On private incentives to acquire household production skills

Steinar Vagstad

Department of Economics, University of Bergen, Fosswinckelsgate 6, N-5007 Bergen, Norway
(Fax: +47-55-58-9210; e-mail: steinar.vagstad@econ.uib.no)

Abstract. In non-cooperative family models, being good at contributing to family public goods like household production may reduce one's utility, since it tends to crowd out contributions from one's spouse. Similar effects also arise in cooperative models with non-cooperative threat point: improved contribution productivity entails loss of bargaining power. This strategic effect must be traded against the benefits of household production skills, in terms of increased consumption possibilities. Since cooperation involves extensive specialization, incentives to acquire household production skills are strikingly asymmetric, with the one not specializing in household production having strong disincentives for household skill acquisition.

1. Introduction

The nature of the sexual division of labor has undergone vast changes the last few decades. The traditional pattern of specialization, with a breadwinning father and a mother solely working at home, is fading in importance.

However, also modern households practice a substantial degree of specialization, for instance with women choosing working arrangements that are compatible with having the main responsibility for children.[1] Also in families without small children we find a pattern of women taking more than half of the household work, while men typically spend more hours than women in paid work. The existence of comparative advantages is one explanation of this phenomenon. Gary Becker (1991) has pointed out that even small comparative advantages may lead to substantial specialization. Moreover, in order to maximize family output the family members should allocate their productive investments (their "education") according to the sector of specialization: the one specializing in household production should invest to improve his – or rather *her*, to frame the discussion using traditional gender stereotypes – household production skills, while the one specializing in market work should undertake investments that improve his labor market performance. This implies that even if "natural" differences between men and women may be rather small, these differences tend to increase as a consequence of investment decisions.[2] If there is learning-by-doing this would work in the same direction.

A problem with Becker's explanation of how comparative advantages may have evolved is that it cannot account for the fact that already at the date of marriage the family members have developed substantial comparative advantages, along traditional gender roles. It is well-known that women and men educate in different directions.[3] Perhaps even more striking are the differences between the sexes in what can be called domestic skills: an average woman about to be married is much better skilled to keep and maintain a house than is her coming husband, and this difference is found for a broad range of housekeeping activities: caring and nursing children, washing and mending clothes, shopping, house cleaning, cooking, baking, etc.[4] These are skills that are rarely acquired through formal educational, but rather passed on from parents to children or acquired by self studies.

Another problem with Becker's explanation is that what is in a family's joint interest is not necessarily in the interest of the individual family members.[5] In particular, the investments ("education") required to maximize family output is not necessarily serving the interests of the individuals who have to make those investments. Therefore, families and households should not be treated as single-person decision-makers, but rather as a collection of individuals with some degree of conflicting interests. Consequently, the fact that specialization maximizes family output is not a fully satisfactory explanation of the observed division of labor: it has to be verified that specialization is in the individual's interest. This applies in particular to decisions that are made before families are formed.

Often, skill acquisition, choice of education and many other decisions in life do not reflect rational decision-making but can rather be seen as responses to some social norms. This raises the question how these social norms have developed. The present paper also attempts to give an answer based on individual incentives – measured by private returns to improve one's household production skills.

Our point of departure is a non-cooperative model of family decisions, as laid out by Konrad and Lommerud (1995). On the topic of private provision of public goods, see Bergstrom et al. (1986). In their model, each of the two family members divide their time between market work and household work.

Household work produces a household good that is jointly consumed by both family members – i.e., it is a public good – while market work yields money income that is a private good for the individual worker. As is well-known from other private-provision-of-public-goods problems, there tends to be underprovision (relative to first-best) of the public good, due to the free rider problem. Moreover, the time spent in household production depends positively on one's productivity in the household production (hereafter called *contribution productivity*) and negatively on the spouse's contribution productivity. This implies that while there is an obvious positive direct effect of increased contribution productivity – the same amount of household goods can be produced with less effort – there is also a strategic effect working in the opposite direction. Thus, improved contribution productivity is not necessarily good for one's utility, even if the costs of improving one's household production skills are zero.

