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"Essays on Family Farms and Inheritance"

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Jury composition:

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A PhD is a work experience as well as a life experience.

After a fascinating stay in the Peruvian Andes collecting data for my MA thesis, I grasped the opportunity to pursue my research by entering a PhD program. Doing a PhD was a mean to work on exiting issues rather than a goal per se. However, doing research in a laboratory or in a library was unthinkable. Taking any opportunities to go back to the field, I went back to Peru a few times; I also got involved in a field survey in rural Kenya; I finally ended up working on a great research project in Mali. All these missions to the field made me aware of the complexity of working in developing countries, especially as practitioners. At the same time, I also realized how important research can be for practitioners and for decision makers. I therefore decided to get involved in an NGO (as a member of the board of directors of *les îles de paix*). I accepted to be the EUDN secretariat and later on, I accepted a part-time job for the MicroInsurance Facility. My implications in all these projects and the time spent as teaching assistant partly explain why it took me some time to finish this collection of essays.

All through these years, I had not only an interesting job but in addition to that I was working in a dynamic and performing research center, the CRED, composed of high quality individuals, be it on the private side as well as on the professional side. I could have never done this work without the support and help from some important persons. The first person I am deeply grateful to is Jean-Philippe Platteau who accepted to supervise my work. I really thank him for his great availability and patience. I very much appreciated the way he trusted me and how, at some points in time, he took me back to my research when I was wandering away from it. He helped me a lot in improving my writing skills and really taught me how to do research in an effective and interesting way. The second person I would like to thank is Imane Chaara, my office-mate and friend. I am very thankful to her for all these hours we spend working and exchanging ideas on our research, on the Arab revolution or on any other subjects, few meters away from each other in a peaceful and friendly atmosphere. I also thank all my colleagues of the CRED, and in particular, Catherine Guirkinger for her confidence and enthusiastic personality, Anne Michels, Maëlys de la Rupelle and Roberta Ziparo for final reading and support until the end. I am also grateful to all the Peruvian and Malian peasants who gave me part of their time answering my long list of questions. And finally, I thank the members of my jury for their constructive comments and suggestions which were useful to improve the quality of my research papers.

A PhD is also a life experience… Doing research does not stop when leaving the office, but life goes on at home. This was maybe, for me, the hardest thing to manage. If I completed this work today, it is thanks to the great understanding and warm support from my closest relatives and friends. I owe a special thank to Sven, and to our children, Lucie and Balthazar, for their patience, their presence, and encouraging smiles.

Thank you.

“Notre pouvoir ne réside pas dans notre capacité à refaire le monde,
Mais dans notre habilité à nous recréer nous-mêmes."

"Be the change you want to see in the world"

-Gandhi

“You can't have the family farm without the family.”

-G. K. Chesterton

“We do not inherit the land from our parents,
We borrow it from our children."

-Ancient Indian Proverb

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Productive inefficiency in patriarchal family farms: Evidence from Mali

Preface

This collection of essays, entirely based on first hand data, brings some new contributions to the fascinating question of the evolution of family structure in poor agrarian societies. Family is a rather complex concept because its composition and role vary from one place to another and, above all, because it gathers human beings who interact in many ways. Relationships between family members are of various kinds. Belonging to a family of any type implies emotional and affective links as well as relations of interest and power, between persons of the same status and also among members from different hierarchical levels.

Families are micro societies that vehicle values and social norms. "One of the fundamental roles played by parents is that of transmitting distinct cultural traits to their children. These traits include elements of preferences such as the degree of altruism, risk aversion, attitude towards fertility and labour force participation, religious traits, etc." (La Ferrara, 2011)[1]. Another important role played by older generations is the transmission of wealth, so that the division of assets also influences the intergenerational transmission of inequality. Furthermore, inheritance patterns are crucial elements in contexts where access to land in severely restricted or where land market is not or hardly developed. The questions of how and when parental wealth is transferred to children are, therefore, of high interest since it can shape the evolution of the future generations.

The first two chapters tackle the issue of land inheritance patterns using first hand data collected in the Peruvian highlands. Andean peasants are among the poorest in Latin America, they mainly live on land which they access through inheritance. These communities are also characterized by a high migration rate and a very low level of education. In this area, the sense of belonging to a family is closely linked to the relation people have with their home land (the "*Pacha Mama*"), with their native community. A better knowledge of inheritance practices is of importance in the study area where rural land market barely exists and which suffers from severe problems of land fragmentation.

In Chapter 1, the land division pattern is analyzed through the estimation of an inheritance function. One of the main results is that a child's caring attitude towards his/her parents has a positive effect on the access to land bequest, especially for migrant children. We also argue that potential heirs play an active role in the determination of the inheritance outcomes.

In Chapter 2, we explore, theoretically and empirically, the influence of migration and parental land endowment on the probability for children to obtain their inheritance in the form of inter vivos transfers, post-mortem bequests, or a combination of both. First, we find that migrant children tend to receive their entire land inheritance post-mortem. Second, we observe that (remaining) children from more wealthy families have a higher probability to obtain their inheritance in the forms of both inter vivos transfers and bequests, while (remaining) children from poorer families tend to obtain it post-mortem.

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[1] La Ferrara, E., 2011. Familiy and kinship ties in development. In Culture, Institutions, and Development: New insights into an old debate, Platteau J-P. and Peccoud R. (eds). Routledge Studies in Development Economics: 107-124.

In the third and last chapter, we study another aspect of the family structure in a completely different society. On the basis of first hand data collected in the San-Koutiala-Sikasso region in Mali, we compare land productivity between collective fields and plots that are individually cultivated by male or female members of the household. We do not focus on the inheritance pattern anymore, yet the individual plots can somehow be considered as inter vivos gifts of land.

During our field work in the old cotton zone in Mali, we were puzzled by the co-existence of various farm-cum-family structures within a same village. We could find large traditional extended families co-existing with smaller 'nuclear' families, on the one hand and, purely collective farms co-existing with mixed farms (farms in which there exist collectively cultivated fields as well as individually cultivated plots), on the other hand.

Inspired by these observations, many research ideas came up and three companion research papers have been written (until now). First, Guirkinger and Platteau (2011a) developed a theoretical model to explain the evolution of large purely collective farms into mixed farms and/or into smaller collective farms (split). Assuming that collective production is plagued with moral-hazard-in-team problem, they show that "as land scarcity increases, or as exit options available to family members improve, the pure collective farm will unavoidably become inferior to alternative farm structures from the standpoint of the family head who draws his entire income from a share of the collectively produced harvest. The intuition is that, when land becomes scarcer, the head has to give more weight to efficiency considerations compared to his rent-capturing ability. This is because he has to satisfy the members' participation constraints under harsher conditions than before".In a second paper, the same authors (2011b) empirically confirmed one of the predictions of their theoretical model: "increasing land scarcity prompt household heads to give individual plots of land to (male) members".

In a third paper (which happens to be the third chapter of this thesis), we compare land productivity between plots controlled by different members of the household by using detailed information on input and output data. Firstly, we find that land yields are significantly larger on (male) private plots than on common plots with similar characteristics planted to the same crop in the same year after all appropriate controls have been included. And secondly, we bring strong suggestive evidence that a moral-hazard-in-team problem exists on the collective fields (yet only with regard to care-intensive crops) that could explain their relatively poor performance. This last result tends to confirm the rightfulness of the assumptions used in the theoretical model.

Despite data limitation, some of the results presented in this thesis offer new insights into the *modus operandi* of families in two different poor areas. The understanding of the way family members interact is crucial so as to design appropriate poverty reduction policies.

Chapter 1

Inheritance patterns in migration-prone communities of the Peruvian highlands

With Jean-Philippe Platteau[1]

Published in *Journal of Development Economics* (2010), 93 (1): 71-87.

Abstract: On the basis of detailed information on inheritance practices collected in the course of an in-depth survey of three Andean communities of Peru, and unlike most empirical studies which rely on remittance functions, we have been able to estimate an inheritance function with a view to identifying the main factors associated with particular patterns of land bequests. A central result is that the positive relationship between caring and access to land bequest indeed exists, yet is only observed for migrant children (whether urban or rural, long-distance or short-distance migrants). Combined with other findings and observations, this result strengthens the case for an interpretation based on an active role of potential heirs in the determination of inheritance outcomes. It therefore calls into question the strategic bequest theory which presumes that parents are the ultimate decision-makers in this matter. In addition, our study shows that inheritance patterns are complex: besides migration and caring behaviour, personal characteristics of potential heirs, such as gender, birth order, and family status (having children or not), do appear to influence division of parental land.

Keywords: land access, inheritance, migration, strategic bequest.
JEL classification codes: D10, 012, 015, Z13

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1. Introduction

A fascinating issue regarding inheritance in general, and the bequest of land in poor agricultural economies in particular, is whether allocation of inheritable wealth among children is egalitarian and, if not, which factors are responsible for receiving a preferential or a discriminatory treatment within one's own family? The question also arises as to whether

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[1] Center for Research in Development Economics (CRED), University of Namur, Belgium.

the incidence of unequal bequests becomes larger when pressure on land is greater? Owing to a lack of suitable data and related empirical studies, these questions have remained largely unanswered to this date. The present paper aims at remedying this important lacuna on the basis of first-hand data on inheritance practices collected in the course of an in-depth survey of three Andean communities of Peru. We want to identify the factors that influence the pattern of (land) bequest in conditions of acute poverty and isolation such as are found in the survey region, which is done by estimating an inheritance function for the sample communities. The latter are especially suited for the purpose since land, although of a rather poor quality, is a critical asset for the livelihood of the resident households.

The literature presents us with two main approaches to the issue of inheritance. The first approach rests on the idea that allocation rules for bequest are pre-determined. At one extreme, we find the practice of impartible or exclusive inheritance in favour of one particular son at the expense of all other children, such as has been applied, for instance, under the system of single-heir devolution in Europe around the eleventh and twelfth centuries. The rule is called primogeniture or ultimogeniture depending upon whether the eldest or the youngest son is entitled to inherit the entire parental landholding.[2] The most common explanation for exclusive inheritance is the presence of scale economies in military expenditures and the indivisibility of political power associated with land, which accounts for its widespread prevalence in the aristocracy. In the same line, and as observed in southern France, a legacy of patriarchy may explain the predominance of this mode of inheritance since in an (extended) family system dominated by patriarchal relations the authority of the household head is deemed indivisible (Platteau and Baland, 2001, pp. 29-46). A different motive has been mentioned by Chu (1991) who argues, with special reference to China and Japan, that parents may choose to concentrate their bequest on one son so as to maximize his chances of becoming rich and reaching an enviable position from which he will then be able to help the rest of the family.

At the other extreme, the pre-determined rule for bequest may be egalitarian. Bernheim and Severinov (2003) interpret this principle as a signal of parental altruistic preferences. When understood strictly, it means that land assets are equally shared among all children (or, at

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[2] A mixed situation combining a fixed inheritance rule and a discretionary element obtains when parents opt for single-heir devolution, yet decide to grant land to the best-qualified child once they will have gathered enough information about the children's respective talents (Baker and Miceli, 2002). Whichever the way to designate the preferred heir, the excluded children are forced to seek a livelihood outside the parental homeland, which generally implies that they have to migrate and work outside the agricultural sector.

least, among all sons). When egalitarian division is construed in a wider sense, the prescription is that children should have an identical share of total family assets, so that inequality of land division may be compensated by inequality in the distribution of other assets. This would occur, for example, if more educated children inherit less land than their siblings, on the ground that the financing of their studies has reduced the stock of inheritable wealth in the hands of the parents, or because the latter have an equal concern for their children and therefore wish to equalize their wealth (as suggested by Becker and Tomes, 1976). A similar situation obtains if, as suggested by Goody (1976) and by Botticini and Siow (2003), daughters do not receive bequests because they have been given a dowry upon marriage. Moreover, a child (say, the youngest son) may be entitled to receive a larger share of land than his siblings because the custom makes him responsible for parents' subsistence in old age. His preferential share is then matched by an additional duty (André and Platteau, 1998).

In between the polar cases of exclusive inheritance and equal division, situations may arise in which parents decide to give some land to all their children (or sons), yet favour some of them on the basis of certain exogenous characteristics, for example, they give more land to sons compared to daughters, or to the eldest or the youngest son (regardless of whether he cares for them).

The second approach to inheritance is grounded in the so-called strategic bequest theory proposed by Bernheim, Schleifer and Summers (1985). The central idea, here, is that "parents reward more attentive children with family heirlooms" (pp. 1046-47). Although altruistic, testators use bequests to influence the behavior of potential beneficiaries, assumed to be selfish, so that they take appropriate actions (attention levels). Since the parental threat to reduce or cancel bequests must be credible, bequests cannot take the form of *inter vivos* transfers only, and there must be more than a single potential heir in the family (see also Hoddinott, 1994). The equilibrium amount of "services" provided by children to testators/parents is then predicted to increase in parental wealth. On the other hand, the strategic bequest model makes no prediction that bequests should be equal across children: optimal division of the parental land property should vary with the characteristics of the children as well as with the attitudes and preferences of the parents (Bernheim et al., 1985, p. 1071).

Under the above two approaches, action is assumed to be on the parental side: the decision about how to divide bequests is made by the parents on the basis of a rule or criterion fixed by them (or the custom). But whereas under the first approach the identity of the favored or discriminated child(ren) is also decided by the parents, under the second approach identification emerges as a result of the behavior strategically followed by the children in the light of the parental rule. What is overlooked is the possibility that patterns of bequest are influenced by the behavior of children acting in an unconstrained manner. Thus, unlike what is observed in the exclusive inheritance scenario, a child may well decide to spontaneously forsake his share of parental assets because he has found a reliable alternative occupation in another (urban) location. This alternative scenario has particular relevance for developing countries in which future prospects are bleak in the agricultural sector, at least in land-hungry families and in remote or semi-arid areas. Under the second, strategic bequest approach, a potential heir who attends to parents is automatically seen as being interested in safeguarding his or her inheritance rights. Such interpretation precludes the possibility of altruistic children willing to relinquish their inheritance yet eager to care for their parents.

The strategic bequest theory has received much attention from economists, both because it rests on an elegant argument and because it yields clean predictions that can be empirically tested. The underlying hypothesis tends to be supported by the evidence available for developing countries.[3] For example, exploiting the variation in descent rules across ethnic groups in Ghana, La Ferrara (2007) was able to show that Akans, the group which is by tradition matrilineal, are significantly more likely to receive transfers from their sons compared to other ethnic groups. Moreover, this effect is reinforced by the presence of a co-resident nephew in the household of the head, which is used as a proxy for the credibility of the enforcement of customary norms.[4]

It is in the context of migration that the above theory has been more systematically put to test. The dependent variable is the amount of care or of remittances going from children to parents, and the critical explanatory variable is potential bequest as approximated by current parental wealth. The hypothesis that migrants make strategic transfers to their parents is empirically tested against alternative hypotheses, such as insuring parents against negative income shocks, investing in local assets, repaying loans given by parents for education and migration purposes, etc. The main conclusion is that migrant children tend, indeed, to support their parents when they expect sizeable inheritance, and to neglect this duty otherwise (see Lucas and Stark, 1985, Lucas and Stark, 1988, for Botswana; Hoddinott, 1992a,b, for Kenya;

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[3] Evidence is less compelling for developed countries (see Perozek, 1998).

[4] Bear in mind that in a matrilineal system the custom requires that a positive fraction of the land remains with the matrikin, and the default allocation is for the entire land endowment to be bequeathed to the nephew, unless the father makes a donation to his own children during lifetime. Hence there is especially strong incentive of children to look after parents when a nephew is present in the household.

Schrieder and Knerr, 2000, for Cameroon; de la Brière et al., 2002, for the Dominican Republic). Such behavior is typically explained by the existence of risky and imperfect (land, credit and labour) markets that motivate long-term migrants to keep a fall-back option in the countryside (Hoddinott, 1994: 469). It bears special emphasis that in all these studies the relationship between attention and inheritance is not directly tested.

As pointed out above, our central objective is to estimate an inheritance function rather than a remittance function, so that we can directly identify the factors influencing the pattern of (land) bequest in conditions of acute poverty and isolation (see Blomquist, 1979, for a similar attempt using data from a developed country, Sweden). Since our data have been obtained at the level of the individual, we are able to highlight personal characteristics that correlate with a preferential, neutral, or disadvantageous child treatment when family assets are divided. Unfortunately, largely because of unobserved children's characteristics, we are unable to safely assess whether action is on their side or that of the parents. Instead of a rigorous test of the above-discussed theories, our econometric work must therefore be seen mainly as a precise descriptive analysis of inheritance patterns in the Andean region, and an attempt to throw light on the mechanisms likely to be at play.

Keeping this caveat in mind, our findings nevertheless indicate that none of the available theories provide a satisfactory account of inheritance practices in our sample communities. In particular, there is strong suggestive evidence that children's decisions drive the inheritance process, thus calling the mainstream view into question. Taking advantage of the presence of a large number of (permanent) migrants in our sample, we show that caring behavior is strongly correlated with inheritance for migrant children but not for those who have stayed in the native village. Furthermore, children do not appear to always act selfishly since some of them attend to parents despite comparatively low inheritance shares. Other findings, such as the existence of a positive correlation between intra-family land pressure and the likelihood of unequal division, are quite consistent with the view of children as key actors in matters of inheritance.

The outline of the paper is as follows. In Section 2, general information is provided about the three sample communities, the sample respondents and the type of data collected. In Section 3, key descriptive statistics are presented about the manner in which land is divided among the children, and about possible factors that influence this division: migration, education, parental wealth, and caring behavior. Section 4 is the core of the paper. After discussing several methodological problems that arise in the testing procedure, we present various econometric estimates aimed at identifying the main factors underlying differential treatment of children with respect to land inheritance. Section 5 concludes.

2. Sample, data and methodology

Sample communities

Our inquiry has taken place (in 2002) in three Andean communities belonging to the department of Cusco, and located at various ecological levels and varying distances from Sicuani, a small town of about 28,000 inhabitants[5] situated on the railway line between the cities of Cusco and Puno. These two factors are strongly correlated since communities situated at higher ecological levels are also more distant from Sicuani. Within any of the three ecological levels considered, choice of the sample communities was not completely random: they were selected among a number of predetermined communities where a Non-Governmental Organization (ITDG −Intermediate Technology Development Group) was involved in local projects of irrigation development. This provided us with a convenient way to enter into contact with the population and establish the necessary degree of trust. We are, of course, aware that such a non-random (stratified) sampling procedure is liable to cause selection biases. None the less, since Indian communities, especially the more distant ones, are very hard to approach for outside researchers, we could not think of an alternative to using ITDG's entry points. Even then, getting acquainted with the people enough to extract reliable information from them proved to be a slow and exacting experience, particularly in the most distant community[6].

The first community, called Sunchochumo (henceforth labeled Suncho), comprises around 70 families and is situated at an altitude (between 3,530-3,700 meters) corresponding to the first ecological level ("Piso de valle," at the bottom of the valley). It takes only twenty minutes by bus and between 10-30 minutes' walk to connect Suncho to Sicuani. The exact connecting time depends on the location of the houses, which are highly scattered. The second community, named Pumaorcco (henceforth labeled Puma), comprises about 120 families and is situated at an intermediate altitude, between 3,820-4,350 meters (in the so-called "Piso de ladera"). It is located further away from Sicuani since it takes forty-five minutes by bus (but the bus service is rather irregular) or about two hours by foot to shuttle between Puma and Sicuani. The third community, named Pataccalasaya (henceforth labeled Pata), has about 130

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[5] Diagnostico economico, micro region Canas-Canchis (1986)

[6] For readers interested in knowing more about the methods followed to win the confidence of the people, see Goetghebuer (2002).

families and is situated on the third ecological level ("Piso de Puna") at an altitude of 4,000-4,780 meters. To reach Sicuani, depending on the exact location of his (her) house in a widely scattered community, an resident of Pata has to walk between 1 and 4.5 hours till Puma, and thereafter take the bus (45 minutes) to Sicuani[7].

Although Andean communities in this area are treated as such by the state of Peru, implying that collective rather than individual titles to land are established by the national land registrar, most agricultural lands are now under individual tenure (the only exception is Pata where dry lands are opened to communal grazing after harvest), and families are typically nuclear. The national law provides that lands belonging to peasant communities may not be disposed of through sale or mortgaging so that only usufruct rights may be transmitted or acquired. In practice, however, sale and other transactions do occur, and peasants may use deeds certified by notaries although they have no legal validity (see Goetghebuer and Platteau, 2005 for more details). Land is the only bequeathable asset in our communities, and children are the only potential beneficiaries. Finally, there are no genuine marriage payments as only symbolic gifts (e.g., coca leaves and alcohol) are customarily exchanged between the families of the bride and the groom before and during the marriage ceremonial.

Sample households

Family stories (FS) were collected by interviewing couples with children. Husband and wife respondents were randomly chosen and queried separately about the inheritance rules followed by their respective parents, as well as the rules they have adopted or intend to adopt vis-à-vis their own children. All the persons contacted agreed to be interviewed. Our data-gathering strategy is expected to produce information about a maximum of three FS per parental couple interviewed. This is a maximum because parents may be too young to have carefully thought over how to share land among their children. Moreover, the number of children and the size of their landholding might well undergo further changes in the future.

Collecting data about the way family land has been actually divided among children, and about the timing of land bequests, is a time-consuming process. In order to restrict the time of interview to manageable limits, we decided to require such data only for children of the sample parental couple (or the sample single parent). In other words, complete details about the total amount of land in the hands of the parents before division takes place, and the manner in which it has been, or is planned to be, divided among the children (including the amount and timing of land transfers), have been obtained only for the sample couples. As far

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[7] Since 2004, there is a weekly bus connection between Sicuani and Pata.

as the ascendants are concerned, we limited our query to the following: (i) the exact amount of land received by a sample spouse from his or her parents; (ii) information about the shares roughly inherited by the siblings, so as to determine whether some children have received a special treatment (positive or negative), or whether all of them have been awarded equal shares[8].

Overall, 80 households were visited, implying that 80 three-part questionnaires were administered. Our sample contains 230 FS: 78 stories about the husband's family, 80 stories about the wife's family (two households were female-headed), and 72 stories about the couple's family. However, since twelve FS are actually redundant[9], the real sample size of our Family-based File is 218 FS. Further removing the irrelevant FS in which a unique child is involved (some siblings may have died before being married, or before having given birth to children), we are left with a reduced sample size of 208 units.

There are two different kinds of stories reported in our sample. On the one hand, we have the FS for which the inheritance process has been completed, typically because both parents are dead, or because all their land assets have been bequeathed although at least one parent is still alive. On the other hand, we have the FS for which inheritance is still ongoing, or has not even started. The latter possibility is especially likely to occur with respect to the respondents' children, yet it also happens that the parents of the respondents have not completely distributed their land, usually because they are alive and have retained some land for themselves. Out of 208 FS, 40% are about completed inheritance processes. In the remaining cases, the information reported concerns partially completed inheritance, or bequest plans.

Decomposition of the full 'family sample' (except for the redundant cases) by community is presented in Table 1. Bearing in mind that each living couple is involved in three different FS, we obtain the maximum number of FS for a given community (see row (4)). These figures, however, grossly exaggerate the set of FS available because the existence of consanguineous ties between many resident families makes quite a number of FS redundant. The percentages shown in row (5) of the table are therefore clear underestimates of the extent of coverage of each community. Yet, on the assumption that the incidence of family ties between households does not significantly differ across the three communities (so that the

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[8] Of course, when children have been treated equally, since we know the amount of land inherited by one of them (the interviewed sibling), it is straightforward to infer the total amount of family land owned by the parents. When such is not the case, however, derivation of the parents' land endowment may prove much more hazardous.

[9] In twelve instances, the same FS was told by two different persons, that is, by parents and one of their children, or by two siblings.

extent of underestimation can be thought to be roughly similar from community to community), the ordinal ranking emerging from row (5) is meaningful, and the coverage of FS appears to be better in Suncho than in Puma and, a fortiori in Pata.

Table 1: Sample sizes of family stories (FS) decomposed by community

Name of community		Suncho	Puma	Pata	Total
Nr of visited households	(1)	26	30	24	80
Number of sample FS [a]	(2)	67 (65) [53]	83 (80) [74]	68 (63) [63]	218 (208) [190]
Population of households	(3)	70	120	130	320
Maximum number of FS	(4)=(3)x3	210	360	390	960
Relative sample size [b]	(5)=(2)/(4)	31.9 % [25.2%]	23.1% [20.6%]	17.4% [16.2%]	22.7% [19.8%]

[a] Between simple brackets, we indicate the number of sample FS which remain after removal of those involving a unique child. Between square brackets, we mention the number of sample FS which have actually occurred in the visited community, itself.

[b] Between square brackets we indicate the percentages obtaining when we consider only the sample FS which have actually occurred in the visited community as opposed to other communities.

The monotonic, inverse relationship between the degree of remoteness of a community and the incidence of coverage is not coincidental. The two more distant communities have comparatively scattered populations, as a result of which respondents were more difficult to reach, a difficulty compounded by bad weather conditions in Pata. Moreover, distance has a psychological dimension as well, a dimension reflected in the fact that people are less easy to approach in the more remote communities (particularly Pata), which are also less educated. Consequently, the more remote the community the longer the time spent per interview.

Measuring the extent of our coverage is further complicated by the fact that a FS reported in a community has sometimes happened in another location, typically because a spouse not born in the community surveyed told the story of own parents. Figures shown between square brackets in row (2) of the table refer to the sample FS that have happened in the community surveyed only. If we limit our attention to those FS, differences in coverage between communities are somehow reduced, as is evident from the percentage figures shown between square brackets in the last row of the table. Our data analysis (whether statistical or econometric) has been made on the basis of the two sets. Since the results are essentially similar, −not a surprising outcome given that, when a spouse comes from another community, that community is generally very close (walking distance) to the one surveyed−, we will only show those based on the complete sample.

Inquiring about a particular FS implied that we collected information regarding all the children involved in the bequest. Given our survey strategy, the beneficiaries of land bequests are either siblings of the interviewed spouses (both husband and wife) or their own children.

They form our Individual-based File, which contains information about education level, gender, age, location of residence, and share of land inheritance. The total number of individuals involved in our sample FS is 1,011 (after removing redundant cases): 326 in Suncho, 383 in Puma, and 302 in Pata. From the breakup of sample respondents by age category, it is apparent that the collected FS span a long time period stretching over (at least) four successive generations.[10]

Before presenting the descriptive statistics pertaining to our central variables, it must be emphasized that the limited size of our sample is entirely the result of the time and cost constraints inherent in the study undertaken. Indeed, such a study involves many subtle, questions that take a lot of time to clarify in front of the respondents, and need careful attention and vigilance on the part of enumerators if reliable answers are to be obtained. In order to ensure maximum reliability of the information gathered, one of the authors (Tatiana Goetghebuer) participated in all the interviews from beginning to end, which seriously limited the sample size. Moreover, she was always accompanied by an educated person born and living in the local community, and who acted as a facilitator (*technico*) on behalf of ITDG, the organization which trained her to work with the grassroots. This person served as a translator from Quechua to Spanish during the interviews. More will be said in the next section about the active role of these facilitators and the quasi-anthropological approach to interviews that we have adopted as a result.

3. Descriptive statistics and key definitions

Since we are interested in identifying the determinants of a child's treatment in land inheritance, we will use our Individual-based File only.[11] In the following, we define our key variables (successively, migration, education, wealth, caring behavior, and treatment in inheritance), and present the relevant descriptive statistics.[12]

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[10] Sample respondents are divided more or less equally between three categories: older than 49 years, between 35-49 years, and below 35 years. Moreover, the presence of respondents older than 70 years guarantees that inheritance rules dating back to almost a century have been reported in our sample data.

[11] In a companion paper (Goetghebuer and Platteau, 2005), we have approached the problem of inheritance from the standpoint of the family, contrasting equal with unequal division of land among all children considered as a whole. The much more restricted Family-based File was then used, to explain variations in family-level inheritance patterns.

[12] For more detailed information about these variables, see Goetghebuer and Platteau, 2005.

Migration

Migration can be either temporary −when a villager works outside the native community for a limited period of time−, or more permanent −when the villager has established himself or herself durably in another location. Only the latter type is considered as migration since temporary movements of labour are commonly observed during the dry season and involve individuals who keep their residence and roots in the native community. Following this definition, we find that 42.3% of the sample individuals are migrants: 54% in Suncho, 41% in Puma, and 30% in Pata.[13] The incidence of migration has increased significantly over time.[14] In computing the above proportions, all children below the age of fifteen have been removed since they have presumably not yet made their decision about migration (see infra).

Because a woman who marries a man of another community and goes to live with him is counted as a permanent migrant, it is not surprising that there are more (permanent) migrants among women (45%) than among men (almost 40%). Although a majority of married women continue to move to their husband's community according to custom, an increasing number of them stay in their own community where they are joined by their husband. This breach of the custom happens when land availability and living conditions are more favourable in the wife's location. Migrations can also be close or distant, a nearby place being defined as one within walking distance of the native community. People can also move to another rural area, or to an urban location (town or city). As expected, women tend to migrate more to nearby rural communities, and less to distant towns or cities. Overall, 75% of all migrants have moved to towns or cities (82% for men and 69% for women), while more than 60% of them have opted for living and working in rather remote locations (69% for men and 55% for women).

Education

As is evident from Table 2, the average level of education is low: the average number of years of study per individual is only 5.6 for the whole sample (6.5 for men and 4.6 for women). While 22% of our sample individuals have not received any education at all (11% for men and 33% for women), 80% of them did not reach the end of their secondary school curriculum (75% for men and 86% for women).[15] Inter-community differences in years of study are large and statistically significant. Education levels have, of course, been raised during the last

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[13] The differences between these proportions are statistically significant.

[14] Thus, for the whole sample, barely 11% of people older than 70 years have migrated, compared to 33% of those aged between 50 and 70 years, and more than 45% of those aged between 15 and 50 years.

[15] We have left out children who are too young to go to school or who are still studying.

decades, but educational progress is more rapid in the intermediate community of Puma which has been able to catch up with Suncho in recent years.

Table 2: Incidence of formal education as per community

	Suncho	Puma	Pata	Total
% of indls with no education	14.9%	24.1%	28.2%	22.3%
% of indls who did not complete secondary schooling*	68.6%	81.6%	92.1%	80.4%
Average nr of years of study	7.2 years	5.5 years	4.0 years	5.6 years

* Including individuals with no education.

Access to public schools in Peru is free, yet since secondary schools are typically located in urban areas, the cost of studying beyond primary school level is non-negligible and includes transport, accommodation and living expenses in town. An important question concerns the extent to which this cost is borne by parents or by the pupil? To answer it, we have computed the equivalent number of years of study financed by parents, counting as one a year of study entirely financed by parents, and as one-half a year of study partly financed by them. A simple index comparing this figure with the actual number of study years obtains as follows. For a given individual, $I_j = (a_j - f_j)/a_j$, where a_j stands for the actual number of years of study which individual j has gone through, and f_j for the equivalent number of years financed by the parents. This index measures the extent to which an individual has self-financed the cost of studying. It equals zero when parents have entirely borne this cost, and one when they have not contributed at all. An average value of the index can then be computed for the complete sample set or for any subset of individuals.

Table 3: Index values measuring the degree of self-financing of post-primary school studies, and percentages of pupils who have borne at least part of the resulting cost, as per gender

	Gender		All individuals
	Men	Women	
Index measuring the degree of self-financing of post-primary school studies	14.8%	29.6%	20.6%
% of indls who have borne at least part of the cost of post-primary schooling (among those who went beyond primary school)	22.4%	30.9%	25.7%

From Table 3, it is noticeable that parental support for post-primary schooling is neatly biased toward boys, an evidence to be combined with the previous observation that school enrollment is smaller for girls. Moreover, the rate of self-financing is the highest in the most educated community, Suncho (almost 29%),[16] while the difference between the other two communities is not statistically significant (12.5% for Puma and 15.9% for Pata).

Finally, Table 4 compares the average number of years of formal schooling for migrants and non-migrants, and for different types of migrants.[17]

Table 4: Differences between educational levels of migrants and non-migrants, as well as between educational levels of various types of migrants

	Average level of education
Non migrants	4.2 years
Migrants	7.4 years
Total	5.6 years
Migrants to a close (distant) community	4.6 years (5.4 years)
Migrants to a close (distant) urban location	8.5 years (8.0 years)
Migrants to plantation areas	7.0 years

As expected, migrants are far more educated than non-migrants, and the difference is highly significant. However, the level of schooling does not significantly differ between local residents and individuals who have migrated to a nearby community[18]. Disparities in education are only observed when we compare local residents with individuals who have migrated to distant places, and they are even more marked when we compare them with urban migrants.

Parental Wealth

To measure wealth differences between households, we have available an ordinal assessment made by the president of the community in the presence of the translator-enumerator (the *technico*), Tatiana Goetghebuer, and one or several knowledgeable persons from the community (typically elder members). After having been explained the importance of taking all dimensions of wealth (land, cattle, quality of housing, consumption levels, etc.) into account, the president was asked to sort the sample households into one of the three following

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[16] In fact, more than 40% of pupils in Suncho had to bear at least part of the cost of post-primary schooling.

