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DOCUMENTOS DE TRABALHO WORKING PAPERS

ECONOMIA ECONOMICS

Nº 03/2007

INTERGENERATIONAL TRANSFERS IN RURAL HOUSEHOLDS: A GAME THEORETICAL APPROACH

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Intergenerational transfers in rural households: A game theoretical approach[1]

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ABSTRACT

The household membership decision is viewed as a *"research project"* where the offspring invests in human and non human capital to influence the probability of finding an alternative to the parental household. The problem is formulated as a differential game between a selfish offspring and altruistic parents. The solution is consistent with facts" such as the *"flexibility of inheritance systems"* and the *"generational fragmentation"* of the family property when the economic opportunities expand outside the parental household.

KEYWORDS: intergenerational transfers, rural households, game theory

[1] Paper presented in the Contributed Paper Session on Rural Development and Environment of the VIII Congress of the European Association of Agricultural Economists, Edinburgh, 3-7 September 1996

1. THE ISSUES

The literature on farm offspring household membership decisions has pointed out the following facts:

- peasant families have *"two conflicting aims: to keep family property intact and to provide for younger children"* (Habakkuk, 1955, p. 1);
- there is *"flexibility of the inheritance systems"* (Hill, 1986, p. 95) in the sense that the formal or informal norms regulating the intergenerational wealth transfers are the object of manipulation by the parents and the offspring (Goody *et al.*, 1976; Gagan, 1976; Silva, 1976, 1983; Berkner and Mendels, 1978; Brandão, 1988; Perrier-Cornet *et al.*, 1991); as more income earning opportunities emerge outside the family production unit, the tension between the conflicting aims mentioned by Habakkuk decreases, so that "generational fragmentation" (Hutson, 1987) of the family property is more likely to happen (Guither, 1963; Goody *et al.*, 1976, Alston and Schapiro, 1984; Florey and Guest, 1988; Tsuya and Martin, 1992);
- all other things being equal, the offspring have more tendency to stay in the parental farm the larger the farm size is (Marsden, 1984; Brandão, 1988).

2. CRITICAL REVIEW OF THE LITERATURE

It is useful to distinguish four types of intergenerational relationships:

- **intergenerational farm decision making transfers** (succession);
- **intergenerational wealth transfers** (inheritance) *inter vivos* or *post mortem*;
- **intergenerational income transfers**;
- **intergenerational family extension**.

By focusing on the offspring household membership decisions we will be dealing mostly with the third and fourth types of intergenerational relationships and the interdependences between these two types of issues.

With the exception of Becker's work (1974, 1981) and the *"strategic bequest motive"* approach initiated by Bernheim *et al.* (1985) and pursued by Sundstrom and David (1988), the literature on intergenerational wealth and income transfers has not explicitely modelled the strategic interactions between parents and offspring. So a serious handicap of the literature up to Becker and Bernheim *et al.* is that it cannot account for the manipulative behaviours of parents and offspring documented in the empirical literature.

Becker's main contribution is known as the *"rotten kid theorem"*. This theorem is based on the following assumptions:

- the child is selfish and the parent is altruistic;
- the child's consumption is a normal good for the parent;
- the utility of parent and children depends solely on transferable consumer goods;
- the sequence of the decision process goes as follows: the child takes some action that affects both his income and parent's income; after the child has made his choices, the parent makes a money transfer to the child.

If these assumptions hold, the selfish child will choose actions which maximize the family income.

The *"rotten kid theorem"* plays an important role in the macrodynamics literature because it provides a basis for the *"Ricardian equivalence theorem"* (Barro, 1974) which states that public forced intergenerational wealth transfers (e.g. public debt) are subsequently undone by the private actions of parents and children so that government intergenerational redistribution programs are neutralised and have no real effects.

In Becker's theory the parents have no need to behave strategically: the selfish child maximizes utility by choosing an action that maximizes the family income. So the parents cannot do better for the maximization of family income than making the *"automatic"* money transfer needed to adjust to the child's best choice. No manipulation of the transfer by the parents can improve upon family income.

