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Risky Investment

—theorizing housekeepers' disadvantageous human capital accumulation—

TANAKA Sigeto (田中 重人)

Graduate School of Arts and Letters, Tohoku University
Kawauti, Sendai, Miyagi, 980-8576 JAPAN

tsigeto@nik.sal.tohoku.ac.jp
http://www.nik.sal.tohoku.ac.jp/˜tsigeto/

Abstract

This paper theorizes a widely believed, but rarely proven notion: the economic disadvantages of being a housekeeper. To be sure, we know that housekeepers are disadvantaged in paid work due to household responsibilities and thereby entail lower earnings. But this is insufficient to lay down the assumption that housekeepers are disadvantaged in the whole of the economic life, for the following reasons: (1) the disadvantages in paid work can be counterbalanced by the advantages in unpaid housework; (2) housekeepers often establish a household and enjoy an equal living standard to their non-housekeeper spouses. This paper aims to refute these two objections and to maintain the assumption of the disadvantage of housekeepers.

We apply human capital theory to discuss (1) the difference between paid work and housework in relation to the market and (2) how dissolution of a household (e.g., by divorce) impacts on housekeepers and non-housekeepers.

(1) Products of paid work are sold in the market, which efficiently finds demands for the products supplied; in contrast, products of housework are consumed within a small household, where demand may be easily depleted.

(2) Housekeepers take risks that can be concealed as long as they live a stable household life.

Housekeepers are disadvantaged in the whole of the economic life because they make a risky investment in human capital for housework instead of the safer investment for paid work.

Keywords: human capital, altruism, intra-household bargaining, inequality

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1 Introduction

The economic disadvantages of taking household responsibilities are widely believed. Especially, most support the idea that women are put at a disadvantage by household responsibilities. However, the cause of the housekeepers' disadvantages has never identified. The discussion remains confused.

This confusion is attributable to the fact that the problem has been considered as a gender problem. The disparity between men and women is a complex phenomenon with numerous factors, as Agarwal [5] discussed. Household responsibilities are just a part of them, not a whole of them. So, for a strict discussion, we have to formulate discrete factors one by one. Regrettably, there have been few works conducting such formulation.

In this paper, we just focus on what will become of the two persons in a household when they specialize on either unpaid housework or paid work. We assume all the other factors are equal between them.

2 Our Perspectives

2.1 Equation of power with the economic advantage

Home economists, policy scientists, and family sociologists have argued on marital power and the living standard decline at divorce. These problems can be formalized as the same problem from the game-theoretic point of view.

The game-theoretic formalization of bargaining gives an importance on the outcome obtained by each player when they do not cooperation. This outcome at non-cooperation is called the "threat point". The threat point plays a dual role in the bargaining game. It determines not only the well-being in the case of non-cooperation but also the "bargaining power". That is, it determines each player's share of the outcome when the players reach to the agreement of cooperation [Ott: 4: p. 35].

The game-theoretic formalization is applicable to intra-household bargaining. In that view, household is an organization of joint production and consumption using resources obtained by the members. A member can bargain with the other members about what they should produce or consume within the household.

2.2 Human-capital perspective

We focus on human capital investment. Human capital is inseparatable from individuals, unlike material capital [Ott: 4: p. 68]. Therefore it is impossible to enforce the redistribution of human capital among household members. So human capital investment is an important determinant of individuals' option outside the household.

2.3 Altruism and selfishness

Game-theoretic approach usually assumes selfish players aiming at the maximization of their own utility under the given settings of the game. However, this assumption may not be suitable for formalization of marriage life, since many couples behave altruistically as Becker [3] formalized.

We shall emphasize the fact that any altruistic marriage life faces to the potential risk of the disappearance of altruism. To be sure, the couple will share their joint household production and consumption so that they enjoy equal level of utility, as long as the marriage life is altruistic. There may be no problem if such altruism continues forever. But once altruism disappears and the intra-household bargaining begins, they must participate the game with the resources they have obtained.

We can say household is a complex of some altruism and some selfishness. We will develop a two-stage model to describe such a half-altruistic and half-selfish family life.

3 Model

3.1 Strategy for formalization and speculation

The real marriage lives show a wide variety depending on the social, cultural, and economic context. Hence it is difficult and unproductive to directly formalize the reality. Instead, we will take a strategy of simplifying the settings of the game.