[17] Note that the sample size is more restricted than the one used in the foregoing computations because, in addition to removing individuals who are still at school or who are too young to go to school, we have to keep out (i) those who are not old enough to make a migration decision (that is, those below 15 years), and (ii) those who live in one of the three sample communities yet have been born in another community (since they have gone through a migration experience).

[18] This result is confirmed by the following complementary finding: the average level of schooling among residents of the sample areas who originate from another community works out to 4.65 years. This is remarkably similar to the figure obtained for the individuals who left the native location for another, rather close, community (4.60 years).

categories: relatively rich, intermediate, and relatively poor. In the end, he was able to appraise the relative wealth of most, but not all, of the sample households.

Besides this subjective information, we have recorded the amounts of land owned by each sample household (essentially, the amounts inherited and the amounts purchased). Because landholdings can be of varying quality, we have measured them in equivalent units of irrigated land.[19] In Table 5, we compare the two indicators by computing the average amount of land owned for each category of subjectively-assessed household wealth. This is done for each community separately: indeed, since both land quality and wealth rankings are community-specific, it is not meaningful to compute aggregate averages over the whole sample. A positive relationship clearly emerges between the subjective ranking of a household's wealth and the amount of irrigated land owned.[20]

<u>Table 5</u>: Comparing subjective wealth judgments with average amounts of land owned (measured in equivalent units of irrigated land –in square meters), as per community [a]

	Suncho	Puma	Pata
Relatively rich households	9,226 m² (4)	/	12,410 m² (4)
Intermediate households	3,704 m² (11)	1,591 m² (17)	6,563 m² (9)
Relatively poor households	2,051 m² (9)	478 m² (5)	3,102 m² (11)
All households	4,005 m² (24/26)	1,338 m² (22/30)	5,951 m² (24/24)
F-statistics: Prob>F	0.0013	0.1370	0.0050

[a] Figures between brackets indicate the number of households for which a subjective wealth judgement is available. In the row reporting information for all households, the figures between brackets indicate the number of households for which such rankings are available compared to total sample sizes.

Such convergence is good news since it will enable us to use the complete sample when attempting to estimate the impact of household wealth on inheritance patterns. Indeed, while we have information about subjective rankings for nearly each interviewed family (see the note below Table 5), land amounts have been reported only for the couples whom we have personally interviewed. Another reassuring finding is the positive monotonic relationship observed between the subjective measure of wealth and the level of education: while the average number of years of study is 7.6 for the individuals belonging to rich families, it is 6.0

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[19] The equivalence scale used is the following: 1 ha of irrigated land = 2 ha of yearly cultivable non-irrigated land = 2*x* ha of non-irrigated land that is cultivated every *x* years = 10 ha of grazing land. This scaling system was proposed to us by Teofilo Alata of the Agriculture Ministry at Sicuani, and is partly based on Gonzales (1986: p. 85).

[20] The relationship is somewhat weaker (it is not statistically significant at the 10% confidence level, yet not far from being so) in the intermediate community of Puma where no household has been considered rich by the local president, and where the variance of land wealth within the intermediate category is quite large. Yet, households in this category still own, on an average, more than three times as much irrigated land as those considered poor in the subjective assessment exercise.

for those from families of the intermediate type, and only 4.2 for members of poor families. These differences are highly statistically significant, and they seem to indirectly confirm the reliability of our subjective wealth variable.[21]

Caring behavior

"Living in town is very expensive. Migrants have to buy every single thing they need, whereas in the community we can eat and sleep for free. Furthermore, the job market is very bad, especially for people with low education levels. Because it is already very hard for them to support their own children, we do not expect them to send cash or consumption goods. Nevertheless, they cannot forget us; they need to care about us"[22].

From the above quotation and from prolonged conversations with villagers, it is evident that parents attach a great value to manifestations of attention from migrant children, especially when they become old. The possibility of relying on children's support, material and emotional, in times of need is a great comfort for parents, especially when they become old and feel lonely. It bears emphasis, however, that expectations of cash transfers exist only when they believe that their children are well-off enough. Since signs of affection and expressions of emotional care can be conveyed in all circumstances, they are a more meaningful measure of attention to parents than expressions of material support which is more constraining for poorer children.

The commonly used measure of remittances is therefore not necessarily appropriate to assess the extent of support and attention shown by children to parents. Thus, in a strategic bequest perspective, parents will not sanction children who show affection yet are not rich enough to send remittances or provide material support. If, on the other hand, inheritance decisions are mainly driven by (migrant) children, those willing to maintain links with their community and family will, as a minimum, inquire more or less regularly about their parents and manifest feelings of filial attention. In addition, as our fieldwork has shown, it is extremely difficult to obtain a reliable measure of remittances, not only because respondents may provide imprecise answers, but also because remittances may be subject to substantial variations depending on exogenous factors (e.g., a drought in the parents' village or the need to meet an exceptional

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[21] Incidentally, it bears noting that the proportion of (permanent) urban migrants is higher among the rich households (42.3%) than among the middle-ranked ones (32.2%), and there are relatively more urban migrants in the latter category than among the poor (22.8%). This finding is the same as that obtained by Hoddinott (1994), but is contrary to the conclusion reached in other studies (see Hoddinott, 1994: 467, for references). Economic theory, here, yields ambiguous predictions. On the one hand, children from poorer families are in greatest need of additional income, yet, on the other hand, those migrating may require financial assistance to meet transportation, job search, or other expenses, assistance that wealthier parents are better able to provide (ibidem).

[22] These are words of an old interviewed couple.

expenditure in the migrant's household) that we do not properly identify. Finally, even assuming that the remittance measure (or any measure of strictly material transfers) is the correct way to assess the extent of support by migrant children, it is much less clear how it can constitute a meaningful yardstick for children who continue to live close to their parents. Time devoted to helping parents in their fields or in other activities is probably a more sensible manifestation of concern on the part of these children. But here again the measurement problem is a tricky one.

For all these reasons, we have chosen not to measure care by means of a metric variable. Instead, we have elicited information about whether a child maintains more or less regular contact with the parents even if this does not take on the form of material transfers.[23] Reporting has been made either by parents (in one-third of the cases) or by siblings (in the remaining cases). Being dichotomous, our measure is admittedly rather crude. Moreover, it is subject to a reporting bias if parents (or siblings) are tempted to justify bequest decisions when they make statements regarding the caring behavior of their children (or siblings).

There are two reasons why we believe that such a bias is limited, however. First, in designing the questionnaire, we have been careful to construct the sequence of questions so as to clearly dissociate the questions relating to children's caring behavior from those dealing with land bequest. It was therefore hard for respondents to link up their answers to the former with their answers to the latter, especially so because the duration of the interview was quite long. Second, it is important to bear in mind the presence and the active role played by the facilitator in each interview. As a matter of fact, the facilitator who is an educated person belonging to the community surveyed turned out to have an intimate knowledge about the situations of all the resident families. Since facilitators also served as translators, it was easy for them to alert us whenever they deemed the answer dubious or incorrect. They then proceeded by further querying about the issue at stake, bringing some facts to the attention of the interviewee, and prompting him (her) to qualify or reverse initial statements if needed. Considerable time was sometimes spent in these operations of clarification and correction.

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[23] Our caring variable is, therefore, an inclusive measure of attention manifested by children to parents. As pointed out above, caring obviously involves varied forms such as sending remittances, providing moral support, medical advice or attention, labour services or sheltering. However, we did not choose to have separate variables for each of these dimensions for the following reasons. First, some forms of attention may not have been displayed because the need did not arise. Second, children living in a distant place may not have been in a position to provide the required services despite their willingness to do so (e.g., a migrant child cannot provide labour services to faraway parents). Third, respondents manifested some edginess while we were asking for detailed information about the care received from children living outside the community. Our fieldwork experience made us realize that respondents actually think of caring as an inclusive category, hence our methodological choice.

From our data, it is apparent that a remarkably high percentage (more than 85%) of sample individuals are reported to currently take care of their parents in old age, or to have taken care in the past if parents passed away[24]. Like in de la Brière *et al.* (2002), this proportion does not vary between boys and girls. Yet, it does vary considerably according to whether the child has migrated or not: while only 6% of those who have stayed in their native community do not provide any care to old parents, this is true for almost 25% of those who have migrated. The gap is still more pronounced if only migrants to distant locations are compared with staying children, thus lending support to the hypothesis that the cost of maintaining contact with parents increases with distance. Since variation in the caring variable is significant only with regard to migrant children, it is in regard of those children only that we can expect to find a relationship between caring and land bequest.

It may be further noted that the percentage of caring children in a family does not significantly change with the level of parental wealth (whether measured subjectively for the complete sample, or on the basis of land area owned for the restricted sample). Caring behavior does not, therefore, appear to vary with bequeathable wealth, as normally predicted by the strategic bequest theory. Estimating a function in which a caring dummy is the dependent variable while parental wealth features on the right-hand side of the equation together with a list of other variables used as controls leads to the same conclusion: the coefficient of the parental wealth variable is not statistically different from zero, and this result is robust to changes in the list of controls used (results not shown in the paper). In addition, when we distinguish children according to the generation to which they belong, we find no relationship with the care variable. In words, there has been apparently no marked change across generations in social norms pertaining to assistance duties vis-à-vis old parents.

Inequality in the division of land bequest

Unfortunately, owing to obvious difficulties in eliciting the corresponding information, our data do not report the precise shares of bequest obtained by different children in the case of unequal division of family land assets. Attempts to get that information had to be given up due to incomplete and inconsistent answers. Instead of using a continuous dependent variable, we follow an ordinal measurement approach to inheritance. It is comforting that, in their study of bequest differences among siblings in the US, Behrman and Rosenzweig (2004)

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[24] To avoid spurious answers, families in which parents died when the respondents were young have been removed from the sample.

have reached the conclusion that, although siblings differ in their recollection of the total bequest, they agree on the inter-sibling bequest distribution.

We consider that for a particular child land bequest can take three different forms according to whether the child has a privileged, a non-privileged or a fair access to the family land.[25] To decide whether a child is privileged, his or her share in this land needs to be assessed against a yardstick of what constitutes fair access. Barring the obvious case in which inheritance is distributed in a perfectly equal manner (all children inherit the same share) −which happens in 28% of our 208 recorded FS−,[26] taking an objective reference point such as the modal value of the inheritance share does not constitute a valid approach. Cases, indeed, exist in our sample where either there is no mode (all inheritance shares differ, which is especially likely to occur when there are few children), or there are several modes. In addition, it may not be satisfactory to use the modal value as the norm of fair access when it corresponds to the highest or the lowest observed value yet the aggregate frequencies of non-modal values is higher than the frequency associated with the mode. Consider the following distribution (20, 20, 14, 13, 12, 11, 10). Is it really meaningful to posit that inheriting 20% of the family land corresponds to fair access or neutral treatment, and that all smaller shares correspond to a non privileged treatment? Could we not alternatively assume that inheriting 20% reflects a privileged treatment?

Our approach consists of defining the norm as the share considered such by the parents themselves. In other words, we follow the convention of adopting the value judgment of the parents as we could infer it from discussions with the respondent. In the above example, we would thus adopt 20% as the fair share only if parents have explained the other shares by reference to this 20% value (e.g., they have explained the lower shares by citing specific reasons why the children concerned were not eligible for receiving 20% of the land).

Since only children are potential heirs, families with only one child have been removed from this sample. In fact, these children have always received 100% of the family bequest. Families with only two children may also cause a potential problem insofar as unequal bequests may imply that privileged access for one child is associated with non privileged access for his or her sibling: thus, if a migrant child gives up his claim, hence being considered as having non privileged access, to the brother who inherits the whole land appears as enjoying privileged access. In our sample, however, no serious bias can result from the

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[25] In this way, we avoid the expression "discrimination in land inheritance" (whether positive or negative) which suggests that the initiative for land division necessarily rests with the parents.

[26] This proportion is remarkably stable across the three communities (for a discussion of this result, see Goetghebuer and Platteau, 2005).

presence of two-children families, because there are only eleven such families, and land bequests have been equal for seven of them. Not surprisingly, removing these eleven families from our sample, or keeping them in, leads to identical results.

On the other hand, we have left out the families which do not possess any amount of land and those in which parents have died young so that they did not need care in old age. Also dropped are families in which children have not started or finished school yet, and/or in which all the children are less than fifteen years old –in such instances, no division of the family land has occurred and the possible plans of the parents may well prove inadequate when the children will have completed their education and decided whether to stay in the community or migrate. Finally, families for which wealth could not be assessed have been kept out, eventually yielding an Individual-based sample of 618 observations. Inspection of these sample data for the dependent variable shows that, out of 618 individuals, 401 (64.9%) have enjoyed fair access, 83 (13.4%) privileged access, and 134 (21.7%) non privileged access if we adopt the above-discussed measurement method.[27]

What are the reasons given by respondents to justify unequal distribution of land assets among children whenever it occurs in their family? The answers provided, and their relative frequencies, are reported in Table 6 (by decreasing order of importance in the whole sample).

Migration and education are among the three most important reasons mentioned by respondents to justify inequality in land bequests. Especially worth noticing is the prominence of migration as the motive invoked by parents for departing from equal division: it is reported in almost half of the instances. Granting privileged access to land to children who support their parents is the second most important justification overall, being mentioned in one-third of the cases. Once we decompose the answers according to the community of the respondents, some significant variations are observed. First, if migration is an equally important source of discrimination in all three communities, a noticeable difference is that migrants are more likely to be totally deprived of access to land in the more remote community, Pata, than in the other two communities.

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[27] Note that, out of the 401 children who have been fairly treated, 116 belong to families which practice equal division (they represent, by definition, all the children's population of these families), and 285 belong to the other families. Adopting the standpoint of the family rather than the individual, we observe that division of land has been equal in the case of 28% of the total number of households, and unequal in the remaining 72%.

Table 6: *Reasons adduced by respondents to justify unequal division of family land, as per community and per decreasing order of importance in the whole sample* [a]

Reported reasons for unequal division of family land	Relative frequencies according to community (in %)			
	Suncho	Puma	Pata	Total
Putting migrant children at a disadvantage	41.7	52.0	52.5	49.2
-Migrants do not receive any land	19.4	32.0	42.5	31.7
-Migrants receive a smaller share	22.3	20.0	10.0	17.5
Preference for caring children	44.4	34.0	22.5	33.3
Putting educated children at a disadvantage	16.6	28.0	25.0	23.8
Preference for sons over daughters	5.5	16.0	35.0	19.8
Preference for eldest or youngest child	30.5	16.0	10.0	18.2
Personal preferences	13.9	8.0	12.5	11.1
Other reasons	5.5	4.0	5.0	5.5
Cumulating prefer. for caring children and for eldest (youngest) child [b]	63.9	46.0	30.0	46.0

[a] The relative frequency for a given reason is defined as the proportion of cases of unequal inheritance for which this reason has been mentioned, alone or jointly with some other reason(s). Since respondents have sometimes mentioned more than one motive, the percentages do not add up to 100%.

[b] Relative number of cases, where one of these motives or both were mentioned.

Second, preference for caring children turns out to be the most important justification for unequal sharing in Suncho, coming even ahead of migration. In the same locality, preference for the eldest or youngest child is the third most important reason mentioned. The latter preference may actually obey the same rationale as the former if custom prescribes that the eldest or youngest child takes special care of old parents, in return for which he (she) receives a larger share in land inheritance. While support given by a child is mandatory when such a custom prevails, as seems to be the case in many Andean rural communities, it is the outcome of a free decision when caring behavior is rewarded by privileged treatment. We have therefore calculated a cumulative frequency by adding up the frequencies associated with each justification, then subtracting the cases where they have been cited together (see the last row of the table). The result is striking: the combined motive comes very close to migration as a vindication of unequal land inheritance. By an ample margin, it even appears as the most important rationale in Suncho, which is the community where migration is the most widespread.

The reasons adduced by parents (or siblings) to account for unequal division of bequests are subject to different sorts of bias. In particular, since unequal sharing may be the outcome of decisions taken by the children themselves, answers may be *ex post* justifications instead of genuine reasons for dividing the land unequally. This is likely to be especially true when non privileged treatment of migrant children has been mentioned by our respondents, so that we have serious ground to suspect that the incidence of this motive as shown in Table 6 is overestimated. In order to gain more reliable insights into the determinants of inheritance, it is necessary to estimate relationships between variables that measure or depict objective aspects of reality, a task to which we can now turn.

4. Results

Hypotheses and methodology

While family-level data are appropriate to deal with the question as to which types of families tend to adopt equal (or unequal) division, individual-level data must be used to address the question as to which types of children tend to be privileged or non-privileged in their access to family land. The former question has been probed in a companion paper (Goetghebuer and Platteau, 2005) which reveals a complex pattern of interaction between migration and wealth[28]. In the present paper, we focus on the second question and use our individual-level data set. Our central interest is, by estimating an inheritance function directly, to determine whether a significant relationship exists between caring behavior and access to land through inheritance. And since we know that the former variable exhibits sizeable variations only with respect to migrant children (bear in mind that only 6% of staying children do not take care of their parents), our care variable needs to be interacted with a variable indicating whether a child is a migrant.

The econometric equation which we want to estimate toward that end has the following form:

$$x_{ij} = \alpha_{ij} + \beta\, c_{ij} + \gamma\, m_{ij} + \delta\, c_{ij} * m_{ij} + \phi\, h_{ij} + \varphi\, Y_{ij} + \eta\, Z_j + \varepsilon_{ij}$$

where x_{ij} stands for the position or status of child *i* from household (family) *j* in the land bequest process; c_{ij} is a dummy indicating whether he (she) cares for the parents; m_{ij} is another dummy indicating whether he (she) is a long-term migrant; $c_{ij}*m_{ij}$ is an interaction term between caring and the child's residence; h_{ij} measures the level of education of the child or, alternatively, the contribution of parents toward the financing of his (her) studies; Y_{ij} is a vector of personal characteristics, including those which can be used as pre-determined criteria upon which division of family land is decided; Z_j is a vector of characteristics of the household to which the child belongs; and ε_{ij} is the error term.

Testing the above model is nonetheless vulnerable to a number of potential estimation problems that include endogeneity and omitted variable problems. The key difficulty lies in the fact that there are at least three stories available to account for the way division of land

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[28] There is a migration effect, but only among poor families, and there is a wealth effect, but only among families with no migrant.

bequest is related to caring on the part of children. According to these three stories, the relationship between caring for parents and a favourable access to family land through inheritance is positive. In the first two stories, the initiative of the inheritance-related decision rests with the parents while in the last story it rests with the child concerned.

The first story is based on the *strategic bequest theory* and supposes that children are rewarded at the time of inheritance only if they have behaved in the way expected by the parents. The reverse sequence is also possible and this is our second story, that of *selective migration*: parents choose early which children they want to keep within the family farm and which ones they want to leave it and migrate. The latter retaliate by not caring for their parents. Note that the mechanism of compensation between education and land inheritance may accord well with this second story, if the two following conditions are fulfilled: (i) parents decide which children will be allowed to study up to a relatively advanced stage and will then be encouraged to seek good employment opportunities outside the native area; and (ii) they consider that the education expenses incurred constitute a sort of pre-mortem inheritance. A variant of the second scenario is based on the idea that some children are in conflict with their parents who presumably react by disinheriting them and pushing them to migrate.

As for the third story, the *demand-for-inheritance story*, it is grounded in the intuition that children who have chosen to migrate may well decide to give up their claims to land inheritance because their income prospects in the area of destination are deemed sufficiently good, and they have therefore no intention to return to their location of origin. If they are selfish, they loose interest in the welfare of relatives remaining in their native village and stop maintaining contact with them. That such a story ought to be taken seriously is suggested by recent anthropological evidence about inheritance practices in nearby Bolivia (Colque, 2007; Barragan, 2007). It bears emphasis that the demand-for-inheritance scenario makes sense only inasmuch as inheritable wealth takes on the form of land assets that cannot be easily converted into money. If this were not the case, migrant children uninterested in holding family land would still be keen to get their share of parental wealth.

Under the selective migration scenario, unobserved characteristics of the children (for example, their skills or talents) explain both their caring behavior and the division of the bequest, resulting in the endogeneity of the caring variable in the equation to be estimated.

We have strong reasons to believe, however, that the selective migration scenario is not plausible in the context of our study. It does not square with a number of observations. First, in the course of the interviews, we were impressed by the sense of disarray expressed by many parents faced with the departure of several of their children. The resulting anxiety for their future subsistence (both physical and psychological) suggests that migration decisions are largely beyond their control. Second, a complementary survey conducted in the city of Cusco among a small sample of rural migrants (about a hundred individuals) have confirmed from the other side of the migration nexus that migratory moves are mainly the outcome of decisions taken by the children themselves. Most migrants interviewed did not think that they were selected for migration by their parents among all the siblings comprising the family (Paquot, 2005). True, decisions to send children for studying outside the community locale are typically made by parents, at least when they are young (less than fifteen years old[29]), yet the decision to prolong a stay in town beyond the study period, and to settle there on a more permanent basis, belongs to the child concerned. On the other hand, according to the sample migrants, their inheritance share is not influenced by whether the decision to migrate has been initially made by the parents or by the child concerned (Lavigne, 2006).

Third, inheritance shares do not seem to depend on the children's wealth, be it measured by an index of apparent assets, by their employment situation, or by their education level (Lavigne, 2006, p. 73). Finally, regarding the conflict variant, only 3.5% of the sample migrants interviewed by Paquot (2005, p. 70) have mentioned a conflict with their parents as the cause of their migration (to Cusco). Moreover, inspection of our sample data reveals that less than 15% of the children who have stayed near their parents while not showing concern for them, hardly a sign of harmonious child-parents relations, have received a non privileged access. This proportion does not significantly differ from that obtained for staying *and* caring children. Tense relations with parents within the confines of the native community do not, therefore, seem to systematically cause negative discrimination in inheritance.

Other problems are susceptible of creating bias in our estimation procedure. To begin with, as has been pointed out by Bernheim et al. (1985) and Perozek (1998), in a strategic bequest perspective, wealth is endogenous if parents tend to increase their bequeathable wealth in order to enhance their bargaining power and attract as much attention as they need from their children. This endogeneity problem, however, cannot be serious in our study area characterized by highly imperfect land markets. Land purchase transactions, officially prohibited, are rare and severely constrained by the localness of the corresponding market. As a result, initial land endowments may not be easily increased.

The endogenous determination of caring behavior may give rise to a second sort of estimation bias: children provide attention to parents not in (strategic) anticipation of receiving a land

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[29] Note that for our analysis, we only consider individuals older than 15 years old.

bequest, but as a result of inter vivos transfer(s), including financial assistance for their education. Plaguing this sort of situations is a serious commitment problem, −particularly because the children concerned may live far away from their parents−, that must be somehow surmounted if care to old parents is to be seen as a consequence rather than a cause of parental transfers. The first thing to note here is that there is weak empirical support for the hypothesis of a correlation between education and attention paid to parents: the average level of education is not significantly different between caring (5.71 years of education) and non-caring children (5.85 years), a conclusion that continues to hold if the sample is split into migrants and non-migrants, and if education is measured in terms of equivalent years of study financed by parents. Looking at pre-mortem gifts of land, evidence again suggests that caring is not endogenously determined. To understand why, look at Table 7, where the timing of land bequest is specified and a distinction is made between caring and uncaring children, and between migrant and staying children. Caring behavior can only be endogenous if children have received land before, or both before and after, their parents' death.

Table 7: Relationship between migration/caring behavior and the timing of land bequest (Figures are in percentages)

Timing of inheritance	Migrant children		Non-migrant children
	Caring	Uncaring	
Never	8.0	54.5	3.0
Pre-mortem only	15.3	5.4	35.4
Post-mortem only	69.3	29.2	25.4
Pre- and post-mortem	7.4	10.9	36.2
Total	100.0	100.0	100.0

From the table, however, it is evident that most migrant children (almost 70%) who attend to parents actually receive their share of land inheritance as a post-mortem bequest.[30] If they neglect their parents, on the other hand, they are often not inheriting any land (about 55% of them). As for children who remained behind, the timing of inheritance varies a lot. We have not differentiated these children according to whether they look after their parents since the number of those who do not is actually too small to allow meaningful comparisons.

Note incidentally that only one out of 71 relatively well-off parental couples (1.4%) has not kept any land for post-mortem bequest, a proportion to be compared with the much higher figure of about 15% (7 out of 47) for relatively poor households. A plausible interpretation of this difference is that, when parents are poor, they may be unable to withstand pressures exerted by their staying children in order to obtain, upon marriage, enough land to make out a

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[30] In the same connection, Hoddinott (1994: p. 471-72) has found that migrants who have received *inter vivos* gifts of land send smaller remittances to their parents.

living. When no land is left for the parents, of course, at least one of their children has to look after them. Another interpretation is more consonant with the strategic bequest theory: by striving to keep land until their death, parents aim at inducing children to give attention and look after them in old age, yet sheer poverty may prevent them from doing so, thus denying them an important source of bargaining power.

A suspicion of endogeneity may also arise from the self-reporting nature of our care variable in so far as parents (or siblings) might have been tempted to self-justify the division of bequest by portraying a discriminated child as undeserving. We have already explained why we nevertheless believe that our method of interview seriously limits the risk of such a bias. Note that self-reporting of care by parents themselves, the presumed decision-makers for land bequests, represents less than one-third of the sampled cases. Most often, it is a sibling who answered to our query. True, the reporting bias does not necessarily disappear because a sibling rather than a parent acts as a respondent. Yet, it is interesting to test whether the type of respondent affects our econometric results, especially when it is interacted with the care variable. Toward that purpose, we have introduced the type of respondent (parents or a sibling) and the interaction term as explanatory variables in our regression model. It is encouraging that the coefficients of these new variables are not statistically different from zero while the other results remain unchanged (results not shown in the paper).

In the end, the most serious estimation problem we are facing is caused by our inability to measure traits of (migrant) children that are susceptible of explaining both inheritance outcomes and caring behavior under the hypothesis that (some) children rather than the parents actually drive the division of bequest. As a consequence, we are not in a position to use our econometric results to differentiate between the strategic bequest and the demand-for-inheritance scenarios.

This being said, we can make predictions about the expected signs of the most relevant coefficients in the above econometric equation. As explained above, the relationship between caring and the division of bequest is expected to be positive ($\beta > 0$). If the strategic bequest scenario prevails, one should not expect the influence of caring on inheritance to vary depending on whether the child has migrated or continues to live in the native village. By contrast, since the division of bequest is influenced by children under the demand-for-inheritance scenario, the impact of caring behavior on inheritance outcomes is likely to be greater in the case of migrant children than in the case of those who continue to live in the native village. Indeed, if they feel sufficiently secure on the economic level to renounce their inheritance right, migrant children are likely to stop attending to their parents if only because the transaction costs involved are high as a direct result of the distance between the native village and the migration destination. The coefficient of the interaction term, δ, is thus predicted to be significantly positive, at least if the demand-for-inheritance scenario holds true. Since (long-term) migration is a proxy for economic success, we predict that it will also affect the division of bequest independently. While most staying children crucially depend on access to family land for their subsistence (bear in mind that land markets are thin or non-existent), successful migrants may be tempted to forsake their inheritance share in whole or in part just because they do not feel the need to keep a fall-back option in the countryside. Therefore, the sign of γ is predicted to be negative.

Regarding education, the expectation is that more educated children receive smaller shares of family land. Two factors support this prediction: the compensation effect which should operate, at least, in the case where these children have benefited from parental financial support; and the effect of education considered as a proxy for wealth (richer children have a smaller interest in maintaining access to rural land). Because we also measure education in terms of equivalent number of years financed by parents, we are able at least to assess whether the compensation effect is present.

With respect to personal characteristics of children, special attention will be paid to gender, birth order, and family status (whether they are themselves parents or not). Regarding gender, since women do not receive genuine dowries in our study area (see supra), we do not a priori expect sons to be favoured compared to daughters in inheritance. Birth order influences inheritance if, regardless of special duties (bear in mind that we control for caring), the custom prescribes that the youngest or the eldest child should receive a preferential share. Family status is of concern because children who have a family of their own might be treated differently from those who have remained childless. Indeed, parents might consider that the former need to be better secured against contingencies, and/or that their grandchildren themselves may one day need land to make a livelihood.

As for household characteristics, we are particularly interested in determining the influence of parental wealth available per child. Since total wealth can be measured only subjectively and categorically with our data (recall that land assets are available only for a restricted sample of FS), the test is carried out by introducing both wealth and the number of children in the regression equations.

Several models can be estimated depending upon the way our dependent variable is defined. First, we may define a dummy, called *exclusion,* equal to one if a child did not or will not inherit any share of family land, and to zero otherwise. A simple *probit* model is appropriate in this case. Second, x_{ij} may be conceived as a categorical variable taking three different values according to whether the child has obtained (or will obtain) privileged, non privileged or fair access to the family land. Here, we have opted for an *ordered probit* model in which the dependent variable, defined as an ordinal variable called *Bequest1*, is ordered from non privileged to privileged access through fair access. Third, we have chosen a *multinomial logit* in which the determinants of privileged and non privileged access are simultaneously estimated against the benchmark of fair access (the dependant variable is called *Bequest2*). This model raises an important problem, however: a key variable, the term of interaction between migration and caring behavior, is dropped in the course of the estimation because all migrants enjoying privileged access are attending to their parents. We will therefore use it only as a robustness check (see Appendix A). Finally, as an additional check, we estimate a simple *probit* model in which the dependent variable, called *Bequest3*, is a dummy with value zero if the child has a non privileged access, and value one if he/she has fair or privileged access (see Appendix B).

Before looking at the results, a final remark is in order. We have tried the IV approach with a view to identifying a caring behavior function, but we failed in this attempt owing to lack of effective enough instruments.

Main results

The first model, in which *exclusion* is the dependent variable, is based on a limited sample of 265 individuals. Since there are only five cases (out of fourty-six) of non-migrant children with zero inheritance share, indeed, we have to restrict our attention to migrant children in our *probit* model estimation (see Table 8).

The key result is that *caring behavior* −a dummy with value one when the individual attends to old parents− is strongly and significantly correlated with access to land through inheritance: when a migrant child attends to his (her) parents, his (her) probability not to inherit any share of family land is drastically curtailed. On the other hand, his (her) level of *education* −measured continuously in years of education completed− does not influence that probability, a result which continues to hold if we measure education by taking into account the potential contribution of parents toward financing (post-primary) studies.

Table 8: Characteristics of migrant children who do not inherit family land: estimation of a probit model.

Explanatory variables	"*Exclusion*" Simple probit Model [+]
Caring behaviour	- 0.425 *** (0.092)
Education	- 0.004 (0.005)
Parental wealth	0.044 (0.048)
Number of sons	-0.017 (0.016)
Number of daughters	-0.028 * (0.016)
Eldest	-0.021 (0.033)
Youngest	-0.071 ** (0.033)
Gender	-0.006 (0.034)
Own family	-0.090 (0.081)
Intermediate generation	-0.040 (0.056)
Younger generation	-0.035 (0.051)
Puma	0.113 (0.094)
Pata	0.163 ** (0.099)
Number of observations	265
Wald chi²	63.32
Prob > chi²	0.0000
Pseudo R²	0.3677

[+] The coefficients displayed correspond to the marginal effects dF/dx for a discrete change of the dependent dummy variable from zero to one (for an average individual). Robust standard errors allowing for the correlation of errors within the same households are shown between brackets.
* means a 10% level of confidence; ** means a 5% level of confidence; and *** means a 1% level of confidence.

Pata, which represents the most remote community, has a significant impact on the dependent variable. *Suncho,* the community closest to a city, is the reference category while *Puma* occupies an intermediate position. The practice of exclusion from land inheritance thus appears to be more common in the remotest community: in fact, as many as two-thirds of the sample cases of exclusion have been observed in Pata.[31] A plausible explanation is that distance creates a fixed transaction cost − e.g., the cost of supervising the use of one's piece of land by a trustee−, that discourages migrants from claiming their inheritance share. Moreover, it causes the value of the land to be comparatively low, all the more so as living conditions are particularly harsh at the high altitudes of distant communities. If this interpretation is correct, the sign of the coefficient for the *Pata* variable appears to bear out the demand-for-inheritance scenario.

Two other significant coefficients concern the influence of the *number of daughters,* measured continuously, and that of birth order, measured by a discrete variable set to one if

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[31] Interestingly, most of the children excluded from land bequest in *Pata* are female migrants.

the individual is the eldest child (named *eldest*), to two if the child is the youngest (named *youngest*), and to zero otherwise. We shall return later to these two effects.

The other variables have no significant impact on *exclusion. Gender* is a binary variable with value one if the child is a man. *Parental wealth* is equal to one when the household is intermediate or rich, according to our subjective assessment measure, and to zero when it is considered poor[32]. *Own family* is a dummy equal to one if the individual has already formed a family understood as a spouse plus at least one child. Finally, the generation to which an individual belongs is identified by computing the mean age of a family's children and classifying it into one of the three following categories: more than 49 years (*old generation*), which is chosen as our reference category; between 35 and 49 years (*intermediate generation*); and less than 35 years (*younger generation*).

The relationship between caring behavior and the division of bequest that clearly emerges from Table 8 needs to be further tested on the basis of a larger sample and by using a dependent variable that displays a larger variance than *exclusion.* The variable to use for that purpose is a discrete variable (*Bequest1*) providing information about whether access to land through inheritance is privileged, non-privileged, or fair. Observations of zero access to family land constitute a polar case in the non-privileged category whereas, at the other end of the spectrum, (the quite few) instances where a child inherits the entire landholding of the parents fall into the privileged category and represent another polar case. Because non-migrant children are well differentiated along this new dependent variable, we can retrieve the entire sample.