A problem with Becker's approach is that it is not appropriate when the parents or the child's utilities do not depend solely on transferable commodities. So it fails, for example, in the situation where the parents supply money transfers to their children who in turn provide the parents with an in-kind service (*"attention"*). Bernheim *et al.* (1985) set up a non cooperative game showing that, in this case, parents need to engage in strategic behaviour in order to obtain *"filial attention"* from their children. To do so they have to establish a bequest rule and precommit to it before children choose their actions, threatening them with disinheritance if they don't behave according to the parents' wants. This is called the *"strategic bequest motive"*.

This result does not require parents and child to be selfish. The parents can be altruistic and the child can derive utility from the attention supplied to the parents. What the *"strategic bequest motive"* says is that the parents want more attention than the child would have provided in the absence of bequest.

This non-cooperative game-theoretical approach is a promising one. The evidence provided in the paper by Bernheim *et al.* strongly suggests that parents behave strategically. There are, however, some critical remarks to make to the non-cooperative set up in Bernheim *et al.* (1985).

1. These authors ignore the existence of exogenous social norms regarding intergenerational wealth transfers. They assume complete freedom of the parents in terms of establishing the bequest. The reality is that parents have to take into account exogenous bequest rules established by law or social custom. So a more interesting set up would be to represent the parents' strategic bequest behaviour as oscillating around the socially established bequest rules. The model could, then, predict under what economic conditions private intergenerational wealth transfers would conform or would deviate from the social norms. This is the kind of model proposed here.

2. Another problem with the model by Bernheim *et al.* is that it does not account for the trade off between the parents' household economic security and an equitable treatment of children. The results of our model will reflect this trade off.

3. Bernheim et al. are simply interested in *"cash bequest for filial attention type of exchanges"*, without caring whether or not the offspring is contributing to the parents' production unit. So their approach has to be reframed if one is interested in the analysis of the intergenerational continuity of the family farm undertaking and the timing of the offspring's exit. The model proposed here can deal with this issue.

The work of Sundstrom and David (1988) was preceeded by a formal treatment of the problem (David and Sundstrom, 1984) as an n-person cooperative bargaining game. The authors proved that an expansion of labour market opportunities beyond the parental household increases the bargaining power of the children and reduces their economic value for the parents.

Bernheim *et al.* and Sundstrom & David do not deal specifically with the offspring household membership decision. McElroy (1985) proposed a Nash bargaining model for this type of decision, but it is a static model which cannot deal with the issue of timing of the offspring's exit.

The Rural Sociology literature has paid some attention to the issues of succession and inheritance in agriculture. A good account of this research is given in the recent book by Gasson and Errington (1993). These issues have deserved much less interest among agricultural economists. Most of their research is normative and has focused on the issue of optimal planning and financing of intergenerational land transfers (Harrison *et al.*, 1968; Levi and Allwood, 1969; Boehlje and Eisgruber, 1972; Longworth, 1972; Reinders *et al.*, 1980; Tauer, 1985). An interesting exception is the work of Rosenzweig and Wolpin (1985) who appeal to the gains from farm specific human capital to explain intergenerational family extension, cost advantages of family relative to hired labor and the scarcity of land sales. This idea of taking into account the accumulation of human capital is an important one and will be explored here but with a different orientation:

- we take into account the fact that the offspring may accumulate not only farm specific human capital but also off farm capital;
- we also take into account the fact that the returns to the offspring’s farm specific human capital depend on the intrafamilial income distribution controlled by the parents and the strategic interactions between parents and offspring about household membership.

3. MAIN FEATURES OF THE MODEL

The approach to this problem captures the **strategic interactions** within the farm households concerning intergenerational income transfers. The offspring have the choice to stay in the parents' household, contributing to family income and benefiting from the home consumption of goods and services, or to leave and be sovereign in the generation and allocation of his income. Parents have the authority to decide about the intra-household income distribution, taking into account the fact that this distribution will influence the offspring's household membership decisions. So the problem will be modelled in game theoretical terms to account for those strategic interactions.

The second feature of this approach is to look at this decision problem as a **"research project"** (Reinganum, 1981, 1982). The offspring accumulates knowledge relevant to the "project" (investment in formal education or other forms of **"human capital"**, search for a partner to marry with, a job alternative to the parents' farm activity and a new place to live, etc.). The "timing of completion of the project" (age at which the offspring leaves the parents' home) is a random variable dependent on the amount of resources invested in the "project".

