Mutual Insurance and non Cooperative Migration Choices

by

Matthieu Delpierre
FNRS Research Fellow,

Department of Agricultural Economics (ECRU), Université catholique de Louvain (UCL),
Place Croix du Sud 2 / 15, B-1348 Louvain-la-Neuve, Belgium
e-mail : **matthieu.delpierre@uclouvain.be**
phone : +32 10 47 21 41
fax : +32 10 47 36 75

Abstract
By diversifying a rural household income sources, migration acts as an insurance device. This paper raises the issue of the internalisation of his relatives' gain by the prospective migrant. We argue that customary sharing norms make a promise of livelihood provision credible, and hence allow the family head to ex ante subsidise a risky urban opportunity. By modelling a non-cooperative decision-making process, we show that, whatever its level, the subsistence norm is unable to make the equilibrium migration choice efficient. In addition, our model accounts for the puzzling possibility that, in cases where the family support is critical in the migration decision, the probability to migrate increases with the rural income even controlling for the value of the urban opportunity.

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Introduction

In developing countries, peasants are faced with a risky income, randomly affected by crop disease or drought. As a consequence of market failure, a rural household's insurance needs are unlikely to be entirely fulfilled by existing sharing norms. Migration offers therefore an additional and valuable means of consumption smoothing by further diversifying the family income sources. However, if one considers the prospective migrant as the ultimate decision-maker, it must be acknowledged that means of making him internalise his relative's gain are few and weak. Indeed, an effective incentive to migrate has to enhance the urban opportunity and, if postponed until the actual decision, has to be credibly promised. As we argue, the commitment to grant livelihood in case of failure of the urban business can be such an instrument since it is enforced by the customary assistance or subsistence norm.

The use of basic tools of non-cooperative game theory is required to raise those issues and to answer the following questions.

First, does the subsistence norm allow the migrant to fully internalise the household's insurance needs? Is the equilibrium migration decision rule efficient?

Second, how do the predictions of a non-cooperative framework differ from those of a cooperative setting?

The purpose of the first section is to discuss the pervasive character of mutual assistance in village societies and its stable translation into customary norms. Section 2 is aimed at arguing that basic non-cooperative game theory may bring additional insights compared to the existing migration literature. Sections 3 is devoted to the model, while sections 4 and 5 discuss the outcome of the migration game in terms of comparative static and of a normative assessment, respectively. Finally, we conclude the paper stating the main results and interpretations.

Section 1: Mutual Insurance as an Equilibrium of Repeated and Closed Interaction

Smallholders adopt several strategies that smooth their consumption path. Among these strategies, we can distinguish between two main categories: stabilisation of one individual's income and risk sharing between or within village households. At the individual level, their total harvest can be partially stabilised by cultivating different scattered and quite remote plots, for example. But risk pooling through exchanges of food, labour, gifts and money is also commonly observed in agrarian communities (Fafchamps, 1992; Caote and Ravaillon, 1993; Platteau, 1997; Thomas and Worral, 2002). Although rather fair over time, these transfers entail no explicit "contractual" counterpart. But reciprocity is the rule. Transfers are granted against the expected and discounted benefit of future help at a critical but unforeseeable point of time. A generally stable membership of the village society ensures that the participants of the insurance scheme compute the right future benefits when they are on the giver side and allows credible threat of retaliation following defection to be made. Informal risk sharing of that kind is a contingent insurance contract seen as equilibrium of repeated and closed interaction. As soon as this equilibrium is subgame perfect, the contract is self enforced and stable over time.

One might consider that customary norms of solidarity and assistance translate the equilibrium strategies into the collective consciousness. And, to a certain extent, analytically, subsequent games are subject to this above outcome since it might constraint the strategy spaces of the players. Our migration game will be in this line. The subsistence rule will be assumed to hold in the model. About the fact that assistance strategies crystallise around social norms, Marcel Fafchamps (1992: 148) writes:

"*There is no contradiction between the fact that people in preindustrial societies pursue their long term self-interest and the central idea of the moral economy of peasants, namely, that the ethical values of precapitalist societies emphasise solidarity as a moral obligation and subsistence as a right.*"

The risk sharing equilibrium strategies and their translation into pervasive social norms imply a kind of poverty ban in the village since assistance is spontaneously and collectively enforced. Disincentive effects may be associated with this norm given that the marginal productivity of efforts is taxed through mutual periodical transfers. But, as already mentioned and as stressed by Platteau (1991), assistance can be of several natures. For instance, labour assistance is an effective means of coping with moral hazard since it makes reciprocal supervision easier. As a matter of fact, ex ante solidarity as assistance in the production process has better incentive properties than has ex post food or cash assistance[1].

Customary rules seem to enforce efficient ways of reaching food security. The first productive assets of a nuclear household (land or livestock) are transmitted upon marriage and provide its main source of livelihood. For example, access to land is an inalienable right whit which every community member is endowed. Nobody is systematically assisted by the lineage as it falls to everyone to procure subsistence food. Platteau and Baland (2001) highlight the immutable character of the equal division rule of land transmission in all Sub-Saharan Africa. Everyone remains tied to land whatever her position and in spite of a growing and acute scarcity in some areas.

To further illustrate the point, consider the two following examples:

First, as far as land transactions are concerned and in areas in which these transactions are socially allowed, selling can not occur without the explicit approval of the elders, and this, despite a growing individualisation of land tenure. Restrictions on land sales are sanctioned by customary land law (Ollennu, 1962; James and Fimbo, 1973; Platteau and Baland, 2001; Platteau, 2004; Soro and Colin, 2005). Taken from Ollennu (1962: 127) in the case of Ghana:

"*An alienation of stool or family land which on the face of it purports to have been made by the occupant of the stool or the head of the family acting with the consent and concurrence of the principal elders, and with that consent and concurrence evidenced by at least one principal member of the family (e. g., a holder of traditional office like a linguist) is not void, but it is voidable (…) in such a suit the onus is upon the family to prove that in fact no consent of the principal elders was obtained*."

Another quotation in the case of Tanzania is as follows (James and Fimbo, 1973: 444, 430):

"*Should the relatives concerned not have been informed that a transaction had taken place they have the right to invalidate the sale by bringing an action against the vendor, who must then return the purchase price he received.*"

A second example from South Botswana involves livestock but shares crucial features with the first in the way subsistence may be at stake. In herder communities, alienation of cattle by its young owner is still subject to the consent of the father (Peters, 1994: 104):

"*A son may not sell his earmarked beasts without the permission of his father. His doing so may be treated as theft by his father and pursued as such in the chief's court. Yet the son does have claims on his earmarked cattle: they are recognized to be his, though subject to his father's decisions until he is able to establish his own compound and herd.*"

Ex ante solidarity through a granted factor endowment has definitely desirable properties in terms of incentive provision. As a consequence, alienation of the basic tool of food generation

[1] See also Fafchamps (1992)

is collectively risky since it might prove costly for the social security network in terms of ex post assistance. Therefore, the custom tends to restrict it.

Nonetheless, even at the community level[2], risk spreading comes up against a limitation. Provided that commitment and incentive problems are solved, it copes quite well with specific risk as disease or death of a family member or even as the unlikely case of individual crop failure. But mutual insurance at best ties the agent's revenue to the aggregate income (full income pooling). Covariate fluctuations keep hurting everyone. Collective risks are not tradable at the village level. Against these aggregate fluctuations, villagers can, parting with livestock or jewellery, vary their asset holding position. A drawback is always entailed with this strategy since either the asset is liquid but unproductive, or it may be productive but owned in inefficient quantity to serve the buffer purpose. It follows that a lack of insurance often remains against covariate bad events, typically affecting harvests. In this perspective, anyone migrating allows to uncouple the perfect correlation of incomes among farmers in a given household or in a given village. Deciding whether to migrate will depend on all the characteristics of the urban opportunity including its insurance properties.

To sum up, first, the mutual assistance equilibrium establishes subsistence as a basic right for each community member and translates into a poverty ban at the village level. Second, ex ante solidarity as access to land is an efficient means of fulfilling part of this collective objective. Therefore, to sell one's land asset or even to give up cultivating for one crop season in order to undertake an urban activity might endanger one's livelihood in case of failure. This is a potential burden to be shouldered by the community or family insurance scheme. A lower labour provision is a cost in that sense. Third and finally, there remains a lack of insurance against covariate shocks.

Section 2: A non-Cooperative Approach to Migration Choices

There are different ways in which the migration choice has been modelled in the literature. As a first rough classification, let us distinguish between papers that assume an individual decision maker and others in which the involvement of the relatives is allowed for.

In the former category, the migration literature is often recognized to originate with Todaro's papers in the AER[3] (Todaro, 1969; Harris and Todaro, 1970). These papers formalise the decision maker as an isolated individual facing a job lottery and comparing expected returns. More recently, Larson and Mundlack (1997) examined the power of wage differentials in explaining rural-urban migration and found strong support for the hypothesis that the wage gap is the main determining factor. However, one can not exclude that other considerations play a part in the decision. Insurance purposes have been put forward by Stark and Levhari (1982). As they argue, at the individual level, a risk averse agricultural worker may be interested in migration provided that the prospect of getting a smooth wage in the urban sector outweighs the disutility associated with a short term period of potentially high income variability in the informal sector.