An *ordered probit* model has been estimated controlling for cluster effects at family level. The results are presented in Table 9. The dependent variable takes on value zero if access to land bequest is non-privileged, value one if it is fair, and value two if it is privileged. Two new explanatory variables are used in this model, namely *migrant* (a dummy equal to one when the child has migrated) and the interaction term, *caring*migrant*.

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[32] Lack of observations in the upper category (there was not a single household considered rich in one of our communities) compelled us to make such a regrouping for the purpose of econometric analysis.

Table 9: Determinants of children's type of access to land inheritance: Estimations of an ordered probit model.

		Marginal effect °		
Explanatory variables	“*Bequest1*” Ordered probit model [+]	(1) “Non-privileg. access”	(2) “Fair access ”	(3) “Privileged access”
Caring behaviour	0.264 (0.396)	-0.073	0.037	0.036
Migrant	-2.134*** (0.389)	0.572	-0.253	-0.319
*Caring*migrant*	1.114*** (0.450)	-0.232	0.008	0.224
Education	0.042** (0.020)	-0.010	0.004	0.006
Eldest	0.004 (0.134)	-0.001	0.000	0.001
Youngest	0.332** (0.148)	-0.074	0.014	0.060
Gender	0.232* (0.136)	-0.058	0.022	0.036
Parental wealth	0.005 (0.117)	-0.001	0.000	0.001
Number of sons	-0.128*** (0.048)	0.032	-0.012	-0.020
Number of daughters	0.007 (0.042)	-0.002	0.001	0.001
Own family	0.467*** (0.168)	-0.133	0.073	0.060
Intermediate generation	0.114 (0.147)	-0.029	0.011	0.018
Younger generation	0.483** (0.201)	-0.106	0.016	0.090
Puma	0.033 (0.147)	-0.008	0.003	0.005
Pata	-0.363*** (0.139)	0.097	-0.045	-0.052
Cut-off point 1	- 0.776 (0.445)			
Cut-off point 2	1.557 (0.475)			
Number of observations	618			
Wald chi²	183.03			
Prob > chi²	0.0000			
Pseudo R²	0.1900			

[+] Robust standard errors allowing for the correlation of errors within the same family are shown between brackets.

* Means a 10% level of confidence; ** a 5% level of confidence; and *** a 1% level of confidence.

° The coefficients displayed correspond to the marginal effects dY/dx of the various explanatory variables on each categorical value of the dependent variable. The effects are computed for an individual who has average value in all dimensions.

The most salient result yielded by this econometric model comes out of the first three rows of Table 9. While it was significantly positive in the preceding table, the coefficient of the care variable is no more significantly different from zero once it is estimated jointly with the coefficients of the migration and the interaction variables. By contrast, the latter two coefficients are strongly significant and have the expected signs (negative for migration and positive for the interaction term). The non-significance of the care effect and the strongly significant effects of *caring*migrant* and *migrant* are very robust across various specifications involving alternative lists of explanatory variables. In particular, if we distinguish between close and distant migrants, or between rural and urban migrants, the aforementioned results appear to hold for the two types considered. Moreover, the estimated coefficients specific to each category do not significantly differ from each other, whether for the *migrant* variable or the interaction term. All these findings lend strong support to the demand-for-inheritance scenario in which inheritance outcomes and caring behavior are simultaneously determined by (migrant) children.[33]

From a simple cross-tabulation of type of access to inheritance with migration and caring characteristics of the child (see Table 10), it is evident that, when migrant children attend to their parents, they have a higher probability of receiving a fair or privileged access. Moreover, migrants who have stopped maintaining contact with parents have never enjoyed privileged access. Since there are only a few uncaring children among those who have stayed in their native community, we do not distinguish them from caring children in Table 10. But it is noteworthy that most of them do obtain a fair or privileged access despite their lack of attention to parents.

Table 10: Relationship between caring behavior and inheritance, distinguishing between migrant and non-migrant children (Percentage figures)

Type of access to land through bequest	Migrant children		Non-migrant children
	Uncaring	Caring	
Fair	24.6	64.2	72.2
Privileged	0.0	6.9	19.6
Non-privileged	75.4	28.9	8.2
Total	100.0	100.0	100.0
Chi sq. statistic	0.000		

More can be learned from the *multinomial logit* model, although the critical interaction term has been dropped in the course of the estimation. From a perusal of the results presented in Appendix A, it is thus evident that an inverse relationship exists between caring behavior and non-privileged access to land through bequest, yet no significant correlation emerges between caring and privileged access. Interpreted in the light of the demand-of-inheritance scenario, this suggests the following mechanism. Lack of emotional communication is a way for (migrant) children to signal to their parents that they have lost all interest in the family farm. Parents are deeply disappointed, but they have no other choice than to accept the situation and

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[33] When testing the possible impact of the village/community on the interaction term, we find that our main results are unchanged. Interestingly, however, the effect of *caring*migrant* appears less strong in *Suncho* compared to *Puma* and *Pata*. Clinging to our interpretative framework in which children are the key actors behind the bequest pattern, the following explanation springs to mind. Since *Suncho* is a significantly less remote place than *Puma* and *Pata*, the transaction cost of manifesting care to parents is smaller. This implies that the cost of altruism is also lower for migrant children from *Suncho*: it is easier for them to visit their parents out of sheer affection, that is, in the absence of any interest in preserving their share of inheritance in the family land. As a consequence, the impact of caring on the bequest pattern for migrant children born in *Suncho* is mitigated compared with those born in the other two communities.

re-allocate the land among their other children. If, on the contrary, migrants send a positive signal by showing attention, parents are all too happy to take note, and stick to the egalitarian rule of bequest division.

A sound basis for such an interpretation emerges when the objective facts of access to inheritance are crossed with some subjective information about the respondents' stated preferences as reported in Table 11. Our precise purpose, here, is to verify whether there exists a relationship between expressing the idea that migrant children should have a less favourable access, and the fact of having uncaring migrant children. As shown in Table 11, the test is strikingly conclusive: those who justify discrimination against migrant children tend to be persons whose family comprises at least one migrant child who failed to maintain (emotional) contact with his parents. To put it in a converse manner, when respondents have positive experiences with their migrant children, they tend not to mention migration as a cause of unequal bequest. Children thus appear to be the main actors in the process of land inheritance.

<u>Table 11</u>: Crossing justifications for unequal land division with actual behavior of own migrant children (the sample is restricted to families with at least one migrant child)

Reasons adduced by respondents to justify unequal division of family land	Migrant and caring children	Migrant and uncaring children
Discrimination against migrant children*	34.6%	71.1%
Other reasons	65.4%	28.9%
Total	100.0%	100.0%
Chi square statistic	0.000	

* "migrant children are not entitled to receive any share of the family land".

The above result shows that when migrants care for their parents they increase their probability of receiving fair access to family land (or decrease the probability of receiving non privileged access), yet do not increase the probability of receiving a privileged access. The hypothesis of siblings' rivalry highlighted in some studies (Garg and Morduch, 1998; Morduch, 2000; Chang and Weisman, 2005) is thus not borne out in our study: migrants willing to maintain access to family land do not apparently enter into direct competition, through their caring efforts, with siblings living in the village of origin. Two provisos are worth making, however. First, if migrants are fairly treated, it is clear that the likelihood for remaining siblings to enjoy preferential treatment would be reduced relative to the case when migrants are excluded from inheritance. Second, when a distinction is made between rural and urban migrants, we observe that the former, yet not the latter, are in apparent competition (rivalry) with their siblings staying in the native village.

Let us now comment on the independent, negative effect of migration on the type of access to land inheritance. The question arises as to whether, when allowing for the effect of caring, the net impact of being a migrant is positive, nil, or negative. First, we test the null hypothesis that the *migrant* coefficient equals the coefficient of *caring*migrant* in absolute terms. Since it is rejected (chi square statistic is 0.000), we may conclude that caring only partially compensates the negative impact on inheritance of being a migrant. Second, an idea of the relative importance of the mitigating effect of caring behavior may be gained from a look at the last three columns of Table 9, which display the marginal effects for an average individual. In particular, the positive marginal effect of *migrant* is more than twice as large as the negative effect of *caring*migrant* in column (1). Migrant children attending their parents are 23 percentage points less likely to receive a non-privileged access to family land than uncaring migrants.[34]

There are at least two plausible explanations for the fact that caring only partly compensates for the fact of being a migrant. The first one is inspired by the strategic bequest scenario and the second one by the demand-for-inheritance scenario. According to the first explanation, parents do not reward all caring children to the same extent because they tend to give a preferential treatment to those remaining in the native community. This attitude does not necessarily hurt the migrants whose main interest may lie in securing access to the local land market in a context pervaded by strong land market imperfections, in keeping a link with the native community and its solidarity networks, and in maintaining a symbolic tie to the native land revered as the *Pacha Mama* (Mother Earth) in local parlance. The second and more plausible explanation is that there are altruistic (migrant) children willing to look after their parents even though they do not want to receive an (equitable) share of the family land. Inspection of our data actually shows that almost 30% of caring migrants have a non-privileged access to land bequest (see Table 10). The proportion of those who do not inherit any land is 8% (see Table 7), and these children, at least, are very likely to be of the altruistic type.

Using simple frequencies, Table 12 shows that migrants, especially distant migrants, are much more likely to have non-privileged access to family land than those who have stayed in the

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[34] From the table reporting the results of the *multinomial logit* model (see Appendix A), we see that being a migrant raises the probability of a non-privileged treatment and decreases that of a preferential one. The results of the simple *probit* model presented in Appendix B confirm that correction of the migrant marginal effect by caring is only partial.

native community.[35] As we have now learned, this large gap arises from two sources: (i) only a fraction of migrants maintain contact with their parents (quantitatively the most important source), and (ii) some caring migrants have non-privileged access, most likely as a result of their own (altruistic) choice.

Table 12: *Frequencies of positive, negative and neutral discrimination in inheritance as per location of residence (Percentage figures between brackets)*

Division of land bequest:	All children	Staying children	Migrants	Distant migrants
Fair	401 (64.9)	255 (72.2)	146 (55.1)	81 (48.8)
Privileged	83 (13.4)	69 (19.6)	14 (5.3)	8 (4.8)
Non-privileged	134 (21.7)	29 (8.2)	105 (39.6)	77 (46.4)
Total	618 (100.0)	353 (100.0)	265 (100.0)	166 (100.0)

A last piece of evidence supports the idea that there are altruistic (migrant) children who voluntarily forsake their rights to inherit some portion of the family land. In-depth discussions with parents have, indeed, shown that they sometimes consider the division of bequest as egalitarian while the land of a migrant definitely passed into the hands of a brother who remained behind. Interestingly, the percentage of FS for which the respondent's statement that family land has been equally distributed does not match (*ex post*) reality on the ground is as high as 20% for families with at least one migrant,[36] while it is less than 4% for those with no migrant.[37] Moreover, in most of the diverging cases, (i) there are caring migrants among the children, and (ii) migrant children have not inherited any land (in the few remaining cases, 3 cases out of 28, they have obtained a smaller share than their siblings).

To sum up, out of 618 individuals, 450 care for parents and enjoy privileged or fair access to land bequest, while 49 do not take care and have non-privileged access. Together, they make up about 81 percent of the sample. On the other hand, 85 individuals (about 14 percent) are presumably altruistic (migrants): they take care of parents but are not rewarded in terms of inheritance. The remaining 34 individuals (about 5 percent) do not show concern for their

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[35] Differences between proportions across staying and migrant children are statistically significant at 0 percent confidence level.

[36] This measure is computed as follows: $\frac{Perceived^{eq} - Actual^{eq}}{Perceived^{eq} + Perceived^{uneq}}$,
where $Perceived^{eq}$ ($Perceived^{uneq}$) is the number of FS for which inheritance has been perceived as equal (unequal) by the respondent, while $Actual^{eq}$ is the number of FS for which we deem that distribution has been actually equal. A positive sign of this indicator therefore means that equality is more often perceived than actually realized.

[37] In one of those few cases, for example, we discovered that parents pretended to have equally shared their land while a daughter received a piece of land of identical amount but much lower quality than her brothers (the land was badly located).

parents yet are not sanctioned by lower shares of inheritance. Additional factors must be brought into the picture to account for the existence of this last category, in particular. Before looking at the results that involve them, it is worth noting that more than half of the 34 individuals forming the fourth category are children who have stayed in their native village. As far as they are concerned, it may be realistically argued that it is difficult for parents to disinherit a child who does not care for them when he (she) lives nearby and crucially depends on a portion of the family land for his (her) subsistence. If this interpretation is valid, the strategic bequest hypothesis stands violated.

Secondary results

After taking stock of the results pertaining to caring behavior and migration, the first variable of interest is education. The number of years of study is not negatively related to favourable access to land inheritance –the relationship even turns out to be significantly positive, yet the size of the coefficient is quite low–, a conclusion that continues to hold if we use the education variable adjusted for financial contributions by parents. One might think that this result is driven by the most remote community, *Pata*, where we observe simultaneously a comparatively large incidence of exclusion from land bequest and comparatively low levels of education. Yet, when the model is re-estimated after dropping the individuals from *Pata*, the absence of compensation between education and access to family land is again observed.

When the *multinomial logit* and the simple *probit* models are used as robustness checks, we find that there is no significant relationship between the dependent variable and either education measure. No compensation effect therefore appears to be at work, which violates the wealth-equalization hypothesis of Becker and Tomes (1976), but confirms the result obtained by Behrman and Rosenzweig (2004) on the basis of US data regarding twins' bequests. In the context of our study, this is probably due to the absence of a genuine selection mechanism: parents tend to encourage all their children to pursue studies as a way of escaping poverty and increasing their social and economic mobility. As we could infer from our field observations, children stand responsible for the decision to drop out. If anything, such a finding weakens the case for scenarios which hypothesize an active role for parents in inheritance decisions, particularly the selective migration scenario. On the other hand, it cannot be argued either that, controlling for other effects, more educated children, presumed to be richer, display a stronger tendency to give up (part of) their claim to inheritance. The absence of such a wealth effect is not really surprising given the generally low education levels in the area: on an average, children do not complete primary school (see supra, Table 2).

Let us now turn our attention to the role of personal characteristics, starting with birth order.[38] The youngest child appears to have a higher chance of being granted at least a fair access to family land.[39] The *multinomial logit* model does not unambiguously confirm this result: being the youngest child increases the probability of being preferentially treated yet does not significantly reduce the probability of having non-privileged access against the benchmark of fair treatment. It bears emphasis that these results are obtained after controlling for migration and caring behavior. In fact, inspection of the raw data shows that youngest sons do not have a higher propensity to stay in than other siblings. Moreover, we tested for the possibility that care for old parents differs between eldest, youngest and intermediate children. The test is inconclusive even when sons are considered separately from daughters. There is thus no compelling evidence of a custom or social norm according to which the eldest or the youngest child is assigned the duty of taking care of parents in old age.

Regarding gender, we have only limited evidence that daughters are treated differently from their brothers: being a boy has a favourable influence on the share of land bequest but the effect is weakly significant (at the 10 percent level).[40] Drawing inspiration from the reasons given by parents to justify unequal treatment of their children (see supra, Table 6), we have interacted *Pata* with gender, which yields a significant coefficient: in *Pata*, the most distant and probably the most traditional among the three sample communities, women receive lower shares of land inheritance than men (results not shown).[41]

Another result that deserves to be brought into evidence concerns the size of the family differentiated according to gender: only the number of sons turns out to have an influence on the land division pattern. Not only is this effect highly significant, but it is also confirmed in the two alternative models. More precisely, a higher number of sons in the family has the effect of increasing the likelihood of unequal land bequest, thus reflecting an increased

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[38] Bear in mind that the birth order variable is equal to 1 for the eldest, 2 for the youngest, and 0 for all the other siblings in the family. We therefore compare access to family land for the youngest and the eldest with access for the other children.

[39] From Table 6, we know that preference for the eldest (or the youngest) child has been mainly expressed in the community of *Suncho*. To test this relationship, we have introduced an appropriate interaction term between birthorder and community in our three models, yet no significant result emerges from such an experiment.

[40] In the simple *probit* model, the coefficient of *gender* is insignificant while the *multinomial logit* shows that, if sons are more likely to be preferentially treated than their sisters, the probability of having a non-privileged access to family land is not higher for daughters than for sons.

[41] When this interaction term is present in the regressions, the coefficient of the location dummy *Pata* ceases to be significant and other results continue to hold.

competition around land (bear in mind that we control for parental wealth). A higher number of daughters does not produce such an effect, suggesting that small, perhaps non-viable land parcels are less problematic when there are many girls than when there are many boys (see Table 13).

Table 13: Average number of children (male and female) as per type of access to inheritance

Division of land bequest	Average nr of children in family	Average nr of sons in family	Average nr of daughters in family
Fair	5.6	2.7	2.9
Privileged	5.8	3.0	2.8
Non-privileged	6.4	3.4	3.0
Total	5.8	2.9	2.9
Statistic: Prob > F	0.0003	0.0000	0.6783

A careful examination of the data shows that the above effect is created by families comprising a minimum of four sons (they represent about 20% of the total sample). The proportion of children with non-privileged access is three times as high for sons belonging to large families (of at least four male children) compared to smaller families, while it barely varies for daughters.[42] This last result is to be related to the aforementioned finding that, in terms of access to family land, boys tend to be preferentially treated compared with girls. Revealingly, the average land endowment of men upon marriage is more than twice as large as that of women.[43] At work is the customary principle according to which the husband is expected to be the mainstay of family subsistence. As a consequence, the land brought by the wife tends to be seen as extra land while that brought by the husband is viewed as the essential portion.[44] Also worth noticing is the fact that families with at least four sons have relatively more migrants. This provides an explanation consistent with our general story for the higher prevalence of unequal sharing in those families.

The implication of these combined findings is the following: when equal partitioning of family land would cause individual parcels to be of insufficient size for male children (but not necessarily for daughters given their smaller needs), some sons receive a preferential

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[42] Exactly the same result actually obtains when families where there are more sons than daughters are compared to families where there are more daughters than sons. The proportion of sons with non-privileged access is three times larger in the former than in the latter type of families while the proportion of daughters with non-privileged access hardly differs.

[43] To compute these averages, we used the restricted sample of the seventy-two couples personally interviewed during the field survey (see supra, Section 2).

[44] When we differentiate family size according to sons and daughters in the regression explaining exclusion from land inheritance (see supra, Table 8), we find that the coefficient of *number of sons* is no longer significant while that of *number of daughters* is weakly significant and negative. In other words, as the number of daughters increases, exclusion of a child from land inheritance is less likely to occur.

treatment vis-à-vis others who therefore have to rely (more) on complementary sources of income. Unfortunately, since we do not have at hand a proper measure of off-farming incomes, we are unable to establish a relationship between non-privileged access to land inheritance and the level of these incomes (which, incidentally, would still leave the causality problem unresolved). Moreover, we do not have direct evidence enabling us to determine whether, in the circumstance, it is parents or the children concerned who cause land allocation to be unequal (bear in mind that we control for caring behavior). An interpretation of these findings based on the demand-for-inheritance scenario is plausible: well-to-do (migrant) children have a higher propensity to forsake (some of) their right to land bequest if the fair share they are entitled to is smaller (for a given amount of parental wealth), and if their siblings (living in the village) have a more acute need for family land.

The impact of family size has been estimated holding parental wealth constant. The wealth variable, however, is an ordinal within-community measure, and it is therefore quite possible that a poor household in, say, *Puma*, would be considered as rich in the poorest community, *Pata*. In order to control for this bias, we have re-estimated the model by differentiating wealth categories according to the community to which each parental couple belongs. It is noticeable that this change in the way of measuring the impact of wealth does not affect our results, and none of the coefficients associated with the different wealth dummies turns out to be significantly different from zero (since adding all these dummies would overload the presentation of the estimates, we refrain from displaying them here).

There is yet another highly significant and robust effect that needs to be commented: a potential heir who has formed a family has a higher probability of enjoying privileged or fair access to family land. This finding is not easy to explain, partly because we do not know whether children of the children surveyed have themselves attended to their grandparents. Leaving that problem aside, an explanation that springs to mind assumes that the initiative in bequest belongs to the parents: parents are more likely to favour children, even if uncaring, when these children have themselves given birth to children who could need land in the future. If they anticipate this behaviour correctly, however, potential heirs should be less keen to attend to their parents when they have a family of their own, a prediction that is not borne out by our data: the propensity to care for parents does not vary when we compare children with a family of their own to childless children.[45]

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[45] In fact, this is true for migrant children only. For staying children, such propensity actually turns out to be relatively stronger among children who have a family of their own, exactly the opposite of the outcome predicted.

Note finally that, in the three communities, the type of marriage, patrilocal or matrilocal, influences access to land bequest neither for men nor for women (result not shown).

Before concluding, let us mention the results of estimating a few variants of the models discussed so far. In the above estimates, fair access to land inheritance may concern both children belonging to equal-division families and children who have been fairly treated in unequal-division families. In order to check whether this aggregation process introduces a bias in our results, we have re-estimated our econometric models after removing all cases of fair treatment pertaining to equal-division families. The sample size is thus reduced to 502 individuals. It is noticeable that all the previous results continue to hold, including the magnitude of the coefficients, and this is also true for the models used as robustness checks.

It also is interesting to control for unobserved heterogeneity in the households' characteristics. Unfortunately, owing to the small size of our sample families, using a family dummy variable leads to inconsistent estimates, and the 'within transformation' to deal with the well known problem of incidental parameters can not be computed while estimating such models (Wooldridge, 2002, pp. 259, 279, 288). To overcome that difficulty, we have used an indirect method which allows us to consistently estimate a (family) random effects logit model in which the binary dependent variable *Bequest3* is used (see Appendix C for the results –Table C.1– and more details about the methodology). All our results remain unaffected by this change of model specification.

As a last test of robustness, we have re-estimated all our models after dropping out the variables *caring behavior* and *caring*migrant,* which might potentially create an endogeneity bias that we are unable to control for. Again, we find that the coefficients are remarkably stable while the results of the significance tests for the remaining variables yield the same conclusions as before.

5. Conclusion

There are essentially three stories susceptible of explaining a positive relationship between caring behavior by children and favourable access to land bequest in the context of migration-prone rural communities. In the first two stories, the responsibility for the inheritance-related decisions rests with the parents while in the last story it rests with the child concerned. The strategic bequest story supposes that children are rewarded at the time of inheritance only if they have behaved in the way expected by parents. Based on the reverse sequence, the alternative story of selective migration implies that parents choose early which children they want to keep within the family farm and which ones they want to migrate. The latter retaliate by not caring for their parents. The idea of compensation between education and land inheritance also fits into this second story. As for the third story, the demand-for-inheritance story, it is grounded in the idea that children who have migrated may well decide to give up their claims to land inheritance because their income prospects in the area of destination are deemed sufficiently good, and they have therefore no intention to use the land in their location of origin. They thus loose interest in the welfare of relatives who have remained in this location and stop maintaining contact with them.

On the basis of original data collected in three poor communities of the Peruvian Highlands, we have been able to estimate an inheritance function (unlike most empirical studies which rely on remittance functions) with a view to identifying the main factors associated with particular patterns of land bequests. A central result is that the positive relationship between caring and access to land bequest indeed exists, yet is only observed for migrant children (whether urban or rural, long- or short-distance migrants). Displaying attention to parents thus mitigates the disadvantage of being a migrant in terms of access to parental land compared with siblings who stayed in the native village. This finding strengthens the case for an interpretation based on an active role of potential heirs in the determination of inheritance outcomes, thus favouring the demand-for-inheritance scenario over the strategic bequest scenario. Furthermore, complementary evidence from studies on migrants conducted in places of destination, and our result about the absence of compensation between education and land bequest, tend to suggest that the selective migration scenario does not provide a credible interpretation of our data.

Additional observations concur to make the third scenario more plausible than the other two. First, a significant number of migrant children who continue to maintain contact with their parents have non-privileged access to family land. The presumption is that these are altruistic children, or children largely motivated by their affection towards their parents. Although the case they represent violates the strategic bequest theory, it is entirely compatible with the demand-for-inheritance hypothesis: although they are not interested in keeping their right of inheritance, they remain emotionally attached to their parents. Second, exclusion from inheritance has been observed to be particularly significant in the remotest and poorest community. The idea is that distance creates a fixed transaction cost that discourages migrants from claiming their inheritance share. Moreover, it causes the value of the land to be comparatively low, especially so because living conditions are particularly harsh at the high altitudes of distant communities.

These pieces of evidence come in support of the impressions gained during many interviews of old parents. They seem overcome with a feeling of helplessness when one or several of their children had left the community and stopped communicating with them. It is therefore not surprising that the motives given to explain unequal bequests often appeared as *ex post* justifications of situations which were largely beyond their control rather than as genuine reasons driving the inheritance process.

It bears emphasis that to analyze patterns of bequest the demand-for-inheritance scenario makes sense only inasmuch as inheritable wealth takes on the form of land (or other) assets that cannot be easily converted into money. If this were not the case, indeed, migrant children uninterested in holding family land would still be keen to get their share of parental wealth. This suggests that the demand-for-inheritance hypothesis is especially relevant in the context of poor economies pervaded by serious (land) market imperfections.

Our study is also rich in other findings which point to the complexity of the inheritance patterns observed in poor communities. Besides migration and caring behavior, personal characteristics of potential heirs, such as gender, birth order, and family status (whether they are themselves parents or not), do appear to influence division of land bequests. Moreover, lower levels of parental wealth available per child (in fact per male child) tend to be associated with more unequal land bequests. This does not imply that parents adopt more exclusionary practices when there is more land pressure, but rather that potential heirs themselves may decide to give up their shares or be content with smaller ones under these hard circumstances. Finally, less educated children are not compensated by receiving higher shares of family land.

All these results have proven to be remarkably robust not only when we shift from one testing model to another, but also when we adopt different ways of defining key variables, and when we vary the list of explanatory variables.

Appendix A

Table A.1: Determinants of type of access to land bequest: estimations of a multinomial logit model[46] *(Reference category: fair access).*

	Explanatory variables	Multinomial model [+] *"Bequest2"*
Privileged access	*Caring behavior*	0.548 (0.869)
	Migrant	-1.290*** (0.360)
	Education	0.020 (0.053)
	Parental wealth	0.058 (0.316)
	Eldest	0.184 (0.330)
	Youngest	0.760** (0.340)
	Gender	0.837** (0.361)
	Own family	0.903* (0.595)
	Intermediate generation	0.448 (0.442)
	Younger generation	1.147* (0.595)
	Puma	-0.054 (0.413)
	Pata	-0.340 (0.434)
	Number of sons	0.071 (0.162)
	Number of daughters	0.115 (0.112)
	Constant	-4.222*** (0.991)
Non-privileged access	*Caring behavior*	-1.960*** (0.443)
	Migrant	2.186*** (0.334)
	Education	-0.080 (0.054)
	Parental wealth	-0.030 (0.378)
	Eldest	0.162 (0.289)
	Youngest	-0.372 (0.343)
	Gender	-0.069 (0.281)
	Own family	-0.678* (0.356)
	Intermediate generation	0.019 (0.409)
	Younger generation	-0.576 (0.543)
	Puma	-0.117 (0.493)
	Pata	0.967** (0.445)
	Number of sons	0.441*** (0.157)
	Number of daughters	0.049 (0.149)
	Constant	-1.400 (0.944)
	Number of observations	618
	Wald chi²	165.30
	Prob > chi²	0.0000
	Pseudo R²	0.2099

[+] Robust standard errors allowing for the correlation of errors within the same households are shown between brackets

* Means a 10% level of confidence; ** means a 5% level of confidence; and *** means a 1% level of confidence.

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[46] The *iia* test conditioning the use of the *multinomial* model has been conclusively performed.

Appendix B

Table B.1: Determinants of the treatment of children in the process of land inheritance: estimations of a probit model.

Explanatory variables	"*Bequest3*" Simple probit model [+]
Caring behaviour	0.126 (0.133)
Migrant	-0.545*** (0.107)
*Caring*migrant*	0.187** (0.084)
Education	0.011 (0.007)
Eldest	-0.016 (0.041)
Youngest	0.055 (0.039)
Gender	0.015 (0.038)
Parental wealth	0.001 (0.047)
Number of sons	-0.055*** (0.020)
Number of daughters	0.006 (0.018)
Own family	0.116** (0.063)
Intermediate generation	0.022 (0.051)
Younger generation	0.093 (0.052)
Puma	0.015 (0.060)
Pata	-0.128** (0.064)
Number of observations	618
Wald chi²	121.56
Prob > chi²	0.0000
Pseudo R²	0.2946

"*Bequest3*" takes value zero if an individual has a non-privileged access; one if he/she receives a fair or privileged access to the family land.

[+] Robust standard errors allowing for the correlation of errors within the same family are shown between brackets. The coefficients displayed correspond to the marginal effects dF/dx for a discrete change of the dependent dummy variable from zero to one (for an average individual).

* Means a 10% level of confidence; ** a 5% level of confidence; and *** a 1% level of confidence.

To test for the robustness of our central results regarding the interaction term (caring*migrant), we have also checked the statistical significance of this coefficient by using the method proposed by Norton, Wang and Ai (2004). In non-linear models (e.g. a probit model) as they have shown, a rigorous test must be based on the estimated cross-partial derivative. The significance of the interaction term appears even stronger after following this new method.

Appendix C

Since, to our knowledge, there is no method available to routinely estimate an ordered logit/probit model or a simple logit/probit model with household fixed effects, we decided to use a Linear Probability Model (LPM) with such effects using our binary dependent variable "*Bequest3*" (which takes on value zero if the individual is non-privileged in land bequest, and one otherwise). Our model turns out to be consistent, and the results are unchanged. Moreover, if we estimate a random effects LPM, we obtain very similar estimated parameters. The Hausman test actually confirms that the estimates of the fixed effects model and the random effects model do not systematically differ (Hausman statistic: 6.25; p-value: 0.79). Hypothesizing that the assumptions underlying the random effects model (normality of the distribution of the individual components in the error term and individual effects independent of the exogenous variables) are not violated, we may obtain an increase in the efficiency of the estimators while guaranteeing consistency by using the random effects model instead of the fixed effects model. It is also feasible to estimate a consistent (family) random effects logit model, and in this case it is legitimate to estimate it since we have now assessed the reliability of using a random effects model (through the LPM). We have thus been able to control for unobserved heterogeneity between households with much higher efficiency than with a fixed effects model. Table C.1 shows the results obtained while running the random effects logit model.

A last remark deserves to be made. When we run an OLS fixed or random effects model using our dependent categorical variable "*Bequest1*", all our results are again found to hold. However, since the Hausman test leads us to reject the null hypothesis that the estimated coefficients of the two models do not systematically differ, we did not estimate a random effects ordered logit model (using a Generalized Linear and Latent Mixed Model).

<u>Table C.1</u>: Determinants of the treatment of children in the process of land inheritance: estimations of a (family) random effects logit model.

Explanatory variables	*"Bequest3"* random effects logit model
Caring behaviour	0.313 (1.139)
Migrant	-6.859*** (1.521)
*Caring*migrant*	3.967*** (1.436)
Education	0.054 (0.065)
Eldest	-0.001 (0.418)
Youngest	0.616 (0.520)
Gender	0.493 (0.413)
Parental wealth	-0.297 (0.568)
Number of sons	-0.555*** (0.199)
Number of daughters	0.133 (0.186)
Own family	0.978* (0.506)
Intermediate generation	0.298 (0.586)
Younger generation	1.679** (0.794)
Puma	0.443 (0.703)
Pata	-1.381** (0.687)
Constant	3.892** (1.639)
Number of observations	618
Number of groups	137
Wald chi^2	63.93
Prob > chi^2	0.0000

"Bequest3" takes value zero if an individual has a non-privileged access; one if he/she receives a fair or privileged access to the family land.

* Means a 10% level of confidence; ** a 5% level of confidence; and *** a 1% level of confidence.

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Chapter 2

Timing of inheritance: Inter vivos transfers and bequests in an agrarian economy

Abstract: To our knowledge, the present paper is the first attempt to explain inter- and intra-household variations in the incidence of inter vivos transfers and bequests in the context of a poor agrarian economy**.** Our exploration is made on the basis of a new theory of inheritance timing in which children value their autonomy (obtained if they set up an independent farm within the native community or if they migrate), while parents derive positive utility from keeping their children close to them (either in the same household or in the same village). A trade-off arises because awarding autonomy to children through inter vivos gifts of land (so as to enable them to set up an independent farm), deprives the parents of a portion of the income they could have obtained by maintaining the stem household as a whole. In particular, we explore, theoretically and empirically, the influence of parental land wealth and migration on the probability for children to obtain their inheritance in the form of inter vivos transfers, post-mortem bequests, or a combination of both. The model predicts that poor parents will avoid making inter vivos gifts of land to their staying children. This prediction is consistently borne out by our case study of the Peruvian Highlands. In the model we assume that, because of the existence of significant transaction costs, migrants only receive post-mortem land bequest. This assumption is supported by our data: migrant children have a significantly lower probability of receiving land pre-mortem and this result is reinforced for distant versus close migrants.

