first part of the term within parentheses. Assuming that $(\partial (U_w - U_{wd}) / \partial H_{wt}) < 0$, the family’s marginal consumption benefit of the wife’s health will increase. Turning to Eq. (13), assuming that $(\partial (U_h - U_{hd}) / \partial H_{ht}) < 0$ and that the change in the threat-point does not affect marginal utilities for a given allocation, we can conclude that the family’s marginal consumption benefit of the husband’s health capital will also increase. Consequently, Eqs. (13) and (14) are consistent with a new equilibrium in which both spouses have larger amounts of health capital. This, however, is not permitted by the family’s life-time budget constraint. Therefore, equilibrium can be restored in either of two ways: either the husband’s health increases and the wife’s health decreases or the husband’s health decreases and the wife’s health increases. Which is more likely to occur? Assuming that each spouse has stronger preferences for own health than for the health of the spouse a small increase, $dH_{wt}^w$, in the wife’s health accompanied with a small decrease, $dH_{ht}^h$, in the husband’s health cannot make the husband better off and the wife worse off. Therefore, the husband’s health will increase and the wife’s health will decrease when the husband’s threat-point increases.

Given the allocation of the consumption commodity only, i.e. also child health capital, $H_{ct}^c$, is free to move, it is possible to rule out certain combinations of changes in the health stocks resulting from an increase in the husband’s threat-point. Since the change is not Pareto improving, it is possible to rule out that child health would increase, while leaving the spouses’ health unchanged, since such a change would increase both spouses’ utilities as married. Assuming, again, that each spouse has stronger preferences for own health than for the health of the spouse and the child, an increase in the child’s health must be accompanied by an increase in the husband’s health and a decrease in the wife’s health, since a decrease in the husband’s health along with an increase in his wife’s health can never make the wife better off and the husband worse off.

The theory of the family predicts specialisation according to comparative advantages, and the single most important reason for this is children. Typically, specialisation means that the wife specialises in household production and, hence, invests in household-related human capital, while the husband invests in market-related human capital. This affects the marital allocations in two ways: the husband’s utility at divorce, $U_{dt}^h$, will increase as his amount of market-related human capital increases. One effect of the rise in the husband’s market-related human capital is that his wage rate will increase. The first effect, which is to increase the relative bargaining strengths of the husband, implies that the Nash-bargaining process will reallocate time and other resources so as to increase the husband’s utility within marriage relative to the wife’s utility within marriage. This has been analysed above. Given a set of not too restrictive assumptions the husband’s health will increase.

More market-related human capital also implies a higher wage rate. A higher wage rate for the husband would mean that $\omega_h(\partial t_s^{wh} / \partial H_{ht}^h)$, i.e. the value of the reduction of sick time as the level of health capital changes, increases. That is, a higher wage rate decreases the net cost of the husband’s health capital and, hence, induces the family to invest more in the husband’s health. Combining the two effects we can, accordingly, conclude that the
presence of a child may lead to specialisation according to comparative advantages, which may induce forces that tend to make the husband healthier and the wife less healthy.

One determining factor for utilities at divorce is family law. In Sweden, the legislation that regulates custody and child support has recently been changed. The new legislation, which came into force at 1 October 1998, contains two important changes. First, the rules for custody were aligned with the child’s need for both parents, i.e. joint custody were made the principal rule. The intention of the legislators was to induce fathers to take more responsibility for the child in case of divorce. Second, the rules for child support were made harsher in that the amount of child support paid from one parent to the other was raised. At the same time, the local social security offices took on an intermediary role between the divorced parents as it assumed responsibility for collecting the child support from the paying parent and paying it to the receiving parent.

In order to analyse the effect of the change in the rules for custody on the allocation of health capital among family members, we assume that a positive shift in the wife’s utility and a negative shift in the father’s utility as divorced can model the change. The rational for this assumption is that after the change in the custody rules the father has to supply more of the nursing-time in case of divorce than he had to before the change. We also assume that this has some effect on the allocation of the nursing-time within marriage. The new legislation may affect the norms that regulate the relationship between men and women to become less approving of a situation in which the division of the nursing-time within marriage is unequal. Typically, then, the husband will increase his share of the total nursing-time within marriage. This implies that \( \omega_h (\partial \tau_s / \partial H_h) \) increases and \( \omega_w (\partial \tau_s / \partial H_w) \) decreases.

The rule is, thus, modelled both as a change in utilities as divorced and a change in the division of the nursing-time within marriage. Because family decisions are made as the outcome of a Nash-bargaining process, in which outcomes at divorce are threat-points, the wife’s utility as married must increase and the husband’s utility as married decrease as a consequence of the policy change. But what does the change in the custody rule imply for the allocation of health capital?