[2] Or even on a larger geographical basis since solidarity networks are sometimes extended far from the village itself. Pseudo family links are adduced to act as a setting in which these committed transfers take place.
[3] A broader review of the migration literature can be found in de Haan (2006).

More importantly and as already argued, since urban wages are not perfectly correlated with the agricultural income, migration allows a diversification of income sources at the household level (Stark and Levhari, 1982). The research on remittance flows (Hoddinott, 1994; de la Brière et al., 2002; Azam and Gubert, 2002; Goetghebuer and Platteau, 2006) provides empirical evidence of risk sharing between the migrant and his family circle. Apart from investment in bequeathable assets[4], informal insurance is the main motive for a migrant to remit. The paper of de la Brière et al. (2002) is aimed at assessing the empirical relevance of both explanations and at highlighting the characteristics of the sender (gender and destination) depending on his motivation.

Given that migration results in the opportunity of informal insurance and hence in additional surplus to be shared among the household members, the relatives are expected to be involved in the original decision-making process which should be modelled accordingly. This is done by a second set of papers in which either the household is assumed to behave as a homogeneous unitary decision maker (Stark and Levhari, 1982), or the choice is a product of the interaction of its members (for example, Hoddinott, 1994). The latter subset of papers is methodologically more satisfactory since it accounts for the equilibrium allocation of the costs and benefits of migration. In fact, there is a general concern about the impact of intra-household heterogeneity on other decisions as well. It is acknowledged that, for instance, the consumption pattern of a given household may differ, for a same aggregate income, depending on who brings it and in what proportion (Browning et al., 1994).
Chiappori (1988, 1992) developed a theoretical framework that allows for diverging individual preferences and interests while assuming that the household always engages in efficient decision-making. The so-called collective setting was extended by Basu (2004). In his paper, Basu argues that, if one acknowledges that the joint decisions are determined by the intra-household's power relations which in turn depend on the respective income earning abilities, then the female labour supply should itself affect the bargaining positions. In a dynamic setting with fixed point reasoning, he then shows that, in the initial choice of leisure consumption and hence of labour supply, the player anticipates the impact of the subsequent power structure on his well-being.

The Nash bargaining solution belongs to Chiappori's collective setting. It is applied to the migration decision in a paper by Hoddinott (1994). His model makes use of the strategic bequest argument in explaining remittances: if the threat of disinheritance is credible, put differently, if the heirs compete for acquiring the family estate, then, the parents have the ability to attract higher levels of care and transfers. A slight methodological discrepancy lies in the fact that equilibrium remittances result from non-cooperative interaction while the migration choice is the outcome of a cooperative solution.

Our contribution precisely consists in using basic non-cooperative game theory to model the decision making process. Our point is to test analytically for efficiency rather than to assume it. The latter approach relies implicitly on a strong assumption. Indeed, suppose that the prospective migrant is not willing to go on his own and that the insurance surplus accruing to the relatives is decisive in making migration worth undertaking from a collective viewpoint. Then the migrant has to be rewarded above the expected migration payoff. In other words, for migration to be undertaken when collectively needed, the household has to transfer ex ante

[4] This explanation of remittances refers to the strategic bequest motive (Bernheim et al., 1985): if the parents can credibly commit to disinherit their child, they are able to attract care and transfers by designing an appropriate reward function. The heirs compete for inheritance which is larger if part of the remittances is invested in the family estate.

utility to the prospective migrant. To be effective as incentive provision, the reward must come afterwards and be credibly promised. Such a mechanism of credible transfer commitment exists in rural communities (Drapier et al., 2001). Indeed, since the above-described subsistence norm is collectively enforced, the family head can credibly commit to grant livelihood to the return migrant in case of failure of his urban business.

The questions we raise are the following: Under what circumstances does migration respond to the household insurance needs? Does the subsistence norm act as an efficient ex ante subsidy to the prospective migrant in a non cooperative framework?

We also show that the predictions of the non-cooperative approach may differ from those of a cooperative setting in terms of comparative statics. In particular, our framework allows, first, to identify reciprocity rules as possible determinants of the migration outcome and, second, to highlight the possibility that, in particular cases, the probability of migration increases with the agricultural income.

The section to follow introduces the model in terms of structure and notation.

Section 3: A Migration Game in Extensive Form

Assumptions

The aim of the model is to represent an interactive decision-making process leading to either permanent or temporary migration.

The story is as follows. Suppose that a son, maybe endowed with particular skills, is faced with the opportunity of leaving agriculture and undertaking an urban business. The agricultural income is random while the urban wage is constant. It therefore offers insurance opportunities to the household. However, migration is uncertain in the sense that the actual payoff realisation is a priori unknown because of a realistic lack of information about either entrepreneurial abilities or other contextual features. There is a range of urban job opportunities from the worst informal occupation to the best formal sector position. Formally, migration is a distribution of types, known to every player:

$$\theta \sim F(\theta|\lambda) = 1 - e^{-\lambda\theta}$$

To each type corresponds a fix wage and λ is the unique parameter of the exponential distribution that assesses its value in our context. Indeed, consider a distribution characterized by a low λ and another characterized by a higher one, the former first-order stochastically dominates the latter.

There are two states of the world. State 1 is associated with a high level of agricultural income, normalised at unity. In the second state that occurs with probability η, the peasant is subjected to an income fall and earns $\theta_L < 1$. In addition, we assume the existence of a subsistence customary threshold $\theta_S < 1$ that triggers assistance transfers in the existing solidarity network. The income required to meet basic needs is indeed a social rather that physiological norm.

Two people belong to the set of players: the prospective migrant (M) and the household head (H).

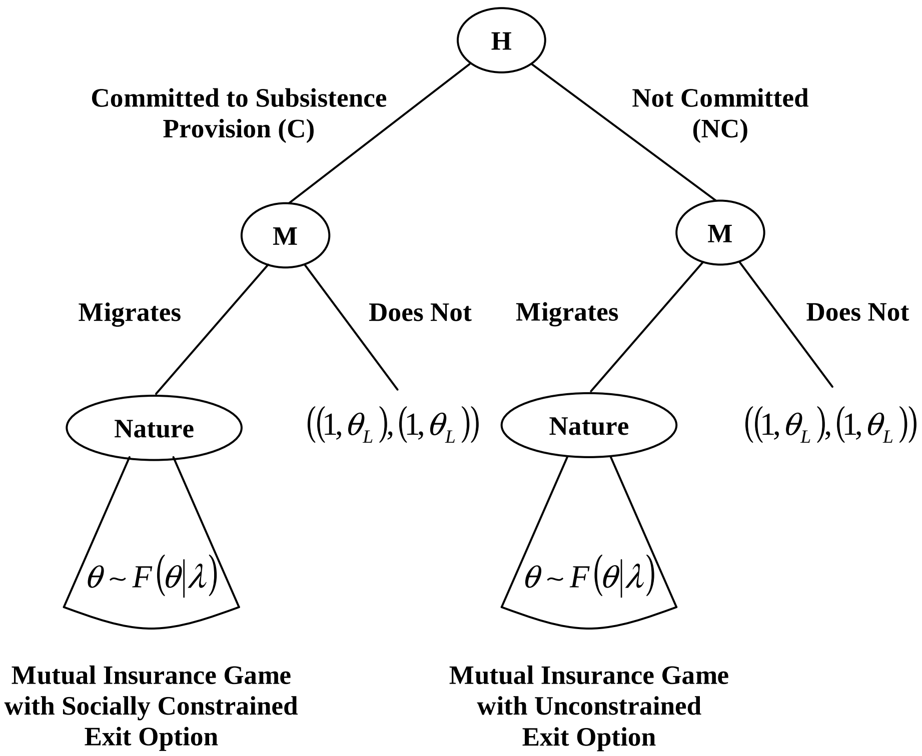
Preferences are described by a constant absolute risk aversion utility function:

$$u_i(x) = -e^{-ax} \quad \forall i \in \{M, H\} \tag{1}$$

where a is the level of absolute risk aversion.

The game tree is depicted in figure 1. Both players are faced with the given migration opportunity of M characterised by λ. The structure of the game is as follows:

Figure 1: The Migration Game in Extensive Form



In a first stage, the household head decides on the promise to grant livelihood to M in case of failure of his urban business. If H consents to M migrating, he implicitly acknowledges his subsistence right and commits to abide by the assistance norm. Since the norm is enforced by the community network, the promise is credible and modelled accordingly in the decision tree; hence the family head is the first mover of the game. However, we also allow for the possibility that H sends a signal to the community that he is not ready to share in the costs of migration. In other words, the household head is supposed to have a binary control over the ex ante utility transfer that represents the subsistence norm.

In a second stage, the prospective migrant either migrates or stays in the village.

If migration is not chosen, both players receive the peasant's payoff, if it is, Nature draws an element from the continuum of types $[0,+\infty)$.