As a description of actual family life the non-cooperative model rests on quite pessimistic assumptions, and a natural way to proceed is to investigate the extent to which similar incentives can also arise in more cooperative families. Here I proceed along the lines of Konrad and Lommerud (2000), who assumes that i) education investments that determine individual wages are determined non-cooperatively; ii) time allocations are determined cooperatively; and iii) the outcome of the bargaining process can be described by the Nash bargaining solution, using equilibrium utilities in the non-cooperative model as fallback. While Konrad and Lommerud (2000) study incentives to improve one's wage, I study incentives to improve one's productivity in the household sector. A more important difference is that while Konrad and Lommerud focus on symmetric incentives to over- or underinvest in education, a key point of the present paper is that investment incentives may be strikingly asymmetric. There are also some technical differences that will be commented on in due course.

In short, also in the cooperative model there are direct and strategic effects, but there are important differences, too. First, in the cooperative model presented there will be full specialization, implying that one of the family members spends all time at home while her spouse devotes all his attention to market work.[6] This maximizes the joint surplus that will subsequently be divided according to the Nash bargaining solution. Since only the one with the highest contribution productivity works at home, there will be no direct effect of increasing her spouse's contribution productivity. In contrast, there is a strong direct effect of increasing her own contribution productivity. The strategic effect now works through the fallback payoffs, and it is clear that it will be negative for both parties: it can be shown that in the non-cooperative model it is always better to have one's spouse improve the contribution productivity than to improve one's own. (This holds for both family members.) Thus, the less productive will experience no direct effect and a negative strategic effect, so he will have disincentives to improve his domestic skills. Moreover, his spouse will experience a strong positive direct effect, and this effect will be only partially offset by the strategic effect, implying that she will still have incentives to improve her domestic skills.

The paper proceeds as follows. In the next section I present a cooperative family model with non-cooperation as the bargaining threat point. Then I derive the equilibrium payoffs to the family members for different combinations of contribution productivities. By performing comparative statics on the

equilibrium payoffs, incentives to invest in household production skills are derived. Discussions are found in Sect. 3, while Sect. 4 concludes the paper.

2. Model

Consider the following simple family model with two persons, 1 and 2, which can be interpreted as a woman and her husband. Utility of person $i \in \{1, 2\}$ is given by a Cobb-Douglas function defined over one private and one public good;

$$u_i = x_i G, \quad i \in \{1, 2\}, \tag{1}$$

where x_i is individual consumption of a private good and G is the (common) consumption of the public good. The two goods are produced by devoting time to either of two tasks: paid work or (unpaid) household production. Let c_i denote the time person i spends on household production and the remaining time $1 - c_i$ in the labor market. The production function for the public good is given by

$$G = h_1 c_1 + h_2 c_2 \tag{2}$$

where the parameters h_1 and h_2 will be referred to as contribution productivities. In what follows we will assume that individual 1 is more productive in the household activity, that is, $h_1 > h_2$.

Individual income is given by

$$x_i = (1 - c_i) w_i, \quad i \in \{1, 2\}. \tag{3}$$

where w_i denotes a person's wage. Then individual utility can be written

$$u_i = (1 - c_i) w_i (h_1 c_1 + h_2 c_2), \quad i \in \{1, 2\} \tag{4}$$

Our description of the cooperative model contains three elements: i) A characterization of efficient allocations and the utility possibility set (i.e., the Pareto frontier); ii) A presentation of the threat point, which will be taken to be the utilities in the non-cooperative model (for a discussion of this approach, see Konrad and Lommerud 2000; and iii) A characterization of equilibrium allocations using the Nash bargaining solution. After the equilibrium is found, what remains is to perform comparative statics on equilibrium payoffs in order to assess the incentives to improve one's domestic skills.