The effect on the allocation of health capital of the changes in threat-points has been analysed above. Given the same assumptions as above, the health capital of the husband will decrease and the health capital of the wife will increase. The effect on child health can be seen using Eq. (15). If the husband has greater amounts of market-related human capital than his wife, his wage rate would be higher and, hence, the family’s net cost of child health, \( \omega_h (\partial \tau_s / \partial H_h) + \omega_w (\partial \tau_s / \partial H_w) \), will decrease. Thus, the family will invest more in child health.

In order to analyse the effect the change of the rules for child support on the allocation of health capital between the family members we, again, assume that a positive shift in the wife’s utility and a negative shift in the father’s utility as divorced can model the change. In this case, however, there is no change in the value of child health but rather only a transfer of income. Nevertheless, the effects on the decisions within marriage will also in this case work through the threat-points, i.e. the utilities as divorced. Hence, the same conclusions as above will apply also in this case.

Another example, the publicly financed parental insurance in Sweden allows parents to nurse their own child for 12 months with full pay with some minor reductions. Originally, the family could allocate these 12 months freely between the spouses. However, in 1995, a
restriction was put on the family’s choices; only 10 months could be allocated freely by the family and 1 month was reserved for each spouse. For the typical family this change can be modelled as an increase in the husband’s nursing time, $\tau^{s,c,h}$, and a decrease in the wife’s nursing time, $\tau^{s,c,w}$. Again, if the husband’s wage rate is higher than the wife’s wage rate the family’s net cost of child health would decrease and family would invest more in child health.

3. Discussion

We have proposed a basic model of the demand for the commodity “good health”. The model treats the family as the producer of “good health”. The spouses are assumed to be Nash-bargainers, which is particularly important for investments in child health, since in this case it is obvious that a single individual does not take decisions. The threat points in the Nash-bargaining game were taken to be utilities at divorce.

The model yielded two fundamental implications: (1) specialisation according to comparative advantages may lead to differences in health and (2) changes in the way in which divorced parents are treated by the legislation will affect the distribution of health capital within marriage. Since the rates of divorce have risen in most countries during the last decades it has become increasingly important to analyse the institutions that regulate divorce. Institutions that do not promote investments in the health of children living in separated families may lead to a situation in which also the health of those children that have not experienced a divorce may be reduced.

Our model does not include uncertainty. It is obvious, however, that different types of uncertainties may affect the decisions of the family — or affect the willingness of each spouse to stick to what has been cooperatively agreed. We will discuss two types of uncertainty. First, uncertainty which is connected to health, and second, other forms of uncertainty, for example unemployment. In our model, the family gives the opportunity to substitute investments in the health of one individual for investments in the health of another individual. Liljas (1998) has shown that if uncertainty is introduced in the health capital, the incentives for investing in health strengthens. Making use of this result in our analysis implies that — if the family shows risk aversion — the introduction of health related uncertainty would strengthen the family’s preferences for investing in the health of that family member which has the greatest variance in possible health statuses in the future. In a more traditional representative individual model the substitution of one type of health investment for another type is not possible, and hence, health related risk would induce the individual to substitute consumption for health investments. This substitution possibility constitutes a rationale for the existence of families where spouses are not identical.

In addition to specialisation, which is argued by Becker (1973) to be the main reason why individuals form families, there is another argument why two individuals would be willing to form a family. (Remember that we have assumed that the marginal costs of both health investments and the consumption good are constant, i.e. there are no gains to specialisation.) In a family model of health investments which allows for health related uncertainty there are gains to marriage coming from risk sharing as long as the risks of the spouses are not perfectly positively correlated.
Unemployment weakens the relative bargaining position of the spouse with the highest risk of unemployment. If the wife has the highest risk of becoming unemployed in case of divorce her threat point will decrease relative to the threat point of her husband. These changes in bargaining strengths will reallocate resources within the family so as to increase the utility of the husband in relation to the utility of his wife.

As health investments are investments in human capital, and as such cannot be part of what is divided at divorce or constitute grounds for alimony, the investments in health may be inefficient. Landes (1978) argues that without some kind of payment between the spouses in the case of divorce the time allocation within marriage will be inefficient. Similarly, King (1982) and Bolin (1996) argue that the risk of divorce disturbs the investments in the human capital of the family members, and that alimony is needed to induce efficient investments within marriage. To arrive at these conclusions one must use models which allow for strategic behaviour of the spouses. The predictions of such models should merely be interpreted as explanations to the outcomes of the family decision-making process. As such, models that allow for strategic behaviour emphasise the fact that in face of divorce other considerations besides the welfare of the family might be important.

By recognising the importance of outside opportunities for the allocation of health capital within the family, our model distinguishes itself from other models used for analysing health investments. We argued that the legislation concerning the terms of divorce affects the allocation of health capital between the family members. In order to analyse investments in child health made by divorced parents a model which allows for strategic behaviour has to be developed. This may be an important and interesting area for future research.

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