The model will be formulated at a level of generality encompassing either the cases of an exit towards a full time or a part time independent farming occupation, or the case of a complete exit from the farm sector. We don't elaborate on this multiple choice problem, leaving it out for future research.

Since there is no periodic dates at which the offspring's exit decision can occur the model should be dynamic. Its outcome will be a hazard function giving the probability that a offspring of a certain age still belongs to the parental household.

The mathematical construct representing this view of the household membership decision is a **differential game**. With specifications of functional forms for some ingredients of the model, namely preferences, it can be explicitly solved to characterize the equilibrium strategies of offspring and parents and the probability distribution of the age at which the offspring quits the parents' home.

4. ASSUMPTIONS

The model is based on the following assumptions.

Assumption A1

At a random time a farm offspring may decide to leave the parents' household.

Assumption A2

The offspring's decision is influenced by the parents' decisions about the share of family income he receives in case of staying in the parental household.

Assumption A3

The offspring's household membership decision is viewed as a "research project"[1]:

- the offspring accumulates knowledge and other forms of capital relevant to the "project" (to leave the parents' household) through the expenditure of resources measurable in monetary units, denoted by $u_2(t)$;

- the timing of completion of the "project" is a random variable with a distribution influenced by the offspring's accumulation of off farm capital;

- if the "project" is successfully completed, the offspring earns an income $Y_{22}(t)$ and the rest of the family earns an income $Y_{21}(t)$;

- $Y_{21}(t)$ is exogenous and $Y_{22}(t)$ is related to the off farm stock of capital $K_2(t)$ as follows $Y_{22}(t) = mK_2(t)$, where m is exogenous and constant over time.

Assumption A4

As long as the offspring stays in the parental household, total family income follows some exogenous path $Y_1(t)$ out of which the offspring receives an amount $u_1(t)$ decided by the parents. Part of this income is used for the offspring's consumption which cannot be smaller than some minimum level denoted by $c_1(t)$, exogenous to this model.

Assumption A5

Parents are viewed as a single agent.

Assumption A6

There are neither savings nor investment, besides the offspring's investment in off farm capital.

Assumption A7

Parents' and offsprings' preferences are intertemporally separable.

Assumption A8

The offspring behaves so as to maximize expected income, discounted at some non-negative rate r.

Assumption A9

Parents behave so as to maximize family utility discounted at rate r.

Assumption A10

The family preference aggregation procedure is exogenous to the model and is assumed to yield the following current utility function:

$$(1) \quad U(t) = [U_1(t)]^{1-\alpha}[U_2(t)]^{\alpha} \quad 0 < \alpha < 1$$

where $U_2(t)$ denotes the expected income of the offspring at time t, $U_1(t)$ denotes the expected income of the rest of the family at time t and α denotes the weight attached to the offspring's welfare by the family preference aggregation procedure.

Assumption A11

Parents' and offspring's decisions are framed in continuous time.

Assumption A12

Parents' and offspring's decision horizons are finite, beginning at the age the offspring becomes strategically active and ending at an age when this decision problem becomes irrelevant. The starting age will be denoted as time zero and the terminal age as time T_2.

Assumption A13

Parents and offspring have perfect information about all the elements relevant to decision making.

5. COMMENTS ON THE ASSUMPTIONS

5.1. INTRAHOUSEHOLD STRATEGIC INTERACTIONS

This set of assumptions captures the role of economic factors (income earning opportunities within and outside the parental household, investment in human and non human capital) and some sociological factors (parental authority over family income distribution, family preference aggregation procedures, social norms about intergenerational transfers) in the offspring's household membership decision.

Assumptions A1-A5, A9 and A10 capture some of the strategic interactions within the family in a simplified way, by collapsing interdependences to the interaction between one offspring and the rest of the family represented by the parents.

The structure of decision making within the family unit is assumed to be such that the offspring has freedom of choice in the allocation of income between consumption and investment in off farm capital. This investment influences positively the probability of finding more attractive earning alternatives outside the parental household. Finally, the offspring has freedom of choice about staying or leaving the parental household when such alternatives arise.