As we noted above, we focus on the difference in the human capital investment. So we will prepare the game settings as the difference in the bargaining power is brought only from the difference in human capital investment during the marriage life. All other conditions should be equal between the players. In our formalization, the sex has no effect on the bargaining power, players have the same set of human capital at the beginning, and they have no material capital or asset to earn nonlabor income.

3.2 Settings

Here we describe the basic settings of the game as follows:

- There are various tasks for housework and paid work, whose sets are denoted as $H = \{H_1, H_2, \ldots\}$ for housework, $M = \{M_1, M_2, \ldots\}$ for paid work
- The game is conducted by two players X and Y
- They have the identical set of human capital when they begin the game, which are denoted by the vector $\boldsymbol{s}$
- They have the same utility function U, which is a function of household production and wage income
- They have no means to obtain nonlabor income
- They have the same working-time constraints: sum of the time for housework and paid work cannot exceed the limit T
- Their marriage life is divided into two periods: in the period A they behave altruistically, whereas in the period B they make bargaining based on selfishness

The household can include members besides the players, for example, children. If the players aim at the better life of such non-player members, this should be reflected in their utility function.

3.3 Altruistic decision-making during the period A

The players X and Y start their marriage life altruistically. They both try to make the best allocation of their labor among various tasks to maximize their utility.

They have a set of human capital for housework and paid work. We assume both housework and paid work include various kinds of tasks, each of which requires different kind of human capital. Let us denote the sets of tasks for housework and for paid work as H and M respectively. And let us denote the row vectors of their human capital at the beginning as follows:

$$\begin{array}{rcll} \boldsymbol{s}_H & = & (s_{H_1} \ \ s_{H_2} \cdots) & \text{for housework} \\ \boldsymbol{s}_M & = & (s_{M_1} \ \ s_{M_2} \cdots) & \text{for paid work} \end{array} \tag{1}$$

Each element of the vectors is the productivity for the task. The players X and Y have in common these vectors, as we mentioned above. They make joint production and consumption using these human capitals.

Here we introduce a constraint to meet our purpose. That is, during the first period of the marriage life, X and Y specialize in housework and in paid work respectively. The player X allocates his/her labor among various household tasks. On the other hand X allocates his/her labor among various occupational tasks.

Under this constraint, X and Y try to find the best allocation of their time. Let $t(j,k)$ denote the time spent by the player $j \in \{X, Y\}$ for the task $k \in H \cup M$. As mentioned above, X specializes in housework while Y specializes in paid work. Both X's paid work time and Y's housework time are therefore to be zero. Besides, their time use is under the constraint that it cannot exceed T. These implies the following:

$$\begin{array}{rcll} \sum_{k \in H} t(X,k) & \leq & T & \\ t(X,k) & = & 0 & \text{for all } k \in M \\ t(Y,k) & = & 0 & \text{for all } k \in H \\ \sum_{k \in M} t(Y,k) & \leq & T & \end{array} \tag{2}$$

The player X makes household production, which is the set of the product of the human capital and working time for each task. Let the function $P_A(X, H)$ give the vector of the products.

$$P_A(X,H) = (s_{H_1} t_A(X,H_1) \ \ s_{H_2} t_A(X,H_2) \ \ \cdots) \tag{3}$$

Analogously, the vector of Y's production for paid work tasks is

$$P_A(Y,M) = (s_{M_1} t_A(Y,M_1) \ \ s_{M_2} t_A(Y,M_2) \ \ \cdots) \tag{4}$$

The wage rate for Y's production depends on what value the labor market places on each task. Let the column vector $\boldsymbol{w}$ denote the values placed by the labor market:

$$\boldsymbol{w} = \begin{pmatrix} w_{M_1} \\ w_{M_2} \\ \vdots \end{pmatrix} \tag{5}$$