The constant wage earned by the migrant offers a new opportunity of consumption smoothing at the household level. As a consequence, we allow a mutual insurance game to be played in a third and final stage. The stake is the distribution of the insurance surplus. An insurance arrangement is a risk allocation defined by a couple of contractual parameters specifying the transfers between agents contingent upon the realised state of nature. With regard to ad interim participation constraints (Coate and Ravaillon, 1993), we assume that the equilibrium contract is enforceable. Ex ante agreed transfers are assumed to be supported by sufficiently strong social sanctions.

To be consistent with the non-cooperative nature of the migration game, we chose Rubinstein's alternating offers game to select the equilibrium contract (Rubinstein, 1982). Actually, a "take it or leave it" set-up would not have appropriately translated a situation, looking like bilateral monopoly, in which, on both sides, players bring in unsubstitutable resources. The entrepreneur brings in an otherwise unaffordable insurance against covariate crop failures while enforceable contracts can be concluded in the village but nowhere else. Indeed, information flows quite efficiently and existing social ties act as enforcement devices.
However, the limiting outcome of strategic bargaining models, obtained when the length of a single offer period tends to zero, is the Nash bargaining solution (Binmore et al., 1986). It is therefore a good approximation and we opt to use it for analytical convenience.
The outcome of this insurance game is subject to customary norms and hence depends on the initial choice of the family head. Either he has committed to grant subsistence or not. In the latter case, the exit options of the players are $((\theta,\theta),(1,\theta_L))$. Each player receives is own income. In the former case, the exit options are

$$\begin{cases} ((\theta_S,\theta_S),(1+\theta-\theta_S,\theta_L+\theta-\theta_S)) & if\ \theta\in[0,\theta_S) \\ ((\theta,\theta),(1,\theta_L)) & if\ \theta\in[\theta_S,+\infty) \end{cases}$$

The rationale for this assumption is what follows: the risk allocation is freely selected by the household members but should a bad type be drawn and a disagreement arise, the failing migrant can involve the community and compel M to make him reach the subsistence level, at worse. So, the poverty ban assumption only applies in case of disagreement. In that sense, the exit options are socially constrained.
In the subsequent developments, the migration game is solved using backward induction.

The Insurance Contract

In this subsection, we first calculate the equilibrium distribution of the insurance surplus if the exit options are unconstrained or, stated in other words, if the household head did not commit to subsistence provision in the first stage.

To begin with, since there is no reason for the insurance surplus not to be exhausted, we have to characterize the efficient risk allocation. In order to do so, we look for the equation of the contract curve. If x_{ij} is the income earned by player i in state of the world j, player i's marginal rate of substitution between x_{i1} and x_{i2} equals

$$MRS_i = -\frac{1-\eta}{\eta}.e^{-a(x_{i1}-x_{i2})}$$

Suppose (x_{m1},x_{m2}) is the income bundle of the migrant after transfers. It follows that $((1+\theta-x_{m1}),(\theta_L+\theta-x_{m2}))$ are the corresponding amounts accruing to the household head.
Equalising the marginal rates of substitution of both players and solving for x_{m2} gives

$$x^*_{m2}(x_{m1}) = x_{m1} - \frac{1}{2}(1-\theta_L) \tag{2}$$

Making use of the aggregate incomes, any risk allocation is characterized by only two coordinates but, if the equilibrium allocation belongs to the contract curve, it is described by a single parameter (x_{m1}). Therefore, for any drawn type θ, the Nash bargaining program can be written as

$$\underset{x_{m1}}{Max} \quad \{Eu_m(x_{m1},x^*_{m2}(x_{m1}))-u_m(\theta)\}.\{Eu_h(1+\theta-x_{m1},\theta_L+\theta-x^*_{m2}(x_{m1}))-Eu_h(1,\theta_L)\} \tag{3}$$

Introducing (1) and (2) in (3) gives

$$\underset{x_{m1}}{Max}\left\{e^{-a\theta}-(1-\eta)e^{-ax_{m1}}-\eta e^{-a\left(x_{m1}-\frac{1}{2}(1-\theta_L)\right)}\right\}.\left\{(1-\eta)e^{-a}+\eta e^{-a\theta_L}-(1-\eta)e^{-a(1+\theta-x_{m1})}-\eta e^{-a\left(\theta_L+\theta+\frac{1}{2}(1-\theta_L)-x_{m1}\right)}\right\}$$

After some calculation, we find the following risk allocation: $\forall\theta\in[0,+\infty)$,

$$\begin{cases} x^*_{m1}=\theta+\frac{1}{2}\left(1-\tilde{\theta}_A\right) & (4.1)\\ x^*_{m2}=\theta-\frac{1}{2}\left(\tilde{\theta}_A-\theta_L\right) & (4.2)\end{cases}$$

$$\begin{cases} x^*_{h1}=1-\frac{1}{2}\left(1-\tilde{\theta}_A\right) & (4.3)\\ x^*_{h2}=\theta_L+\frac{1}{2}\left(\tilde{\theta}_A-\theta_L\right) & (4.4)\end{cases}$$

where

$$\tilde{\theta}_A=-\frac{1}{a}.\ln\left((1-\eta)e^{-a}+\eta e^{-a\theta_L}\right)<1$$

is the certainty equivalent of the agricultural income.

These are the payoffs of the players for a given realisation of the migration opportunity (θ) in the right part of the decision tree.

As expected, remittances flow from the urban migrant to the village in cases of bad agricultural outcome while rural-urban transfers reward the migrant in the other state of the world. As a preliminary to the final results, notice that, if H did not promise to procure livelihood, he is totally insensitive to the realisation of migration since his payoff is independent of θ.

Let us turn to the left part of the decision tree. As highlighted in the first section, solidarity and assistance behaviours are enforced by customary norms. This above equilibrium restricts the strategy space of our insurance game. Specifically, all physically feasible allocations are not contractible since not socially accepted. The basic and inalienable right to subsistence accruing to each community member translates into a poverty ban in the village. Otherwise, the breach of assistance duty by the involved relatives would be collectively punished.

Accordingly, we calculate the equilibrium insurance contract with socially constrained exit options. For all θ higher than the subsistence threshold θ_S, the payoffs are identical to those that are described above since the poverty ban is not binding. For lower types, we do the same calculations with the constrained exit options, that is

$$\underset{x_{m1}}{Max}\left\{Eu_m\left(x_{m1},x^*_{m2}(x_{m1})\right)-u_m(\theta_S)\right\}.\left\{Eu_h\left(1+\theta-x_{m1},\theta_L+\theta-x^*_{m2}(x_{m1})\right)-Eu_h\left(1+\theta-\theta_S,\theta_L+\theta-\theta_S\right)\right\}$$

This gives the following payoffs, in the left part of the decision tree, $\forall\theta\in[0,\theta_S)$,

$$\begin{cases} x^*_{m1}=\theta_S+\frac{1}{2}\left(1-\tilde{\theta}_A\right) & \\ x^*_{m2}=\theta_S-\frac{1}{2}\left(\tilde{\theta}_A-\theta_L\right) & (5.2)\end{cases}$$

$$\begin{cases} x^*_{h1}=1-(\theta_S-\theta)-\frac{1}{2}\left(1-\tilde{\theta}_A\right) & (5.3)\\ x^*_{h2}=\theta_L-(\theta_S-\theta)+\frac{1}{2}\left(\tilde{\theta}_A-\theta_L\right) & (5.4)\end{cases}$$

Under the poverty ban assumption and in case of failure of the urban business, one might notice that the urban wage is shouldered at the margin by the household head who fills the migrant's income gap.

The Migration Decision

We first wonder whether the prospective migrant would be ready to seize the urban opportunity without the family head's commitment to provide him with subsistence in case of failure. For that purpose, let us compute the expected utility of migration as a function of λ. Further on, this utility level will be compared with the value of agriculture.
Taking into account the equilibrium insurance transfers (making use of (4.1) and (4.2)), the expected utility that procures a given urban wage can be written as

$$Eu_m(\theta) = -(1-\eta)e^{-a\left(\theta+\frac{1}{2}(1-\tilde{\theta}_A)\right)} - \eta e^{-a\left(\theta-\frac{1}{2}(\tilde{\theta}_A-\theta_L)\right)} = u(\theta).\chi$$

where

$$\chi(a,\eta,\theta_L) = \frac{(1-\eta)e^{-\frac{a}{2}} + \eta e^{-\frac{a}{2}\theta_L}}{e^{-\frac{a}{2}\tilde{\theta}_A}} \tag{6}$$

This amount can be shown to be strictly lower than 1. Recall that the utility is negative. Hence, χ embodies the utility gain due to risk sharing as compared to a situation in which the migrant would have consumed his constant wage alone.
For the purpose of expressing the ex ante utility of migration, the payoff corresponding to a given wage remains to be integrated against the distribution of types:

$$E_\theta[Eu_m(\theta)] = \int_0^{+\infty} u(\theta).\chi.dF(\theta;\lambda) = -\chi.\frac{\lambda}{a+\lambda}$$