5.2. PREFERENCES

According to assumptions A8 and A10, the utility of parents and offspring depend solely on transferable consumer goods. So offspring are assumed to be selfish and parents are altruistic. The type of altruism implicit in function (1) takes the form of a **generalized Nash bargaining social welfare function** with zero disagreement payoffs. The family income distribution chosen by the parents then has the following properties (Myerson, 1991):

1. **Pareto efficiency**

Changing the chosen income distribution to benefit one family member cannot be done without making at least another member worse off.

2. **Individual rationality**

No family member gets a zero income.

3. **Scale independence**

Affine transformations of the utility function of the form $U_i^* = \alpha U_i$ don't change the chosen income distribution, that is, the chosen income distribution is independent of the money units in which income is measured.

4. **Independence of irrelevant alternatives**

Eliminating feasible alternative income distributions that would have not been chosen does not affect the distribution chosen by the parents. This property means that the relevant income distributions are only those close to the one chosen by the parents[2].

This way of representing the family decision process supposes that there is some bargaining within the household about income distribution, but this process is not modelled explicitly. An agreement is reached among the family members and then the parents act as the enforcers of that outcome. The "bargaining power" of the offspring in this process is represented by the parameter α.

5.3. TIME FRAME

Because there are no periodic dates at which the exit decision can occur, the model is framed in continuous time.

6. FORMULATION OF THE MODEL

Because of the strategic interactions among family members, the household membership decision will be formulated as a game. Since the time frame is continuous and the solution concept is perfect equilibrium, the model will be a differential game[3].

To specify the objective functions of parents and offspring, consider first the offspring's expected income $U_2(t)\delta t$, that is, the utility over the time interval $[t, t+\delta t]$.

1) At the beginning of the time interval, if the offspring is still in the parents' home, he receives an income $u_1(t)$, out of which he might make some investment in off farm capital.

2) The offspring has freedom to leave at any time later if more attractive alternatives come up. According to assumption A3, the probability distribution of the timing of offspring's exit from the parents' household is related to the offspring's stock of off farm capital. This distribution will be denoted $S_{12}(t)$

$$(2) \quad S_{12}(t) = P(T \le t) = 1 - S_{11}(t)$$

where $S_{11}(t)$ is the survivor function denoting the probability the offspring is still in the parents' household by time t.

Assumption A14

Each future increment in off farm capital is equally likely to be the one that allows the offspring to leave if that has not yet happened by time t. So the survivor function has an exponential distribution as follows:

$$(3) \quad S_{11}(t) = P(T > t) = e^{-x(t)}$$

where $x(t)$ is the stock of off farm capital at time t.

According to assumption A3, $u_2(t)$ denotes the value of the resources invested in off farm capital at time t. The cost function of this investment is described by the following assumption.

Assumption A15[4]

The investment cost in off farm capital $u_2(t)$ is equal to $k_2(t)$.

$$(4) \quad k_2(t) = u_2(t)$$

We have then the following relationship:

$$(5) \quad K_2(t) = \int_0^t k_2(s)ds = \int_0^t u_2(s)ds = x(t)$$

Given (3) and (5), $u_2(t)$ is a hazard function. So, if T denotes the random time of departure from the parental household, $u_2(t)$ can be interpreted as follows:

$$(6) \quad u_2(t) = \lim_{\delta t \to 0} \frac{1}{\delta t} P(t < T \le t + \delta t / T > t)$$

$u_2(t)$ is then the probability of leaving during the arbitrarily small time interval $(t, t + \delta t]$ conditional on the fact that the offspring has not left by time t. $u_2(t)$ is always non negative but can be greater than one and therefore is not exactly a conditional probability. However, for an arbitrarily small time interval $(t, t + \delta t]$, $u_2(t)\delta t$ is a good approximation to the conditional probability $P(t < T \le t + \delta t / T > t)$.