Keywords: land inheritance timing, inter vivos gift, post-mortem bequest.
JEL classification codes: D10, 012, 015, R20, Z13

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1. Introduction

During the last decades, a growing body of economic literature has been devoted to the analysis of transfers of parental wealth to children. A central question addressed in this literature concerns the division of bequests among potential heirs, and the two main available theories, the exchange model (Bernheim et al., 1985 ; Cox, 1987; Cox and Rank, 1992) and the altruism model (Becker, 1974; Becker and Tomes, 1979; Becker, 1991) agree that bequests should generally be unequal. Confronted with the observation of equal bequests, alternative explanations have been put forward, such as the desire of parents to avoid conflicts between children, or the existence of a social norm prescribing equal treatment of children coupled with parental concern about post-mortem reputation (Wilhelm, 1996; Lundholm and Ohlsson, 1999; Baland and Platteau, 2001). Most empirical studies in this field are based on data collected in developed countries. As for the literature concerned with developing countries, it has largely focused on the strategic bequest theory which is typically tested through the analysis of the children's remittance or gift-giving behaviour (Hoddinott, 1992; Schrieder and Knerr, 2000; de la Brière et al., 2002; La Ferrara, 2007). Quisumbing (1994), Goetghebuer and Platteau (2010) and Michels (2011) take a different approach since they characterise and explain inequality in land bequests, the former by looking at gender differences (in the Philippines), and the latter two by directly estimating an inheritance function to identify the determinants of unequal sharing of family land between all children (in the Peruvian highlands and the Bolivian Altiplano). Moreover, in the last two papers, evidence is adduced to the effect that parents are not the only decision makers regarding inheritance: children are often found to influence land division outcomes.

A second question addressed in this literature is the issue of inheritance timing: is parental wealth transferred to children post-mortem in the form of bequests, or pre-mortem in the form of inter vivos gifts, or both? Much of the economic literature seeks to explain the motivation behind these intergenerational transfers, with special emphasis on the issue of altruism vs. exchange in order to understand their distributional effects (Kohli and Künemund, 2003). Despite the substantial amount of research, a consensus has not yet been reached about the importance of these alternatives models (McGarry, 1999; Light and McGarry, 2004).

Inter vivos transfers are to a large extent unequally distributed across all children in the family and seem to go in higher proportion to the more needy children (see, e.g., Altonji et al., 1997; Dunn and Philips, 1997; Lundholm and Ohlsson, 1999, Norton and Van Houtven, 2006). The desire of altruistic parents to compensate less well-off children through inter vivos gifts arises from the normatively imposed constraint that post-mortem bequests ought to be equal across all the heirs (see, e.g., Gotman, 1998). The dominant explanation for this unequal treatment is that inter vivos gifts, because they are more easily concealed, can be better adjusted to the characteristics of the children and idiosyncratic circumstances than publicly observable bequests. For example, the presence of liquidity constraints faced by (some) children may induce the parents to make early transfers of wealth to the constrained heirs (Cox, 1990; Cremer and Pestieau, 1998; McGarry, 1999).

In contrast to the above literature, Cox and Rank (1992) find that parental inter vivos transfers are positively correlated with recipients' incomes, and are therefore not compensatory (see also Cox, 1987). According to these authors, the empirical patterns of inter vivos transfers are therefore more consistent with exchange than altruism. Finally, Cremer and Pestieau (1996) theoretically show that, in a setting of moral-hazard and adverse selection, altruistic parents (who are not perfectly informed about the earning abilities of their children) will make equal inter vivos transfers (for the sake of efficiency), while distributing compensatory bequests (for the sake of equity) so as to discipline their children and provide them with incentives to reveal their true capacity (see Halvorsen and Thoresen, 2011, for empirical evidence using Norwegian data).

Others motives behind inter vivos transfers are also discussed in the literature. First, somewhat related to the 'liquidity constraint' motive is the existence of dowry, viewed as a pre-mortem inheritance given by parents to daughters on the occasion of their marriage (Goody, 1973; Goody 1976; Botticini and Siow, 2003). Second, inter vivos transfers may be triggered by bequest tax policies: since bequests are (heavily) taxed while inter vivos gifts often escape taxation, parents are tempted to substitute the latter for the former (see e.g., Joulfaian, 2000; Poterba, 2001; McGarry, 2001; Page, 2003; Bernheim et al, 2004).

As attested by the above references, almost all empirical studies addressing the motives behind the division patterns at different points in time are concerned with the developed world. Studies explicitly dealing with the context of poor countries, albeit motivated by empirical observations, are of a theoretical nature. Foster and Rosenzweig (2002) and Guirkinger and Platteau (2011) provide alternative frameworks to account for the emergence of branch households in agrarian economies such as those of West Africa. Being typically born out of the split of the stem household, these branch households are the outcome of inter vivos transfers of parental land wealth.

To our knowledge, the present paper is the first attempt to explain inter- and intra- household variations in the incidence of inter vivos transfers and bequests in the context of a poor agrarian economy where there is no marriage payment[1]. Grounded in first-hand data collected in three communities of the Peruvian highlands, it is a systematic effort to document and explain the heterogeneity in timing of land inheritance rather than its division pattern[2] when

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[1] Botticini and Siow (2003) formally analyze the timing of inheritance in the specific context of gender relations when parents provide inter vivos gifts for daughters and bequests for sons. The inter vivos gifts correspond to dowries since daughters receive them upon marriage when they move to the house of their husband's parents. The alleged rationale behind this rule is the need to mitigate a free-riding problem between the leaving daughters and the married sons who stay in the parental business.

[2] The issue of land division is explored in a companion paper (Goetghebuer and Platteau, 2010) based on the same dataset as the one used in the present study. There, the dependant variable is a measure of land inheritance obtained by aggregating inter vivos gifts and post mortem bequest.

land is the dominant form of wealth and migration opportunities exist. Our exploration is based on a new theory of inheritance timing in which children value their autonomy while (selfish) parents derive positive utility from keeping their children close to them (either in the same household or in the same village). A trade-off arises because awarding autonomy to children through inter vivos gifts of land so as to keep them inside the native community deprives the parents of a portion of the income they could have obtained by maintaining the stem household as a whole. In particular, we explore the influence of parental land wealth and migration on the probability for children to obtain their inheritance in the form of inter vivos transfers, bequests, or a combination of both.

The outline of the paper is as follows. In Section 2, some key relevant features of the economy of the Peruvian highlands are highlighted that will help set the framework of hypotheses used in the model presented in section 3. In the section 3, we propose a simple theory of inheritance timing and we derive the analytical predictions which will be econometrically tested in the next section. Section 4 is divided in two parts. We describe the survey and the key variables used for the purpose of empirical testing, before presenting and commenting our results. Section 5 concludes.

2. Land tenure, inheritance, and family structure in the Peruvian highlands

This section focuses on a number of key characteristics of the surveyed Andean communities (of the department of Cusco) with respect to land tenure, inheritance, and family structure. It will help set the hypotheses used in the theoretical model presented in the next section.

The national land registrar of Peru attributes a collective land title to a community, making it practically impossible for a person or a household to obtain an individual title inside his or her community.[3] When land was abundant, there were periodic redistributions, according to current needs, among families member of the same community for the purpose of individual cultivation. Access for grazing after the harvest nevertheless remained open to all animals (see Baland and Platteau, 1998). Nowadays, as land pressure has increased, redistribution of communal land is rarely observed[4], and families tend to hold permanent, individualized rights

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[3] The Peruvian law stipulates the conditions to be fulfilled in order to get a private land title within a community, but these conditions are so strict (two-thirds of community members need to agree to formally divide the land, each landhold should be measured by an official geometrician against payment, etc.) that such procedure has never been followed in the area of study (see Goetghebuer and Platteau, 2005).

[4] Except for some dry lands in some remote communities, which are opened to communal grazing after the harvest.

over agricultural landholdings. As a matter of principle, no land market is allowed to emerge since the national law teaches that land belonging to communities may not be disposed of through sales or mortgaging: only usufruct rights may be acquired or transmitted. In practice, however, sales and other land transactions do occur, but only to the extent that they take place among community members. As a result, land inheritance, of which the owner's children are the only potential beneficiaries, consists of the bequest of usufruct rights. Land is typically the only bequeathed asset since animals are usually sold to pay for funerals, and money holdings or jewellery are a scant possession of the households in the area.

The parents may give land to children while still alive or upon their death, or both. An inter vivos transfer typically occurs when a child gets married (following the customary ritual), or when he or she decides to co-reside with a partner (under the so-called 'conviviente' status).[5] Interestingly, an inter vivos transfer of land on the occasion of marriage is never seen as a marriage payment: only symbolic gifts are exchanged between the groom's and the bride's families when a wedding is celebrated.

Pre-mortem land transfers are conceived neither as a compensation for children who did not benefit from parental investment in education, nor as a special reward for those who have given care or attention to their parents. On the one hand, the average educational level is not significantly different between children who received a pre-mortem share of land and those who did not. On the other hand, the timing of inheritance does not vary significantly between caring and non-caring children (for precise evidence, see Goetghebuer and Platteau, 2010: Table 7).[6]

Upon receiving an inter vivos gift of land, a child typically starts his or her own farm and becomes economically independent from his/her parents. What the beneficiary may not do, however, is to dispose of the received landholding, an action that is tolerated only after the death of the parents. According to some statements heard on the field, since land received pre-mortem is a gift, "to sell it would be showing disrespect to the living parents", and is therefore "unthinkable". Behind this symbolic justification lies the more mundane reason, often explicitly mentioned, that parents fear the destitution of their children if they part with the land received. In spite of this customary restriction of the heirs' rights, inter vivos gifts are genuine bequests: a piece of land obtained pre-mortem is as secure as a piece received post-mortem. According to our respondents, as far as they can remember, parents have never taken

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[5] Couples increasingly resort to the latter practice allegedly for lack of means to pay for a traditional marriage celebration.

[6] In particular, the percentage of migrants, who received inter vivos gifts of land, hardly varies whether they care or not for their parents.

back a plot of land given to a child during their lifetime. The rationale of such a rule is evident from an incentive viewpoint, but the implication is that parents may not punish a child with whom they are in conflict by rescinding a gift of land. Parents are also unable to enforce transfers from their children, and they therefore need to keep some portion of the land for their own cultivation and subsistence until they die.

Children are eager to gain economic independence as soon as they are able to start a family. If they do not opt for migration, a pre-mortem inheritance of land is the main gateway to emancipation in local conditions where agriculture is almost the only source of living. As our field interviews again show, parents are acutely aware of this trend. Thus they repeatedly emphasized that granting land inter vivos is required to avoid serious conflicts within the family and prevent children from leaving the community on bad terms with their parents. Hence the continuous concern with the need to maintain the family cohesion.

Pre-mortem gifts of land are all the more necessary as land market purchases or rentals appear to be largely conditional on prior possession of inherited land. Evidence from the sample communities shows that 82 percent of those couples which benefited from a pre-mortem gift of land participate in the land market, compared to only 33 percent for those which did not. One plausible interpretation of this finding is the following: by giving land pre-mortem, parents send a signal to the community that they allow the recipient to become independent and develop his or her own farm. Local residents may therefore sell or rent out land to him or her without antagonizing the parents. Exceptions to this rule may nevertheless occur − residents sell or rent out land to landless couples− if parents accept that their children set up their own farm even though they do not have enough land to make inter vivos gifts. The above mechanism is actually embedded in the notion of community: in order to be eligible to participate in the (informal) local land market, a person needs to be recognized as an official member of the local assembly, which in turn requires that the person be married and endowed with some land.

It is also noteworthy that when parents distribute family land, they do not make selective gifts[7]: all (married) children, whether daughters or sons, are entitled to a piece of land if they are willing to accept it. Interviewed farmers stressed that pre-mortem gifts of land are not discriminatory in the sense that such gifts are made simultaneously to all (married) children so as to avoid intra-family conflict. Children, however, have the right to refuse such a gift. When

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[7] The available data for our study area do not actually allow us to assert that pre-mortem gifts of land are equal, only that the father does not give out pre-mortem land to one son while abstaining from giving to others. (see Goetghebuer and Platteau, 2010 and also Table 6, infra).

that happens, priority will be given to these children during the post-mortem bequest process. In other words, the prevailing norm is that of equal treatment of children over time (for more detailed evidence, see Goetghebuer and Platteau, 2011; Michels, 2011).

Refusal of pre-mortem gifts of land is a possibility that is generally availed of by migrant children since they may not be interested in possessing land in their native community when their parents are still alive. This is because of the substantial costs involved in monitoring its use and measuring the ensuing output (under sharecropping contracts),[8] as well as the costs of participating in the life of the community, which includes collective works (*faenas*) for the maintenance of the irrigation system and for other purposes. Upon the death of their parents, the possibility for migrants to sell the inherited land is not automatically granted. First, the migrant should be recognized as the usufruct rights holder of the inherited plot, and second, the sale transaction should be supported by the community assembly. Numerous cases of conflict reported to us[9] attest that even the possession of official papers by the migrants may not enable them to get hold of the rights on the inherited land. The community typically requires that the migrant be known by the local assembly and recommended by some official members so that the bequest can be written down in the "libro de actas". In case the migrant does not fulfill these requirements, his/her land becomes communal land. (Note that such strictures are not specific to our Peruvian communities since they have also been observed in the Indian communities of the Bolivian Altiplano – see Michels, 2011). On the other hand, actually selling the land inherited may prove difficult owing to local land market imperfections (such as shortage of cash in the hands of willing buyers).

There is a last observation that is of relevance to the theoretical argument developed in the next section, and it pertains to the preferences of both parents and children. Parents in the sample communities have often expressed a strong desire to have their children living near to them so as to avoid emotional and physical isolation in old age and the associated subsequent stress and anxiety. Such a desire has to be reconciled with their children's own urge for autonomy, which is often reflected in conflicts about the choice of crops, the use of harvest proceeds, or other matters, and which has allegedly grown as a result of increasing land scarcity and/or growing consumption needs of the younger generations. One obvious way to achieve this, according to many household heads, is to allow children to set up their own farm (when they start a family) on a portion of the family land given to them pre-mortem. The hope

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[8] Fixed-rent contracts are not used, presumably because villagers are facing severe liquidity constraints arising from poverty and highly imperfect credit markets.

[9] These cases were reported to us by presidents of the sample communities as well as by some persons belonging to a local NGO ('La Casa Campesina de Cusco').

is that children would thus be dissuaded from migrating to a distant location. It bears stressing, indeed, that in the Andes, migration is typically the outcome of a decision of the concerned child (Paquot, 2005; Lavigne, 2005, for Peruvian Highlands; and, Michels, 2011 for the Bolivian Altiplano). Migration is actually frequent in the region, and children often move to cities where they settle permanently: more than 40 percent of the sample individuals are permanent migrants, and three-fourths of them live in an urban location.

3. A theory of inheritance timing

The model

We write a simple sequential decision model that can predict the choice of land inheritance timing by parents who attach importance to the proximity of their children and whose children, the only potential beneficiaries, have a strong desire for autonomy and have opportunities to migrate to distant locations. The parents choose whether they will distribute a share of the family land while still alive, or keep the whole land for bequest after their death. In doing so, they are constrained by the so-called 'Equal Treatment Norm' (ETN) which is driven by equity considerations governed by the custom. Supported by empirical evidence pertaining to lineage-based societies in general (Platteau and Baland, 2001), this norm compels the parents to equally share the family land. This also applies to the case where they decide to distribute land pre-mortem. The children, the only potential beneficiaries, choose whether to accept or reject inter vivos gifts of land, and whether to remain in the native community or migrate. When some children refuse the inter vivos gift, the ETN implies that they will be compensated upon the death of their parents.

In order to make our model easily tractable, and achieve clear predictions that focus on the effect of parental land endowment on inheritance timing, we assume that children who have migrated will automatically refuse a pre-mortem gift of land. The rationale behind this simplifying assumption is grounded is the existence of substantial transaction costs. More precisely, if a migrant would accept a pre-mortem gift of land, since he is not allowed to sell it, he would have to rent it out under some form of agrarian contract. Under uncertainty, the share contract prevails. It gives rise to incentive problems that need to be mitigated through supervision. Managing land from a migration destination is hypothesized to involve a fixed transaction cost which has the two aforementioned elements: a monitoring cost and the cost of participation in collective activities which the local community imposes as condition for possessing land in the locality (for empirical evidence on the importance of such costs in the context of the Bolivian Altiplano, see Michels, 2011).

Both components, more evidently the second one, plausibly increase with the distance between the native community and the destination of migration. There must then exists a critical distance above which migrants will not find it profitable to manage a plot of land. Those migrants will therefore refuse a pre-mortem gift of land. To assume that all migrants refuse pre-mortem bequest is, therefore, tantamount to assuming that destinations for migrants are located so far away from their native community that the fixed cost exceeds the benefits obtainable through sharecropping (even if the pre-mortem gift of land consists of the whole family endowment). [10]

Finally, we assume that children are all identical, in the sense that they have the same ability implying that they have the same exit opportunity. We do need this assumption to limit the number of possible equilibrium outcomes. However, since it is quite restrictive, we shall discuss the implications of its relaxation after presenting the results of the basic model.

Let us now turn to the specifics of the model. The household head has *N* children of whom *n* remain in the native community, either as co-workers on the parental farm, n^f, or as independent farmers working on a portion of the family land, n^i. In the former instance, male children work along with their father and obtain their labour income from him. In the latter instance, the income obtained on the independent farms entirely accrues to the children: there is no transfer from children to parents (see above). As a consequence, the household head may never distribute the whole family land in the form of inter vivos transfers. His total land endowment is denoted by A, and the total land distributed pre-mortem by A^p (with $A^p < A$). The production technology is identical across all landholdings, whether family or individual plots. It is represented by the production function $f\left(a,L\right)$, where a is the amount of land used and *L* the labour effort applied. We assume that father and children exert the same individual level of effort which we normalise to one: $l_f = l_s = 1$. We thus rule out incentive considerations such as labour-shirking by children when working with their father, an approach followed by Botticini and Siow (2003) or Guirkinger and Platteau (2011). In our model, we have indeed chosen to focus attention on the extra utility that children derive from working independently or, conversely, the loss of utility from which they suffer if they work with their father.

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[10] One could have assumed, alternatively, that all rural or close migrants accept pre-mortem gifts while all urban or distant migrants reject them.

The father is assumed to be selfish, yet his utility does not depend only on his own consumption, c_f, but also on the number of children who stay in the native community, *n*. The underlying idea is that the family head is sensitive to the presence of children around him because he values the physical proximity of his (male) descendants. We represent his utility function as $U_f\left(c_f, n\right)$. The utility of a child, written as $U_s\left(c_s, \alpha\right)$, also has two arguments: it depends both on his consumption, c_s, and on his desire for autonomy represented by the parameter α. When the child continues to live and work on the family farm, $\alpha = 1$, and when he is either an independent farmer working on a portion of the family land or a migrant, $\alpha = \overline{\alpha} > 1$. Finally, each child has an alternative labour income opportunity under the form of a wage, w, that he can earn as a migrant.

Let us now describe the timing of the game. In the first period, the father announces to his children the amount of land which he is willing to give out pre-mortem, and the consumption level for the children remaining on the parental farm. Since inter vivos transfers of land are aimed at enabling children to set up their own independent farm, the ETN implies that when $A^p > 0$, it is equally divided among all the children who accept the land transfer, and that the number of children working with the father on the family land becomes zero, $n^f = 0$. On the other hand, if $A^p = 0$, no child is able to set up an independent farm within the native community, $n^i = 0$. In the second period, all the children maximise their utility by taking the choices of the other children as given. A child chooses amongst three actions: (1) he stays in the family farm; (2) he sets up an independent farm in the native community; and (3) he migrates (and refuses any pre-mortem gift).

In the third period, the ETN implies that all migrant children are given priority when the land which had been kept for his own use by the father is bequeathed upon his death. This may mean, for instance, that all the remaining land is shared among the migrants who are willing to accept the bequest, yet only to the extent that their share does not exceed the share accruing to the brothers residing in the native community (or nearby). If the latter are awarded additional amounts of land upon their parents' death, they can be said to benefit from both pre- and post-mortem bequests.

The timing of the game can be summarized as follows:

(1) The father announces A^p and c_s (with $s = 1...N$) under the ETN constraint.

(2) Children decide whether to migrate or remain to live in the native community. If they make the former decision, they refuse any pre-mortem gift of land (by assumption) while if they make the latter, they always accept such a gift (because it is rational for them to do so).

(3) Father dies and the remaining family land, $A - A^p$, is given in priority to children who have not yet accepted any share (migrants).

To find the outcome of the game, we solve it by backward induction. The father anticipates the reaction of his children (whether to accept or refuse a pre-mortem share of the family land and whether to migrate or not) when announcing his decision to give out land pre-mortem A^p, and defining c_s.

Formally, we write the father's maximisation problem, given that each child has an identical reservation utility, $\underline{u}_s$, as follows:

$Max_{A^p, c_s} U_f \left\{ c_f, n \right\}$ where $c_f = f\left(A - A^p, l_f + n^f l_s\right) - n^f c_s$ subject to:

(1) The problem of each child

$\underset{d \in \{1,2,3\}}{Max} U_s^d$, for $s = 1...N$, with

$U_s^1 = U_s \left\{ c_s, 1 \right\}$ if the child stays on the family farm;

$U_s^2 = U_s \left\{ f\left((\frac{A^p}{n}, l_s \right), \overline{\alpha} \right\}$ if the child sets up an independent farm in the native community;

$U_s^3 = U_s \left\{ w, \overline{\alpha} \right\} = \underline{u}_s$ if the child migrates.

(2) The ETN: $A^p > 0 \Rightarrow c_s = 0 \; and \; n^f = 0 \Rightarrow n^i = n \; with \; N \geq n \geq 0$

(3) $c_f > 0$; $c_s > 0$

Possible inheritance timing outcomes

The purpose of the theoretical exercise is to find conditions under which the father may prefer to distribute pre-mortem a portion of his land between his children rather than keeping the family land property as a whole until his death. For the model to become analytically tractable, we take specific functional forms that are as favourable as possible to collective production on the family field (increasing returns to scale[11]). In this way, we will be able to make an *a fortiori* case for the possibility of a pre-mortem division of (part of) family land assets in the event that it turns out to be a feasible option.

Technology on the family field and on any independent farm are respectively described by the following functions:

$f(a,L) = f\left(a, l_f + nl_s\right) = a\left(1+n\right)$;

$f(\frac{A^p}{n}, l_s) = \frac{A^p}{n}$.

The utilities of both the father (U_f) and the child (U_s) are depicted by a Cobb-Douglas function:

$U_f\left(c_f,n\right) = \left[(A-A^p)\left(1+n^f\right) - n^f c_s\right]^{\beta} n^{1-\beta}$;

$U_s\left(c_s,\alpha\right) = \alpha\ c_s$ with $\alpha = 1$ if the child works on the parental farm; and

$\alpha = \overline{\alpha} > 1$ if he works independently or migrates.[12]

To solve the model, we deal separately with two mutually exclusive regimes: (a) the *regime of family production* when $A^p = 0$, in which only post-mortem bequest occurs; and (b) the *regime of pre-mortem division* when $A^p > 0$, which always implies a post-mortem bequest of the plot cultivated by the parents themselves. Since the father maximises his own utility, the participation constraint is binding, implying that

$U_s(c_s,1) = c_s = \underline{u}_s$ if $A^p = 0$; and that

$U_s(f\left(\frac{A^p}{n}, l_s\right)_s, \overline{\alpha}) = \overline{\alpha}\frac{A^p}{n} = \underline{u}_s$ if $A^p > 0$

(a) Under the *regime of the family production*, the father maximises his utility $U_f\left(c_f,n\right) = \left[A\left(1+n\right) - n\underline{u}_s\right]^{\beta} n^{(1-\beta)}$ with respect to n.

We have: $\frac{\partial U_f}{\partial n} = n^{-\beta}\left[A(1+n) - n\underline{u}_s\right]^{\beta}\left[n\beta\left(A-\underline{u}_s\right)\left(A\left(1+n\right) - n\underline{u}_s\right)^{-1} + \left(1-\beta\right)\right]$

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[11] This assumption is not as odd as it may appear at first sight. Bear in mind that land pressure is quite strong in our sample communities as reflected in the following figures: on average a family cultivates 1,538 square meters (in equivalent irrigated land units) per member.

[12] We assume that the son's utility is linear for simplicity. Assuming an increasing and concave utility function as the one considered for the father does not change the central results (the share of the parental land given pre-mortem is exactly the same).

This expression is inferior or equal to zero if $A < \underline{u}_s$ but is unambiguously positive if $A \geq \underline{u}_s$.

Two cases therefore need to be distinguished:

(i) When $A < \underline{u}_s$, there are three values of *n* which yield $\frac{\partial U_f}{\partial n} = 0$, yet only one of them corresponds to a maximum.

The first value, $n^* = 0$, implies U_f=0.

The second value, obtained by setting the first term between brackets equal to zero, is $n^* = \frac{A}{\underline{u}_s - A}$ (positive if $A < \underline{u}_s$). The meaning is straightforward: since the numerator is the (constant) marginal productivity of individual labourers and the denominator is the surplus of each child's reservation utility over his individual productive contribution, the ratio measures the number of children that entirely exhausts the family production. With such a value of n^*, therefore, the father's consumption is dissipated and his utility is again nil. It is easily checked that $f(A, L) = n^* \underline{u}_s \Leftrightarrow n^* = \frac{A}{\underline{u}_s - A}$.

The third value, obtained by setting the second term between brackets equal to zero, is $n^* = \frac{A(1-\beta)}{\underline{u}_s - A}$, which is positive and corresponds to a maximum[13].

An interior solution exists because the father obtains utility not only from his consumption but also from the company or proximity of his children, thus creating a trade-off between these two considerations. Indeed, with $A < \underline{u}_s$, the family land endowment is so small that the reservation utility of each child exceeds his individual marginal productivity. As a consequence, the father will be able to retain children on the family farm only if he is ready to share with them part of his own productive contribution.

The associated value of the father's utility is equal to $U_f = A\beta^{\beta} \left(\frac{(1-\beta)}{(\underline{u}_i - A)} \right)^{(1-\beta)}$.

According to expectation, we have that $\frac{dn*}{dA} > 0$ and $\frac{dn*}{d(1-\beta)} > 0$: the optimal number of children retained by the father on the family farm increases with the size of his land

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[13] This optimal number of children remaining in the family farm, n^*, is thus comprised between zero and $\frac{A}{\underline{u}_s - A}$.

endowment, and with the weight attached to the number of staying children relative to their own consumption in the father's utility function.

(ii) When $A \geq \underline{u}_s$, we have the corner solution $n^* = N$: the family land endowment is sufficiently large to allow the father to keep all the children on the family field. The intuition is clear: since the (constant) marginal productivity of a child is higher than his reservation utility, the father is able to extract a constant surplus from each of them, and his total surplus always increases with the number of children working on the family farm.

(b) We can now shift our attention to the *regime of pre-mortem division*. When $A^p > 0$, the father maximises his utility

$U_f\left(c_f, n\right) = \left[A - A^p\right]^{\beta} n^{(1-\beta)}$, subject to $U_s(f\left(\frac{A^p}{n}, l_s\right)_s, \bar{\alpha}) = \bar{\alpha}\frac{A^p}{n} = \underline{u}_s$.

He chooses A^p and, indirectly, n since there is a minimum amount of land given pre-mortem that enables a child to achieve his reservation utility.
Three different cases need to be considered here:
(i) $A^p < \underline{u}_s \frac{1}{\bar{\alpha}}$; (ii) $A^p \geq \underline{u}_s \frac{N}{\bar{\alpha}}$; (iii) $\underline{u}_s \frac{1}{\bar{\alpha}} \leq A^p < \underline{u}_s \frac{N}{\bar{\alpha}}$.

(i) When $A^p < \underline{u}_s \frac{1}{\bar{\alpha}}$, all children refuse the pre-mortem gift and migrate since the total amount of land distributed pre-mortem, A^p, is not even sufficient to allow a single child to sustain his livelihood. Formally, $U_s\left(f\left(A^p, l_s\right), \alpha\right) = \bar{\alpha}A^p < \underline{u}_s$, implying $n^* = 0$ and $U_f\left(c_f, n\right) = 0$.

(ii) The other extreme case is obtained when $A^p \geq \underline{u}_s \frac{N}{\bar{\alpha}}$. There is enough land made available pre-mortem by the father to make it possible for all children to remain in the village and form their own family farm.

Formally, $U_s\left(f\left(\frac{A^p}{N}, l_s\right), \alpha\right) = \bar{\alpha}\frac{A^p}{N} \geq \underline{u}_s$, so that $n^* = N$.

Since the participation constraint is binding at equilibrium:

$A^p = N\underline{u}_s \frac{1}{\overline{\alpha}}$ and $U_f\left(c_f, n\right) = \left(A - N\underline{u}_s \frac{1}{\overline{\alpha}}\right)^{\beta} \left(N\right)^{1-\beta}$.

(iii) In the remaining case, $\underline{u}_s \frac{1}{\overline{\alpha}} \leq A^p < \underline{u}_s \frac{N}{\overline{\alpha}}$, a fraction only of the N children are able to become independent farmers in their native community. The others prefer to migrate and by assumption refuse the pre-mortem share of family land.

The child's utility function becomes $U_s\left(f\left(\frac{A^p}{n^*}, l_s\right), \alpha\right) = \overline{\alpha}\frac{A^p}{n^*} = \underline{u}_s$, from which we derive

$n^* = \overline{\alpha}\frac{A^p}{\underline{u}_s}$, the optimal number of children remaining in the native community, and

$U_f\left(c_f, n\right) = \left(A - A^p\right)^{\beta}\left(\overline{\alpha}\frac{A^p}{\underline{u}_s}\right)^{1-\beta}$, the father's utility.

Maximisation of the father's utility, $U_f\left(c_f, n\right)$, with respect to A^p, yields the simple expression $A^p = A(1-\beta)$. Replacing A^p with its equilibrium value, we derive the optimal number of remaining children n^* and the father's indirect utility:

$n^* = \frac{A(1-\beta)\overline{\alpha}}{\underline{u}_s} < N$ and $U_f\left(c_f, n\right) = A\beta^{\beta}\left(\frac{(1-\beta)\overline{\alpha}}{\underline{u}_s}\right)^{1-\beta}$.

We again verify that $\frac{dn^*}{dA} > 0$ and $\frac{dn^*}{d(1-\beta)} > 0$. Moreover, $\frac{dn^*}{d\overline{\alpha}} > 0$: when the children give a greater weight to independence relative to own consumption, the father can afford to reduce the amount of individual pre-mortem landholdings and with a given total amount of pre-mortem land (bear in mind that $A^p = A(1-\beta)$, which is independent of $\overline{\alpha}$), he is then able to allow more independent farms to be established.

All the above outcomes of the model are summarized in Table 1. Using the equilibrium value of A^p, the conditions associated to each regime have been expressed in terms of the key parameters of the model: total family land endowment, *A*; the children' reservation utility, $\underline{u}_s$; the weight attached by the father to the company or proximity of his children, $\left(1-\beta\right)$; and the importance attached by the children to their autonomy and independence, $\overline{\alpha}$.

Table 1: Possible outcomes of inheritance timing

Regimes	Sub-regimes	n^*	$U_f^{\ *}$	Inheritance timing outcomes
(a) *Regime of family production* $A^p = 0$	(a.1) $A < \underline{u}_s$	$\dfrac{A(1-\beta)}{(\underline{u}_s - A)} < N$	$U_f^1 = A\beta^\beta \left(\dfrac{(1-\beta)}{(\underline{u}_s - A)} \right)^{1-\beta}$	n^* children work on the parental farm, and $N - n^*$ children migrate →*Family production+Migration* ⇒*Post-mortem bequest*
	(a.2) $A \geq \underline{u}_s$	N	$U_f^2 = \left(A(1+N) - N\underline{u}_s \right)^\beta (N)^{1-\beta}$	All children work on the parental farm →*Family production* ⇒ *Post-mortem bequest*
(b) *Regime of pre-mortem division* $A^p > 0$	(b.1) $A < \dfrac{\underline{u}_s}{\overline{\alpha}(1-\beta)}$	0	$U_f^3 = 0$	All children migrate →*Migration* ⇒ *Post-mortem bequest*
	(b.2) $\dfrac{\underline{u}_s}{\overline{\alpha}(1-\beta)} \leq A < \dfrac{N\underline{u}_s}{\overline{\alpha}(1-\beta)}$	$\dfrac{A(1-\beta)\overline{\alpha}}{\underline{u}_s} < N$	$U_f^4 = A\beta^\beta \left(\dfrac{\overline{\alpha}(1-\beta)}{\underline{u}_s} \right)^{1-\beta}$	n^* children create their own farm, and $N - n^*$ children migrate →*Pre-mortem division+Migration* ⇒*Pre&post-mortem bequest*
	(b.3) $A \geq \dfrac{N\underline{u}_s}{\overline{\alpha}(1-\beta)}$	N	$U_f^5 = \left(A - \dfrac{N\underline{u}_s}{\overline{\alpha}} \right)^\beta (N)^{1-\beta}$	All children create their own farm in the village →*Pre-mortem division* ⇒ *Pre&post-mortem bequest*

The effect of land endowment and outside options

We are now in a position to seek an answer to the central question that motivated our theoretical foray: what is the influence of land endowment on the decision to distribute land pre-mortem? So far, we have identified the conditions under which the regimes of pre-mortem and exclusively post-mortem division, as well as the associated sub-regimes, can exist. What we need to do now is to compare the utility of the father under the two regimes, through a comparison of the relevant sub-regimes (defined in Table 1), as we increase A parametrically holding $\underline{u}_s$ constant, so as to be able to rank them. Bear in mind that for the regime of family production, there are two sub-regimes depending on whether A is higher or smaller than $\underline{u}_s$. For the regime of pre-mortem division, however, the situation is more complex: there are now three possible sub-regimes the boundaries of which are determined not only by $\underline{u}_s$ but also by the values of the other parameters of the model (N, α and β). Since our objective is to derive the optimal outcome of inheritance timing while increasing the family land endowment from 0 to +∞ holding $\underline{u}_s$ constant, three scenarios emerge as theoretically possible which are defined by different conditions on N, α and β.