Therefore, M migrates if and only if

$$E_\theta(Eu_m(\theta)) \geq u(\tilde{\theta}_A)$$

$$\Leftrightarrow -\chi.\frac{\lambda}{a+\lambda} \geq -e^{-a\tilde{\theta}_A} \Leftrightarrow \lambda \leq \frac{ae^{-a\tilde{\theta}_A}}{\chi - e^{-a\tilde{\theta}_A}}$$

$$\Leftrightarrow \lambda \leq \tilde{\lambda}^{NC} = \frac{u'(\tilde{\theta}_A)}{\chi + u(\tilde{\theta}_A)} \tag{7}$$

where the superscript NC stands for "not committed". Any migration opportunity characterised by a lower λ first-order stochastically dominates the indifference level and hence should be seized by the prospective migrant.
As a benchmark, suppose that the migrant can not act as an insurance supplier. In this case,

$$\tilde{\lambda} = \frac{u'(\tilde{\theta}_A)}{1+u(\tilde{\theta}_A)} \tag{8}$$

characterises the indifference threshold. This is the decision rule that would adopt an isolated decision maker.

$$\frac{\partial\tilde{\lambda}^{NC}}{\partial\chi} < 0 \text{ and } \chi < 1\text{, hence, } \tilde{\lambda} < \tilde{\lambda}^{NC}$$

Put differently, having the ability to extract part of the mutual insurance surplus, the migrant is less demanding regarding the value of the urban opportunity.

Second, in the event that the household head should commit to subsistence provision, how worth is the indifference migration project? In this case,

$$Eu_m^C(\theta)=\begin{cases} u(\theta_S).\chi & if\ \theta\in[0,\theta_S) \\ u(\theta).\chi & if\ \theta\in[\theta_S,+\infty) \end{cases}$$

Accordingly, migration is preferred to agriculture, if and only if it gives a higher expected utility, that is

$$E_\theta\left[u_m^C(\theta)\right]=u(\theta_S).\chi.F(\theta_S;\lambda)+\int_{\theta_S}^{+\infty}u(\theta).\chi.dF(\theta;\lambda)\geq u\left(\tilde{\theta}_A\right)$$

$$\Leftrightarrow -\chi.\left[e^{-a\theta_S}\left(1-e^{-\lambda\theta_S}\right)+\lambda\int_{\theta_S}^{+\infty}e^{-\theta(a+\lambda)}d\theta\right]\geq -e^{-a\tilde{\theta}_A}$$

$$\Leftrightarrow \lambda\leq\tilde{\lambda}_m^C=\frac{u'\left(\tilde{\theta}_A-\theta_S\right)-a.\chi.F\left(\theta_S;\tilde{\lambda}_m^C\right)}{\chi+u\left(\tilde{\theta}_A-\theta_S\right)} \qquad (9)$$

where $\tilde{\lambda}^C$ is implicitly defined and is the indifference threshold below which M migrates following the credible promise of livelihood provision. The subsistence level θ_S ensures to M a minimal bargaining position. Concerning $\tilde{\lambda}_m^C$, two results are worth noting.

On the one hand, as is shown in appendix 1,

$$\frac{\partial\tilde{\lambda}_m^C(\theta_S)}{\partial\theta_S}\geq 0$$

Intuitively, the higher is the customary protection that is granted to the migrant, the lower is the value of the urban opportunity that is required for him to leave the village.

On the other hand, as can be seen from (7),

$$\tilde{\lambda}_m^C(0)=\tilde{\lambda}^{NC}$$

Obviously, promising no social protection amounts to promising nothing at all.

To sum up,

$$\tilde{\lambda}<\tilde{\lambda}^{NC}<\tilde{\lambda}_m^C(\theta_S) \qquad \forall\theta_S>0$$

Third and finally, let us take the point of view of the family head.

As a first possibility, let us assume that $\lambda\in\left[0,\tilde{\lambda}^{NC}\right]$.

If this is true, H plays NC.

Indeed, in the right part of the decision tree and whatever the drawn type (using (4.3) and (4.4)),

$$Eu_h^{NC}=u\left(\tilde{\theta}_A\right).\chi$$

while under the subsistence commitment (using (5.3) and (5.4)),

$$Eu_h^C(\theta)=\begin{cases} u\left(\tilde{\theta}_A\right).\chi.e^{a(\theta_S-\theta)} & if\ \theta\in[0,\theta_S) \\ u\left(\tilde{\theta}_A\right).\chi & if\ \theta\in[\theta_S,+\infty) \end{cases}$$

Since the utility is always negative and $e^{a(\theta_S-\theta)}>1$,

$$E_\theta\left(Eu_h^{NC}\right)>E_\theta\left(Eu_h^C(\theta)\right)$$

$$\Leftrightarrow F(\theta_S;\lambda)>0$$

$$\Leftrightarrow \theta_S>0$$

this is assumed. This result is very intuitive. If H anticipates that migration is going to be undertaken whatever his first stage decision regarding the livelihood provision, he always chooses not to promise it. Analytically, if $\lambda \leq \tilde{\lambda}^{NC}$, then the family head has an incentive to free ride on the costs of migration. Indeed, committing to subsistence provision entails an ex ante utility cost. In other words, in case urban opportunities are worth seizing from an individual point of view, there will be no expected utility transfer from the relatives to the prospective migrant. Free riding is a first possible equilibrium path.

As a second possibility, suppose that $\lambda \in \left(\tilde{\lambda}^{NC}, \tilde{\lambda}_m^C\right]$.

In this case, the prospective migrant is willing to leave if and only if he receives the social protection. The choice of the household head is therefore between status quo and consumption smoothing at the cost of committing to subsistence provision should the urban business fail. Formally, H plays C if and only if the expected utility of the latter exceeds the utility level of the former:

$$E_\theta\left[Eu_h^C(\theta)\right] = u\left(\tilde{\theta}_A\right).\chi.\left[\int_0^{\theta_S} e^{a(\theta_S-\theta)} dF(\theta;\lambda) + \left(1 - F(\theta_S;\lambda)\right)\right] \geq u\left(\tilde{\theta}_A\right)$$

$$\Leftrightarrow \chi.\left[e^{a\theta_S}\lambda\int_0^{\theta_S} e^{-\theta(a+\lambda)} + e^{-\lambda\theta_S}\right] \geq 1$$

$$\Leftrightarrow \lambda \leq \tilde{\lambda}_h^C = \frac{u'(\theta_S).\left(1-\chi.e^{-\tilde{\lambda}_h^C\theta_S}\right)}{\chi + u(\theta_S)} \qquad (10)$$

H has in mind a truncated distribution of types since only the left tail of the density, where assistance is required, matters.

Finally, assume $\lambda \in \left(\tilde{\lambda}_m^C, +\infty\right)$.

In this last case, migration never occurs. H is indifferent between playing C and NC.

As a general outcome, let $\overline{\lambda}$ denote the effective migration threshold. Any urban opportunity that dominates this particular level will be seized at equilibrium.

$$\overline{\lambda} = \max\left\{\tilde{\lambda}^{NC}, \min\left\{\tilde{\lambda}_m^C, \tilde{\lambda}_h^C\right\}\right\} \qquad (11)$$

This results from a twofold argument. First, as explained above, there are outside opportunities that are worth seizing even without customary protection and that actually lead the household head to free ride on the costs of migration. Second, in the other cases, migration only occurs when two conditions are simultaneously fulfilled: the ex ante subsidy provides M with sufficient incentives to leave and the family head effectively chooses to commit to subsistence provision. As a consequence, the binding constraint is the lowest threshold or the more valuable indifference migration project.

In the following section, we discuss the outcome in terms of its positive properties, while section 5 is devoted to a normative assessment of the equilibrium of the non-cooperative migration game.

Section 4: A Positive Assessment of the Migration Equilibrium

The aim of this fourth section is to assess the impact of the parameters on the effective migration threshold (11). Notice that the higher is the indifference threshold, the broader is the range of urban opportunities that are seized by the prospective migrant. Hence, in a given context, the probability of migration increases. We are going to use the latter interpretation in order to simplify our statements.

As a preliminary step, let us first characterise the agricultural income in terms of mean and variance:

$$\begin{cases} \mu = (1-\eta) + \eta\theta_L \\ \sigma^2 = (1-\theta_L)^2 \eta(1-\eta) \end{cases} \Leftrightarrow \begin{cases} \theta_L = \theta_L(\mu, \sigma^2) = \mu - \left(\dfrac{\sigma^2}{1-\mu}\right) & (12) \\ \eta = \eta(\mu, \sigma^2) = \dfrac{(1-\mu)^2}{(1-\mu)^2 + \sigma^2} & (13) \end{cases}$$

We use this information to do comparative statics calculations with respect to both parameters.