The offspring's expected income at time t denoted by $U_2(t)$ is:

$$(7) \quad U_2(t)dt = \{u_2(t)mx(t) + e^{-x(t)}[u_1(t) - u_2(t)]\}dt$$

By similar arguments, the expression for the current family utility is the following:

$$(8) \quad U(t)dt = \{u_2(t)mx(t) + e^{-x(t)}[u_1(t) - u_2(t)]\}^{\alpha} \times \{u_2(t)Y_{21}(t) + e^{-x(t)}[Y_1(t) - u_1(t)]\}^{1-\alpha} dt$$

The household membership decision problem can be formulated as follows:

$$(9) \quad Max \int_0^{T_2} e^{-rt}\{u_2(t)mx(t) + e^{-x(t)}[u_1(t) - u_2(t)]\}dt$$

$$(10) \; Max \int_0^{T_2} e^{-rt}\{u_2(t)mx(t) + e^{-x(t)}[u_1(t) - u_2(t)]\}^{\alpha} \times \{u_2(t)Y_{21}(t) + e^{-x(t)}[Y_1(t) - u_1(t)]\}^{1-\alpha} dt$$

(11) $s.t. \quad dx(t)/dt = u_2(t)$

(12) $x(t) \in [0, \infty]$

(13) $u_1(t) \in [0, \infty]$

(14) $u_2(t) \in [0, c_1(t)]$

(9)-(14) define a differential game with the following features:

- there is only one state variable[5] $x(t)$;
- the control variables appear linearly in the offspring's utility function and non linearly in the parents' utility function;
- the kinematic equation involves only the control variable $u_2(t)$ in a linear fashion.

7. SOLUTION OF THE MODEL

To characterize the (not necessarily unique) perfect equilibria of the game defined by expressions (9)-(14), we begin with the two current value Hamiltonian functions:

$$(15) \quad H_1(x,u_1,u_2,v_1) = U_1(x,u_1,u_2) + v_1u_2$$

$$(16) \quad H_2(x,u_1,u_2,v_2) = U_2(x,u_1,u_2) + v_2u_2$$

where v_1 and v_2 are the current value Lagrange multipliers.

We now look for the strategy choices $u_i^*[x, v_1(x), v_2(x)]$ which are Nash equilibria for the Hamiltonian game:

$$(17) \quad \underset{u_i}{Max} \quad H_i(x,u_1,u_2,v_i) \quad i=1,\,2$$

The equilibrium strategies do not depend on v_1. This means that the choice of optimal strategies by both players depends on the effects of changes in the state variable in so far as they affect the offspring's utility but not the parents' utility. This is due to the fact that the kinematic equation (11) depends on u_2 but not on u_1.

7.1. CHARACTERIZATION OF THE OFFSPRING'S EQUILIBRIUM STRATEGIES

As is typical in differential games for an action variable which appears linearly, there is a situation of **"bang-bang" equilibrium strategies**:

Case 1.1

$$(18) \quad u_2^*(x) = 0 \qquad if \quad v_2 < e^{-x} - mx$$

Case 1.2

$$(19) \quad u_2^*(x) = \text{constant} \qquad if \quad v_2 > e^{-x} - mx$$

In case 1.1, given the parents' optimal strategy choice u_1^*, the Hamiltonian H_2 is a straight line with negative slope equal to

$$(20) \quad v_2 - e^{-x} + mx$$

So it reaches its maximum for the minimum value that u_2 can take which is zero.

In case 1.2, the Hamiltonian function H_2 is still a straight line, given the parents' strategy choice, but its slope is now positive. Therefore, the Hamiltonian reaches its maximum for the maximum value that u_2 can take. This maximum value is constrained by the amount of income u_1 the parents choose to allocate to the offspring. It is constrained also by the minimum income the offspring has to spend to meet consumption needs. So, in case 1.2, his optimal strategy choice is

$$(21) \quad u_2^*(x) = u_1^*(x) - c_1$$

Calculation of the time path of the costate variable $v_2(t)$ can be done by starting from the following equation of motion:

$$(22) \quad \frac{\partial v_2}{\partial t} = -\frac{\partial H_2}{\partial x} = -mu_2 + e^{-x}(u_1 - u_2)$$

The general solution of this equation is

$$(23) \quad v_2(t) = -mx(t) + e^{-x(t)} + \int_0^t e^{-x(s)} u_1(s)ds + C$$

The value of the constant of integration C can be determined by appealing to the transversality condition:

$$(24) \quad v_2(T_2) = 0$$

to get

$$(25) \quad C = mx(T_2) - e^{-x(T_2)} - \int_0^{T_2} e^{-x(s)} u_1(s)ds$$

Substituting this result in expression (23) yields

$$(26) \quad v_2(t) = -mx(t) + e^{-x(t)} + \int_0^t e^{-x(s)} u_1(s)ds + mx(T_2) - e^{-x(T_2)} - \int_0^{T_2} e^{-x(s)} u_1(s)ds$$