- Scenario I: $\bar{\alpha}(1-\beta) > N$, which implies $\underline{u}_s > \frac{N\underline{u}_s}{\bar{\alpha}(1-\beta)}$
- Scenario II: $N > \bar{\alpha}(1-\beta) > 1$, which implies $\underline{u}_s \in \left[\frac{\underline{u}_s}{\bar{\alpha}(1-\beta)}, \frac{N\underline{u}_s}{\bar{\alpha}(1-\beta)}\right]$
- Scenario III: $N > 1 > \bar{\alpha}(1-\beta)$, which implies $\underline{u}_s < \frac{\underline{u}_s}{\bar{\alpha}(1-\beta)}$

To illustrate the analytical method followed to derive optimal sub-regimes corresponding to different values of A, we focus on Scenario II.

When $A < \underline{u}_s$, the relevant father's utility under the sub-regime of family production (a.1) is U_f^1 (see Table 1, supra) which must be successively compared to the father's utilities, U_f^3 and U_f^4, under the relevant sub-regimes of pre-mortem division, (b.1) and (b.2). Sub-regime (b.3) is ruled out because the condition characterizing Scenario II, $N > \bar{\alpha}(1-\beta) > 1$, makes the conditions defining sub-regimes (a.1) and (b.3) incompatible. When $A \geq \underline{u}_s$, U_f^2 becomes the relevant father's utility under the sub-regime of family production (a.2) that must be compared to U_f^4 and U_f^5 under the relevant sub-regimes of pre-mortem division, (b.2) and (b.3). (See Table 1, supra and Appendix A.1, Scenario II)

Beginning with the former set of comparisons, it is evident that, when $\bar{\alpha}\left(1-\beta\right)>1$ (such as is true in Scenario II), the condition associated with (b.1) is binding vis-à-vis that associated with (a.1). The first interval of variation of *A* is, therefore, $A\in\left[0,\frac{\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)}\right[$. In that domain, the utility of the father under (a.1) obviously exceeds that obtained under (b.1): $U_f^1>U_f^3$. Family production combined with migration is the optimal sub-regime.

When $A\in\left[\frac{\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)},\underline{u}_s\right[$, the relevant comparison is between U_f^1 and U_f^4. The ranking of the two sub-regimes now appears to depend on the location of A relative to the threshold, $\frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}$. We first examine the instance in which this threshold belongs to the above interval. It is straightforward that, if $A\in\left[\frac{\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)},\frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}\right[$, $U_f^1<U_f^4$: pre-mortem division combined with migration prevails over family production combined with migration. The opposite outcome ($U_f^1>U_f^4$) is obtained if $A\in\left]\frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}},\underline{u}_s\right[$. Finally, if the value of the threshold is such that $\frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}<\frac{\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)}$, we find that $U_f^1>U_f^4$ on the interval $\left[\frac{\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)},\underline{u}_s\right[$.

Note that the value of the threshold $\frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}$ can never be greater than $\underline{u}_s$, since $\frac{\left(\bar{\alpha}-1\right)}{\bar{\alpha}}<1$.

When the value of A is further raised so that $A\in\left[\underline{u}_s,\frac{N\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)}\right[$ or $A\in\left[\frac{N\underline{u}_s}{\bar{\alpha}\left(1-\beta\right)},+\infty\right[$, we show that $U_f^2>U_f^4$ and $U_f^2>U_f^5$, respectively. In other words, when $A\geq\underline{u}_s$, family production always dominates the pre-mortem division regime, implying that all or at least some children remain in the community to work on the parental farm rather than being allowed to set up their own farm.

All these results, as well as those pertaining to Scenarii I and III, are proven in Appendix A.2 and summarized in Table 2. It is noteworthy that the equilibrium outcomes achieved when $\underline{u}_s$ is decreased from $+\infty$ to 0, holding A constant, are exactly identical to those obtained when A is increased from 0 to $+\infty$, holding $\underline{u}_s$ constant.

<u>Table 2</u>: Possible sequences of equilibrium outcomes of inheritance timing as land endowment becomes larger holding the children' reservation utility constant, or vice-versa.

Scenarii	Conditions	Outcomes as *A* gradually increases
Scenario I	(I.1) $\alpha(1-\beta) > N > (\alpha-1)(1-\beta) > 1$	Family production combined with (high rate of) migration ↓ Pre-mortem division combined with migration* ↓ Family production combined with (low rate of) migration ↓ Pre-mortem division* ↓ Family production
	(I.2) $\alpha(1-\beta) > (\alpha-1)(1-\beta) > N > 1$	Family production combined with migration ↓ Pre-mortem division combined with migration* ↓ Pre-mortem division* ↓ Family production
	(I.3) $\alpha(1-\beta) > N > 1 > (\alpha-1)(1-\beta)$	Family production combined with migration ↓ Pre-mortem division* ↓ Family production
Scenario II	(II.1) $N > \alpha(1-\beta) > (\alpha-1)(1-\beta) > 1$	Family production combined with (high rate of) migration ↓ Pre-mortem division combined with migration* ↓ Family production combined with (low rate of) migration ↓ Family production
	(II.2) $N > \alpha(1-\beta) > 1 > (\alpha-1)(1-\beta)$	Family production combined with migration ↓ Family production
Scenario III	(III.1) $N > 1 > \alpha(1-\beta)$	Family production combined with migration ↓ Family production

*Pre-mortem division combined or not with migration implies post-mortem bequest as well, since we assume that parents always keep land for their own subsistence until they die.

What are the central lessons from Table 2? First, when land is very abundant, or the children' reservation utility very low, no land is distributed pre-mortem by the father, and all children work on the family farm. At the other extreme, when land is very scarce, or the children' reservation utility very high, there is again no pre-mortem bequest, and a fraction of the children, possibly all of them, opt for migration. Second, except under Scenario III and the second case of Scenario II, pre-mortem division of land, combined or not with the migration of some children, is a possible outcome for intermediate values of the family land endowment or the children' reservation utility. Third, because they can be combined with the migration of a varying number of children, the two regimes, family production and pre-mortem division, do not necessarily follow each other in a linear manner. Thus, in the first variant of Scenarios I and II, family production combined with migration can be both superior and inferior to pre-mortem division combined with migration, as the value of A is increased (or the value of $\underline{u}_s$ is decreased). Fourth, when pre-mortem division combined with migration and pre-mortem division without migration are two feasible regimes, the former always occurs for lower values of land availability.

To sum up, whenever it is observed, pre-mortem division of land only occurs for intermediate values of either parental wealth or children's reservation utility. Moreover, it may be combined with migration of some children or not. We therefore write the following prediction regarding the effect of land endowment on the existence of pre-mortem land inheritance.

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Prediction 1: *Inter vivos transfers of land are likely to occur only for intermediate values of family land endowment or the children's reservation utility. When land is abundant, or when the reservation utility is low, family production is the equilibrium regime whereas, when land is scarce or the reservation utility is high, family production combined with (high rate) migration is the dominant outcome.*

The underlying intuition is the following. When land is very scarce or when children's reservation utility is very high, the amount of land given out pre-mortem or the level of consumption offered to children working on the parental farm would need to be so high to prevent children from migration that it is optimal for the parents to let at least some children migrate, and to keep most of the land for their own subsistence. At the other extreme, when land is plentiful or when children's reservation utility is very low, parents are able to offer their children an income from work on the family farm which is high enough to compensate their loss of autonomy, so that children remain in the parental farm. For intermediate values of land availability, it is more profitable for the parents to satisfy the children's participation constraint by allowing all or some of them to farm independently on portions of the family land than by keeping them on the parental landholding and depriving them of the benefits of autonomy. To put it in another way, the cost of the latter option in terms of consumption level to be granted to co-working children becomes too high when the amount of land available is sufficiently large, yet not too large.

Prediction 1 is put to test in the empirical section which follows. In order to check that the story behind this prediction is valid, we check whether one of the key assumptions of the model is supported by our data: the tendency of migrant children to refuse pre-mortem gifts of land because of the existence of substantial transaction costs. Based on this hypothesis, we derive a second prediction[14] concerning the impact of migration on inheritance timing:

Prediction 2: *Migrants are less likely to benefit from inter vivos land gifts than staying children and, among the former, distant migrants are less likely than close migrants to benefit from these gifts.*

A last point is in order before turning to the empirics. For the sake of simplicity, we have assumed that children are identical. Let us now relax this assumption and consider the case where there are two types of children, high- and low-ability children, and where the parents can perfectly distinguish between these two types. If, on the one hand, differences in ability are reflected in reservation utilities –children of high ability have better income opportunities through migration−, parents will let high-ability children leave the community and retain low-ability children whether they opt for pre-mortem gifts of land or not. At least, this will be so provided that parents do not prefer the presence of high-ability children near them ((1-β) is identical for the two types). However, the selection issue involved should not modify the effect of land endowment on the incidence of various regimes as derived above.

If, on the other hand, high ability is taken to mean higher labour productivity in agriculture and if reservation utilities do not differ between the two types of children, the selection will operate in the opposite way. But, again, this should not affect our comparative-static results

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[14] For simplicity we call it "prediction 2", even if this prediction is derived from an assumption of the model and not from the model itself.

in any essential manner. Therefore, taking into account the children's ability would not add major insights regarding the effect of parental wealth on inheritance timing.

4. An application to the Peruvian highlands

The sample

Detailed data on inheritance practices were collected in 2002, in three Andean communities located at varying distances from Sicuani (a small town, on the railway line between Cusco and Puno, South of Peru), and at various ecological (altitude) levels. Sunchochumo (henceforth labelled Suncho) is the closest community from Sicuani (more or less 30 minutes to connect the two places by regular bus), and the one at the lowest altitude (between 3530 m and 3700 m above sea level). Pumaorcco (henceforth labelled Puma) is situated at an altitude between 3820 m and 4350 m, and at more or less an hour by bus from Sicuani (one up to four buses a day). From Sicuani, it takes at least 2 hours to reach the third and highest community (from 4000 m and above), Pataccalasaya (henceforth labelled Pata)[15].

Since we were interested in inheritance practices, our data collection strategy consisted in recording family stories (FS) by interviewing couples with children. The households were randomly selected and both spouses were separately queried about the land division among them and their siblings, as well as the timing of the division of their parental land. The couple was also questioned about the timing and the division of their land among their own children. Overall, 80 three-part questionnaires (the first one concerning the husband's family, the second one for the wife's family and the third part concerning the couple's children) were administered. After removing the redundant cases[16], we are left with a sample of 218 FS. Inquiring about a particular FS implies that information was collected for all the children involved in a bequest (either the children of the selected couple or the selected spouse and his/her siblings). They form our individual-based dataset which contains information about gender, age, place of origin and residence, education level, parental wealth, timing and division patterns of inheritance for 1011 individuals (326 in Suncho, 383 in Puma, and 302 in Pata). We should keep in mind that 40% of the FS are about completed inheritance processes (either parents are dead or they have bequeathed all their land estate). In the remaining cases,

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[15] For more detailed information about the sample communities, see Goetghebuer and Platteau (2010).

[16] The same FS was thus told by two different persons, as we interviewed parents and one of their children; or two siblings.

the collected data concern partially completed inheritance or bequest plans (usually when parents are very young).

Before presenting our key variables, it must be emphasized that the limited size of our sample is entirely the result of time and cost constraints inherent to the study. Indeed, such a study involves many subtle questions that take a lot of time to clarify in front of the respondents, and need careful attention and vigilance on the part of the enumerator. To ensure the maximum reliability of the information gathered, the author conducted all the interviews from beginning to end, and was always accompanied by a translator (Spanish-Quechua). Born and living in the village surveyed, this person was an educated facilitator ("tecnico campesino") trained by ITDG.

Key variables

The objective of this section is to briefly define the main variables used in the empirical analysis. We successively define migration, parental wealth, education, and the timing of land bequest.

Migration can either be temporary (e.g. for work during the dry season) or permanent depending upon whether the peasant continues to reside in the native community. We only consider the latter type of migrants. In our sample, 42.3% of the individuals above 15 years old[17] have established themselves durably in another location within the country[18] (54% in Suncho; 41% in Puma; and 30% in Pata). Peasants can move to another rural area (25% of the sample individuals) or to an urban location (75%), to a place close (walking distance) or rather remote (31% and 69%, respectively) from their native community.

Regarding parental wealth, only a subjective assessment of a household's wealth is available in our data for the complete sample. Indeed, details about the total land amount in the hands of the parents before the division takes place could only be obtained for the interviewed couples. To gather the subjective information on parental wealth, the president of each community, after having been explained the importance of taking all dimensions of wealth (land, cattle, house, consumption level…) into account, was asked to sort the sample households into one of the three following categories: relatively rich, intermediate, relatively poor. This exercise was made in the presence of the translator-enumerator (also a member of the surveyed community), one or several knowledgeable (usually old) villagers, and the

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[17] All children below the age of 15 have been removed since they have presumably not made their decision about migration yet (see Goetghebuer and Platteau, 2010).

[18] None of the individuals from our survey lives outside Peru.

author. In order to check whether our subjective variable is coherent with objectively measured wealth, we have compared it with the actual landholdings of the interviewed couples, an information available for a third of the sample. Fortunately, the relationship between these two indicators turns out to be significantly positive (whether the land amounts are measured per capita or not), suggesting that it is legitimate to infer wealth for the whole sample from our subjective measure (see Goetghebuer and Platteau, 2010: Table 5). Moreover, it is reassuring that there is also a strong, positive correlation between this subjective measure and average education at family level.

The average level of education is low: only 6.5 years of study for the sample men and 4.6 for the sample women (5.6 years for the whole sample). As many as 22% of the whole sample did not receive any education, and 80% of them did not complete their secondary school. As expected, school enrolment is smaller for girls, and migrants (7.4 years of education), especially urban migrants (8.2 years), are far more educated than children remaining in the native community (4.2 years).

Let us now turn our attention to the dependent variable, the timing of land bequests. From our individual data, we know when each sibling listed in the survey received or will receive a portion of family land, pre-mortem (typically on the occasion of his/her wedding and/or when the couple starts to live together)[19] and/or post-mortem. Since we did not query about the precise amount of land that individuals received at each moment (except for the couples who were directly interviewed), and since the sample is too small to allow us to distinguish between these various moments, we rely on the simple pre-mortem versus post-mortem distinction (whether the individual has received a parcel of land when his/her parents are both alive, or upon a parent's death). Four different outcomes are thus possible: 0- no land inheritance; 1- the bequest is entirely in the form of inter vivos gifts of land; 2- it is entirely received post-mortem; 3- both forms are used.

The original sample has been skimmed in order to eliminate the families for which wealth could not be assessed, those which do not possess any amount of land, and those in which children have not started or completed school, and/or in which all the children are less than fifteen years old. In the latter circumstances, indeed, no division of the family land has

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[19] We encountered many couples who were not married, yet have been living together for years. These couples were unable to meet the expenditure involved in the celebration of marriage at the beginning of their relationship, and they did not know if they would be able to celebrate it one day. It is nevertheless important that the proportion of "*conviviente*" does not significantly differ between 'relatively wealthy' and 'relatively poor' families. This is a reflection of the fact that being 'wealthy' is a relative concept in our context of communities that are generally poor or very poor.

occurred yet, and any bequest plan is likely to be revised by the parents after their children will have completed their education and decided whether to stay in the community or migrate. The final size of our individual-based sample is 669 units. Inspection of the values of the dependent variable for these data shows that: (i) about 40 percent of the sample do not receive any land until their parents pass away; (ii) about 23 percent receive all their land bequest when parents are alive; (iii) about 21 percent receive it before and after their parents' death; and (iv) the remaining 15 percent are deprived of any land inheritance (see Table 3).

Table 3: Frequencies of the timing of the land bequest

Timing	Observations	Frequencies (%)
0. No inheritance	98	14.65
1. Pre-mortem bequest only	156	23.32
2. Post-mortem bequest only	271	40.51
3. Pre- and Post-mortem bequest	144	21.52
Total	669	100.00

To avoid problems of sample selection bias, individuals with no inheritance are not removed from the sample used in the econometric analysis. But since there is no attendant issue of inheritance timing, the results that concern them will not be discussed (for more details, see Goetghebuer and Platteau, 2011).

Preliminary evidence

Before relating the regime of inheritance timing to parental wealth, it must be stressed that in the sample communities our observations do not span the whole spectrum of wealth values. Indeed, the families that figure out as 'rich' families are so only in relative terms when compared with really land-hungry families which are considered poor. They do not, therefore, genuinely represent the category of rich households as conceived in the theoretical part, but look more like the families of intermediate wealth. If we thus adapt Prediction 1 to our context, it becomes: *staying children from relatively 'rich' families tend to receive more inter vivos gifts of land than those who have relatively poor parents.*

Using the restricted sample of interviewed couples from whom we know the exact amount of land endowment, we find that the average size of parental land endowment per child is perceptibly larger for families who combine pre- and post-mortem inheritance than for those who practice post-mortem bequest only (4,318 against 3,100 square metres measured in equivalent irrigated land). Using the whole sample for which only the subjective measure of wealth is available, we observe that pre-mortem land bequests occur in more than four-fifths of the 'rich' families while the same proportion for the poor families is smaller than two-thirds (the difference is statistically significant). Moreover, when attention is restricted to the treatment of married and staying children, a striking difference between rich and poor families emerges: while the proportion of rich families in which land inheritance was exclusively post-mortem is 23 percent, the proportion of poor families in the same situation is as high as 40 percent (see Table 4).[20]

Table 4: Relationship between parental wealth and inheritance timing, using the family-based dataset

Timing of inheritance	Rich families	Poor families	Total
(1) All married and staying children receive a pre-mortem share of the family land (combined or not with a post-mortem bequest)	35 72.9%	24 53.3%	59 63.4%
(2) All married and staying children receive a post-mortem land bequest only	11 22.9%	18 40%	29 31.2%
(3) Some married and staying children receive a pre-mortem bequest while some others have not (or will not)	2 4.7%	3 6.7%	5 5.4%
Total	48 100%	45 100%	93 100%

Pending further confirmation from econometric testing, the hypothesis regarding the treatment of migrant children is neatly borne out by the data (see Table 5). The pattern of inheritance timing clearly differs depending on whether migrants or staying children are concerned: while only one fourth of the staying children have not received any pre-mortem bequest, this is true for as many as 60 percent of the migrants. If we do not take into account children excluded from inheritance, the contrast is even more striking when migrants are regrouped according to the distance between the native village and the place of destination: 70 percent of the close migrants (67/96) have not received any pre-mortem bequest against 89 percent of the distant migrants (103/116).

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[20] It may also be remarked that the practice of unequal treatment of children in regard to pre-mortem bequests is rare (see Table 4, line (3)).

Table 5: Land inheritance timing according to migrant status, distinguishing between close and distant migrant

Timing	Non migrants	Migrants	Close migrants	Distant migrants	Total
0. No inheritance (no timing)	19 (5.0%)	79 (27.1%)	18 (15.8%)	61 (34.5%)	98 (14.6%)
1. Pre-mortem bequest only	135 (35.7%)	21 (7.22%)	14 (12.3%)	7 (3.9%)	156 (23.3%)
2. Post-mortem bequest only	101 (26.7%)	170 (58.42%)	67 (58.8%)	103 (58.2%)	271 (40.5%)
3. Pre- and Post-mortem bequest	123 (32.5%)	21 (7.22)	15 (13.2%)	6 (3.4%)	144 (21.5%)
Total	378 (100.0%)	291 (100%)	114 (100.0%)	177 (100.0%)	669 (100.0%)
Chi2 test: P-value	0.000		0.000		

A last observation concerning the prevalence of the pure family production regime[21] deserves to be made. Since our theory predicts that this regime should be adopted by the richest families and since we argued that very rich families do not exist in our sample communities, it is interesting to note that such a regime is rarely observed. It concerns only 8 out of 110 families. All of them are headed by very old parents (more than 75 years old), have few children (two or three), and only two out of eight belong to the 'rich' category. This latter observation does not support the theoretical prediction but since we rely on an extremely small sample, we cannot conclude anything. A plausible interpretation would be that pure family production regime was the norm before land pressure increased (therefore a norm adopted by the older generations).

Econometric testing

In this section, we aim at putting our two predictions to test. Bearing in mind the situation of relative poverty in our sample area (as explained above) and the dichotomous nature of our wealth variable, we expect staying children from poor families to receive their land inheritance upon parent's death and, pre-mortem inheritance to be observed among the so-called 'rich' families (adjusted Prediction 1). Since the theory also predicts that pre-mortem inheritance is influenced by exit opportunities, it is important to control for them. In the context of the Andean communities, the level of education achieved is probably a good proxy for reservation utility, as attested by the strong correlation obtained between migration and the number of years of study (see Section 4 above). Regarding Prediction 2, we test the impact of

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[21] Post-mortem inheritance only, unaccompanied by migration

transaction costs on inheritance timing by distinguishing between staying and migrant children, on the one hand, and between distant and close migrants amongst the latter, on the other hand. Note, however, that even if this test shows a positive relationship between migrant status and post-mortem bequest, it does not allow us to identify the decision maker: do migrant children refuse pre-mortem gift of land or do parents simply decide not to give them such a gift because they anticipate their children's refusal.

Since the model describes the parents' timing decisions, the most meaningful way to test the theory is by relying on our family-level dataset. The role of both migration and education will therefore be brought in by aggregating the corresponding individual characteristics. We wish to test the robustness of the results by using our individual-based dataset. Two advantages of this second step deserve to be pointed out. First, bearing in mind that the impact of wealth on inheritance timing is predicted for staying children specifically, we are able to determine whether pre-mortem inheritance is more likely to be observed for staying children from 'rich' families than for the poorer ones and for staying children than for migrants. In addition, we may split the sample into migrants and staying children. Separating out the staying children may bring to light the influence of individual characteristics other than family wealth.[22] Focusing on migrants enables us to check whether distance between the location of the native community and migration destination affects the occurrence of pre-mortem inheritance, as predicted by the transaction-cost approach.

The econometric model applied to our family-based dataset is a simple probit model whereas a multinomial probit model is estimated on the basis of the individual-based dataset. The inheritance timing function estimated at the family level is:

$$FamilyT_j = \alpha + \beta poor_j + \delta fam\_charact + \gamma community + \varepsilon_j \ .$$

The dependent variable, $FamilyT_j$, is the timing measure for family *j.* It takes on value one when the parents have transferred land pre-mortem to at least one of their children, and zero otherwise. The key explanatory variable is another dummy variable, labeled *poor*, which is equal to one when parents are poor, and to zero when they are relatively wealthy. *Community* is a vector of dummies which are introduced to take account of the fact that wealth is

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[22] We do not follow the alternative course of interacting the non-migrant status variable with some other explanatory variables because we are unable to apply Norton, Wang and Ai (2004)'s estimation technique for non linear models with interaction term. They, indeed, propose an estimation technique which allows to compute the correct coefficients, but only when a single interaction term has to be estimated.

subjectively assessed at the community level, thus making inter-community comparisons irrelevant. *Pata* is the most remote community, *Suncho* is the most accessible one, and *Puma* stands in an intermediate location. We also control for the potential influence of other family characteristics, such as the generation which is measured with a categorical variable. It is equal to one when the mean age of the family's children is above 49 years old, we call it the *Old generation*, then we have the *Intermediate generation* (average age of the children is between 35 and 49 years old), and the *Young generation* (average age of children is less than 35 years old). We also control for the *number of children* and, alternatively, for the *number of migrants* and the *number of stayings*. Finally the average education level of all the children above 15 years of age **(***mean education***)** is also introduced, and can be thought of as a proxy for the children's reservation utility.

The results are displayed in Table 6 from where it is evident that poor families have a lower proclivity to distribute land pre-mortem to their children. The coefficient of *mean education* is not significantly different from zero, and the same non-significant result is obtained when we use alternative measures, the maximum level of education achieved inside the family, in particular. Note, however, that the level education is relatively low and positively correlated with parental wealth, yet it does not become significant when parental wealth is removed from our list of explanatory variables.

In the estimation displayed in column (3), instead of controlling for the number of children, we control for the number of migrant and staying children separately. Two new results emerge. Firstly, we see that pre-mortem bequest has a higher probability to happen among the younger generations. We can interpret this result as a sign that young people attach more importance to their autonomy than older ones.[23] Secondly, parents tend to have a higher probability to give out land pre-mortem when they have numerous children staying with them, yet the number of migrant children does not seem to influence that decision.[24]

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[23] If we use a continuous (children's mean age) instead of a discreet variable to control for the influence of generation, results hold but are a bit less significant because of too much multi-colinearity.

[24] Since n*, the number of staying children, can also be predicted from our theoretical model, it would have been interesting to integrate it in our dependant variable (for example by adding categories: pre-mortem with 1 or 2 or 3 … migrants). Unfortunately, due to the small sample size, it is not relevant to create more categories in the dependent variable.

Table 6: Simple probit estimations of the inheritance timing function (Family-timing equals one if pre-mortem bequest occurs, and zero, otherwise - using the family-based dataset)

Explanatory variables	(1) *Family-timing°*	(2) *Family-timing°*	(3) *Family-timing°*
Poor parents	-0.183** (0.086)	-0.154* (0.084)	-0.141* (0.079)
Suncho	0.145 (0.092)	*Omitted category*	*Omitted category*
Puma	*Omitted category*	-0.142 (0.120)	-0.181 (0.124)
Pata	0.038 (0.096)	-0.132 (0.127)	-0.206 (0.136)
Young generation		0.182 (0.108)	0.209* (0.094)
Intermediate generation		0.082 (0.102)	0.105 (0.104)
Old generation		*Omitted category*	*Omitted category*
Number of children		0.042 (0.026)	
Number of migrants			-0.008 (0.037)
Number of stayings			0.084** (0.033)
Mean education		-0.018 (0.018)	-0.009 (0.018)
Number of observation	110	110	110
Pseudo R^2	0.054	0.102	0.146

Significant at *** 1%, **5% and * 10%. Robust standard errors in parenthesis.
° The coefficients displayed correspond to the marginal effects computed for a family who has average value in all dimensions.

Let us now move to the second step and examine our testable predictions when bequest timing is considered at the individual level. This enables us to differentiate children according to personal characteristics, such as their age, gender, education (proxy for reservation utility) [25], civil status, birth order, and, last but not least, their place of residence. Furthermore, because the sample size of the individual-based dataset is much larger than that of the family-based dataset, we are able to define the dependent variable more precisely.

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[25] In our model, reservation utilities have been assumed to be identical among all children, and the father chooses the number of migrating members but does not select who will stay and who will migrate. Exit opportunities may actually vary between children of the same family. The father then maximises his utility by letting the children with the highest reservation utility leave the native community (assuming that all children can provide him with the same utility for their company). This is consistent with the finding that migrants tend to be more educated than remaining children.

The inheritance functions which we estimate have the following form:

$$(1)\ T_{ij} = \alpha_{ij} + \beta\ staying_{ij} + \delta\ poor\_parents_j + \lambda staying * poor\_parents_{ij} + \gamma\ individual\_charact_{ij}$$
$$+\phi\ fam\_charact_j + \varepsilon_{ij}$$

$$(2)\ T_{ij} = \alpha_{ij} + \beta\ mig_{ij} + \delta\ poor\_parents_j + \gamma\ individual\_charact_{ij} + \phi\ fam\_charact_j + \varepsilon_{ij}$$

T_{ij} stands for the timing of land bequest of child *i* from family *j*. It is a categorical variable which can take on four different values: 0- if no land inheritance is expected; 1- if the bequest is entirely in the form of an inter vivos gift; 2- if is entirely received post-mortem; and 3- if both forms are used. The explanatory variables are the following: mig_{ij} is a dummy indicating whether he (she) is a permanent migrant; $individual\_charact_{ij}$ is a vector of other personal characteristics; $poor\_parents_j$ is the (subjective) parental wealth variable which equals one if parents are 'poor' and zero, if it is a so-called 'rich' family; fam_charact$_j$ is a vector of other characteristics of the family; and ε_{ij} is the error term clustered at family level.

Before turning to the results, we want to discuss some potential endogeneity problems. First, if parents simultaneously select which children migrate and decide the timing of land bequest, we have an endogeneity problem: our migration related variable would then be correlated with the residuals. For our study area, however, several studies have shown that migration decisions appear to be taken mainly by the children themselves (Goetghebuer and Platteau, 2010: 79; Paquot, 2005; Lavigne, 2005). In a particularly detailed study, conducted in neighbouring Bolivia, Michels (2011) has analysed migration decisions in the light of data collected from both parents and children. In most instances, the children and not parents appear to decisively influence the migration decision.

Second, if a child migrates because he anticipates that he will not receive any pre-mortem share of the family land, we have a problem of reverse causality.[26] Since there is no instrument available in our data which could be used to prove the causality, we are not able to rule out this scenario. We therefore show correlations and argue that migrants have an influence on inheritance timing. This being said, our qualitative interviews strongly suggest that the causality runs in the direction represented by our econometric specification. If children may decide to migrate because they anticipate that too little land will be left for them to cultivate (owing to the small endowment of their parents relative to the number of potential heirs), they do not seem to anticipate a negative discrimination ex ante whether at the level of

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[26] Note that in our theoretical model, a child migrates because he anticipates that the share given pre-mortem by the parents will not enable him to have a decent life if he remains.

bequest shares or inheritance timing. In the aforementioned study on Bolivia, migrants are shown to play an active role in choosing the moment they make access to family land. Revealingly, even when parents are dead, migrants usually try to persuade their siblings to postpone the official distribution of family land so as to avoid bearing the resulting transaction costs.

Third, if parents simultaneously decide which children are going to get educated and which ones will be compensated through inter vivos gifts of land, or if they see land bequest as a way to compensate children who fail at school, another endogeneity problem arises. We have argued elsewhere that in our study area, however, no genuine selection mechanism appears to be at work for education (Goetghebuer and Platteau, 2010: 80). There is no evidence that parents consider land bequest and education as perfect or partial substitutes In-depth discussions with the respondents and field observations reveal that parents tend to encourage all their children to pursue studies as a way of escaping poverty and increasing their social and economic stability. However, parents are aware that their children's chance to find a good job in town is small because the quality of schooling is extremely low in the countryside, and that Andean peasants are strongly discriminated against in cities.

Table 7 presents the results of our multinomial probit estimation of the timing for inheritance function using the whole sample. In column (1), we directly test the theoretical prediction regarding the impact of wealth by interacting the wealth measure with the place of residence of the child (*staying*poor*). In column (2) we give more attention to the second prediction regarding the role of migration. Toward that purpose, we leave out the above interaction term and redefine the location characteristic of the children by using the *migrant* binary variable. Table 8 re-estimate the inheritance timing equation for staying children (column 1) and for migrants (column 2) separately.

Our explanatory variables are the following. *Staying* is a binary variable which is equal to one if the child remains in the native community and zero if he (she) is a migrant. For some estimations, we re-define this variable and label it *Migrant,* a binary variable taking on value one if the child is a migrant and zero otherwise. Alternatively, we use the variable *Distant migrant* which takes on value two if the child lives in a location further away than one day walking from the native community, value one if he (she) has migrated to a nearby location, and, zero if he (she) has not migrated. *Daughter* is a dummy with values one for a daughter and zero for a son. We also control for birth order with a discrete variable comprising three possible categories: *Eldest child*, *Intermediate position*, or *Youngest child*.[27] *Years of education* is a continuous measure of the number of years a child has been at school.[28] *Married/cohabiting* measures the civil status and is equal to one if the individual lives with a spouse. In Goetghebuer and Platteau (2010), where the determinants of exclusion from inheritance are systematically explored, the children's caring attitude toward their parents has been shown to significantly reduce the probability of exclusion. Since children excluded from land bequest are considered in our sample, a (binary) measure of child's c*aring attitude* is therefore included in the list of independent variables: it is equal to one if the child maintains more or less regular contact with the parents regardless of whether he (she) provides material support, and zero otherwise.[29] We also control for the parental wealth with a variable labelled *poor parents*, it takes on value one if parents are poor and zero if they are relatively wealthy. Finally, the generation to which an individual belongs is identified by computing the mean age of a family's children (or alternatively by a continuous variable indicating the age of the individual). Three different categories are distinguished: the *Old generation* (more than 49 years old), the *Intermediate generation* (between 35 and 49 years old), and the *Young generation* (less than 35 years old).