The Impact of the Variance

First, for given preferences, the variance embodies the inherent risk of agriculture. Other things being equal, a higher agricultural risk is expected to trigger more migrations for insurance purposes at the individual as well as at the collective level. This intuition is confirmed by the model. Indeed, in view of (7),

$$\tilde{\lambda}^{NC} = \tilde{\lambda}^{NC}\left(\tilde{\theta}_A(\mu, \sigma^2), \chi(\mu, \sigma^2)\right) \tag{14}$$

with

$$\frac{\partial \tilde{\lambda}^{NC}}{\partial \tilde{\theta}_A} < 0; \frac{\partial \tilde{\theta}_A}{\partial \sigma^2} < 0$$

On the one hand, if the variance increases, the certainty equivalent of agriculture decreases which, in turn, increases the probability that M migrates, even without the parental support. On the other hand,

$$\frac{\partial \tilde{\lambda}^{NC}}{\partial \chi} < 0; \frac{\partial \chi}{\partial \sigma^2} < 0$$

This means that the marginal utility gain from consumption smoothing getting larger, insurance is more powerful as an incentive to migrate.

The same is true for $\tilde{\lambda}_m^C$. And, finally,

$$\tilde{\lambda}_h^C = \tilde{\lambda}_h^C\left(\chi(\mu, \sigma^2)\right)$$

In view of (10), it can be seen that the decision of the household head does not depend on $\tilde{\theta}_A$. Under our strong assumption of strictly selfish preferences, H does not internalise the relative values of both businesses. His only interest lies in the opportunity of diversifying the family income sources. Using (10), one can show that if the random agricultural income degenerates to a constant value, $\tilde{\lambda}_h^C$ converges to zero. Put differently, if the insurance need vanishes, the family head does not support any migration project whatever its intrinsic value. His purchase of insurance through the commitment to subsistence provision only occurs for sufficiently high risk levels. The players' perceptions of a same migration option may therefore diverge

and a dispute may arise over the issue. This makes sense once the individual incentives are properly depicted. This is allowed by the use of a non-cooperative setting that highlights the impact of diverging interests on the migration outcome.
It follows from the above derivatives that, as expected, the probability of migration increases with the agricultural risk.

$$\frac{\partial \overline{\lambda}}{\partial \sigma^2} > 0$$

The Impact of the Mean

Second, the impact of the mean agricultural income on the migration outcome is accounted for. Making use of (7) and (14), as the intuition suggests,

$$\frac{\partial \tilde{\lambda}^{NC}}{\partial \tilde{\theta}_A} < 0; \frac{\partial \tilde{\theta}_A}{\partial \mu} > 0$$

This first effect is obvious. The certainty equivalent of agriculture is an increasing function of the mean. Following an improvement of the rural living standards, M is less keen to migrate. Nevertheless, in our model at least, the second effect on the insurance needs goes in the opposite direction since, as is shown in appendix 3,

$$\frac{\partial \tilde{\lambda}^{NC}}{\partial \chi} < 0; \frac{\partial \chi}{\partial \mu} < 0,$$

meaning that the benefit from mutual insurance increases with the mean agricultural income[5]. Stated in other words, our result implies that insurance is a normal good[6]. We acknowledge that this result is not unrelated to our choice of a CARA utility function. Nevertheless, its empirical relevance has been noted by several authors (Showers and Shotick, 1994; Foncel and Treich, 2007).
It can be shown that the first effect dominates the latter "demand for insurance" effect. As a consequence, $\tilde{\lambda}^{NC}$ is a decreasing function of the mean. The same holds true for $\tilde{\lambda}_m^C$.
But, provided that our assumptions on the preferences also reasonably apply to peasant communities, a surprising result arises. Indeed, since the household head is insensitive to the first effect,

$$\frac{\partial \tilde{\lambda}_h^C}{\partial \mu} = \frac{\partial \tilde{\lambda}_h^C}{\partial \chi} . \frac{\partial \chi}{\partial \mu} > 0$$

As a consequence, the relationship between the effective migration threshold and the mean rural income is non monotonic. As appears in figure 2, there exist values of μ for which the probability of migration increases with the agricultural income. More precisely, under the assumption that insurance is a normal good and in cases where the parental decision is binding, a rise in rural income may result in a higher probability of migration occurring. Hoddinott (1994) found, controlling for education which could be considered as a proxy for urban opportunities, a positive relationship between the probability of migration and parental wealth. Having recourse to the strategic bequest argument, the author gives the interpretation that wealthier parents are more able than other to control the behaviour of their children and hence to extract more surplus from their urban position. Our finding is also consistent with this empirical evidence. Both interpretations share the first common feature that they are grounded on the positive relationship between income or wealth and the parental demand for

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[5] Recall that the utility is negative. Hence, the lower is χ, the higher is the benefit from consumption smoothing.
[6] For a careful theoretical discussion of the issue, see Aase (2007).

or consent to migration. The second step of the argument is also similar and consists in acknowledging that the migration decision may depend on the parental choice as a binding constraint.

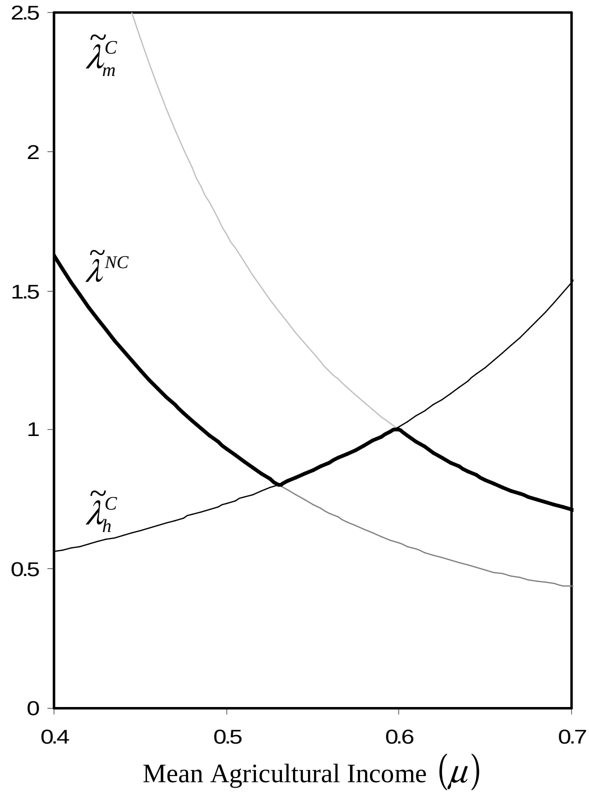

Figure 2: The Effective Migration Threshold as a Function of the Agricultural Mean Income

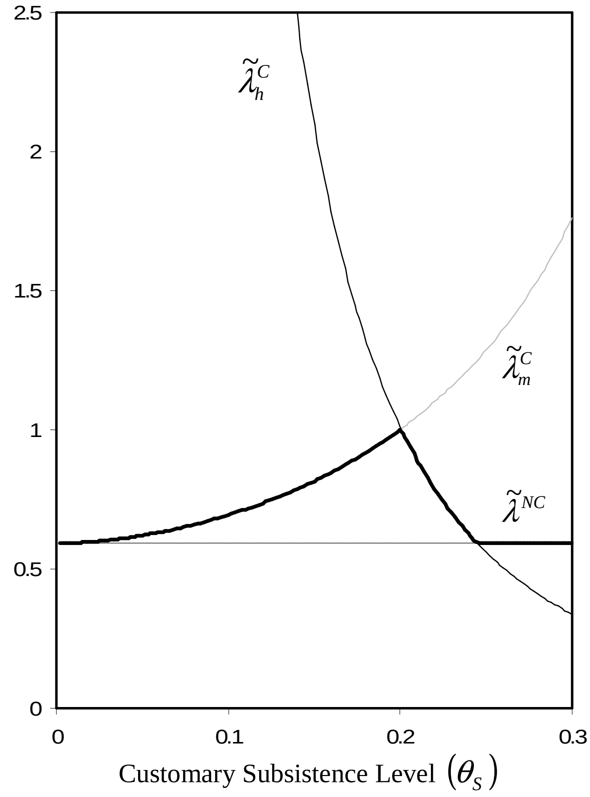

Figure 3: The Effective Migration Threshold as a Function of the Subsistence Level

The Impact of the Customary Subsistence Level

Third, how does the effective migration threshold react to hypothetical changes in the subsistence level?

On the one hand, as mentioned above, $\tilde{\lambda}_m^C$ increases with the customary hunger insurance since it amounts to raise the subsidy that is granted to the prospective migrant.

On the other hand, as shown in appendix 2,

$$\frac{\partial \tilde{\lambda}_h^C}{\partial \theta_S} < 0$$

This illustrates the fact that the higher is the level of social protection, the more is transferred to the prospective migrant. As a consequence, a given migration opportunity is more costly to subsidize. It follows that the household head’s indifference value of the urban project increases with the subsistence level. In other words, consider H as a hunger insurance supplier. Then, for a given willingness to pay for consumption smoothing, a higher probability of failure of the urban business can be substituted for a lower compensation granted to the migrant.