The player Y earns wage income L_{AY} as the summation of the product of the working time, human capital, and the "value" for each paid work task:

$$L_{AY} = P_A(Y,M)\boldsymbol{w} = \sum_{k \in M} t_A(Y,k) s_k w_k \tag{6}$$

The players' unitary utility U is determined by their consumption using the household production and wage income. During the period A, the unitary utility is given by the utility function U_A , which is determined by the environment of the players' household in the period:

$$U = U_A(P_A(X,H), L_Y) \tag{7}$$

The utility depend on how the player use the time among housework and paid-work tasks. She or he can maximize the utility, under the given parameters $\boldsymbol{s}$, $\boldsymbol{w}$, and T. We denote the maximum of U as V_A . Suppose the utility function $U_A()$ is monotonously increasing, convex upward, and differentiable for the whole domain of time-use by the players. Then you can obtain the maximum of the utility V_A , when you put the time-use $t_A(j,k)$ as to equalize the partial derivative $\partial U / \partial t_A(j,k)$ for all $j \in \{X,Y\}$ and $k \in H \cup M$, under the given constraints.

As is apparent, there is no disparity between the players in the period A. They enjoy the same utility V_A .

3.4 Consequences of human capital investment

In the period A, players X and Y had the common vectors of human capital $\boldsymbol{s}_H$ and $\boldsymbol{s}_M$. But in the beginning of the period B, as a consequence of the different time use in the period A, there will be a difference between the human capital of X and Y.

We assume that "learning-by-doing" is the only source to improve the productivity. That is, we think of the time spent for a task as human capital investment. We also assume that the effectiveness of such investment differs by task. Let us denote the effectiveness as the coefficient $a_k (k \in H \cup M)$. During the period B, the productivity of the player j for the task k is $a_k t_A(j,k) + s_k$. Let us define the functions $b(j,H)$ and $b(j,M)$ as j's productivity for housework and paid work respectively. As a result of the investment in the period A, the player X has gained the human capital for housework, while Y have gained that for paid work. In contrast, since X's human capital for paid work and Y's for housework has not been invested, these are still the same as the beginning.

$$\begin{array}{rcl} b(X,H) & = & (a_{H_1} t_A(X,H_1) \;\; a_{H_2} t_A(X,H_2) \;\; \cdots) + \boldsymbol{s}_H \\ b(X,M) & = & \boldsymbol{s}_M \\ b(Y,H) & = & \boldsymbol{s}_H \\ b(Y,M) & = & (a_{M_1} t_A(Y,M_1) \;\; a_{M_2} t_A(Y,M_2) \;\; \cdots) + \boldsymbol{s}_M \end{array} \tag{8}$$

3.5 Bargaining during the period B

In contrast to the altruism in the period A, the players no longer behave altruistically in the period B. They now selfishly behave and aim to maximize their own utility. They may continue the cooperation with each other, if it is profitable. But they may stop the cooperation, if it is not profitable. That is, they have now two options:

- Cooperation (c): To continue the joint production/consumption
- Non-cooperation (d): To stop the joint production/consumption and live on his/her own

In case of cooperation

When they continue the cooperation, they will distribute the household production and wage income between them. Let $t_c(j,k)$ denote the time spent by the player j for the task k, where $t_c(j,k)$ follow the same constraint as $t_A(j,k)$ in Equation (2). We define the function $P_c()$ that gives the vector of household production when the players cooperate, analogously to Equations (3) and (4),

$$P_c(X,H) = ((a_{H_1}t_A(X,H_1)+s_{H_1})t_c(X,H_1) \ \ (a_{H_2}t_A(X,H_2)+s_{H_2})t_c(X,H_2) \ \ \cdots) \tag{9}$$
$$P_c(Y,M) = ((a_{M_1}t_A(Y,M_1)+s_{M_1})t_c(Y,M_1) \ \ (a_{M_2}t_A(Y,M_2)+s_{M_2})t_c(Y,M_2) \ \ \cdots) \tag{10}$$

and the sum of the earned wage income L_{cY} , analogously to Equation(11),

$$L_{cY} = P_c(Y,M)\boldsymbol{w} = \sum_{k\in M}(a_k t_A(Y,k)+s_k)t_c(Y,k)w_k \tag{11}$$

Let $\eta(j)$ denote the vector of household production distributed to the player j, and $\mu(j)$ the vector of wage income distributed to j. The player X's or Y's own utility is as follows:

$$\begin{cases} U_{cX} &= U_c(\eta(X),\mu(X)) \\ U_{cY} &= U_c(\eta(Y),\mu(Y)) \end{cases} \text{where } \eta(X)+\eta(Y)=P_c(X,H) \text{ and } \mu(X)+\mu(Y)=L_{cY} \tag{12}$$

Note that X and Y here still have the common utility function $U_c()$. This may be different from U_A, their utility function in the period A, if their environment have changed. Therefore, suppose there is a difference between U_{cX} and U_{cY} , because of the difference in $\eta()$ or $\mu()$, say, the intra-household distribution. These functions $\eta()$ and $\mu()$ are subjected to the bargaining between the players, so dependent on their bargaining power, as we will discuss below.