Primary results

Results shown in Table 7, column (1) confirm our theoretical prediction regarding the influence of parental wealth on the inheritance timing of the children remaining in the native community: staying children who have relatively poor parents have a higher probability to receive all their land post-mortem compared to staying children from relatively rich families. The latter tends to receive their share of the family land both as pre- and post-mortem bequests or only as pre-mortem inheritance. When we restrict our analysis to the sub-sample of staying children (Table 8, column 1), the results are the same.

The combined results of the probit model run on the family-based dataset and the multinomial probit model estimated on the individual-based dataset thus confirm proposition 1 and may be summed up as follows: staying children from poor families are less likely than those from richer families to benefit from pre-mortem transfers of parental land.

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[27] We also use a continuous measure of birth order.

[28] An alternative measure of education that takes into account the financial contribution of the parents is also used.

[29] For more details on the caring variable, see Goetghebuer and Platteau, 2010.

A major result emerging from Table 7 (column 2) bears out Prediction 2: migrant children have a higher probability to receive their land inheritance upon the death of their parents than to receive the whole or part of it as a pre-mortem gift. This result is not only highly significant, but it also appears to be quite robust across various estimation models and alternative lists of explanatory variables. If we decompose the category of migrant children into distant and close migrants and estimate their influence on inheritance timing separately, we find that the probability to benefit from a purely post-mortem land bequest increases significantly with migration, especially when a child resides in distant location. The coefficient obtained for distant migrants is twice as large as the one obtained for close migrants (results not shown). Confirmation of the role played by distance between the native village and the migration destination is obtained by restricting attention to the subsample of migrant children (Table 8, column 2). Indeed, distant migrants have a smaller probability than close migrants to benefit from pre-mortem land inheritance.

Among the sample communities, Suncho is the most accessible since it is located near a large road that connects Cusco and Puno, two major cities of southern Peru. As a consequence, the transaction costs of managing and supervising the use of agricultural land are significantly lower for Suncho than for Pata and Puma. It is, therefore, not surprising that pre-mortem gifts of land are more likely to occur in the community of Suncho than in the other two communities (see Table 7, column 2 and Table 8, column 2). These latter results are evidence in support of the transaction cost approach to the timing of land bequests.

Table 7: Multinomial probit estimation of the land inheritance timing function (using the individuals-based dataset and showing marginal effects for a median individual[30])
(For the general estimations see Appendix B)

Explanatory Variables	(1)	(2)
"Post only"		
Staying	-0.531*** (0.080)	*Omitted category*
Migrant	*Omitted category*	0.418*** (0.071)
Daughter	0.058 (0.038)	0.057 (0.042)
Youngest child	0.229*** (0.067)	0.204*** (0.067)
Intermediate position	0.057* (0.035)	0.056 (0.039)
Eldest child	*Omitted category*	*Omitted category*
Years of education	0.011 (0.007)	0.011 (0.008)
Married / cohabiting	-0.109 (0.069)	-0.097 (0.067)
Caring attitude	-0.003 (0.073)	-0.016 (0.086)
Poor parents	-0.108** (0.054)	0.047 (0.068)
*Staying*poor*	0.334*** (0.111)	
Number of children	-0.005 (0.015)	-0.006 (0.017)
Suncho	-0.081 (0.065)	-0.095 (0.075)
Puma	0.020 (0.069)	0.016 (0.076)
Pata	*Omitted category*	*Omitted category*
Young generation	*Omitted category*	*Omitted category*
Intermediate generation	0.077 (0.52)	0.084 (0.056)
Old generation	0.126 (0.101)	0.135 (0.101)
"Pre+Post"		
Staying	0.353*** (0.087)	*Omitted category*
Migrant	*Omitted category*	-0.262*** (0.070)
Daughter	-0.002 (0.061)	0.006 (0.058)
Youngest child	-0.115** (0.058)	-0.080 (0.058)
Intermediate position	-0.124** (0.049)	-113** (0.048)
Eldest child	*Omitted category*	*Omitted category*
Years of education	-0.021** (0.010)	-0.020** (0.009)
Married / cohabiting	0.169** (0.069)	0.146** (0.064)
Caring attitude	0.006 (0.121)	0.040 (0.113)
Poor parents	0.030 (0.133)	-0.204*** (0.074)
*Staying*poor parents*	-0.320*** (0.086)	
Number of children	0.003 (0.020)	-0.113** (0.048)
Suncho	0.235** (0.107)	0.236** (0.108)
Puma	0.027 (0.102)	0.030 (0.098)
Pata	*Omitted category*	*Omitted category*
Young generation	*Omitted category*	*Omitted category*
Intermediate generation	-0.002 (0.070)	-0.006 (0.066)
Old generation	-0.107 (0.096)	-0.104 (0.088)

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[30] The marginal effects for an average individual are more or less similar to the ones presented for a median individual. We also computed marginal effects for special individuals and the main results hold. However, showing the results for a median individual is more relevant because we have many categorical variables.

Explanatory Variables	(1)	(2)
“Pre only”		
Staying	0.295*** (0.077)	*Omitted category*
Migrant	*Omitted category*	-0.273*** (0.068)
Daughter	-0.053 (0.054)	-0.60 (0.052)
Youngest child	-0.118** (0.060)	-0128** (0.058)
Intermediate position	0.064 (0.045)	0.052 (0.045)
Eldest child	*Omitted category*	*Omitted category*
Years of education	0.010 (0.011)	0.008 (0.010)
Married / cohabiting	0.022 (0.075)	0.037 (0.071)
Caring attitude	0.125 (0.097)	0.128 (0.094)
Poor parents	0.069 (0.127)	0.133 (0.083)
*Staying*poor parents*	-0.021 (0.118)	
Number of children	0.004 (0.022)	0.003 (0.022)
Suncho	-0.148 (0.091)	-0.134 (0.089)
Puma	-0.055 (0.094)	-0.055 (0.091)
Pata	*Omitted category*	*Omitted category*
Young generation	*Omitted category*	*Omitted category*
Intermediate generation	-0.080 (0.070)	-0.084 (0.069)
Old generation	-0.033 (0.104)	-0.047 (0.101)
“No inheritance”	Marginal effects not shown [31]	
Number of observations	669	669

Significant at *** 1%, **5% and * 10%.
Robust standard errors clustered at family level in parenthesis.

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[31] We choose not to present the marginal effects for this category because understanding the determinants of the exclusion from land inheritance is not the purpose of this paper (general results of the regressions, including results for children excluded from inheritance, are shown in Appendix B, Table B.1 and Table B.2, respectively). (For more details on that topic, see Goetghebuer and Platteau, 2010)

Table 8: Multinomial probit estimation of the land inheritance timing function (using the individuals-based dataset split into two sub-sample -staying and migrant children- and showing marginal effects for a median individual[32]*)*
(For the general estimations see Appendix B)

Explanatory Variables	(1) Staying children	(2) Migrant children
“Post only”		
Distant migrant		0.225** (0.102)
Daughter	0.028 (0.064)	0.178** (0.075)
Youngest child	0.337*** (0.082)	0.067 (0.097)
Intermediate position	0.049 (0.047)	0.027 (0.098)
Eldest child	*Omitted category*	*Omitted category*
Years of education	0.015 (0.014)	0.009 (0.011)
Married / cohabiting	-0.027 (0.108)	-0.066 (0.116)
Caring attitude	-0.278* (0.147)	0.325*** (0.106)
Poor parents	-0.146** (0.058)	-0.145 (0.110)
Number of children	0.049 (0.048)	0.008 (0.026)
Suncho	-0.065 (0.103)	0.127 (0.144)
Puma	-0.022 (0.089)	0.098 (0.133)
Pata	*Omitted category*	*Omitted category*
Young generation	*Omitted category*	*Omitted category*
Intermediate generation	0.059 (0.115)	0.001 (0.107)
Old generation	0.090 (0.109)	0.097 (0.139)
“Pre+Post”		
Distant migrant		-0.279*** (0.110)
Daughter	0.010 (0.052)	-0.109 (0.080)
Youngest child	-0.085* (0.050)	-0.071 (0.088)
Intermediate position	-0.105** (0.050)	-0.081 (0.105)
Eldest child	*Omitted category*	*Omitted category*
Years of education	-0.022 (0.012)	-0.010 (0.011)
Married / cohabiting	0.128** (0.068)	0.120* (0.073)
Caring attitude	0.100 (0.081)	0.001 (0.115)
Poor parents	-0.337*** (0.094)	0.048 (0.098)
Number of children	0.008 (0.017)	0.005 (0.028)
Suncho	0.119* (0.071)	0.224* (0.119)
Puma	0.063 (0.094)	-0.062 (0.121)
Pata	*Omitted category*	*Omitted category*
Young generation	*Omitted category*	*Omitted category*
Intermediate generation	0.006 (0.079)	-0.132 (0.087)
Old generation	-0.072 (0.112)	-0.168 (0.117)

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[32] The marginal effects for an average individual are more or less similar to the ones presented for a median individual. We also computed marginal effects for special individuals and the main results hold. However, showing the results for a median individual is more relevant because we have many categorical variables.

Explanatory Variables	(1) Staying children	(2) Migrant children
"Pre only"		
Distant migrant		-0.045 (0.074)
Daughter	-0.038 (0.064)	-0.044 (0.053)
Youngest child	-0.251*** (0.076)	0.015 (0.065)
Intermediate position	-0.056 (0.058)	-0.010 (0.057)
Eldest child	*Omitted category*	*Omitted category*
Years of education	0.006 (0.016)	0.001 (0.006)
Married / cohabiting	-0.006 (0.155)	0.092 (0.075)
Caring attitude	0.190 (0.151)	0.062 (0.061)
Poor parents	0.191* (0.100)	0.036 (0.052)
Number of children	0.001 (0.024)	0.014 (0.014)
Suncho	-0.054 (0.114)	0.007 (0.079)
Puma	0.047 (0.111)	0.004 (0.078)
Pata	*Omitted category*	*Omitted category*
Young generation	*Omitted category*	*Omitted category*
Intermediate generation	-0.119 (0.123)	-0.030 (0.051)
Old generation	-0.018 (0.144)	-0.042 (0.074)
"No inheritance"	Marginal effects not shown [33]	
Number of observations	378	291

Significant at *** 1%, **5% and * 10%.
Robust standard errors clustered at family level in parenthesis.

Secondary results and robustness checks

Let us briefly comment on additional results. When attention is focused on staying children (Table 8, column 1 and Table B.3, in the Appendix B), we observe that the youngest child has a significantly higher probability than his (her) eldest sibling to inherit land only upon the death of the parents. This is not surprising since inter vivos transfers of land typically take place on the occasion of marriage, and the youngest children are more likely to be married only after their parents have passed away. In other words, the eldest child has a higher probability than siblings to receive land both pre- and post-mortem. A plausible explanation runs as follows. Eldest children tend to be the first to marry, and when they receive an inter vivos gift of land, the parents often ignore how many children will stay to claim a pre-mortem share of the family land. In such a context of uncertainty, land is awarded cautiously inter vivos upon the expectation that shares can be adjusted post-mortem.

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[33] We choose not to present the marginal effects for this category because understanding the determinants of the exclusion from land inheritance is not the purpose of this paper (general results of these regressions, including results for children excluded from inheritance, are shown in Appendix B, Table B.1 and Table B.2, respectively). (For more details on that topic, see Goetghebuer and Platteau, 2010)

When attention is shifted to migrants (Table 8, column 2 and Table B.4, in the Appendix B), gender appears to matter: daughters have a higher probability than son to receive their share of the family land post-mortem, but only when they have left the native community and settled in their husband's community.
From the estimations on the whole individual-based dataset (Table 7, column 1 and 2), two other results emerge. We observe that children with more years of education have a lower probability to receive land as pre- and post-mortem bequest. A possible explanation is that the opportunity cost of managing and supervising land received pre-mortem is higher for children with better non-agricultural income-earning opportunities (proxied by education). On the contrary, being married or cohabiting increases the probability for an individual to receive family land in the form of pre- and post-mortem transfers. This result is not surprising in the light of the fact that inter vivos gifts of land are often made on the occasion of marriages.

Let us end the discussion with a few remarks on the robustness of our results. First, when we remove the education variable from the RHS of the regression, so as to control for its possible endogeneity, all the results stand. Second, when we modify the list or the definition of explanatory variables −for example, when we measure education by the equivalent number of years of study (partly) financed by the parents instead of the number of years of study, when we measure the generation variable continuously rather than categorically (using the age of the individual), when we measure birth order continuously, or when we replace the number of children by the number of sons and the number of daughters, or if we add the migration order−, the signs and statistical significance of the corresponding coefficients stand unchanged. Third, results also hold when attention is restricted to a sub-sample of families for which the inheritance process is completed. Fourth, adding family fixed effects, we find that our result concerning migrant children holds within a family: migrants are less likely to receive pre-mortem inheritance than their staying siblings. Fifth, redefining the dependent variable by clubbing together pre-mortem inheritance with pre- and post-mortem bequest again does not alter the results. Finally, in order to check whether the coefficients of the interaction terms used in Table 7 (column 1) are 'correct', we run a simple probit model using this new dependent variable[34] and apply the estimation technique developed by Norton et al. (2004)[35]. The test is conclusive.

Another approach aimed at testing the robustness of the multinomial probit model results consists of estimating an ordered probit model in which the dependent variable is measured by assuming that absence of any land inheritance is the worst outcome and receiving all the land pre-mortem is the best. It is thus equal to zero for no inheritance, one for post-mortem inheritance only, two for pre- and post-mortem inheritance, and three for pre-mortem inheritance only. If we run the ordered probit model, all the results continue to hold (results not shown).[36]

5. Conclusion

When deciding upon the timing of land bequest, the problem faced by the household head is whether to maintain the family farm as a whole, or give out inter vivos gifts of land to his children to enable them set up their independent farm within the native community. He then balances income considerations against considerations pertaining to non-material components of his utility, particularly the emotional value attached to the close presence of his children (whether in the collective farm or in independent, branch farms in the native community). Since he must simultaneously take into account his children's desire for autonomy (satisfied if they set up an independent farm on portion of the family land or if they migrate), awarding them land inter vivos may prove superior to maintaining the family farm as a whole until his death. While considering such a problem, we assume that the head perfectly anticipates the number of children who migrate, and we also assume that migrants refuse inter vivos gifts of land because of transaction costs argument. In this set up, there are various possible regimes of inheritance timing: family land is distributed only post-mortem, or family land is distributed both pre- and post-mortem, and in the two cases, migration occurs or not. The

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[34] The re-defined dependant variable takes on value one if the child only receives post-mortem land inheritance, and zero if he/she receives land pre-mortem or pre- and post-mortem (those who have been excluded from the inheritance process are not considered in this regression).

[35] On Stata, it is the `inteff` command which can only be applied after running simple probit/logit models (Norton et al., 2004).

[36] We also learn from this regression that individuals receiving only pre-mortem bequest or a combination of pre- and post-mortem land inheritance appear to be quite similar (the cuts are overlapping), yet significantly different from those who receive their entire land inheritance upon the death of their parents (or from those who do not inherit any land).

model predicts that poor parents will avoid making inter vivos gifts of land to their staying children.

This prediction is consistently borne out by our case study of the Peruvian Highlands. In addition, the distinction between staying and migrant children appears to be crucial. The latter have a significantly lower probability of receiving land pre-mortem and this result is reinforced for distant versus close migrants. Such evidence gives support to the transaction cost approach according to which the cost of managing land from a distance has a critical effect on inheritance timing.

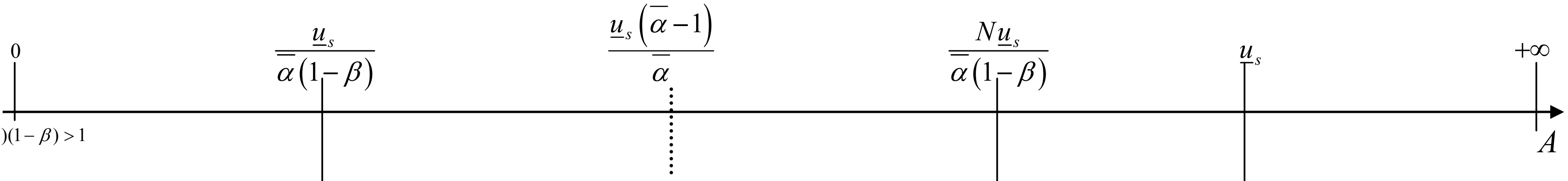
Clearly, more refined data are needed to test more precisely and more rigorously the predictions derived from the theory of inheritance timing proposed in this paper. Moreover, to have a better intuition of the influence of parental wealth and migration on bequest decision, we need a more complex theory which would model both migration and bequest timing (and division) decisions. We only hope that our pioneer attempt to frame the problem and provide preliminary evidence in support of the resulting theory will be inspiring enough to incite other researchers to pursue the effort.

Appendix A.1

Synthetic presentation of the results obtained when increasing *A* holding $\underline{u}_s$ constant under each conditions presented in Table 2

Scenario I with $\alpha\left(1-\beta\right)>N>1$

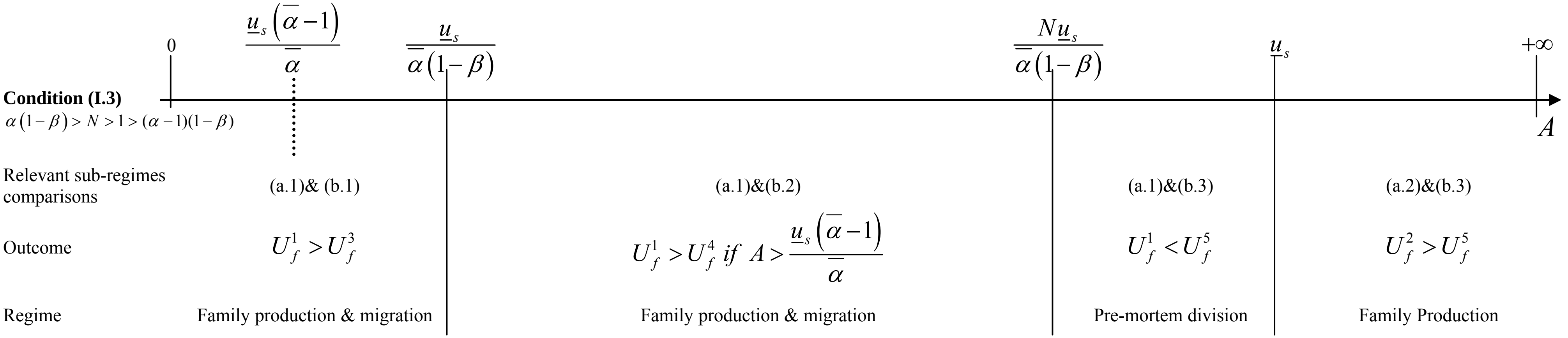
Condition (I.1)
$\alpha\left(1-\beta\right)>N>(\alpha-1)(1-\beta)>1$



Relevant sub-regimes comparisons	(a.1)& (b.1)	(a.1)&(b.2)		(a.1)&(b.3)	(a.2)&(b.3)
Outcome	$U_f^1>U_f^3$	$U_f^1<U_f^4\ if\ A<\frac{\underline{u}_s\left(\overline{\alpha}-1\right)}{\overline{\alpha}}$	$U_f^1>U_f^4\ if\ A>\frac{\underline{u}_s\left(\overline{\alpha}-1\right)}{\overline{\alpha}}$	$U_f^1<U_f^5$	$U_f^2>U_f^5$
Regime	Family production & migration	Pre-mortem division & migration	Family production & migration	Pre-mortem division	Family Production

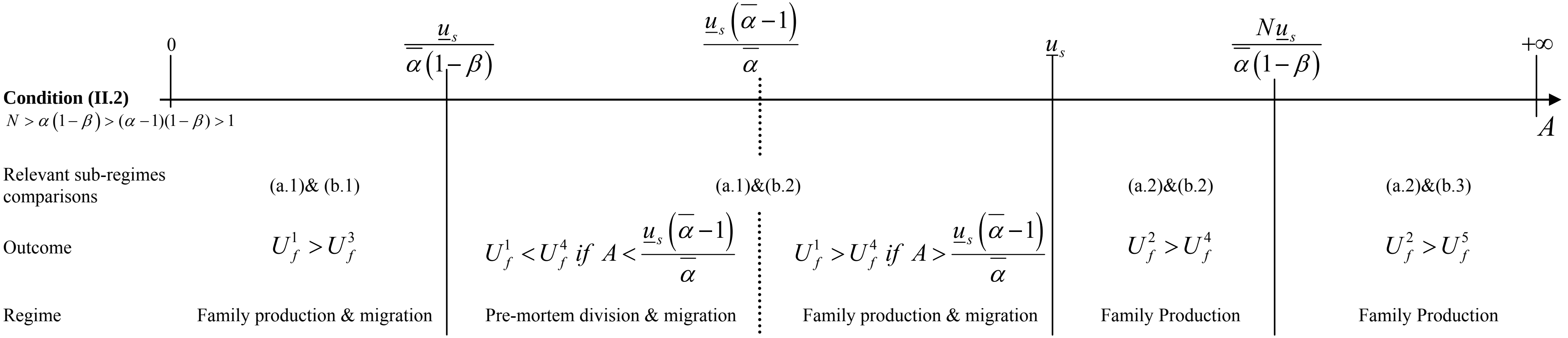
Condition (I.2)
$\alpha\left(1-\beta\right)>(\alpha-1)(1-\beta)>N>1$

Relevant sub-regimes comparisons	(a.1)& (b.1)	(a.1)&(b.2)	(a.1)&(b.3)	(a.2)&(b.3)
Outcome	$U_f^1>U_f^3$	$U_f^1<U_f^4\ if\ A<\frac{\underline{u}_s\left(\overline{\alpha}-1\right)}{\overline{\alpha}}$	$U_f^1<U_f^5$	$U_f^2>U_f^5$
Regime	Family production & migration	Pre-mortem division & migration	Pre-mortem division	Family Production

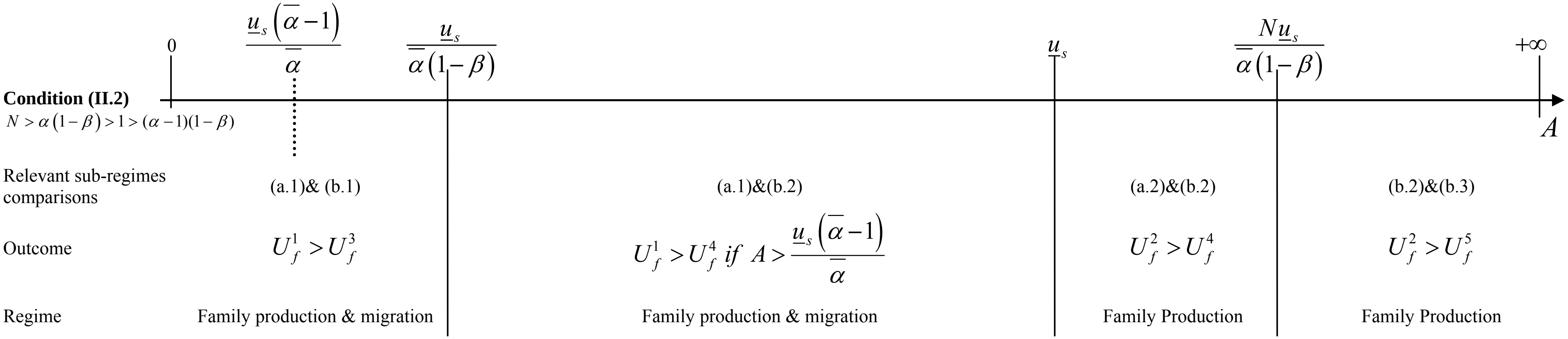


Relevant sub-regimes comparisons	(a.1)& (b.1)	(a.1)&(b.2)	(a.1)&(b.3)	(a.2)&(b.3)
Outcome	$U_f^1 > U_f^3$	$U_f^1 > U_f^4 \ if \ A > \frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}$	$U_f^1 < U_f^5$	$U_f^2 > U_f^5$
Regime	Family production & migration	Family production & migration	Pre-mortem division	Family Production

Scenario II with $N>\alpha\left(1-\beta\right)>1$



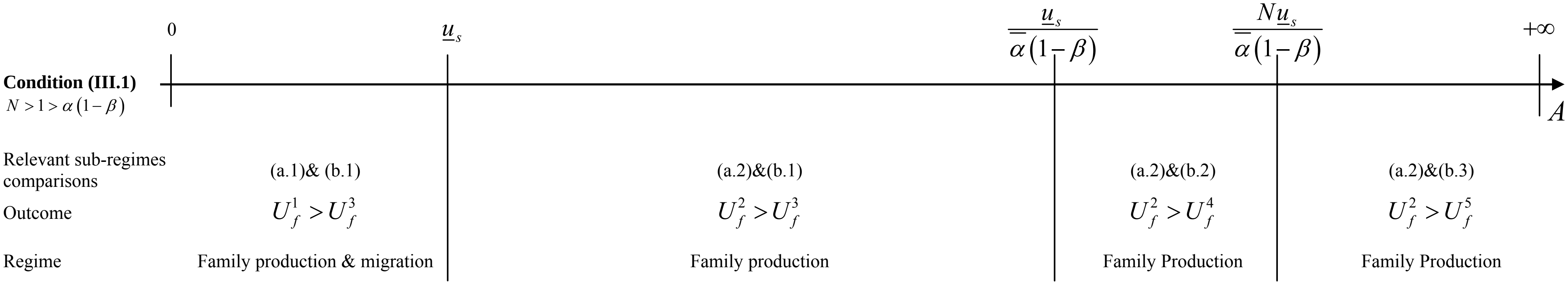
Relevant sub-regimes comparisons	(a.1)& (b.1)	(a.1)&(b.2)		(a.2)&(b.2)	(a.2)&(b.3)
Outcome	$U_f^1 > U_f^3$	$U_f^1 < U_f^4 \ if \ A < \frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}$	$U_f^1 > U_f^4 \ if \ A > \frac{\underline{u}_s\left(\bar{\alpha}-1\right)}{\bar{\alpha}}$	$U_f^2 > U_f^4$	$U_f^2 > U_f^5$
Regime	Family production & migration	Pre-mortem division & migration	Family production & migration	Family Production	Family Production



Condition (II.2)
$N > \alpha\left(1-\beta\right) > 1 > (\alpha-1)(1-\beta)$

Relevant sub-regimes comparisons	(a.1)& (b.1)	(a.1)&(b.2)	(a.2)&(b.2)	(b.2)&(b.3)
Outcome	$U_f^1 > U_f^3$	$U_f^1 > U_f^4 \; if \; A > \frac{\underline{u}_s\left(\overline{\alpha}-1\right)}{\overline{\alpha}}$	$U_f^2 > U_f^4$	$U_f^2 > U_f^5$
Regime	Family production & migration	Family production & migration	Family Production	Family Production

<u>Scenario III</u> with $N > 1 > \alpha\left(1-\beta\right)$



Condition (III.1)
$N > 1 > \alpha\left(1-\beta\right)$

Relevant sub-regimes comparisons	(a.1)& (b.1)	(a.2)&(b.1)	(a.2)&(b.2)	(a.2)&(b.3)
Outcome	$U_f^1 > U_f^3$	$U_f^2 > U_f^3$	$U_f^2 > U_f^4$	$U_f^2 > U_f^5$
Regime	Family production & migration	Family production	Family Production	Family Production

Appendix A.2

Proofs of the ranking of the relevant sub-regimes by comparing the father's utility under these sub-regimes.

- <u>Comparison of the sub-regimes (a.1) and (b.1)</u> :

With $U_f^1 = A\beta^{\beta}\left(\frac{(1-\beta)}{(\underline{u}_s - A)}\right)^{1-\beta}$ and $U_f^3 = 0$

Since $U_f^1 > 0$

We conclude therefore that $U_f^1 > U_f^3$

- <u>Comparison of the sub-regimes (a.1) and (b.2)</u>:

With $U_f^1 = A\beta^{\beta}\left(\frac{(1-\beta)}{(\underline{u}_s - A)}\right)^{1-\beta}$ and $U_f^4 = A\beta^{\beta}\left(\frac{\overline{\alpha}(1-\beta)}{\underline{u}_s}\right)^{1-\beta}$

We have $U_f^1 > U_f^4 \Leftrightarrow \frac{1}{\underline{u}_s - A} > \frac{\alpha}{\underline{u}_s} \Leftrightarrow \frac{\underline{u}_s(\alpha-1)}{\alpha} < A$

We then conclude that $U_f^1 < U_f^4$ if $A < \frac{\underline{u}_s\left(\overline{\alpha}-1\right)}{\overline{\alpha}}$ and that $U_f^1 > U_f^4$ if $A > \frac{\underline{u}_s\left(\overline{\alpha}-1\right)}{\overline{\alpha}}$

- <u>Comparison of the sub-regimes (a.1) and (b.3):</u>

With $U_f^1 = A\beta^{\beta}\left(\frac{(1-\beta)}{(\underline{u}_s - A)}\right)^{1-\beta}$ and $U_f^5 = \left(A - \frac{N\underline{u}_s}{\overline{\alpha}}\right)^{\beta}(N)^{1-\beta}$

We have that $U_f^1 = A\beta^{\beta}\left(\frac{(1-\beta)}{(\underline{u}_s - A)}\right)^{1-\beta} = (A\beta)^{\beta}\left(\frac{A(1-\beta)}{(\underline{u}_s - A)}\right)^{1-\beta}$ with $\frac{A(1-\beta)}{(\underline{u}_s - A)} = n^* < N$

➔ $\left(\frac{A(1-\beta)}{(\underline{u}_s - A)}\right)^{1-\beta} < (N)^{1-\beta}$

We now show that $(A\beta)^{\beta} < \left(A - \frac{N\underline{u}_s}{\overline{\alpha}}\right)^{\beta} \Leftrightarrow A > \frac{N\underline{u}_s}{\overline{\alpha}(1-\beta)}$, this last inequality is always true on the considered interval

We then conclude that $U_f^1 < U_f^5$

- Comparison of the sub-regimes (a.2) and (b.2):

With $U_f^2 = \left(A\left(1+N\right)-N\underline{u}_s\right)^{\beta}\left(N\right)^{1-\beta}$ and $U_f^4 = A\beta^{\beta}\left(\frac{\overline{\alpha}\left(1-\beta\right)}{\underline{u}_s}\right)^{1-\beta}$

We have that $U_f^4 = A\beta^{\beta}\left(\frac{\overline{\alpha}\left(1-\beta\right)}{\underline{u}_s}\right)^{1-\beta} = (A\beta)^{\beta}\left(\frac{A\overline{\alpha}\left(1-\beta\right)}{\underline{u}_s}\right)^{1-\beta}$ with $\frac{A\overline{\alpha}\left(1-\beta\right)}{\underline{u}_s} = n^* < N$

➔ $\left(N\right)^{1-\beta} > \left(\frac{A\overline{\alpha}\left(1-\beta\right)}{\underline{u}_s}\right)^{1-\beta}$

We then show that $\left(A\left(1+N\right)-N\underline{u}_s\right)^{\beta} > (A\beta)^{\beta} \Leftrightarrow A+N\left(A-\underline{u}_s\right) > A\beta$, this last inequality is always true because $N\left(A-\underline{u}_s\right) > 0$ on the considered interval, while $\beta < 1$

We then conclude that $U_f^2 > U_f^4$

- Comparison of the sub-regimes (a.2) and (b.3):

With $U_2 = \left(A\left(1+N\right)-N\underline{u}_s\right)^{\beta}\left(N\right)^{1-\beta}$ and $U_5 = \left(A-\frac{N\underline{u}_s}{\overline{\alpha}}\right)^{\beta}\left(N\right)^{1-\beta}$

We show that $\left(A\left(1+N\right)-N\underline{u}_s\right)^{\beta} > \left(A-\frac{N\underline{u}_s}{\overline{\alpha}}\right)^{\beta} \Leftrightarrow A+AN-N\underline{u}_s > A-\frac{N\underline{u}_s}{\overline{\alpha}} \Leftrightarrow A > \frac{\underline{u}_s(\overline{\alpha}-1)}{\overline{\alpha}}$, this last inequality is always true on the considered interval

We then conclude that $U_f^2 > U_f^5$

Appendix A.3

Assuming that N>2, we compute the interval of values for α under the conditions found in Table 2.