The utility possibility set. By construction the cooperative outcome is efficient. Suppose that a transfer of size t goes from individual 1 to individual 2. Then we can write the sum of utilities as

$$u \equiv u_1 + u_2 = (x_1 - t)G + (x_2 + t)G = (x_1 + x_2)G \tag{5}$$

which is independent of t. Hence a necessary condition for an allocation to be efficient is that it maximizes xG, where $x \equiv x_1 + x_2$. In what follows we normalize both wages to 1. In the working paper version (Vagstad 1999) I

provide the extension to cases in which wages may differ. Clearly, at least one of the family members will be fully specialized, implying that (since $h_1 > h_2$) either $c_1 = 1$ or $c_2 = 0$ or both.[7] Suppose that $c_1 = 1$. Then the optimal c_2 maximizes aggregate utility given by $u = (2 - c_1 - c_2)(h_1 c_1 + h_2 c_2) = (1 - c_2)(h_1 + h_2 c_2)$, and

$$\frac{\partial u}{\partial c_2} = h_2(1 - c_2) - (h_1 + h_2 c_2) = -(h_1 - h_2) - 2h_2 c_2 < 0 \qquad (6)$$

yielding $c_2 = 0$. Conversely, suppose that $c_2 = 0$. Then the optimal c_1 maximizes $u = (2 - c_1 - c_2)(h_1 c_1 + h_2 c_2) = (2 - c_1)h_1 c_1$. Then

$$\frac{\partial u}{\partial c_1} = (2 - c_1)h_1 - h_1 c_1 = 2h_1(1 - c_1) > 0 \quad \text{for } c_1 < 1) \qquad (7)$$

implying that c_1 should be set equal to 1. In conclusion, the unique efficient allocation of effort entails full specialization. The resulting aggregate utility to be shared is then given by $u = h_1$. The solution above implies that the family members' bargaining problem is reduced to bargaining over how to divide an aggregate amount $x = 1$ of the private good, both agreeing on a joint consumption of $G = h_1$ of the public good. Consequently, the utility possibility set is given by $\{(u_1, u_2) | u_1 + u_2 \le h_1\}$.

Fallback utilities. We take non-cooperation as the alternative to reaching an agreement in the cooperative model. Therefore, the fallback utilities will be taken to be the payoffs in a non-cooperative model, in which the familiy members simultaneously and non-cooperatively decide how to allocate their time. An interior Nash equilibrium in pure strategies exists if the two contribution productivities do not differ too much. We therefore make the following assumption on productivity differences: $h_1 < 2h_2$.

Now the (interior) non-cooperative equilibrium is found by first solving the set of first order conditions for c_1 and c_2 and then substituting the solution back into the variable definitions above. The first order conditions $(\frac{\partial u_1}{\partial c_1} = (h_1 - 2h_1 c_1 - h_2 c_2)w_1 = 0$ and $\frac{\partial u_2}{\partial c_2} = (h_2 - h_1 c_1 - 2h_2 c_2)w_2 = 0)$ yield $c_i = c_i^* \equiv \frac{2h_i - h_j}{3h_i}$, $G = G^* \equiv \frac{1}{3}(h_1 + h_2)$ and $x_i = x_i^* \equiv \frac{w_i}{3h_i}(h_1 + h_2)$ $(i, j \in \{1, 2\} \wedge i \ne j)$. Note that $\frac{\partial c_i^*}{\partial h_j} < 0$, telling us that improved productivity leads to a reduction in one's spouse's contribution to the public good. What we are most interested in is equilibrium utilities, since these will serve as the threat points in the bargaining game:

$$u_i = u_i^* \equiv \frac{w_i}{9h_i}(h_1 + h_2)^2, \quad i \in \{1, 2\}. \qquad (8)$$

For use in the subsequent discussion, we will take a closer look at investment incentives in a purely non-cooperative model before we proceed. Differentiating individual utility with respect to the contribution productivities yields

$$\frac{\partial u_i^*}{\partial h_j} = \frac{2w_i}{9h_i}(h_1 + h_2) > 0, \quad \text{and} \tag{9}$$

$$\frac{\partial u_i^*}{\partial h_i} = \frac{w_i}{9}\left[1 - \left(\frac{h_j}{h_i}\right)^2\right] > 0 \quad \text{iff } h_i > h_j. \tag{10}$$