In case of non-cooperation

If they choose non-cooperation, X and Y must conduct household production and consumption on her/his own. We assume that each of X and Y does both housework and paid work in that case. So the players' time use $t_d()$ is under the constraint as follows, instead of Equation (2):

$$\begin{aligned} \sum_{k\in H\cup M} t_d(X,k) &\le T \\ \sum_{k\in H\cup M} t_d(Y,k) &\le T \end{aligned} \tag{13}$$

The housework/paid-work production for each task is the element of $b()$ multiplied by the corresponding element of $t_d()$. Analogously to Equations (9) (10), we define row vectors of these products, $P_d(j,H)$ and $P_d(j,M)$:

$$P_d(X,H) = ((a_{H_1}t_A(X,H_1)+s_{H_1})t_d(X,H_1) \ \ (a_{H_2}t_A(X,H_2)+s_{H_2})t_d(X,H_2) \ \ \cdots) \tag{14}$$
$$P_d(X,M) = (s_{M_1}t_d(X,M_1) \ \ s_{M_2}t_d(X,M_2) \ \ \cdots) \tag{15}$$
$$P_d(Y,H) = (s_{H_1}t_d(Y,H_1) \ \ s_{H_2}t_d(Y,H_2) \ \ \cdots) \tag{16}$$
$$P_d(Y,M) = ((a_{M_1}t_A(Y,M_1)+s_{M_1})t_d(Y,M_1) \ \ (a_{M_2}t_A(Y,M_2)+s_{M_2})t_d(Y,M_2) \ \ \cdots) \tag{17}$$

The sum of the earned wage income is an analog of Equation(11):

$$L_{dj} = P_d(j, M)\boldsymbol{w} = \sum_{k \in M} (a_k t_A(j,k) + s_k) t_d(j,k) w_k \tag{18}$$

The utility of each player is determined by his/her own household production and wage income:

$$U_{dX} = U_d(P_d(X, H), L_{dX}) \tag{19}$$
$$U_{dY} = U_d(P_d(Y, H), L_{dY}) \tag{20}$$

In the same way as we maximized U, the utility in the period A, the player j can maximize U_{dj} by equalizing the partial derivative $\partial U_d / \partial t_d(j,k)$. We denote the maximum as

$$V_{dX} = \max U_{dX} \tag{21}$$
$$V_{dY} = \max U_{dY} \tag{22}$$

to which we refer as the player's *threat point* .

Nash solution

Under the conditions above, the players bargain about how the time-use and the distribution of the outcome should be. They will come to no agreement of cooperation unless they both get a positive *cooperation gain*, which is $U_{cX} - V_{dX}$ for X and $U_{cY} - V_{dY}$ for Y. If they come to the agreement, the distribution of the outcome shall follow the Nash solution, at which the product of their cooperation gains reach its maximum:

$$\max N = (U_{cX} - V_{dX})(U_{cY} - V_{dY}), \text{where } U_{cX} > V_{dX} \text{ and } U_{cY} > V_{dY} \tag{23}$$