Those contradictory behaviours are depicted in figure 3 from which it can be seen that the probability to migrate is non monotonic in the ex ante subsidy. Indeed, intuitively, if it is too low, the incentive is too weak, while if it is too high, the cost is unaffordable for the family head. In communities that are characterised by very egalitarian solidarity norms, the parents are expected to free ride on the cost of migration. Somewhat paradoxically, strict reciprocity rules are predicted to result in weak actual solidarity towards failing migrants.
As developed below, intermediate sharing norms ensure a better internalisation of the relatives' insurance needs by the prospective migrant.

The Impact of Risk Aversion

Finally, let us shortly analyse the impact of risk aversion on the probability to migrate. As is briefly explained by the arguments to follow, this impact is ambiguous. Take the point of view of an isolated individual, that is without taking into account risk sharing.

$$\frac{d\tilde{\lambda}}{da} = \frac{\partial \tilde{\lambda}}{\partial \tilde{\theta}_A} . \frac{\partial \tilde{\theta}_A}{\partial a} + \frac{\partial \tilde{\lambda}}{\partial a}$$

where

$$\frac{\partial \tilde{\lambda}}{\partial \tilde{\theta}_A} < 0 ; \frac{\partial \tilde{\theta}_A}{\partial a} < 0 ; \frac{\partial \tilde{\lambda}}{\partial a} < 0$$

The net effect is indeterminate.
Indeed, on the one hand, a higher level of risk aversion strengthens the incentives to get a constant wage instead of a random harvest while, on the other hand, the agent is less keen to take the short term risk implied by the urban job lottery.
As another example involving the family head,

$$\frac{d\tilde{\lambda}_h^C}{da} = \frac{\partial \tilde{\lambda}}{\partial \chi} . \frac{\partial \chi}{\partial a} + \frac{\partial \tilde{\lambda}_h^C}{\partial a}$$

where

$$\frac{\partial \tilde{\lambda}_h^C}{\partial \chi} < 0 ; \frac{\partial \chi}{\partial a} < 0 ; \frac{\partial \tilde{\lambda}_h^C}{\partial a} < 0$$

If the family head is more risk averse, the utility gain from risk sharing is higher, increasing his willingness to support migration. However, it is more costly in utility terms to commit to provide subsistence to the return migrant should he fail his urban undertaking.

The following section is devoted to our search of a benchmark in order to compare the non-cooperative migration outcome with the efficient collective choice of migration. We will also show that the efficient solution has different implications in terms of comparative statics.

Section 5: A Normative Assessment of the Migration Equilibrium

As a preliminary comment, note that, since the efficient migration threshold that is calculated in this section is the outcome of joint utility maximisation, it corresponds to the cooperative solution of the household migration game. We use it as a benchmark, to assess the normative properties of the non-cooperative equilibrium and to compare the predictions of both models.

Our strategy consists in showing that to each urban opportunity λ corresponds a Pareto frontier and hence a level of joint utility.

As a first step, it is shown that, taking into account the whole mutual insurance surplus, to each urban wage θ corresponds a constant aggregate certainty equivalent to be shared. Recall from (2) that

$$Eu_m\left(x_{m1}, x_{m2}^*\left(x_{m1}\right)\right) = Eu_m\left(\tilde{x}_m\left(x_{m1}\right)\right) = -(1-\eta)e^{-ax_{m1}} - \eta e^{-ax_{m1}+\frac{1}{2}a(1-\theta_L)}$$

where $\tilde{x}_m$ is the certainty equivalent of the random income accruing to M. Rearranging the terms, we find

$$x_{m1} = \tilde{x}_m + \frac{1}{a}\ln\left[(1-\eta) + \eta e^{\frac{1}{2}a(1-\theta_L)}\right] \quad (15)$$

Similarly, using the aggregate income in both states of the world,

$$Eu_h\left(\tilde{x}_h\left(x_{m1}\right)\right) = -(1-\eta)e^{-a(1+\theta-x_{m1})} - \eta e^{-a\left(\theta_L+\theta+\frac{1}{2}(1-\theta_L)-x_{m1}\right)}$$

$$\Leftrightarrow x_{m1} = \theta - \tilde{x}_h - \frac{1}{a}\ln\left[(1-\eta)e^{-a} + \eta e^{-\frac{a}{2}(1+\theta_L)}\right] \quad (16)$$

Equalizing (15) with (16) and making use of (6) gives

$$\tilde{x}_T(\theta) = \theta + \tilde{\theta}_A - 2\frac{1}{a}\ln\chi \quad (17)$$

which is the aggregate certainty equivalent and where the subscript T stands for “total”.

This total amount has to be shared between the stakeholders. As a second step, we look for the allocation of the aggregate certainty equivalent that maximises a weighted sum of utilities.

$$\underset{t}{Max} \quad u_h\left(\tilde{x}_T - t\right) + \delta.u_m(t) \qquad \delta \in [0,+\infty)$$

The first order condition provides us with an optimal transfer t^* as a function of the weights and of the drawn urban wage θ:

$$u_h'\left(\tilde{x}_T - t\right) = \delta.u_m'(t)$$

$$\Leftrightarrow t^*(\theta,\delta) = \frac{\ln\delta}{2a} + \frac{\tilde{x}_T(\theta)}{2} \quad (18)$$

As a third step and final step, recalling that the actual realisation of the urban wage is a priori unknown, we calculate the expected utility attached to a given level of opportunity **λ**. Taking the household head’s point of view and using (17) and (18),

$$U_h(\lambda) = E_\theta\left[u_h\left(\tilde{x}_T(\theta)\right) - t^*(\theta)\right] = -\sqrt{\delta}\lambda\int_0^{+\infty} e^{-a\frac{\tilde{x}_T(\theta)}{2}} e^{-\lambda\theta} d\theta$$

$$\Leftrightarrow \sqrt{\delta} = -\frac{(a+2\lambda).U_h}{2\lambda.\chi.\sqrt{\left|u\left(\tilde{\theta}_A\right)\right|}} \quad (19)$$

Similarly, from the prospective migrant’s point of view,

$$U_m(\lambda) = E_\theta\left[t^*(\theta)\right] = -\frac{1}{\sqrt{\delta}}\lambda\int_0^{+\infty} e^{-a\frac{\tilde{x}_T(\theta)}{2}} e^{-\lambda\theta} d\theta$$

$$\Leftrightarrow \sqrt{\delta} = -\frac{2\lambda.\chi.\sqrt{\left|u\left(\tilde{\theta}_A\right)\right|}}{(a+2\lambda).U_m} \quad (20)$$

Equalizing (19) and (20) enables to make the weight disappear. As a result, we are left with the equation of the Pareto frontier for a given urban opportunity λ. We find that the product of the utilities is a constant that is given by the following expression[7]:

$$U_h U_m = \left(\frac{2\lambda}{a+2\lambda} \right)^2 \chi^2 \left| u\left(\tilde{\theta}_A\right) \right| \tag{21}$$

Once endowed with the Pareto frontier of the urban opportunity, we are able to compare it with the welfare possibilities of the status quo (both players remain in the village and cultivate) and to assess the collective value of migration. We calculate the Pareto frontier of agriculture and then derive the optimal decision rule, in other words, the efficient migration threshold.

If both players cultivate,

$$Eu_h . Eu_m = \left(-e^{-a\tilde{\theta}_A}\right)\left(-e^{-a\tilde{\theta}_A}\right) = e^{-2a\tilde{\theta}_A} \tag{22}$$

Therefore, comparing (21) with (22), an urban project is collectively worth undertaking if and only if

$$\left(\frac{2\lambda}{a+2\lambda} \right)^2 \chi^2 \left| u\left(\tilde{\theta}_A\right) \right| \leq e^{-2a\tilde{\theta}_A}$$

$$\Leftrightarrow 4\left(\chi^2 - e^{-a\tilde{\theta}_A}\right)\lambda^2 - 4ae^{-a\tilde{\theta}_A}\lambda - a^2 e^{-a\tilde{\theta}_A} \leq 0$$

There are two roots but it can be shown that one of them is negative. The positive root gives the efficient migration threshold:

$$\lambda^* = \frac{u'\left(\frac{\tilde{\theta}_A}{2}\right)}{2\left[\chi + u\left(\frac{\tilde{\theta}_A}{2}\right)\right]} \tag{23}$$

The efficient migration threshold is used to highlight a set of four normative results that are worth discussing.

First, as a consequence of the lack of flexibility of the subsistence rule, the internalisation of the household's insurance needs by the prospective migrant is always imperfect. In other words, the effective threshold is strictly lower than the efficient threshold. There exist situations in which status quo is selected as the equilibrium outcome while diversification of family income would prove worth from a collective viewpoint. Player M's decision may be binding and an acute insurance need may remain unfulfilled. A higher subsistence level would improve this situation since the migrant's indifference threshold would rise until it crosses H's indifference threshold that diminishes. The converse is true in the opposite situation in which the family head's decision is binding, meaning that his initial commitment to livelihood provision is too costly compared with the utility gain from consumption smoothing.