Using these results, the condition for case 1.1 is

$$(27) \quad mx(T_2) - e^{-x(T_2)} < \int_0^{T_2} e^{-x(s)} u_1(s)ds$$

and for case 1.2

$$(28) \quad mx(T_2) - e^{-x(T_2)} > \int_0^{T_2} e^{-x(s)} u_1(s)ds$$

Since the value of the term $e^{-x(T_2)}$ is likely to be very small and T_2 is the end point of this decision problem, the LHS in expressions (27) and (28) is approximately equal to the wealth the offspring can get outside the parental household at time T_2. It will be called the **outside wealth at time T_2.**

The RHS in expressions (27) and (28) represents the sum of the income the offspring will get from the parents up to time T_2, if he stays in the parental household. So it is a measure of his **expected stock of farm capital** at that time.

Results (18), (19), (27) and (28) can be interpreted as follows:

- to decide about whether or not it is worth to invest in off farm capital, the offspring compares the outside wealth at time T_2 (the time by which the offspring is bound to have taken a decision about staying or leaving the home farm) with his expected stock of farm capital at that time;

- the offspring will make no effort to leave the parental household if the outside wealth at time T_2 is less valuable than his expected stock of farm capital at that time and will invest to leave the parental household if it is not so.

7.2. CHARACTERIZATION OF THE PARENTS' EQUILIBRIUM STRATEGIES

The first order condition for the parents' decision problem is the following:

$$(29) \quad \frac{\partial H_1}{\partial u_1} = \alpha[u_2 Y_{21} + e^{-x}(Y_1 - u_1)] - (1-\alpha)[u_2 mx + e^{-x}(u_1 - u_2)] = 0$$

From (29) we get

$$(30) \quad u_1^*(x) = \alpha Y_1 + \alpha e^x u_2 Y_{21} + (\alpha - 1) e^x u_2^* mx + (1-\alpha) u_2^*$$

For the two cases discussed in the previous section the equilibrium strategies are:

$$(31) \quad u_1^*(x) = \alpha Y_1 \qquad u_2^*(x) = 0 \qquad if \qquad v_2 < e^{-x} - mx$$

$$(32) \quad u_1^*(x) = \alpha Y_1 + [u_1^*(x) - c_1](Ae^x + 1 - \alpha)$$

$$u_2^*(x) = u_1^*(x) - c_1 \quad if \quad v_2 > e^{-x} - mx$$

where

$$(33) \quad A \equiv \alpha Y_{21} - (1-\alpha) mx$$

Case 2.1: "Generational consolidation" case[6]

This corresponds to equation (31). In this case it is not worth for the offspring to invest in off farm capital. The share of the family income he gets is equal to the weight α ascribed to him in the family welfare function. Hereafter, this level of income will be referred to as the **"offspring's entitlement"**. This is what Peyton Young (1994) calls the case of **"transparent equity"**.

Case 2.2: "Generational fragmentation" case[7]

This corresponds to equation (32). In this case it is worth for the offspring to invest in off farm capital and u_1^* **deviates from the offspring's entitlement** αY_1 (case of **"transparent inequity"**). To determine the direction of this deviation, the parents compare the income $mx(t)$ the offspring can get off the farm, in case of leaving at time t, with the income per capita of the family members staying with them.

To see this, consider the term A in the RHS of expression (32). To interpret its economic meaning it is easier to work with the case of an "egalitarian" entitlement structure, that is, one where $\alpha = 1/n$. In this case we have:

$$(34) \quad A = \frac{n-1}{n}\left(\frac{Y_{21}}{n-1} - mx\right)$$

There are three possible cases to consider for the value of A.