In our model, when $V_{dX} \neq V_{dY}$, the Nash solution deviates from the equality, biased in favor of the player who have the higher threat point. To understand this, let us draw the frontier of the utility they could gain when they cooperate (Figure 1). Our model assumes X and Y have the same utility function, which is monotonously increasing, differentiable, and convex upward. Therefore, the frontier is a smooth convex curve that is symmetric with respect to the line $U_{cX} = U_{cY}$. Its gradient is therefore -1 at the point E, the crossing of the frontier and the line $U_{cX} = U_{cY}$. Remember that E gives the equality between the players. On the other hand, N in Equation (23) can be represented by a hyperbola that is symmetric with respect to the line $U_{cX} - V_{dX} = U_{cY} - V_{dX}$. Its gradient is therefore -1 at the point G, the crossing of the hyperbola and the line $U_{cX} - V_{dX} = U_{cY} - V_{dX}$. Remember that G gives the same cooperation gain for the players. The Nash solution is represented by the tangential point of the frontier and the hyperbola. As apparent from the graph, the point of Nash solution shall be between E and G (exclusive of the points E and G themselves). If G is at the left of E, that is, $V_{dX} < V_{dY}$, then $U_{cX} < U_{cY}$. If G is at the right of E, that is $V_{dX} > V_{dY}$, then $U_{cX} > U_{cY}$. Thus those with the higher threat point have the stronger bargaining power as to gain the advantageous position.

Note that the only difference between the players is the human capital investment in the period A. Other parameters, such as the wage function, the utility function, and the initial human capital set are all identical between them. But since they had made the different human capital investment during the period A, now they have the different set of human capital, denoted as the vector $b()$. So the difference in the bargaining power should be caused by the difference of the human capital investment.

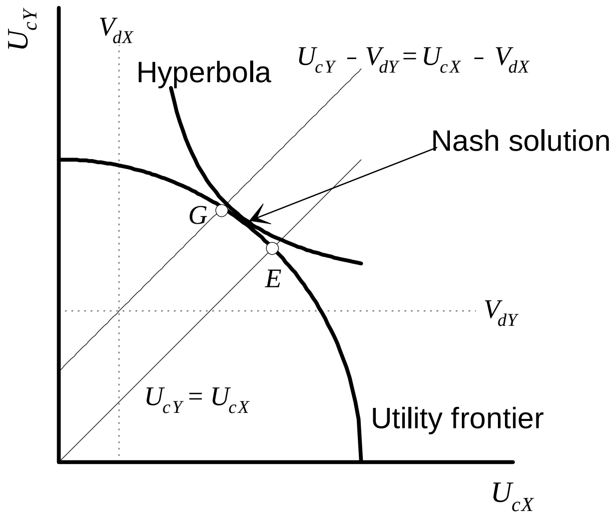

Figure 1 The Nash solution

4 How Housekeepers are Disadvantaged

4.1 The threat point of the housekeeper and the earner

As we formalized above, V_{dX} and V_{dY} represent the threat point, in the game theoretic terminology, which determines both the bargaining power within the marriage and the well-being out of the marriage. So, suppose that housekeepers are disadvantageous in the economic term, the threat point of housekeepers must be lower than that of earners, that is, $V_{dX} < V_{dY}$. Hereafter we will discuss what is the cause of such difference in the threat point.

As we have argued, in our model any difference derived only from the difference in human capital investment. So what matters is the difference in the vectors of human capital $b()$ for the period B. From Equation (8), we can derive that the difference in human capital are

$$\begin{array}{rclcl} b(X,H) - b(Y,H) & = & b(X,H) - \boldsymbol{s}_H & = & (a_{H_1} t_A(X,H_1) \ \ \cdots) \\ b(X,M) - b(Y,M) & = & \boldsymbol{s}_M - b(Y,M) & = & (-a_{M_1} t_A(Y,M_1) \ \ \cdots) \end{array} \quad (24)$$

The housekeeper (X) have more housework-related human capital, while the earner (Y) have more paid-work-related human capital.

Suppose housekeepers to be disadvantaged, because the investment in housework-related human capital is disadvantaged. That is, housework must be a bad investment while paid work be a good investment.

4.2 Nature of the demand function for household production

It is noteworthy that, in our model, human capital investment occurs along with working during the period A. So the investment shall be determined as to meet the demand in the period A. However, at the bargaining in the period B, the demand may change. So there may be a case that a task highly needed in the period A is no longer needed in the period B. Or, more precisely, it is expected to be not needed when the game ends in non-cooperation.

In our model these factors are represented by the difference in the utility function $U_A()$ and $U_d()$. The "value" of each task can be measured by the partial derivative of the utility by the time spent on the task: $\partial U/\partial t_A(j,k)$ and $\partial U_{dj}/\partial t_d(j,k)$. Let us define the concept *demand* *declining* as the phenomenon that the value of a task measured by $U_{dj}()$ is smaller than that measured by $U_A()$.