Second, as suggested by the above reasoning, in a given context, there is a subsistence level that maximises the probability of migration. Since it makes the share of the relatives' insurance needs that is internalised by the migrant as large as possible, this level characterises

[7] The fact that this expression is an increasing function of λ should not be a source of confusion. Recalling that the utility is always negative, it can be seen that a lower product corresponds to a higher collective welfare. Hence, a lower λ is preferable as is always the case in our model.

the second best situation. Analytically, the best subsistence level θ_S^* is such that there is no more room for relaxing a constraint without tightening the other:

$$\tilde{\lambda}_m^C(\theta_S^*) = \tilde{\lambda}_h^C(\theta_S^*)$$

In practical terms, this theoretical view seems ineffective. Indeed, the subsistence level is a social norm which is not likely to react to changes in contextual parameters because of the institutional inertia. Moreover, it must be recognized that giving incentives to migrate is not the only purpose that is served by solidarity norms.

However, incidentally, if one considers that this variable belongs to the strategy space of the family head, in other words, if one assumes that the community network can make any amount enforceable, then the optimal choice of H would consist in adopting the following decision rule:

$$\text{if } \lambda \in \left[0, \tilde{\lambda}^{NC}\right], \text{ play } \theta_S = 0$$

$$\text{if } \lambda \in \left(\tilde{\lambda}^{NC}, \tilde{\lambda}_m^C(\theta_S^*)\right], \text{ play } \theta_S = \tilde{\lambda}_m^{C-1}(\lambda)$$

$$\text{if } \lambda \in \left(\tilde{\lambda}_m^C(\theta_S^*), +\infty\right], \text{ select any } \theta_S \in \left[0, \tilde{\lambda}_m^{C-1}(\lambda)\right)$$

where $\tilde{\lambda}_m^{C-1}(\lambda)$ denotes the reciprocal of $\tilde{\lambda}_m^C(\theta_S)$. If the urban opportunity is highly valuable to such an extent that the migrant is ready to leave on his own, then H free rides on the cost of migration. For intermediate opportunities, player H selects the subsistence level that makes M indifferent between migration and status quo, put differently, H triggers migration at the lowest cost. Finally, for opportunities that are strictly worse than $\lambda = \tilde{\lambda}_m^C(\theta_S^*) = \tilde{\lambda}_h^C(\theta_S^*)$, H plays arbitrarily any amount such that M does not migrate since giving incentives enough would be too costly for H.
To conclude this short digression, let say that to endogenise the subsistence level gives an additional flexibility to this instrument and removes part of the inefficient cases, but it remains that $\tilde{\lambda}_m^C(\theta_S^*)$ is strictly lower than the efficient threshold.

Coming back to the initial assumption that the subsistence norm is exogenous and as already stated, societies characterised by extremely weak or extremely strict reciprocity and solidarity rules should have less migrants that others where sharing norms are intermediate. This contrasts with the prediction of the cooperative setting following which migration should not depend on the subsistence level (see equation (23)).

Third, H being the first mover prevents the prospective migrant from seizing a bad opportunity. Indeed, suppose that the livelihood granted by the group is not at stake. In this hypothetical situation, the household would always share part of the cost of the uncertainty entailed by the urban opportunity. Hence incentives would always be biased towards migration which may be problematic in some contexts. In the opposite cases of great opportunities, deciding on his potential commitment allows the family head to benefit from mutual insurance without bearing any cost in the event of adverse cases.

Fourth and finally, the efficient migration threshold is a decreasing function of the agricultural income. Therefore, the opposite prediction could only be highlighted by the use of a non-cooperative setting.

Table 1 compares the predictions of both models in terms of comparative statics and concludes the normative analysis.

Table 1: Comparison between the Effective Migration Threshold and the Efficient Migration Threshold in Terms of Comparative Statics

	Effective Migration Threshold (11) *(Probability to Migrate in the Non Cooperative Setting)*	***Efficient Migration Threshold (23)*** *(Probability to Migrate in the Cooperative Setting)*
Agricultural Risk (σ^2)	Positive	Positive
Agricultural Mean Income (μ)	Non Monotonic: Negative / Positive / Negative	Negative
Subsistence Level (θ_S)	Non Monotonic: Positive / Negative	Nil
Risk Aversion (a)	Indeterminate	Indeterminate

Conclusion

A rural household can draw different benefits from the migration of one of its members. Apart from the leading example of consumption smoothing, migration relaxes the natural resource constraint by decreasing land pressure. In addition, the urban worker is a source of accommodation facilities for schoolchildren and of information about job opportunities. However, as can be seen from those examples, the relatives' gain is often binary in the sense that it only depends on migration occurrence, not on the actual realisation of the urban business. On the one hand, the relatives are insensitive to the intrinsic value of the opportunity, on the other hand, the prospective migrant does not automatically internalise his household's insurance needs. In this particular context, the migration decision is unlikely to result from an efficient aggregation of individual preferences. Therefore, to assess properly the impact of strategic interaction between self-interested agents in a non-cooperative setting seemed useful.

Faced with expected insurance gains, the family circle has an incentive to influence the migration decision by enhancing the urban prospects. First, the parents can incur expenses that increase the likelihood of success, as investment in education, or even contribute to the transaction costs of the shift of occupation. However, if the household is credit constrained, those instruments are unaffordable. It follows that future and hence credible rewards are called for. In this perspective, customary norms of reciprocity and assistance allow to enforce a commitment to grant livelihood to the migrant should he fail in his urban occupation.

To conclude the paper, let us recall the main contributions of the non-cooperative setting.

First, resulting from its lack of flexibility, the subsistence norm does not allow to reach an efficient migration decision. Nonetheless, a second best subsistence level has been shown to exist for each given context.

Second, depending on the value of the outside opportunity and on the extent of the household's insurance needs, the family support may or may not be critical for the urban opportunity to be seized. If the urban job market is sufficiently attractive, the migrant is expected to join it whatever the initial move of the household head. In this first case, the relatives have an incentive to free ride on the cost of migration.

In other cases, the final decision depends on the choice of the family head. Would it not be the case, due to sharing rules, incentives would be biased towards migration. The initial move of the family head prevents the migrant from weighing too heavily on the assistance scheme. Inefficient migration should not exist.

Finally, we found a rationale for a possible positive relationship between the rural income and the probability of migration. Provided the family support is binding, migration translates the household's effective demand for consumption smoothing. Either insurance is a normal good, or, since a higher income is often correlated with a better access to liquidity, other forms of transfer, such as investment in education or participation in transaction costs, become affordable. Both explanations, or even a combination of them result in a higher effective demand for insurance.

Appendix 1

In this first appendix, it is shown that $\frac{\partial \tilde{\lambda}_m^C}{\partial \theta_S} \geq 0$.

Rearranging (9) allows to see that $\tilde{\lambda}_m^C$ is such that

$$\tilde{\lambda}_m^C \left[\chi + u\left(\tilde{\theta}_A - \theta_S\right)\right] - u'\left(\tilde{\theta}_A - \theta_S\right) + a.\chi.\left(1 - e^{-\tilde{\lambda}_m^C \theta_S}\right) = 0 \tag{A.1}$$

Applying the implicit function theorem on (A.1), we first calculate the derivative of the left hand side with respect to λ.

$$\frac{\partial lhs(A.1)}{\partial \lambda} = \left[\chi + u\left(\tilde{\theta}_A - \theta_S\right)\right] + a.\chi.e^{-\lambda \theta_S} \theta_S > 0$$

Therefore,

$$\frac{\partial \tilde{\lambda}_m^C}{\partial \theta_S} > 0 \Leftrightarrow \frac{\partial lhs(A.1)}{\partial \theta_S} < 0$$

where

$$\frac{\partial lhs(A.1)}{\partial \theta_S} = -\tilde{\lambda}_m^C u'\left(\tilde{\theta}_A - \theta_S\right) + u''\left(\tilde{\theta}_A - \theta_S\right) + a.\chi.e^{-\tilde{\lambda}_m^C \theta_S} \tilde{\lambda}_m^C$$

This expression is evaluated in $\theta_S = 0$:

$$\frac{\partial lhs(\theta_S = 0)}{\partial \theta_S} = -\tilde{\lambda}_m^C u'\left(\tilde{\theta}_A\right) + u''\left(\tilde{\theta}_A\right) + a.\chi.\tilde{\lambda}_m^C \leq 0$$

$$\Leftrightarrow -e^{-a\tilde{\theta}_A} \tilde{\lambda}_m^C - a e^{-a\tilde{\theta}_A} + \chi.\tilde{\lambda}_m^C \leq 0$$

$$\Leftrightarrow \tilde{\lambda}_m^C(\theta_S = 0) \leq \frac{u'\left(\tilde{\theta}_A\right)}{\chi + u\left(\tilde{\theta}_A\right)}$$

As it happens (see (7)),

$$\tilde{\lambda}_m^C(\theta_S = 0) = \frac{u'\left(\tilde{\theta}_A\right)}{\chi + u\left(\tilde{\theta}_A\right)} = \tilde{\lambda}^{NC}$$

Furthermore,

$$\frac{\partial^2 lhs(A.1)}{\partial\theta_S^2} = \tilde{\lambda}_m^C u''(\tilde{\theta}_A - \theta_S) - u'''(\tilde{\theta}_A - \theta_S) - a.\chi.e^{-\tilde{\lambda}_m^C\theta_S}\tilde{\lambda}_m^{C\,2} < 0$$

Hence,

$$\frac{\partial lhs(A.1)}{\partial\theta_S} \le 0 \Leftrightarrow \frac{\partial\tilde{\lambda}_m^C}{\partial\theta_S} \ge 0 \qquad \forall\theta_S \ge 0$$

Appendix 2

We now show that, on the contrary, $\frac{\partial\tilde{\lambda}_h^C}{\partial\theta_S} < 0$.