Both these partials are interesting in the sense that they say something about private incentives to influence the contribution productivities in a non-cooperative family. The first one, (9), tells us that it is in a family member's interest that the other family member improves his or her contribution productivity. The second one, (10), reveals that it is unclear whether it is an advantage or not to be productive in the household sector:

Proposition 1. *If time allocation is decided non-cooperatively, the individual having the highest contribution productivity would prefer to be even more productive, while the individual having the lowest contribution productivity would prefer to have even lower productivity.*

Note that Proposition 1 depends on our particular model formulation. Most important is the degree of substitution implicitly assumed by our choice of utility function. Clearly, as the strategic effect works mainly through substitution between the two goods, any utility function involving less substitutability will entail weaker strategic effects with the possibility of both individuals having incentives to improve their domestic skills,[8] while utility functions involve more substitutability may result in both partners having negative investment incentives.

Nash bargaining. It is somewhat dissatisfactory to base one's results on an assumption of families being unable to reach efficient decisions. From now on we will work with the opposite assumption: that decisions in the family are efficient. However, we maintain the assumption that decisions taken before families are formed are made non-cooperatively (and that such decisions may therefore not be efficient). To be more precise, suppose that the family members decide cooperatively how to allocate their time (i.e., effort), but that productivities are decided before the families are formed. To avoid the complications arising if the choice of productivity investments affects who marries whom, we will leave the discussion of possible marriage market effects until Sect. 3. That is, in this section we assume that men and women match randomly to form families.

Let Δ denote the gains from bargaining, defined as follows:

$$\Delta = u_1 + u_2 - (u_1^* + u_2^*) = h_1 - \left(\frac{1}{9h_1}(h_1 + h_2)^2 + \frac{1}{9h_2}(h_1 + h_2)^2\right) \tag{11}$$

In the Nash bargaining solution this gain will be split evenly, implying that individual utilities in the bargaining equilibrium equal

$$u_1 = \frac{1}{9h_1}(h_1 + h_2)^2 + \frac{\Delta}{2} = \frac{1}{2}h_1 - \frac{1}{18}\frac{h_1 - h_2}{h_1 h_2}(h_1 + h_2)^2 \tag{12}$$

$$u_2 = \frac{1}{9h_2}(h_1 + h_2)^2 + \frac{\Delta}{2} = \frac{1}{2}h_1 + \frac{1}{18}\frac{h_1 - h_2}{h_1 h_2}(h_1 + h_2)^2 \tag{13}$$

Incentives to improve contribution productivities. Differentiating these expressions for individual equilibrium payoffs yields

$$\frac{\partial u_1}{\partial h_1} = \frac{1}{18} \frac{8h_1^2 h_2 - 2h_1^3 - h_2^3}{h_1^2 h_2} > 0 \tag{14}$$

$$\frac{\partial u_2}{\partial h_1} = \frac{1}{18} \frac{2h_1^3 + 10h_1^2 h_2 + h_2^3}{h_1^2 h_2} > 0 \tag{15}$$

$$\frac{\partial u_1}{\partial h_2} = \frac{1}{18} \frac{h_1 h_2^2 + 2h_2^3 + h_1^3}{h_1 h_2^2} > 0 \tag{16}$$

$$\frac{\partial u_2}{\partial h_2} = -\frac{1}{18} \frac{h_1 h_2^2 + 2h_2^3 + h_1^3}{h_1 h_2^2} < 0 \tag{17}$$

Again both cross partials are positive, but for slightly different reasons than before. When the more productive family member improves – h_1 increases – his spouse gains twofold. First, the set of feasible allocations expands. Second, the spouse's relative bargaining position improves.[9] When it is the less productive who improves, the first effect is absent: due to complete specialization, it is only the most productive's productivity parameter that matters for the utility possibility set. However, the second effect – on bargaining position – is still there. In sum, also in the cooperative model an individual benefits from having a spouse who has a high contribution productivity.