Scenarios	Conditions	Interval of α	For example if N=2 and β=0.5
Scenario I	(I.1) $\alpha(1-\beta) > N > (\alpha-1)(1-\beta) > 1$	$\alpha \in \left]\frac{N}{1-\beta}, \frac{N+1-\beta}{1-\beta}\right[$	$\alpha \in]4,5[$
	(I.2) $\alpha(1-\beta) > (\alpha-1)(1-\beta) > N > 1$	$\alpha \in \left]\frac{N+1-\beta}{1-\beta}, +\infty\right[$	$\alpha \in]5,+\infty[$
	(I.3) $\alpha(1-\beta) > N > 1 > (\alpha-1)(1-\beta)$	$\alpha \in \left]\frac{N}{1-\beta}, \frac{2-\beta}{1-\beta}\right[$	Impossible if N≥2 for any value of β
Scenario II	(II.1) $N > \alpha(1-\beta) > (\alpha-1)(1-\beta) > 1$	$\alpha \in \left]\frac{2-\beta}{1-\beta}, \frac{N}{1-\beta}\right[$	$\alpha \in]3,4[$
	(II.2) $N > \alpha(1-\beta) > 1 > (\alpha-1)(1-\beta)$	$\alpha \in \left]\frac{1}{1-\beta}, \frac{2-\beta}{1-\beta}\right[$	$\alpha \in]2,3[$
Scenario III	(III.1) $N > 1 > \alpha(1-\beta)$	$\alpha \in \left]-\infty, \frac{1}{1-\beta}\right[$	$\alpha \in]-\infty,2[$

Appendix B

Table B.1 and B.2 show the general results of the estimations of Table 7 column (1) and column (2), respectively. Similarly, Table B.3 and B.4 show the general results of Table 8 column (1) and column (2), respectively. In these tables, individuals who receive no land inheritance, or who receive only pre-mortem land inheritance, or who receive both pre- and post-mortem inheritance, are compared to those receiving post-mortem inheritance only (the reference category)

Table B.1: General results of the multinomial probit estimation of the land inheritance timing function –for marginal effects see Table 7, column (1)- (Base outcome **“Post only”***)*

Explanatory Variables	(1)	*Explanatory Variables*	(1)
“No inheritance”		**“Pre+Post”**	
Staying	-0.543 (0.431)	*Staying*	2.559*** (0.344)
Daughter	-0.332 (0.244)	*Daughter*	-0.207 (0.219)
Youngest child	-0.312 (0.276)	*Youngest child*	-0.812*** (0.232)
Intermediate position	0.224 (0.256)	*Intermediate position*	-0.434** (0.183)
Eldest child	*Omitted category*	*Eldest child*	*Omitted category*
Years of education	-0.045 (0.040)	*Years of education*	-0.078** (0.035)
Married / cohabiting	-1.079***(0.345)	*Married / cohabiting*	0.723** (0.311)
Caring attitude	-1.629***(0.328)	*Caring attitude*	0.027 (0.399)
Poor parents	0.801*(0.431)	*Poor parents*	0.490 (0.416)
*Staying*poor parents°*	-0.384 (0.573)	*Staying*poor parents°*	-1.901*** (0.445)
Number of children	-0.102 (0.086)	*Number of children*	0.024 (0.072)
Suncho	-0.677* (0.383)	*Suncho*	0.719* (0.387)
Puma	0.334 (0.411)	*Puma*	-0.004 (0.362)
Pata	*Omitted category*	*Pata*	*Omitted category*
Young generation	*Omitted category*	*Young generation*	*Omitted category*
Intermediate generation	0.784**(0.354)	*Intermediate generation*	-0.285 (0.281)
Old generation	0.236 (0.466)	*Old generation*	-0.582 (0.399)
Constant	1.451* (0.851)	*Constant*	-1.658** (0.732)
“Pre only”		***Number of observations***	669
Staying	2.122 *** (0.307)		
Daughter	-0.312* (0.184)		
Youngest child	-0.834*** (0.249)		
Intermediate position	-0.049 (0.184)		
Eldest child	*Omitted category*		
Years of education	-0.011 (0.036)		
Married / cohabiting	0.340 (0.274)		
Caring attitude	0.328 (0.400)		
Poor parents	0.570 (0.357)		
*Staying*poor parents°*	-0.767* (0.424)		
Number of children	0.026 (0.813)		
Suncho	-0.087 (0.337)		
Puma	-0.187 (0.335)		
Pata	*Omitted category*		
Young generation	*Omitted category*		
Intermediate generation	-0.445 (0.279)		
Old generation	-0.405 (0.404)		
Constant	-1.724 (0.743)		

Significant at *** 1%, **5% and * 10%.

Robust standard errors clustered at family level in parenthesis.

° We applied Norton, Wang and Ai (2004)’s estimation technique for non linear models with interaction terms to check whether the magnitude, sign and significance of the interaction term is correct. The test was conclusive. In addition, note that this wealth effect remains if we run this estimation (without the interaction term) on a subsample of staying children (results not shown).

Table B.2: General results of the multinomial probit estimation of the land inheritance timing function –for marginal effects see Table 7, column (2)- (Base outcome **“Post only”***)*

Explanatory Variables	(2)	*Explanatory Variables*	(2)
“No inheritance”		**“Pre+Post”**	
Migrant	0.698** (0.318)	*Migrant*	-1.763*** (0.256)
Daughter	-0.326 (0.246)	*Daughter*	-0.151 (0.219)
Youngest child	-0.290 (0.274)	*Youngest child*	-0.639*** (0.239)
Intermediate position	0.216 (0.259)	*Intermediate position*	-0.396** (0.182)
Eldest child	*Omitted category*	*Eldest child*	*Omitted category*
Years of education	-0.045 (0.039)	*Years of education*	-0.076** (0.035)
Married / cohabiting	-1.076*** (0.345)	*Married / cohabiting*	0.636** (0.300)
Caring attitude	-1.608*** (0.278)	*Caring attitude*	0.139 (0.425)
Poor parents	0.582 (0.381)	*Poor parents*	-0.765** (0.317)
Number of children	-0.102 (0.086)	*Number of children*	0.027 (0.072)
Suncho	-0.682* (0.386)	*Suncho*	0.739* (0.396)
Puma	0.330 (0.410)	*Puma*	0.027 (0.360)
Pata	*Omitted category*	*Pata*	*Omitted category*
Young generation	*Omitted category*	*Young generation*	*Omitted category*
Intermediate generation	0.793** (0.356)	*Intermediate generation*	-0.271 (0.267)
Old generation	0.244 (0.469)	*Old generation*	-0.582 (0.388)
Constant	0.812 (0.728)	*Constant*	0.481 (0.654)
“Pre only”		***Number of observations***	669
Migrant	-1.760*** (0.249)		
Daughter	-0.291 (0.182)		
Youngest child	-0.770*** (0.252)		
Intermediate position	-0.039 (0.183)		
Eldest child	*Omitted category*		
Years of education	-0.012 (0.037)		
Married / cohabiting	0.314 (0.264)		
Caring attitude	0.373 (0.402)		
Poor parents	0.145 (0.280)		
Number of children	0.024 (0.081)		
Suncho	-0.061 (0.341)		
Puma	-0.171 (0.335		
Pata	*Omitted category*		
Young generation	*Omitted category*		
Intermediate generation	-0.429 (0.271)		
Old generation	-0.417 (0.398)		
Constant	0.175 (0.702)		

Significant at *** 1%, **5% and * 10%.
Robust standard errors clustered at family level in parenthesis.

Table B.3: General results of the multinomial probit estimation of the land inheritance timing function –for marginal effects see Table 8, column (1)- (Base outcome **“Post only”***)*

Explanatory Variables	(1) Staying children	*Explanatory Variables*	(1) Staying children
“No inheritance”		**“Pre+Post”**	
Daughter	0.105 (0.335)	*Daughter*	-0.036 (0.293)
Youngest child	-0.097 (0.527)	*Youngest child*	-1.060*** (0.296)
Intermediate position	-0.225 (0.455)	*Intermediate position*	-0.467 (0.218)
Eldest child	*Omitted category*	*Eldest child*	*Omitted category*
Years of education	-0.107 (0.094)	*Years of education*	-0.123 (0.053)
Married / cohabiting	-3.457*** (0.612)	*Married / cohabiting*	0.624 (0.487)
Caring attitude	-1.44* (0.740)	*Caring attitude*	1.059* (0.548)
Poor parents	1.682*** (0.641)	*Poor parents*	-1.316*** (0.347)
Number of children	0.042 (0.185)	*Number of children*	0.054 (0.091)
Suncho	-0.193 (0.713)	*Suncho*	0.800* (0.454)
Puma	1.743** (0.707)	*Puma*	0.266 (0.412)
Pata	*Omitted category*	*Pata*	*Omitted category*
Young generation	*Omitted category*	*Young generation*	*Omitted category*
Intermediate generation	2.629*** (0.759)	*Intermediate generation*	-0.123 (0.433)
Old generation	1.082 (1.053)	*Old generation*	-0.517 (0.537)
Constant	-1.006 (1.492)	*Constant*	-0.186 (979)
“Pre only”		***Number of observations***	378
Daughter	-0.137 (0.253)		
Youngest child	-1.193*** (0.310)		
Intermediate position	-0.043 (0.204)		
Eldest child	*Omitted category*		
Years of education	-0.029 (0.057)		
Married / cohabiting	-0.082 (0.397)		
Caring attitude	0.944 (0.575)		
Poor parents	-0.140 (0.352)		
Number of children	0.026 (0.091)		
Suncho	0.070 (0.419)		
Puma	-0.022 (0.409)		
Pata	*Omitted category*		
Young generation	*Omitted category*		
Intermediate generation	-0.369 (0.448)		
Old generation	-0.313 (0.553)		
Constant	0.079 (0.935)		

Significant at *** 1%, **5% and * 10%.

Robust standard errors clustered at family level in parenthesis.

Table B.4: General results of the multinomial probit estimation of the land inheritance timing function –for marginal effects see Table 8, column (2)- (Base outcome **"Post only")**

Explanatory Variables	(2) Migrant children	*Explanatory Variables*	(2) Migrant children
"No inheritance"		**"Pre+Post"**	
Distant migrant	0.931*** (0.361)	*Distant migrant*	-1.057*** (0.387)
Daughter	-0443 (0.292)	*Daughter*	-0.683** (0.306)
Youngest child	-0.179 (0.371)	*Youngest child*	-0.348 (0.421)
Intermediate position	0.488 (0.303)	*Intermediate position*	-0.260 (0.393)
Eldest child	*Omitted category*	*Eldest child*	*Omitted category*
Years of education	-0.012 (0.048)	*Years of education*	-0.044 (0.043)
Married / cohabiting	-0.474 (0.423)	*Married / cohabiting*	0.565 (0.360)
Caring attitude	-1.862*** (0.379)	*Caring attitude*	-0.740* (0.411)
Poor parents	0.739* (0.410)	*Poor parents*	0.384 (0.414)
Number of children	-0.176** (0.083)	*Number of children*	0.001 (0.113)
Suncho	-1.301*** (0.476)	*Suncho*	1.126*** (0.529)
Puma	-0.448 (0.496)	*Puma*	-0.363 (0.626)
Pata	*Omitted category*	*Pata*	*Omitted category*
Young generation	*Omitted category*	*Young generation*	*Omitted category*
Intermediate generation	0.622* (0.366)	*Intermediate generation*	-0.515 (0.336)
Old generation	0.322 (0.535)	*Old generation*	-0.894 (0.546)
Constant		*Constant*	-0.433 (0.869)
"Pre only"		***Number of observations***	291
Distant migrant	-0.669* (0.387)		
Daughter	-0.594* (0.346)		
Youngest child	-0.028 (0.430)		
Intermediate position	-0.098 (0.369)		
Eldest child	*Omitted category*		
Years of education	-0.009 (0.046)		
Married / cohabiting	1.116** (0.489)		
Caring attitude	-0.257 (0.442)		
Poor parents	0.480 (0.335)		
Number of children	0.062 (0.105)		
Suncho	-0.186 (0.554)		
Puma	-0.140 (0.542)		
Pata	*Omitted category*		
Young generation	*Omitted category*		
Intermediate generation	-0.199 (0.353)		
Old generation	-0.458 (0.599)		
Constant	-1.824* (1.000)		

Significant at *** 1%, **5% and * 10%.
Robust standard errors clustered at family level in parenthesis.

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Chapter 3

Productive inefficiency in patriarchal family farms: Evidence from Mali

Abstract: In Mali, there exist various farm-cum-family structures, so that agricultural production occurs on plots controlled by different members of the household. In this paper, we want to lay emphasis on the under-researched differentials between collective and individual plots (attended by male or female farmer) in the context of extended family farms using input and output first hand data collected in the south-eastern part of Mali. First, we find that land yields are significantly larger on (male) private plots than on common plots with similar characteristics planted to the same crop in the same year after all appropriate controls have been included. And, second, we bring strong suggestive evidence that a moral-hazard-in-team problem exists on the collective fields (yet only with regard to care-intensive crops) that could, at least partly, explain their relatively poor performance.

Keywords: Land productivity, family structure, moral-hazard-in-team problem, collective fields
JEL classification codes: D13, D57, J12, 012, 013, Q12, Q15, R20

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1. Introduction

There has been a recent surge of interest in African family farms where common plots that are collectively managed and worked coexist with private plots held and cultivated by individual members. On the one hand, economists have tried to understand the rationale behind the existence of various forms of farm-cum-family structures. Their theories aim at explaining either the shift from a pure collective farm to a mixed structure in which private and common plots coexist, or the split of the collective farm into individual units (see Fafchamps, 2001, for an explanation of the former, Foster and Rosenzweig, 2002, for an explanation of the latter, and Guirkinger and Platteau, 2011a, for an explanation of both). On the other hand, many studies have compared the productivity of plots (with similar characteristics) controlled by different types of farmers across households or more frequently within the same household. A large number of these studies have identified systematic gender productivity differentials and conclude to a non optimal land allocation: ceteris paribus, men tend to be more productive than women (Udry et al., 1995; Udry, 1996; Bindlish, 1993, all dealing with Burkina Faso; Goldstein and Udry, 2008, for Ghana; Sidhar, 2008 for Nepal; Holden et al., 2001, for Ethiopia; Jacoby, 1992, for Peru; Koru and Holden, 2011, for Uganda).[1]

Much fewer studies have compared land yields between collectively and (male) individually cultivated plots. Kanzianga and Wahhaj (2010) compare productivity of senior male plots (assumed to be collectively farmed) with junior male private plots and female private plots using first-hand data from Burkina Faso. They show that plots owned by the household head (common plots) are farmed more intensively and achieve higher yields than plots with similar characteristics owned by other household members. Yet, they do not find any gender differences in productivity once they compare male and female family members who do not head the household.

In this paper, we want to lay emphasis on the under-researched differentials between collective and individual plots (male or female) in the context of extended family farms. There are three different views or theories explaining why such differentials may exist or not. First, if certain activities are subject to scale economies while others are not, it seems natural to practice the former on collective plots and the latter on private plots. This consideration is used by Foster and Rosenzweig (2002) to explain the persistence of large collective farms when scale economies (and the financing of household public goods) outweigh the advantages of land tenure individualization (split households) stemming from diverging preferences over these household public goods. Besides, if farmers adopt relatively land-saving and labour-using techniques for which quality of labour matters, significant management diseconomies exist. Boserup (1965) shows that in such a context, where labour is costly to monitor, the advantage of private farming on individual plots increases. Interestingly, in Hungarian cooperatives before the collapse of communism, care-intensive activities were conducted on households private plots, whereas activities easy to standardize and monitor remained the province of collective work on the cooperative fields (Swain, 1985; Guillaume, 1987; see also Chayanov, 1991: Chap. 13). If this line of interpretation is correct, we should observe that different crops are grown on collective and private fields and we should not expect significant differences in land productivity between them.

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[1] Note that in these studies, male plots include both collective and private holdings; the authors are usually not able to distinguish between them. As for female plots, the problem is simpler since they are private, except for the rare cases of female-headed households.

Second, Kanzianga and Wahhaj (2010) emphasize the public character of the good produced on the family field while potential scale economies are ignored. The main originality of their theory consists in assuming the existence of social norms that govern production on collective fields. Since collective production is aimed at providing a public good at family level, the members of the household are expected to be more willing to work on the collective field than on their private plots. Common plots managed by the household head should therefore use family labour more intensively, and achieve higher yields than plots with similar characteristics farmed by individual members. These predictions are confirmed by their results empirical work on a survey of agricultural households in Burkina Faso.

Finally, guided by field observations in Mali, Guirkinger and Platteau (2011a) argue that production on the collective plots is plagued by the moral-hazard-in-team (MHT) problem while first-best efficiency is achieved on private plots where members have optimal incentives to work. The possible coexistence of the two types of plots is explained as the outcome of a trade-off between rent capture and efficiency considerations: acting as a patriarch, the head aims at extracting a rent from collective production since he is unable to enforce transfers from the private plots managed individually by the (male) members. These private plots are awarded to members when land scarcity becomes high enough to compel the patriarch/head to pay attention to efficiency considerations owing to the need to meet the members' reservation utilities. This particular prediction has been put to test and confirmed in another paper based on first-hand data collected in the south-eastern part of Mali (Guirkinger and Platteau, 2011b). In complete contrast to Kanzianga and Wahhaj's argument, the other prediction of the theory of the patriarchal family is that land yields should be larger on private than on common plots. It is worth stressing that, given his concern to reap a rent from the collective field, the patriarch is not interested in achieving first-best allocative efficiency on the whole family farm. Efficiency considerations enter into the picture only as a constraint imposed by scarce land endowments.

In the same line, the theory of agricultural cooperatives has advanced the idea that collective farming acts as an insurance mechanism: its output is shared equally among the members, thus redistributing income from lucky to unlucky members (Putterman and DiGiorgio, 1985; Carter, 1987). At the same time, the rule of equal sharing gives rise to a moral-hazard-in-team problem, hence a trade-off between efficiency and risk-sharing considerations. This line of reasoning has been recently extended to family farms (Delpierre et al., 2011). The prediction regarding productivity differentials is exactly the same as under Guirkinger and

Platteau's argument: yields are expected to be smaller on the collective fields. These lower yields are the price to pay for insurance.

On the basis of a detailed analysis of input and output data collected from the same survey as that used in Guirkinger and Platteau (2011b), this paper aims at testing whether there are significant differences in land yields between collective and (male) individual plots. The next step consists of investigating the possible causes of yield differentials if they turn out to exist. We find that yields are higher on private than on collective plots with similar characteristics and planted to the same crop within the same household. We also find strong suggestive evidence that a moral-hazard-in-team problem exists on the collective fields, yet only with regard to care-intensive crops.

The remainder of the paper is organized as follows. In Section 2, we describe the original survey that yielded the dataset used in this paper and present our empirical strategy. In Section 3, after presenting some descriptive statistics of the key variables, we use econometric analysis to test for the possible existence of yield differentials between (male) individual and collective plots. In Section 4, we inquire whether the lower yields obtained on collective plots can be attributed to the moral-hazard-in-team problem. The last section concludes.

2. Data and empirical strategy

The survey

The data used in this paper is first hand data collected in the southeastern region of Mali in 2007. An interesting feature of this region is that family farms appear to be in constant evolution: traditional collective farms headed by a patriarch are still widespread although there is an increasing tendency toward more individualized forms of cultivation. We randomly sampled 17 villages in the three districts of Koutiala, Sikasso and San, which belong to the old cotton zone of Mali. Within each village, we randomly selected 12 households from a complete listing of the local households population. Two survey instruments were used to elicit the required information. First, a questionnaire was administered to each household head. In addition to detailed information on the composition of the household, we collected information on the size and structure of the associated farm, including the listing of the common fields managed by the family as a whole, as well as all the family members who cultivate private plots.

Second, a questionnaire was addressed to a random sample of private plot holders. We initially intended to cover all these individual farmers, yet due to time and budget constraints only two-thirds of them (68%) could be interviewed.[2] The selection of the sampled individual farmers was made randomly by a qualified researcher from the CRED (Centre for Research in Economic Development, university of Namur) acting as field supervisor.[3] A significant portion of the interview time was allotted to the collection of output and input data. Information regarding all the common plots was obtained from the head within the framework of the general household questionnaire. Data pertaining to the private plots were gathered from their holders within the framework of the individual questionnaires. In order to have a more complete view of the household *modus operandi*, precise qualitative questions were asked about the different rights and duties of the household members, and about the pros and cons of collective versus mixed farm structures.

Farm and family structures

A household is a group of individuals who "work jointly on at least one common field under the management of a single decision-maker and draw an important share of their staple foodstuffs from one or more granaries which are under the control of that same decision-maker" (Matlon, 1988 cited in Udry 1996: 1016). "Traditionally, a West African rural household is large and complex. It extends both vertically (in the sense that married sons continue to live with their father) and horizontally (brothers of the head, their wives and children are part of the household)" (Guirkinger and Platteau, 2011b). In our sample, 41.2 percents of household heads live with their brothers while, at the other extreme, only 21.6 percents have neither brothers nor married sons around (strictly speaking, they are nuclear households). Moreover, more than half of the household heads are polygamous. On average, the sample households count 11 individuals above 12 years old with a maximum family size of 30.

Extended households managing collective farms remain a characteristic feature in Mali and, in particular, in the study area. However, over the last decades mixed farm structures have emerged in which individual plots coexist with the collective family field. On the latter, members continue to work as a team and the output is shared among all the co-workers after

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[2] On an average, the interview of a household comprising only collective family fields lasted half a day while the interview of a household with a mixed farm structure lasted a whole day, the second half being devoted to the interviews of private plot holders.

[3] We believe that we do not have any biased sample of private plot holders since we do not find any systematic differences between interviewed individual farmers and those who have not been selected.

the head has retained his own portion. The incomes that have been individually obtained are rarely transferred to the patriarch.

The practice of private plots granted to women is much older than the practice of private plots granted to men, and in fact, the rationale behind the two practices differs. Women holding private plots (also called "garden plot") are expected to partly use them for the benefit of the family (producing condiments for collective meals) and are generally freed from the duty to work on the collective field. Male private plots holders are typically allowed to keep the whole output for themselves (and mainly use it for non-food expenditures).

Our sample includes 204 farms evenly spread over 17 villages. Table 1 shows 58 households (28.5%) are purely collective farms. It means that their cultivated land exclusively consists of jointly managed fields. Out of the remaining 146 households, 69 (47%) have distributed individual plots to female members only, while 63 (43%) have awarded such plots to both male and female members.

Table 1: Structure of the sample farm households.

Type of family farms	Number of observations	Percentages %
Purely collective farms	58	28.5
Mixed farms	146	71.5
*With male and female IP**	*63*	*43.1*
*With only male IP**	*14*	*9.6*
*With only female IP**	*69*	*47.3*
Total	204	100

**IP: Individual Plots*

Table 2 provides information about the number of plots distinguished on the basis of three characteristics: whether they are collective or individual; and when individual, whether they belong to male or female household members; and whether they are of high or low quality. Column 4 displays the number of respondents corresponding to each land plot category. We see that our sample includes 488 collective fields and 535 private plots, out of which 71% belong to female household members and 29% belong to male household members. From the third and fourth columns, it appears that, on average, a private plot farmer holds slightly more than one plot in the mixed farms (94% of these individual farmers hold a single plot). In contrast, there is an average of 2.4 collective fields per farm household. In the last two columns of the table, we provide the average size of collective and private plots and the average size of collective and private holdings when all the plots forming them are aggregated. Two facts emerge: (i) the average size of collective landholdings is considerably larger than the average size of private holdings, and (ii) the average size of private male plots is nearly twice as large as that of female plots.

Table 2: Description of the sampled plots

	(1) Nr of dry land plots	(2) Nr of bottom land plot	(3) Nr of plots	(4) Nr of interviewed farmers	(5) Av. size of plot in ha (std. dev.)	(6) Av. size of holding in ha (std. dev.)
Collective Plot	439 (90%)	49 (10%)	488	204	4.44 (5.18)	10.62 (7.19)
Individual Plot	268 (50%)	267 (50%)	535	459	0.44 (0.79)	0.52 (0.93)
Male plot	*83*	*71*	*154*	*133*	*0.66* *(1.22)*	*0.77* *(1.46)*
Female plot	*185*	*196*	*381*	*326*	*0.35* *(0.50)*	*0.41* *(0.56)*
Total	707	316	1023	663	2.35 (4.13)	3.62 (6.18)

Any study dealing with land productivity has to give great attention to quality variations between plots. We will come back to this important point later. For the moment, we simply focus on the critical distinction between dry and bottom lands. Dry lands are lands that can be farmed only during the rainy season because they entirely depend on rainfall for bringing moisture to the soil. Bottom lands, by contrast, correspond to plots located in a flood-recession area or irrigable with a well, so that they can be possibly cultivated beyond the rainy season and allow the growing of more water-demanding crops, such as vegetables. During our exploratory field work, the bottom versus dry distinction appeared of critical importance to farmers. Interestingly, however, they were unable to point to any subtle grading of land quality that did not verge on the idiosyncratic.

The difference in allocation of land with respect to quality is considerable when we compare collective with private plots: whereas 10 percent of the former consist of bottom lands, the proportion works out to 50 percent for the latter (a proportion that does not perceptibly vary between male and female plots). The difference in land area between the two types of plots would thus be significantly reduced if we would allow for quality variations.

Table 3 depicts the type of relationship existing between the individual plot holder and the head of the household along with the average area of dry and bottom land and the average age of the plot holder. It shows that, in our survey area, families may have quite a complex structure (they can extend vertically by including several successive generations, but also horizontally by including brothers of the head with their wife (wives) and children). About half of the female private plots belong to spouses of the head while male private plots are more or less equally distributed between sons, brothers, nephews of the head, and the head himself. On average the household head and the men of his generation (brothers and cousins) tend to cultivate a bigger area of low quality land (Table 3, column 2) than the other individual farmers. This relation is the reverse regarding high quality land (column 3). It is also interesting to note that among women, the mothers of the head have access to a quite bigger area than other women of the farm (even though there are few observations).

We may incidentally note that in purely collective farms, the total land area and the total family size are significantly smaller than in mixed farms. In the latter, the family has typically a more complex structure than in the former.

Table 3: Individual farmer's characteristics w.r.t their relationship to the household head

Relationship to the head	(1) Nr of individual farmers (%)	(2) Average area of dry land in ha (nr of plots)	(3) Average area of bottom land in ha (nr of plots)	(4) Age
Head himself	37 (8.1)	1.43 (19)	0.27 (18)	57.4
Spouse	142 (30.9)	0.38 (77)	0.32 (91)	43.8
Sister/ sister in law	60 (13.1)	0.69 (29)	0.32 (34)	33.5
Mother	16 (3.5)	0.61 (12)	0.47 (8)	58.5
Daughter in law	63 (13.7)	0.25 (38)	0.40 (31)	26.5
Cousin/niece in law	45 (9.8)	0.35 (23)	0.19 (25)	36.6
Brother /step brother	28 (6.1)	1.30 (19)	0.26 (14)	47.1
Son/nephew	40 (8.5)	0.39 (21)	0.39 (20)	32.1
Cousin	20 (6.3)	1.46 (12)	0.16 (9)	40.9
Total	459 (100)	0.60 (255)	0.31 (258)	47.9

It is also noteworthy that when private plots are awarded to either male or female members, all members of the same gender typically receive a plot provided that they are married. It directly follows that the head does not earmark private plots for members with special characteristics, relatively skilled and hard-working members, for example. Also to be noted is that we do not observe any adoption of new agricultural techniques among these individual farmers.

Land allocation between crops

Table A.1, displayed in Appendix A, provides a detailed account of the distribution of the lands of the household between the available crops during the rainy season. Bearing in mind that a given plot, whether collective or individual, may be dedicated to more than one crop, we note a number of tendencies. When all types of plots are clubbed together, cotton appears to be the most important crop in terms of area followed by sorghum, millet, and niebe. Rice and groundnuts are generally cultivated on relatively small areas (about half a hectare). On the collective fields, cotton precedes sorghum, niebe and millet. On the private plots, cotton comes first followed by maize, sorghum, and millet. Women tend to specialize in rice and groundnuts (but in terms of cultivated area, rice and maize are predominant) whereas men tend to give preference to the production of groundnuts and red chili (but cotton, sorghum, maize, and groundnuts dominate in terms of cultivated area).

Two features revealed by Table A.1 deserve special attention. First, cereals are produced not only on the collective fields but also on the private plots. Second, we do not observe complete crop specialization according to the type of plot: groundnuts and sorghum, in particular, but also rice, maize, and millet to a lesser extent, are cultivated on both collective fields and private plots (within mixed structure). In the light of these findings, we can dismiss the hypothesis according to which the coexistence of collective and individual plots is due to the operation of scale economies on the former and scale (management) diseconomies on the latter.

Table A.2 (in Appendix A) completes the picture by showing the cropwise distribution of household lands during the dry season. Since farming is only feasible on the bottom lands during the dry season and since there are not many of those lands that are collectively cultivated, Table A.2 essentially describes the situation on private plots. Onions appear as the most commonly cultivated crop in terms of frequency (for both men and women), followed by sweet potatoes and groundnuts, whereas potatoes predominate in terms of cultivated area.

It remains to compare the output mixes on dry lands and bottom lands during the rainy season. This is done in Table A.3 (Appendix A). Sorghum is most frequently grown on the dry lands, followed by groundnuts, millet, maize, and cotton. By contrast, rice is by far the most important crop grown on the bottom lands, but if we look at the situation in terms of cultivated area, maize is more or less at par with rice.

Finally we discuss two characteristics of cropping pattern that may have an effect on plot productivity. The first concerns the inter-cropping practice. Inter-cropping only occurs on 12.8% of the sample cultivated plots, and this frequency does not significantly differ between collective and individual plots (14.2% of collective plots and 11.5% of the individual plots are planted to more than one crop at a time). However, inter-cropping is significantly less frequent on male individual plots than on female individual or collective plots (respectively 7.8%, 13.0%, and 14.2%). The second characteristic is the relative importance of subsistence crops cultivation. The share of the cultivated area devoted to subsistence crops is not correlated with family size. Among cultivators of both types of crops (subsistence and care-intensives crops), the area devoted to subsistence crops represents 60% of the collectively cultivated area, compared to 47.5% of the area cultivated by a male individual farmer (difference is significant at 5%).

Measurement procedures of input and output data

The crop pattern adopted by the sample farms is even more complex than what the above presentation suggests, leading to tricky measurement problems that need to be discussed in detail. Over a particular season (rainy or dry), our data show that a farmer can plant as many as eight different crops by subdividing a plot. In addition, given the possibility of inter-cropping, there exist additional combinations of crops that can be adopted on a plot. In comparing land yields between collective and individual plots, we can use either crop-specific physical yield measures or an aggregate monetary measure that takes into account all the crops grown on one plot. While the former approach considers crop choice decisions as exogenous, the latter allows for the possibility that yields vary from plot to plot because of differences in the crop mixes selected by the farmer. Our empirical strategy will follow both approaches.

The practical difficulties in implementing them are considerable, not only because of the amount of data to deal with, but also because of the heterogeneity of the measurement units used in each village (sometimes in each household) to report physical quantities of produce harvested and sold. We have therefore spent an important amount of time to express in kilograms the various reported measures of crop quantities (such as the cartload, the tin, the box, the plate, the handful, etc.), which may themselves be differently defined depending on the village where they are used. In the case of some crops, hopefully minor crops (e.g., cassava, taro, tobacco, cashew nuts, salads, bissam, and fruits), we could not find a proper way to convert the harvested amount into a single measurement unit. We have therefore decided to keep them out of the analysis (which implies that the afferent cultivation areas have also been left out).

Price data are likewise complex since the harvest of a given plot may have been disposed of at different points in time and a portion may have been retained for self-consumption purposes. The strategy followed consisted of using the price reported by the farmer for the most substantial sale and to value the entire harvest of a given crop on that basis. An alternative solution could have consisted in calculating the median price obtained for each crop over the whole sample area and use those prices to give a value to the quantities produced everywhere. Unfortunately, this option did not turn out to be feasible for the aforementioned reason. Owing to the great heterogeneity of physical measurement units, we could only derive unit prices (prices per kilogram) for the most common crops, that is, seven out of forty-one different crops found in our sample. Evaluating in monetary terms the entire production was nevertheless possible since most respondents provided homogeneous quantity and price information (quantity and price per tin, for example).

Two last remarks deserve to be made. While computing the yields per hectare, we divided the production value or quantity by the area actually cultivated[4] after subtracting the area devoted to crops for which we lack crucial information (see above). Furthermore, we avoided to count an area twice when it was cultivated both during the dry and the rainy seasons, or when it was allocated to inter-cropping.

Measuring the inputs used in agricultural production proved to be as complex as measuring the outputs. Data about chemical fertilizers were collected on a plot basis. We then had to add up quantities of various fertilizers applied at several points of time and to value them at the reported prices. When fertilizers were acquired from the CMDT ("*Compagnie Malienne pour le Développement des Textiles*"), a public agency in charge of marketing cotton and cereal fertilizers, prices were uniform over our study area. When, on the other hand, they were purchased from private traders, we chose to apply the median price calculated over the whole sample in order to minimize measurement noise. Data about organic fertilizers are unfortunately unavailable. Yet, we know that this input has a significant impact on production only if it can be applied in sufficient quantity and quality. Our field observations

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[4] It implies that fallow land area is not taken into account in our yield computation. Note incidentally that fallow practice is seldom in the survey area, most of the sample plots have not been left in fallow for the last five years.

have suggested that this condition remains typically non-satisfied.[5] Nowhere we could note the presence of manure pits on the farm sites. At best, farmers use animal dung to fertilize their fields. To take this possibility into account, we use the size of the cattle herd as a proxy for organic manure applied on the collective fields.

Regarding seeds, the main point is that, except for cotton, the sample farmers do not seem to buy improved seed varieties as most of them use self-generated seeds. We have ignored cotton seeds altogether because quantities applied are standardized and actually fixed by the CMDT on a per hectare basis. Finally, concerning agricultural equipment, our data enable us to discern whether a household owns at least a pair of oxen and a plough (nobody was observed to have any mechanical equipment in the survey area). We also know when a household has rented these draught animals.