We can speak of housework as a bad investment, if demand declining is more likely to occur to housework tasks than to paid work tasks. Below we discuss some factors that may bring demand declining to housework.

The demand function for the reduced-scale economy

First, we point out a simple problem that the number of workers is different. At the period A, two workers cooperate. But at the non-cooperate case in the period B, only one worker works. We can think of this as the reduction of the scale of the economy, where the household cannot enjoy the scale merit in production and consumption. In contrast, if the scale of the economy is large, the household enjoys the scale merit where the "value" of time of each worker is greater.

This problem is analogous to the income effect on the necessities and luxuries. When the total amount of income is small, people first consume necessities. They consume luxuries only after the income increased and needs for necessities were satisfied to a certain extent.

In a similar way, we can regard money as "necessity" and housework as "luxury". This explanation is probably true, at least for industrialized societies. In industrialized societies, it is difficult to live without money. The market covers most spheres of such a society, whereas the family's function has been reduced. Consequently there are rare occasion when a housework task cannot replaced by market service.

Dependency on the household composition

Apart from the problem of scale of the economy, the composition of the household member may cause demand decline. There may be the case where a housework task is highly needed in a household of certain composition but it is no use in another household of different composition. For example, caring task is useful when there is the care receiver in the household. But in one-person household, for example, caring task is no use.

Dependency on the lifestage

There are occasions when the demand function in the period B is different from that in A, no matter whether the players cooperate or not. Some household tasks are for consumers at a specific lifestage. For example, childcare is for little children. After the children grow up, the demand for childcare must decline.

Dependency on the relationship

Some housework tasks require knowledge or skill specific to the particular person. Most caring tasks fall in this category. Especially, caring the spouse requires "learning his or her preferences and personal history, forming attachments with in-laws," and so on [England + Kilbourne: 2: p. 175]. Investment in such kind of human capital must face the demand decline in the non-cooperation phase in the period B, where the player is separated from the spouse.

5 Risk Problems

5.1 Insecure altruism

The discussion in the section above demonstrates that the disadvantage of housekeeper is a matter of risk. Housekeeper is no disadvantageous in the period A. Therefore, there is no inequality if the period A covers the whole life of the players and the duration of B is zero. In reality, however, there are many couples enter the period B and begin bargaining. In these couples, the housekeeper will face the demand declining. This lowers his/her threat point and results in less power.

These suggest the limit of the family's altruism. To be sure, in the period A couples would equally share the household production and the wage income. Nevertheless, the difference in human capital may emerge in this period. Because human capital is inseparatable from the investor, equalization of the future bargaining power is difficult. Family altruism is thus irresponsible to the risk that may appear after the altruism itself disappears.

5.2 Secure nature of the labor market

In contrast, the labor market has some mechanisms to secure risks. In our formulation, this mechanism is represented by the vector of wage $\boldsymbol{w}$. It manages risks in two ways: either to minimize the risk as to maintain the wage rate, or to pay a premium for the future risks.

First, wage is usually paid by money. Money is "liquid" [England + Kilbourne: 2: p. 178], that is, you can exchange it to almost whatever you need. Workers can efficiently meet their demand through this "liquidity".

Second, the labor market is a part of the large market, in which goods and services are exchanged. The large market provides an efficient matchmaking mechanism for demand and supply. As long as the mechanism find demand within the market, it makes match between the demand and corresponding supply.

Lifestage-dependent industries survive utilizing this matchmaking mechanism. For instance, schools offer services to children at a specific lifestage, so lifestage-dependent. Notwithstanding, schools do not go bankrupt when their students graduate. They continue the service by admitting the new generation of students. Thus the matchmaking mechanism find the new demand for the lifestage-specific services.

In these cases, the risks are successfully minimized. However, some kind of risks cannot be minimized. In this case, the market pays premium. Becker's "firm-specific training" [1] provides an example. Firm-specific training develops skills that increase productivity for the particular firm. These skills are no use in the other firms. If the firm needs workers who received this training, it must pay a premium, including the foregone income during the training; otherwise no worker will take such a training.

The labor market thus hedges risks. Of course, this is not perfect. So there are unhedged risks within the labor market. But, in general, risks are smaller than housework.

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