More interesting is the own derivatives, as they determine the incentives to acquire household production skills. We see that – qualitatively speaking – the results from the non-cooperative model are valid also in the cooperative model:

Proposition 2. *Also in the cooperative model, the most productive family member has incentives to improve, while the less productive has disincentives to do so.*

The intuitions behind Propositions 1 and 2 are slightly different, however. Consider a change in the most productive person's contribution productivity. Such a change affects the utility possibility set: when h_1 increases, the Pareto frontier shifts outward. (Clearly, this has some of the same flavor as the direct effect in the non-cooperative model, but it should be noted that they are not the same.) Moreover, increasing h_1 reduces person 1's bargaining power, in a way that resembles the strategic effect in the non-cooperative model. But again they are different. One important difference becomes evident when the contribution productivities are almost equal. In the non-cooperative model we then know that incentives in either direction are weak ($\frac{\partial u_i^*}{\partial h_i} = \frac{1}{9} \left[1 - \left(\frac{h_j}{h_i} \right)^2 \right]$ ≈ 0 when $h_i \approx h_j$). In contrast, in the cooperative model $\frac{\partial u_1}{\partial h_1} = \frac{1}{18} \frac{8h_1^2 h_2 - 2h_1^3 - h_2^3}{h_1^2 h_2} \approx \frac{5}{18}$ and $\frac{\partial u_2}{\partial h_2} = -\frac{1}{18} \frac{h_1 h_2^2 + 2h_2^3 + h_1^3}{h_1 h_2^2} \approx -\frac{4}{18}$ when $h_1 \approx h_2$, implying that even the smallest difference in contribution productivities produces distinct incentives to differentiate further.

Second, consider a change in the less productive's contribution productivity. Such a change does not affect the utility possibility set, implying that in the cooperative model there are no positive effects on u_2 from increasing h_2. The change affects the bargaining positions, however, and this effect is strong and clear even at the smallest possible differences.

3. Discussion

We have seen that wage differences do not affect contributions in the non-cooperative model. In the cooperative model things are more complicated. In the working paper version (Vagstad 1999) I allow for differences in labor market skills as well as household production skills. In what follows I briefly sketch the method and the main result, and refer the interested reader to Vagstad (1999) for details.

First, efficient allocations maximize aggregate utility given by $u = (x_1 + x_2)G = ((1 - c_1)w_1 + (1 - c_2)w_2)(h_1c_1 + h_2c_2)$. Depending on absolute as well as comparative advantages, efficiency may entail full specialization (i.e., one family member works full time in the market while the other works full time in household production) or only partial specialization (i.e., only one member is fully specialized while the other split his or her attention between household production and market work).

After finding the efficient allocations, we employ the Nash bargaining solution to find how the gains from cooperation is split. This yields equilibrium payoff of each family member as explicit functions of all the parameters of the problem, that is, w_1, w_2, h_1 and h_2. Finally, investment incentives are found by differentiation of equilibrium payoffs. One robust result stands out from the crowd of partial derivatives (proof in Vagstad 1999):

Proposition 3. *The one with a comparative advantage for market work gets more than 50% of total output. Moreover, the same person would prefer to be even less domestically skilled, and would also prefer to have a spouse with even lower wage.*

Many matters of interest have been left out of the above analysis. In the cooperative model investigated above I have implicitly assumed that it is clear who will have the higher contribution productivity already at the time when the investments in household production skills are made. This is a strong assumption, if we are talking about the way children are brought up. The assumption may nevertheless be reasonable in a particular sense: even if a couple does not know the identity of their daughter's particular future husband, they may rationally believe that he will be brought up as a typical boy, that is, not being taught how to run a household. Conversely, parents of boys may rationally believe that his prospective wife will be brought up to have a rather high contribution productivity. Consequently, it appears that rational expectations may turn into self-fulfilling expectations.