Case 2.2.1

$$(35) \quad u_1^*(x) = \alpha Y_1 + (1-\alpha)[u_1^*(x) - c_1] \quad if \quad mx = \frac{Y_{21}}{n-1}$$

In this case, the offspring's off farm income at time t is equal to the income per capita the other family members would have if the offspring leaves at that time. In this case, the optimal strategy choice for the parents is to allocate to the offspring an income greater than his entitlement. Rearranging (35) as follows

$$(36) \quad u_1^*(x) = Y_1 - \left(\frac{1-\alpha}{\alpha}\right)c_1$$

and considering the entitlement structure $\alpha = 1/n$, we can see that the parents' optimal strategy choice is such as to allocate to the offspring the portion of family income remaining from giving to the other $n-1$ family members a total income equal to $(n-1)c_1$, that is, an income allowing them to reach the same level of consumption as the offspring.

Case 2.2.2

$$(37) \quad u_1^*(x) = \alpha Y_1 + [u_1^*(x) - c_1](Ae^x + 1 - \alpha) \quad with \quad Ae^x + 1 - \alpha > 0 \quad if \quad mx < \frac{Y_{21}}{n-1}$$

In this case, the offspring's off farm income at time t is lower than the income per capita the other family members would have if the offspring leaves at that time. The parents' optimal strategy choice is to allocate to the offspring an income greater than his entitlement. By investing in order to leave the parents' home, the offspring expects to accumulate a greater wealth than by staying with the parents forever and his departure will not make the other family members poorer than him. The parents help to prepare this departure by giving him an allowance greater than his entitlement which reduces the gap between his income outside the farm and the income of the other family members.

Case 2.2.3

(38) $u_1^*(x) = \alpha Y_1 + [u_1^*(x) - c_1](Ae^x + 1 - \alpha) \quad with \quad Ae^x + 1 - \alpha < 0 \quad if \quad mx > \dfrac{Y_{21}}{n-1}$ The offspring invests in the departure from the parents' home, but if this happens the other family members will become poorer than him. In this case, the parents' optimal strategy choice is to give him an income smaller than his entitlement. This reduces his possibilities for investing in off farm capital and the chances of leaving the home farm.

8. CONCLUSIONS

1. These results are consistent with the **"flexibility of inheritance systems"**: even though there are social norms (formal or informal) about intergenerational wealth and income transfers (represented in the model by the parameter α, they are manipulated by the parents to influence the behaviour of the offspring.

2. The results yield a testable hypothesis about the orientation of those manipulative behaviours.

a) **"Transparently equitable" intergenerational income transfers** - the offspring gets an income equal to his entitlement if he can accumulate a greater wealth by staying with the parents than by leaving;

b) **"Transparently inequitable" intergenerational income transfers favourable to the offspring** - he gets more income than his entitlement if he can accumulate a greater wealth by leaving and if the family members remaining in the parental household will not become poorer than him after his departure;

c) **"Transparently inequitable" intergenerational income transfers unfavourable to the offspring** - he gets less income than his entitlement if he can accumulate a greater wealth by leaving and if the family members remaining in the parental household will become poorer than him after his departure.

So it is through mechanisms of "transparently equitable or inequitable" intergenerational **income** transfers towards the offspring that parents try protect their household **wealth** and respond to the Habakkuk's dilemma.

3. Either the case of **generational consolidation** or the case of **generational fragmentation** can happen to the parents' household and property, depending on the economic opportunities for the offspring inside and outside the parental household. The offspring invests in his departure if he expects to accumulate outside a greater wealth than by staying with the parents forever. Therefore, all other things being equal, the pattern of **generational fragmentation** is more likely to be found:

- among poor households than among rich households;
- in a context of economic growth, than in a stagnant economy.

NOTES

1. This view of the problem was inspired by applications of differential games to the analysis of Research and Development with rivalry (Reinganum, 1981, 1982).

2. This assumption has been the object of many criticisms and several authors have proposed "more reasonable" alternative assumptions which lead to the same Nash bargaining solution. A good discussion of these issues is contained in the set of papers edited by Binmore and Dasgupta (1987).

3. A useful presentation of differential games is given in Case (1979).

4. In this case the marginal cost of investing in off farm capital is constant and equal to 1.

5. Differential games with more than one state variable are harder to treat mathematically.

6. This expression is taken from Hutson (1987).

7. This expression is taken from Hutson (1987).

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