As can be seen from (10), $\tilde{\lambda}_h^C$ is such that

$$\tilde{\lambda}_m^C[\chi + u(\theta_S)] - u'(\theta_S).(1 - \chi.e^{-\tilde{\lambda}_m^C\theta_S}) = 0 \qquad \text{(A.2)}$$

Again, applying the implicit function theorem on (A.2), we get, on the one hand,

$$\frac{\partial lhs(A.2)}{\partial\lambda} = \chi + u(\theta_S) - \theta_S u'(\theta_S).\chi.e^{-\tilde{\lambda}_m^C\theta_S} > 0$$

$$\Leftrightarrow \chi + u(\theta_S) > \theta_S u'(\theta_S).\chi.e^{-\tilde{\lambda}_m^C\theta_S} + \theta_S u'(\theta_S) - \theta_S u'(\theta_S)$$

$$\Leftrightarrow \frac{1}{\theta_S} > -\frac{u'(\theta_S)(1-\chi.e^{-\tilde{\lambda}_m^C\theta_S})}{\chi + u(\theta_S)} + \frac{u'(\theta_S)}{\chi + u(\theta_S)}$$

$$\Leftrightarrow \frac{1}{\theta_S} + \tilde{\lambda}_m^C\left(1 - \frac{1}{(1-\chi.e^{-\tilde{\lambda}_m^C\theta_S})}\right) > 0$$

$$\Leftrightarrow 1 - \chi.e^{-\tilde{\lambda}_m^C\theta_S}(1 - \tilde{\lambda}_m^C\theta_S) > 0 \qquad \text{(A.3)}$$

Either $\tilde{\lambda}_m^C\theta_S \le 1$, in which case the second term on the left hand side of (A.3) is strictly lower than 1, or $\tilde{\lambda}_m^C\theta_S > 1$ implying that this second term is negative. In both cases, condition (A.3) is fulfilled.

On the other hand,

$$\frac{\partial lhs(A.2)}{\partial\theta_S} = \tilde{\lambda}_h^C u'(\theta_S) - u''(\theta_S)(1 - \chi.e^{-\tilde{\lambda}_h^C\theta_S}) - u'(\theta_S).\chi.e^{-\tilde{\lambda}_h^C\theta_S}\tilde{\lambda}_h^C > 0$$

$$\Leftrightarrow \tilde{\lambda}_h^C u'(\theta_S) - u''(\theta_S) > 0$$

which is the case.

Appendix 3

The aim of this third appendix is to show that $\frac{d\chi}{d\mu} < 0$. In other words, the utility gain from mutual insurance increases with the agricultural income. Making use of (6), (12) and (13), and after some calculation,

$$\frac{d\chi}{d\mu}=\frac{\partial\chi}{\partial\eta}.\frac{\partial\eta}{\partial\mu}+\frac{\partial\chi}{\partial\theta_L}.\frac{\partial\eta}{\partial\mu}<0$$

$$\Leftrightarrow -\frac{2(1-\mu)\sigma^2\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)}{\left[(1-\mu)^2+\sigma^2\right]^2}\left[e^{-\frac{a}{2}\tilde{\theta}_A}-\frac{1}{2}.\chi.\left(e^{-\frac{a}{2}\theta_L}+e^{-\frac{a}{2}}\right)\right]$$

$$+\left(1-\frac{\sigma^2}{(1-\mu)^2}\right)\frac{a}{2}\eta\left[\chi.e^{-a\theta_L}-e^{-\frac{a}{2}\left(\tilde{\theta}_A+\theta_L\right)}\right]<0$$

Substituting for η and simplifying the common factors gives

$$-2\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)\left[e^{-\frac{a}{2}\tilde{\theta}_A}-\frac{1}{2}.\chi.\left(e^{-\frac{a}{2}\theta_L}+e^{-\frac{a}{2}}\right)\right]+\left[(1-\mu)^4-\sigma^4\right]\frac{a}{2}e^{-\frac{a}{2}\theta_L}\left[\chi.e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}\tilde{\theta}_A}\right]<0$$

$$\Leftrightarrow -2\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)\left[e^{-a\tilde{\theta}_A}-\frac{1}{2}\left(e^{-\frac{a}{2}\theta_L}+e^{-\frac{a}{2}}\right)\left((1-\eta)e^{-\frac{a}{2}}+\eta e^{-\frac{a}{2}\theta_L}\right)\right]$$

$$+\left[(1-\mu)^4-\sigma^4\right]\frac{a}{2}e^{-\frac{a}{2}\theta_L}\left[e^{-\frac{a}{2}\theta_L}\left((1-\eta)e^{-\frac{a}{2}}+\eta e^{-\frac{a}{2}\theta_L}\right)-e^{-a\tilde{\theta}_A}\right]<0$$

where χ has been substituted for. Rearranging and substituting for $\tilde{\theta}_A$, we obtain

$$\left[e^{-\frac{a}{2}\theta_L}\left((1-\eta)e^{-\frac{a}{2}}+\eta e^{-\frac{a}{2}\theta_L}\right)-e^{-a\tilde{\theta}_A}\right].\left[\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)+\left[(1-\mu)^4-\sigma^4\right]\frac{a}{2}e^{-\frac{a}{2}\theta_L}\right]$$

$$+\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right).\left[e^{-\frac{a}{2}}\left((1-\eta)e^{-\frac{a}{2}}+\eta e^{-\frac{a}{2}\theta_L}\right)-e^{-a\tilde{\theta}_A}\right]<0$$

$$\Leftrightarrow (1-\eta)\left(e^{-a\left(\frac{1+\theta_L}{2}\right)}-e^{-a}\right).\left[\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)+\left[(1-\mu)^4-\sigma^4\right]\frac{a}{2}e^{-\frac{a}{2}\theta_L}\right]$$

$$+\eta\left(e^{-a\left(\frac{1+\theta_L}{2}\right)}-e^{-a\theta_L}\right)\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)<0$$

$$\Leftrightarrow \left(e^{-a\left(\frac{1+\theta_L}{2}\right)}-e^{-a}\right).\left[\sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)+\left[(1-\mu)^4-\sigma^4\right]\frac{a}{2}e^{-\frac{a}{2}\theta_L}\right]$$

$$+\left(e^{-a\left(\frac{1+\theta_L}{2}\right)}-e^{-a\theta_L}\right)(1-\mu)^3\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)<0$$

$$\Leftrightarrow \sigma^2(1-\mu)\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)+\left[(1-\mu)^4-\sigma^4\right]\frac{a}{2}e^{-\frac{a}{2}\theta_L}$$

$$+(1-\mu)^3\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)+(1-\mu)^3\frac{\left(e^{-\frac{a}{2}\theta_L}-e^{-\frac{a}{2}}\right)\left(e^{-a}-e^{-a\theta_L}\right)}{\left(e^{-a\left(\frac{1+\theta_L}{2}\right)}-e^{-a}\right)}<0$$

$$\Leftrightarrow \sigma^2(1-\mu)+\frac{a}{2}\frac{\left[(1-\mu)^4-\sigma^4\right]}{\left[1-e^{-\frac{a}{2}(1-\theta_L)}\right]}-(1-\mu)^3 e^{\frac{a}{2}(1-\theta_L)}<0$$

$$\Leftrightarrow \sigma^2(1-\mu)\left[1-e^{-\frac{a}{2}\left[\frac{(1-\mu)^2+\sigma^2}{(1-\mu)}\right]}\right]+\frac{a}{2}\left[(1-\mu)^4-\sigma^4\right]+(1-\mu)^3\left[1-e^{\frac{a}{2}\left[\frac{(1-\mu)^2+\sigma^2}{(1-\mu)}\right]}\right]<0 \qquad \text{(A.4)}$$

If $a=0$, the left hand side of (A.4) is equal to zero. Furthermore,

$$\frac{\partial lhs(A.4)}{\partial a}<0 \Leftrightarrow \sigma^2\left[e^{-\frac{a}{2}\left[\frac{(1-\mu)^2+\sigma^2}{(1-\mu)}\right]}-1\right]+(1-\mu)^2\left[1-e^{\frac{a}{2}\left[\frac{(1-\mu)^2+\sigma^2}{(1-\mu)}\right]}\right]<0$$

Since this is the case,

$$\frac{d\chi}{d\mu}<0 \quad \forall a>0$$

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