This is not at all clear, however. Even if the average suitor has little household production skills, it is possible for a girl (or her parents) to undercut that level by appropriate (lack of) skill acquisition. How come parents do not engage in such undercutting? One possible explanation could be that it may be undesirable to have two persons without household production skills

form a family – such families suffer in terms of a small utility possibility set. In this sense specialized upbringing can be seen as a coordination device – it assures that at least one of the family members is skilled in household production.[10]

Another explanation can be sought in marriage market forces. Suppose that instead of random matching, matching is based on utility-maximizing behavior – behavior that can be turned into forces of supply and demand. What follows is a brief discussion of the demand for partners with certain productivity parameters. I also discuss the demand for what can be seen as the alternative to domestic skills: labor market skills (measured by wage levels). Underlying the discussion is an assumption of highly incomplete marriage contracts. In particular, a marriage contract is taken to be only a commitment to play a particular game (either the non-cooperative or the cooperative game) with a specific partner – there are no up-front payments (i.e., no dowries or bride prices).

First, in the cooperative model as well as the non-cooperative model there will be a positive demand for spouses with high contribution productivities, suggesting that the negative incentives to acquire household production skills may be mitigated by forces in the marriage market: having high skills for household production may be bad for you once you are married, but it makes you more attractive as a marriage partner.

Perhaps more interesting is the demand for labor market characteristics: in the non-cooperative model, wages are irrelevant as a sorting criterion – they are neutral as regards contribution to the public good. This is not so in the cooperative model. The most plausible assumption is perhaps that women have an absolute advantage in household production while men have an absolute advantage in the labor market. If so, the strategic effect then dominates in two cases: the husband's utility is decreasing in his wife's wage as well as in his own contribution productivity, while all other derivatives (own and cross) are positive (see Vagstad 1999, for details). The intuition for this pattern is that since the wife will spend all her time in household production and the husband will spend all his time in market work, increasing the wife's wage marginally will not affect the utility possibility set at all, it will only make her demand a larger share of total output.

Finally, the demand for high-wage husbands is somewhat unclear a priori. The effect on the utility possibility set suggests that there will be a demand for high-wage men, but since high-wage men (just like high-wage women) will demand a larger share of total output, it is a priori unclear whether there will be demand for high-wage men. In this model, however, the positive effect always dominates, creating a positive demand for high-wage men.

To sum up the marriage market effects, the above discussion suggests that women improve their market positions by investing in household production skills and disinvest in improving their labor market performance. In contrast, for men both attributes are valuable in the marriage market. There will be a certain demand for men with high contribution productivities, because such men will demand a smaller fraction of output. But there will also be demand for high-wage men, in spite of such men being more demanding, because they expand the utility possibility set.[11] Consequently, optimizing women will concentrate on household production skills, while optimizing men will try to improve along two dimensions, which is to say that women have stronger incentives to become domestically skilled.

4. Concluding remarks

If family members have common preferences, Becker (1991) – among others – has argued that family members will specialize according to comparative advantages, not only regarding division of labor, but also when it comes to investments that improve one's skills. Therefore, investments tend to increase any productivity differences. We have seen that even if families are less harmonic, Becker is basically right on this point: individual investment incentives tend to increase specialization also when we allow for explicit conflicts of interest between family members.

Becker's second hypothesis concerns efficiency: with common preferences, investments as well as time will be allocated in a way that maximize joint surplus. This result does not hold when we relax the assumptions of common preferences. To be more specific: with truly non-cooperative families, neither investments nor time allocations will be efficient, for well-known reasons: there are strong positive externalities from contributing to household production as well as from investing in domestic skills, giving rise to a serious free-rider problem. In what I have called a cooperative family, time allocations will be efficient (by assumption), but this may give rise to even less efficient investments, in order to affect the outcome of the bargaining process.

I conclude with a short list of issues for further research. The first concerns policy issues. My analysis points at two problems that I believe deserve attention. First, from an efficiency point of view one should be concerned about the welfare effects of underinvestment in household production skills. Second, from a distributional point of view one should be concerned that investment incentives increase the gender differences, not only in time and investment allocations (which is hardly a problem in itself) but, more seriously, in equilibrium payoffs.

The fact that a decrease in one person's contribution to the public good increases the other person's contribution is what gives rise to underinvestment. Consequently, anything that can break the substitutability between the family members' contributions should in principle reduce the underinvestment problem. The government may affect this substitutability in many ways. First, the they may promote the provision of close substitutes to the household public good (publicly provided day care for children is only one example), implying that if one family member contributes less than his or her "just" share, he or she may be told to buy the rest in the market. Second, also taxation may affect specialization. In particular, progressive taxation based on individual labor income will discourage specialization and therefore reduce substitution. Third, implementing a cap on how many hours a week one is allowed to work will also limit specialization. It is more difficult to imagine explicit regulation of division of labor within the family, but social norms may have a similar effect: if the public goods to be provided can be divided in "male" and "female" tasks that are socially sanctioned, this should have a beneficial effect on investment incentives – although the benefits must of course be traded against the possible inefficiencies such rigidities may entail.

Finally, the marriage market forces discussed in the previous section warrants more analysis. In particular, important features of modern societies like the increase in divorce rates and the number of single-person households should be incorporated in future work.

Endnotes

[1] For some US evidence, see, e.g., Fuchs (1989) and Hersch (1991). Relevant facts from Britain and Germany are found in Joshi (1989) and Beblo (1998), respectively.

[2] From nature's side men and women's comparative advantages in market work and household production appear to be of limited importance today. Women's natural advantage in taking care of children should apply only for small babies, and physical strength is of little or no importance in most jobs today.

[3] Looking at education we see – roughly speaking – that women choose educations that are compatible with housekeeping: nurses and kindergarten teachers are prime examples. In contrast, men educate themselves to traditional bread-winning positions in the labor market: industrial workers, engineers and managers.

[4] There are of course exceptions to this general pattern, however: different types of light maintainance work – e.g., fixing the car when it is broken – are typically done by men. What should be noted, however, is that the activities in which the women are more skilled comprise the bulk of household production activities.

[5] This was first formally analyzed by Manser and Brown (1980) and McElroy and Horney (1981). More recent contributions include Lundberg and Pollak (1993) and Konrad and Lommerud (1995, 2000). For surveys, see Ott (1992) or Lommerud (1997).

[6] Clearly, this result depends upon the particular parameterization of the model. More generally one will expect cooperation to promote specialization, with similar qualitative effects.

[7] If none were fully specialized, then output could be increased with the same total effort by shifting attention in the direction of comparative advantages.

[8] See e.g. Konrad and Lommerud (2000), whose model features quasi-linear utility.

[9] For this to be the case, u_2^* must increase more than u_1^* when h_1 increases. Simple differentiaton reveals that $\frac{\partial u_2^*}{\partial h_1} - \frac{\partial u_1^*}{\partial h_1} = \frac{1}{9}(h_1 + h_2)\frac{2h_1^2 - h_2 h_1 + h_2^2}{h_1^2 h_2} > 0$ whether $h_1 > h_2$ or not. This implies that one's bargaining position always deteriorates with increasing contribution productivity.

[10] A full-fledged analysis of the interplay between beliefs and investment decisions is beyond the scope of this paper. See Francois (1998) and, in particular, Lommerud and Vagstad (2000) for a discussion of the considerations involved in such an analysis.

[11] Some limited support for these conjectures is found in data for firms doing professional marriage partner search in Germany (see Nitschke 1998). Such firms typically price discriminate by charging lower prices if you are attractive yourself, and by looking at prices, Nitschke finds that what makes a man attractive is a high ability to provide money, while what makes a woman attractive is being young and pretty. He also quotes figures telling that it is particularly difficult to find partners to older women with higher education (i.e., high potential wages).

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