The most problematic input is labour. To be meaningful, indeed, a measure of labour inputs should provide information about effective labour use or effort (labour in efficiency units). Nominal units of labour time are not of much help because they may conceal quite different amounts of effort. We know that there are rules enforced by the head, varying from village to village and from household to household, that prescribe the nominal amount of work to be performed on the common fields by their household members or, conversely, the amount of time that they are residually allowed to devote to the cultivation of their private plots. Yet, the heads themselves are well aware that there is a long way between a nominal and an effective allocation of labour effort between common and individual plots. Revealingly, when queried about the best ways to improve yields on the collective fields, the household heads have mentioned enhancing the quality of labour efforts together with greater application of organic fertilizers and better access to water.

This being said, even the nominal amounts of working time were so hard to collect that they would have been unreliable. This is largely due to the fact that the time allocation across fields and crops may vary significantly each day depending on the agricultural calendar, and recall bias is enormous when farmers are asked about the labour allocation of the entire family over the course of an entire year. In fact, the only information that we could reliably elicit from the respondents regarding labour inputs is who works on the common fields and who works on each individual plot, whether they have hired labour and what are the formal rules governing the time allocation between the two types of plots.

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[5] It is estimated that in order to restore soil fertility in the area a minimum of ten tons of organic fertilizers per hectare should be applied (personal communication of field agronomists working in the area).

Regarding the latter, the constraints imposed by the heads on members are often quite tight[6]: male members are granted only one day (the rest day) or two days a week for private work in 42 percent and 15 percent of the households, respectively. Men have the permission to work for themselves each and every day but only before and after the prescribed time of work on the common fields (typically the best coolest hours of daytime -before sunrise and after sunset-) in 15 percent of the sample households[7]. In the remaining cases (28 percent), which refer mainly to household heads and their brothers, men are allowed to work on their private fields more or less freely. Female members are granted more freedom to cultivate their individual fields, the production of which is partly consumed by the household. For them, we obtain the following figures: 22 percents (one day per week), 13 percents (two days per week), 22 percents (before and after working on the common fields), and 43 percents (more or less a free decision).

With such labour input data, we are not in a position to compare labour effort between common and private plots. The main reason is that there are differences across households that we do not properly measure. For example, we know that the number of weekly rest day(s), the number of working hours per day, or the working time before sunrise and after sunset differ across villages and even across farms. Constructing a labour intensity variable would require so many assumptions that it would be unreliable.

Empirical strategy

Our investigation of productivity differentials across plot types proceeds in three steps. First we perform a descriptive analysis of the differences in yields and inputs used between common and individual plots. We conclude that male individual plots are significantly more productive than common and female individual plots. This difference holds whether the comparison, between individual and common plots, is based on total plot productivity or on productivity of care-intensive crops. For subsistence crops, however, the difference is no more significant. Second, we use econometric analysis to investigate whether male individual plots remain more productive than common fields once we control for all observable differences across plots and for household fixed effects. We still find important productivity differentials between male individual and common plots, again especially for care-intensive crops.

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[6] Lallemand (1977, p.46), an anthropologist, also mentions the existence of such a rule in Burkina Faso.

[7] Individual workers might also be allowed to work on their private plots on the rest day.

We then turn to the question of the source of the productivity differential across individual and collective plots. We begin by arguing that this result cannot be attributed to any substantial difference in land quality because it subsists once we control for crop choice, bottom land, plot location and fallow practice. Since labour effort is the main input that we do not properly account for, we claim that the remaining productivity differential is at least partly attributable to differences in labour intensity applied on common and male individual plots.

In section 5, we provide direct evidence in favour of the existence of labour incentive problems plaguing collective production. Specifically, we first report descriptive quantitative evidence pointing to the existence of MHT problems. We then exploit the sub-sample of collective plots for which we can proxy the labour effort by the total number of workers and exploit the distinction between care-intensive and subsistence crops cultivation for which we expect a different effect of the labour force on production. Indeed, the type of plot management (individual versus collective) matters more for the care-intensive crop. We show that the estimated marginal productivity of labour is, for care-intensive and subsistence crops cultivation, in line with the theoretical prediction of a simple model of labour allocation in the presence of MHT.

3. Productivity differentials between collective and (male) individual plots

Descriptive statistics

Table A.4 (see Appendix A) presents descriptive statistics for key output and input variables. It comprises several blocks. Yields expressed in money value in FCFA (Francs issued by the "*Communauté Financière Africaine"*), and crop-specific physical yields are displayed in the first and second blocks, respectively. The third block includes different measures of farming areas, and the fourth block reports information regarding the various inputs used. For each block, aggregate figures for the whole sample are provided side by side with figures that are obtained for each type of plot (common or individual, and male or female).

In terms of gross monetary yields, private plots appear to be about four times as productive as the common plots, and this gap persists if yields are computed net of the expenses incurred on chemical inputs. The difference in land productivity between common and private plots is observed with more or less the same magnitude whether we consider dry lands or bottom lands separately. As expected, yields on the higher quality land, bottom lands, are considerably higher than on dry lands, and this is true for common fields as well as for private plots, whether male or female.

When a distinction is made between the main care-intensive crops[8] (rice, groundnuts, maize, cotton, and onions) on one hand, and traditional (subsistence) crops (millet and sorghum) on the other hand, a striking difference emerges: while yields on common fields are significantly smaller than yields on private plots for the former, they are roughly similar for the latter. This observation is broadly confirmed when we look at crop-specific physical yields. There is thus no statistically significant difference between yields on common and private plots for millet and sorghum while there is a marked difference for groundnuts, rice, and maize. The difference also exists for cotton and onions, yet it is not statistically significant because of the small number of observations made on one type of plot (common plots for onions and private plots for cotton). According to these various measures, male individual plots often turn out to be more productive than female plots. The third block contains information that has already been partly summarized in Table 2. We also see that the average size of a bottom land plot is considerably smaller than that of a dry land plot. Moreover, the advantage of common fields in terms of plot area holds whether we consider traditional or care-intensive crops.

Regarding the last block, it is noteworthy that total expenses on chemical inputs are significantly larger for private plots than for common fields, and for male private plots than for female plots. While chemical fertilizers applied to common fields come in more or less equal proportions from the CMDT and private traders, those used on private plots come almost exclusively from the latter. This is an important difference because modern inputs acquired from the CMDT (through the channel of local farmer associations "*Associations Villageoises*") are repaid after the harvest[9] whereas those acquired from private traders must typically be paid cash. Two last observations deserve to be emphasized. First, hardly 15 percent of individual plots have benefitted from the services of rented capital, mainly draught animals. This recourse to rented animals and plough is generally made by individual members who do not have easy access to the equipment of the household. Second, land tenure security as measured by the right to plant trees is stronger on common fields than on private plots and, concerning the latter, it is stronger for men than for women.

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[8] Care-intensive crops are crops for which quality of labour plays an important role, all through the agricultural seasons, in the form of careful application of fertilizers, diligent weeding, proper land management, row planting, etc.

[9] The value of the chemical inputs is subtracted from the proceeds paid to the farmer by the CMDT which acts as an exclusive purchaser of cotton produce (in 2007).

Two last comments deserve to be made regarding another available measure of the land quality. We know whether a plot was lying fallow for at least one year over the last five years. Table A.5 (see Appendix A) reveals that only 17.5 percent of collective plots were lying fallow for a minimum of one year over that period and that 86% of them belong to the household head. As for the private plots, their holders have never declared that their plot lied fallow over the last five years. Note that only 2.3% of these farmers are the owners of the plots they cultivate. Second, collective plots which have lied fallow for at least one year over the past five years seem to be less productive than those which have been cultivated without resting during the same five year period. We are then tempted to believe that collective plots which lie fallow are of less quality than those which are cultivated every year. However, we cannot say that an individual plot is systematically of better quality because it rarely (never) lies fallow. Indeed, the individual plot holders might not practice fallow period on their plots since they suffer from a land security problem: fallow individual land might be claimed back by its owner.

To sum up, it appears that private plots are on average of smaller in size and higher quality (higher proportion of bottom land), and receive greater quantities of chemical inputs, while common fields are at an advantage regarding the access to farm equipment and land security. Recall also that labour time allocation rules tend to be more favourable to the cultivation of common plots (see section 2). We now turn to an econometric analysis to examine whether private plots remains more productive once all these differences are accounted for.

Econometric analysis

In this section, we first want to examine whether the superiority of individual plots in terms of productivity remains after controlling for the intrinsic characteristics of the plots, like area, quality, location, and land rights. In this first step, we do not control for variables that potentially reflect strategic choices by the farmers.

In a second step, we do introduce such controls measured by crop choices and the use of non-labour inputs. Controlling for crop choice allows for the possibility that holders of individual plots make more profitable crop choices since they are presumably less subject to the constraint of providing foodstuffs used in family consumption. Then, we need to consider the contribution of material inputs to production to determine whether land productivity differentials subsist and, if yes, which theory is best able to account for them. If the

Kanzianga/Wahhaj (2010) hypothesis is true, one should observe a reversal of the direction of the land productivity differential: private plots become less productive than common fields once the intrinsic characteristics of the plot and the role of all complementary inputs except labour are taken into account. It could then be inferred, as these authors have done in their own empirical study, that the productivity advantage of common fields stems from a better application of labour efforts. Conversely, if the Guirkinger/Platteau (2011a) hypothesis is true, we should not observe any such reversal: because effort incentives are distorted on the common fields, private plots should remain more productive even after allowing for the contribution of non-labour inputs.

In this section, we use a simple OLS model on our most disaggregated data, measured at the plot level. In accordance with the two-step strategy highlighted above, we estimate the two following equations:

$$(1)\ Y_{ijh} = \alpha + \beta_1 female\_plot_{ijh} + \beta_2 common\_plot_{ijh} + \beta_3 area_{ijh} + \beta_4 location_{ijh} + \beta_5 land\_rights_{ijh} \\ + \eta quality_{ijh} + \gamma\, farmer\_charact_{jh} + \omega_h HH_h + \varepsilon_{ijh}$$

$$(2)\ Y_{ijh} = \alpha + \beta_1 female\_plot_{ijh} + \beta_2 common\_plot_{ijh} + \beta_3 area_{ijh} + \beta_4 location_{ijh} + \beta_5 land\_rights_{ijh} \\ + \eta quality_{ijh} + \chi nonfam\_labour\_input_{ijh} + \gamma\, farmer\_charact_{jh} + \delta_c CROP_{ijh} + \omega_h HH_h + \varepsilon_{ijh}$$

in which Y_{ijh} is the money value of the production per hectare of plot *i*, cultivated by farmer *j*, belonging to household *h*. The intrinsic characteristics of a plot are described by the following variables: three dummy variables indicating the type of land plot, the first one is *male private plot* (the reference category), the second is *female private plot*, and the third is *common plot*; $area_{ijh}$, the land area measured either continuously (in ha) or categorically (in quartiles); $location_{ijh}$, a continuous variable measuring the amount of time (in minutes) needed to cover by walk the distance between the plot and the farmstead; $land\_rights_{ijh}$, a binary variable which is equal to one if the farmer is allowed to plant trees, and to zero otherwise ; and finally $quality_{ijh}$, a vector of two dummy variables, the first one, *bottom,* takes on value one if the land is of high quality and value zero if it is dry, the second one labeled *fallow_5years* takes on value one if the plot was lying fallow at least once during the last five years, and zero if the fallow on that plot dates from more than five years ago. As for the farmer's intrinsic characteristics, they include his/her *age*; his/her level of *education*[10], which is a binary variable equals to one if the farmer completed primary education and zero otherwise[11]. In this first estimation, to control for unobserved household characteristics, we allow for household fixed effects, HH_h, a vector of dummy variables that identify each household of the sample. Finally, ε_{ijh}, are the robust standard errors clustered at the household level.

In our second estimation, we add a vector ($nonfam\_labour\_input_{ijh}$) of non-family labour input variables such as $chemical\,inputs$ which measures the expenses on chemical inputs, and two other binary variables related to the possible recourse of the farmer to externally-provided productive services, $hiring\,labour$ which is equal to one if the farmer has hired outside labour, and $renting\,equipment$ which equals one if the farmer has rented in draught animals and a plough. In this second estimation, we allow for crop fixed effects, $CROP_{ijh}$, a vector of dummy variables for each possible crop, so as to control for the possibility that holders of individual plots make more profitable crop choices[12].

The results are presented in Table 4. In the first column, we display the results that are obtained when equation (1) is estimated and land area is measured continuously. In the second column, land area is measured by a categorical variable based on a quartiles distribution. The third column presents the results based on equation (2), with land area measured continuously, and the fourth column presents the same with land area measured categorically.

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[10] For collective plots, we use the age and the level of education of the household head.

[11] In the sample area, the average level of education is extremely low: 85.5% of the sample individuals have never been to school, and only 2.5% of the sample farmers have their primary school degree.

[12] We include 14 crop dummies which are the most frequent crops grown and/or crops cultivated on a relatively large area (more than half an hectare, on average).

Table 4: Plot yield estimation using an OLS model

Dependant variable: Plot yield in value terms (FCFA/ha)				
	(1)	(2)	(3)	(4)
Explanatory variables	Equation 1	Equation 1a	Equation 2	Equation 2a
Female private plot	-237255.0**	-256867.0**	-86083.8	-93564.8
	(116552.3)	(117754.1)	(86783.4)	(82476.6)
Common plot	-354995.2***	-272062.9***	-186778.0**	-144038.0*
	(89245.8)	(97923.3)	(76691.7)	(79782.8)
Area	1906.5		-10066.6	
	(8022.5)		(12036.8)	
Squared area	349.5		460.3	
	(330.9)		(365.3)	
2nd quartile		-191509.4***		-64243.1
		(64842.2)		(85967.8)
3rd quartile		-190763.6***		-120048.2*
		(56280.1)		(68755.3)
4th quartile		-135876.9***		-155129.8*
		(63031.6)		(83802.5)
Bottom land	327463.9***	301578.1***	49168.0	29531.3
	(85726.6)	(87676.3)	(110952.8)	(106268.4)
Fallow_5years	-41229.7	-59447.1	-4152.3	-11002.6
	(47520.0)	(42303.2)	(51360.6)	(52817.2)
Location	-969.9	-758.4	-219.9	-176.0
	(657.3)	(677.7)	(566.6)	(589.2)
land right	152019.5**	152101.4**	129222.5**	131119.1**
	(74020.9)	(73459.1)	(63754.3)	(64578.5)
Chemical inputs			4.6*	4.6*
			(2.5)	(2.5)
Hiring labour			4916.3	13336.3
			(45680.8)	(45268.5)
Renting equipment			93937.2	105736.5
			(180916.6)	(174316.2)
Age of farmer	-2476.8	-1582.2	-2187.3	-1810.6
	(2482.5)	(2465.7)	(1829.2)	(1879.4)
Education of farmer	30495.7	28539.9	23985.9	26187.0
	(71742.0)	(80552.4)	(81063.1)	(82768.2)
Constant	116372.3	217581.8**	63010.6	89611.7
	(93300.9)	(99848.5)	(145210.8)	(149776.9)
Crop FE	*No*	*No*	*Yes*	*Yes*
Household FE	*Yes*	*Yes*	*Yes*	*Yes*
Nr of observations	895	895	895	895
Nr of clusters	202	202	202	202
R-squared	30.7	31.4	48.8	48.9

Significant at ***1%, **5% *10%; robust standard errors clustered at household level in parenthesis

From columns (1) and (2), it appears that, controlling for plot size and land quality in particular, male private plots have a significantly higher productivity than female plots and common fields. Incidentally, this finding is not consistent with the idea that common fields benefit from scale economies. Bottom land and the extent of rights held over the plot turn out to have a positive effect on land productivity. These results continue to hold when plot size is measured categorically and it now appears that comparatively large plots are less productive than plots belonging to the lowest end (quartile) of the distribution. Provided that land quality is properly measured, the latter result supports the view that the inverse relationship between land size and productivity, well-known in the agricultural economics and development literature, stems from input market imperfections rather than from differences in quality (also highlighted by Bhalla, 1988). The greater productivity of plots benefiting from higher land tenure security is consonant with our expectation based on the existing literature (Besley, 1995; Brasselle et al., 2002). Note that these last two results continue to hold when we control for farmer's decision variables, non-family labour inputs and crops choice (see column 3 and 4).

The relatively low productivity of the common fields is confirmed when taking into account non-labour inputs and when crop fixed effects are introduced (see columns 3 and 4 of Table 4): for plots owned by the same household, with similar characteristics, and planted to the same crop(s), those which are farmed individually prove to be more productive than those farmed collectively. Bear in mind that, given the rule followed by the head awarding private plots, these plots are not suspect of having been attributed to more dynamic members within the household (as explained above). It is worth pointing out that the coefficient of *common plot* in estimation (2a) remains quite large[13], even after having added all the necessary controls. These controls allow us to account for nearly 70% of the difference observed in the descriptive statistics: private plots appear now about twice more productive than common plots (use Table 4, column (4) and Appendix A, Table A.4, columns (3) and (8) to compute these numbers).

When controlling for material inputs and crop fixed effects, the advantage of men over women with respect to their private plots vanishes. Both controls seem to play a role since adding them separately leads to similar results: the coefficient of *female private plot* remains

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[13] The productivity (per ha) premium of a male private plot compared to a common plot with similar characteristics is, on average, 144,038 FCFA (219.6 €) per year. Bearing in mind that in Mali the PPP annual income per capita is 778.6€ (WDR, 2010), the advantage of farming a private plot is non negligible.

insignificant. This suggests that women have less recourse to material inputs and do not make optimal crop choices, which is not surprising to the extent that they are expected to provide ingredients for collective meals (see supra).[14]

Finally, we re-estimated equation (2) for two specific crops. These crops are groundnuts and sorghum which present the nice features of being simultaneously grown on the three types of plots in a sufficiently large number of cases, and of being mostly grown on dry lands. The dependent variable is now a physical measure of land productivity which is less noisy than the monetary measure since it does not include prices. The sample is now reduced to mixed structure only. Since the number of households in which there are both collective and individual (male) plots allotted to groundnut cultivation is limited, we do not control for household fixed effects but for village fixed effects instead. This means that we compare yields on private and collective plots across households within a particular village.[15]

As can be seen from the first column of Table 5, the estimation for groundnuts cultivation, the central result reported above continue to hold when we control for dry versus bottom lands. However, the difference in physical harvest is no more observed between male private and common plots when sorghum cultivation is considered (Table 5, column (2)). When we restrict the sample to low-quality plots (dry lands) where groundnuts and sorghum are mostly grown, we find similar results (not shown). Along the same line, we have clubbed together all the care-intensive crops –groundnuts, cotton, rice, maize, and onions−, which also happen to be cash crops, and re-constructed our dependent variable defined in value terms. When we re-estimate equation (2), we find again that our results stand whether we control or not for crop fixed effects and when we use alternative measures of land area (see Table 5, columns (3), (4) and (5)): common fields tend to be less productive than male private plots. When we club together the other main crops, sorghum and millet (both subsistence crops), we see that our result does not hold anymore (see Table 5, column (6)).

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[14] If we re-estimate the regression presented in Table 4, column (4), using *female private plot* as the reference category for the type of plot variable, we find that neither the coefficient of *common plot*, nor the coefficient of *male private plot* are significantly different from zero.

[15] When attention is restricted only to households in which groundnuts are grown on both types of plots (male individual and common plots), the sample size is reduced to 26 households, which is obviously a too small sample to apply inference tests. The average yield for groundnuts grown on (male) private plots in these 26 households is 743.45 kg/ha which is significantly (5%) larger than the yield of 383.33 kg/ha obtained on the common fields.

Table 5: Crop-specific plot yield estimations

Dependant variable	Plot physical yield (kg/ha)		Plot yield in value terms (FCFA/ha)			
Explanatory variables	(1) Equation 2 Groundnuts	(2) Equation 2 Sorghum	(3) Equation 2 Care-intensive crops[a]	(4) Equation 2a Care-intensive crops[a]	(5) Equation 2b Care-intensive crops[a]	(6) Equation 2 Subsistence crops[b]
Female private plot	-29.6	-328.8	-253210.6	-262906.0	-264470.4	-16096.2
	(142.3)	(331.6)	(208867.3)	(205463.1)	(220457.0)	(40795.0)
Common plot	-245.2*	24.8	-288435.2**	-314521.6**	-229136.0*	-6429.5
	(131.8)	(281.2)	(129728.7)	(144799.6)	(128427.9)	(28615.8)
Area	-135.5*	-72.7***	-9062.3	-11578.0		-3415.8*
	(80.5)	(26.4)	(9127.9)	(11254.9)		(2004.3)
2nd quartile					-295572.3**	
					(133091.5)	
3rd quartile					-279106.2***	
					(93607.9)	
4th quartile					-299251.9**	
					(119540.6)	
Bottom land	620.1**	-149.2	-308.0	167309.3**	26723.3	36500.2
	(291.2)	(107.9)	(153469.5)	(67546.8)	(128740.7)	(56115.5)
Fallow_5years	-52.0	-290.8**	-84636.3	-70763.2	-67313.8	-9571.0
	(139.7)	(111.3)	(92767.2)	(98026.1)	(92455.7)	(6973.5)
Location	0.2	-2.6	-403.9	-624.8	-75.5	211.8
	(0.9)	(2.4)	(562.8)	(472.0)	(558.1)	(374.9)
Land right	186.2*	130.6	33513.2	47228.5	60446.7	20790.6
	(98.5)	(276.5)	(77240.1)	(77775.4)	(79514.4)	(44687.4)
Chemical inputs	0.0	0.0	8.5	8.7*	8.2	0.7
	(0.0)	(0.0)	(5.4)	(5.3)	(5.3)	(0.5)
Hiring labour	-23.3	-166.9	24547.5	-14806.4	26637.3	-1313.7
	(85.9)	(114.5)	(70000.0)	(79646.9)	(66574.3)	(7970.1)
Renting equipment	-292.2***	-266.8**	64358.4	64414.1	114520.2	-41248.9
	(81.9)	(125.8)	(147326.5)	(140647.9)	(159078.2)	(24819.5)
Age of farmer	0.7	-0.9	-2373.3	-1906.3	-2092.2	-773.6
	(3.0)	(5.6)	(2986.5)	(2827.6)	(3000.9)	(977.1)
Education of farmer	-47.8	-275.9	65010.7	56737.5	31732.5	4344.9
	(131.7)	(173.2)	(70490.2)	(70813.2)	(73783.1)	(45364.1)
Constant	255.9	860.9	311567.2	251091.4	463484.9*	65746.4
	(187.4)	(427.4)	(208733.5)	(181000.8)	(266517.3)	(47368.0)
Crop FE	*No*	*No*	*Yes*	*No*	*Yes*	*Yes*
Household FE	*No*	*No*	*Yes*	*Yes*	*Yes*	*Yes*
Village FE	*Yes*	*Yes*	*No*	*No*	*No*	*No*
Nr of observation	195	271	620	620	620	429
Nr of clusters	89	129	198	198	198	196
R-squared	26.1	9.1	49.2	48.7	50.2	52.8

Significant at ***1%, **5%, *10%; robust standard errors clustered at household level in parenthesis

[a] Cotton, maize, rice, onion, groundnuts; [b] Sorghum and millet

To sum up, we find that individual plots farmed by male members are, on average, more productive than collective plots when we account for all observable differences across those plots. This is especially true for plots planted to care-intensive crops. Since we do not properly control for labour input in these estimations, the difference in land productivity might be due to substantial variation in labour effort applied on these plots. Inspired by our field interviews and by the work of Guirkinger and Platteau (2011a), we believe that MHT problem plagues collective production while the optimal level of effort is applied on (male) individual plots. This kind of incentive problem is more likely to arise when crops require effort of a minimum quality, implying that care is a key input into the production process. On the contrary, efficiency losses caused by incentive problems are not likely to be severe for crops requiring less care, so that effort quality plays a less important role in the production process. In the next section, we provide evidence of the existence of the MHT problem, especially when care-intensive crops are being grown.

It could be objected that the relationship between the type of plot and land productivity is instead driven by differences in unobserved land quality. The type of plot would then be a proxy for a dimension of land quality that we do not measure. Fortunately, we have (at least partly) overcome the problem of rough measurement of land quality through the use of crop fixed effects and location**,** as well as through crop(s) specific estimations. The underlying idea is that there exists a strong relationship between the type of crop grown and land quality, so that controlling for the former is about equivalent to controlling for the latter. It is thus revealing that in Burkina Faso, a country very similar to Mali (both are Sahelian, neighbouring countries), Udry (1996) has shown that "the primary impact of the soil type and location variables runs through the choice of which crop to plant on a given plot. Much of the effect of these characteristics, therefore, is picked up by the household-year-crop effects in the regressions. There is a very strong correlation between both the location and the soil type of a plot and the crop planted on that plot" (p. 1025). Interestingly, in the last two regressions of Table 4 (columns 3 and 4), the coefficient of *collective plots* decreases and the coefficient of the *bottom land* dummy stop being statistically significant, especially once we add crop fixed effects. This suggests that, with such controls, we are relatively successful in picking up variations in land quality. To conclude, even if no fully satisfying measure of land quality is available to us (such as could be obtained from soil analysis), there is rather solid ground to believe that unobserved differences in land quality are not driving our results.

Robustness checks

We have carried out various robustness checks on the basis of equation (2) which confirm our main results. First, we re-estimate the model on the basis of a restricted sample (of 830 plots) from which we have removed all the purely collective farms (farms in which there are collective plots only). Indeed, we want to avoid mixing collective plots that are subject to competition caused by the presence of private plots and collective plots that are immune to such a competitive effect (in the use of labour). Second, and essentially for the same reason, attention is restricted to households in which the three types of plots coexist (sample size is then reduced to 302 plots). Whether the former or the latter procedure is followed, we find that plots with similar characteristics, planted to the same crop by the same household exhibit higher productivity when cultivated individually (by male members) than when cultivated collectively (results not shown).

Third, it is possible that the superiority of private plots exists only for certain values of the plot area. To check this possibility, we add to the list of explanatory variables an interaction term between the area and the type of plot, a dummy with value one for collective plots and zero for male private plots. We find that the coefficient of this interaction term is positive and statistically significant (at 10 percent), yet is considerably smaller than the negative coefficient of the type-of-plot variable (significant at 5 percent) (results not shown). In other words, increasing plot size has the effect of mitigating the productivity advantage of private over common plots. Fourth, if we alternatively estimate a non-linear function or if we define the dependant variable as the net output per ha in value terms (meaning that we directly deduct the chemical inputs expenses from the gross output value), results remain unchanged. Fifth, when we add a dummy variable indicating the presence of inter-cropping, all our results hold and the coefficient of this new variable is never significantly different from zero. Sixth, we test whether the relationship to the household head has an influence on the relative productivity of the male individual plots. Instead of using a male individual plot variable, we distinguish between three types of male landholders: the household heads; those belonging to the generation of the household head; and those belonging to the head's sons generation[16]. The three coefficients are not significantly different from each other, and are all significantly positive.

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[16] We use three categories instead of four as presented in Table 3, to have enough observations per category.

Finally, in order to check for the possibility that our results are driven by extreme values, we have used estimation models robust to outliers. We have re-estimated equations (1) and (2) either by down weighing observations associated to large residuals[17] (Verardi and Dehon, 2010; Verardi and Croux, 2009; Dehon, Gassner and Verardi, 2009), or by removing these identified outliers from the sample. Not only do our results stand, but they also turn out to be sharper in explaining yield differentials between common and (male) individual plots (results not shown): the coefficients of *common plot* become significant at 1 percent. Yield differentials between different types of plots (common and male private plots) with similar characteristics, planted to the same crop are more important across households in a same village than within household.

4. Evidence of the moral-hazard-in-team problem on collective plots

So far, we have shown that male private plots are more productive than common fields when we control for plot and farmer characteristics as well as crop choice and material inputs. This could suggest that the productivity advantage of private plots stems from the application of more intensive labour effort conceived as the residual factor explaining productivity differentials (since we do not measure labour effort). In this section, we move one step further by examining whether the lower yields obtained on the common fields might be caused by the moral-hazard-in-team (MHT) problem. This hypothesis has been suggested by our interviews during which many household heads explicitly referred to the incentive problems plaguing collective production. On the one hand, many patriarchs complained that household members do not do their best while cultivating the collective plots as they give priority to work on their own individual plots[18]. On the other hand, it does not appear feasible to differentiate payments according to individual effort contributions to collective production. The main reason put forward by family heads is that serious intra-family conflicts would inevitably result.

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[17] The Stata commands are “`mmregress`” and “`rregress`”.

[18] For example, one of them said that “more effort is applied to the individual plots and when members work on the collective plot, they are tired". Another one complained that when they work on the collective field, his sons “are prone to keep energy in reserve for their individual plots" (“*ils se réservent*”) (Guirkinger and Platteau, 2011a: 12). Many interviewed household heads also mentioned that a better quality of labour (more intense labour efforts) would increase collective output.

Descriptive evidence: labour time allocation rules are stricter in context prone to MHT

Before embarking upon econometric testing of the MHT hypothesis, we show suggestive evidence derived from more qualitative information. We know that cultivation of individual plots is constrained by specific timing rules imposed by the household head. If the MHT problem exists and the head is aware of it, we expect him to impose relatively stricter rules when the problem is rather severe owing to the participation of numerous people in collective farming operations. Along this line, we construct a variable which describes the work rule applicable to male individual plots.[19] Three possibilities are considered, which we rank by decreasing order of severity: (1) male members are allowed to work only one or two day(s) a week on their individual plots; (2) they may work before sunrise and after sunset (that is, during the coolest hours of the day), and sometimes also one day a week; and (3) they may work five or six days a week, or whenever they want. The result, reported in Table 10, is according to expectation: the number of workers participating in collective production is greater in households where the most constraining rule is in force (see column (1)).

Guirkinger and Platteau (2010b) have argued that "the temptation to free ride on other members' efforts on the collective fields appears to be perceptible when several married men work together". The idea is that, since the families of married men are very likely to be of unequal size, the way of distributing the collective output might look arbitrary to some parents: whether the head decides to distribute output equally among all sons, or to give shares proportionate to their family size, the rule will distort incentives (for members with larger family size in the former case, and for members with smaller family size in the latter). In addition, it is plausible that once they get married male members tend to identify with their nuclear family more than with the extended family. As a result, they may not feel as loyal as before to the large household unit, thereby weakening solidarity links and triggering feelings of competition and rivalry. In order to test that idea, we correlate the degree of severity of the time allocation rule with the number of married men, rather than the total number of workers on the collective field (see column (2)). We again find that the rule is comparatively stricter when the number of married men is higher.

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[19] In some households, we observe that the head imposes different rules on his male members. For these cases, we take the stricter rule imposed as the rule in force for the whole household.

Table 10: Relationship between the time allocation rule and the number of workers, the number of married men or the type of family

Time allocation rules for work on private (male) plots (by decreasing order of severity)	(1) Nr of workers (std.dev.)	(2) Nr of married men (std.dev.)	(3) Nr of extended families (%)	(4) Nr of simple families (%)	(5) Nr of hholds with male private plots
(1) One or two day(s) a week	12.3 (6.0)	4.2 (2.0)	26 (70.3)	12 (41.4)	38
(2) Coolest hours of the day + sometimes one day	7.6 (3.1)	2.4 (1.0)	4 (10.8)	7 (24.1)	11
(3) Five or six days a week / free choice	9.8 (5.7)	3.2 (1.9)	7 (18.9)	10 (34.5)	17
(1) ≠ (2) t-test: P-value	0.009***	0.005***			
(1) ≠ (3) t-test: P-value	0.076*	0.078*			
Number of households			37	29	66

In the same line, we check whether a relationship exists between the type of rule used by the head and the type of household. The hypothesis is that a more severe rule should prevail when families are extended in the sense of comprising brothers and nephews. In other words, a greater discipline is expected to be imposed by the head when there are more distant intra-family links and, therefore, greater temptation to free ride on other members' efforts. Column (3) (Table 10) appears to bear out this last hypothesis: in extended families, the most severe time allocation rule is applied in about 70 percent of the cases, as against 40 percent for the other families. A more formal way to test this hypothesis is to construct an index of family cohesion based on the Hamilton rule. Our index is the ratio of the Hamiltonian weighted sum of workers to the total number of workers[20]. We find that the time allocation rule imposed by the head is significantly stricter when the cohesion index is smaller[21].

Finally, assuming that the household head monitors effort if he is himself present on the collective field, we expect his presence to be more frequently observed when there is a higher risk of labour shirking, that is, when there are numerous workers or married men, or when the family is of the extended type. Our data, however, do not confirm this hypothesis. On the contrary, we find that the household head participates in collective production when there are

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[20] Weights are determined by the genetic links between the household head and the workers on the collective plot, for example sons or brothers are given a weight of 0.5, grand-children 0.25, nephews or cousins 0.125.

[21] The cohesion index values with respect to working time allocation rule are (between parenthesis: standard deviation and number of observations, respectively): 0.30 (0.11; 71) when rule (1) is applied; 0.33 (0.09; 30) for rule (2); and 0.36 (0.12; 37) for rule (3). Means differences test of index values between rule (1) and rule (2), or between rule (1) and rule (3) are statistically significant at 5%.

fewer workers available to farm the collective fields. This suggests that the presence of the head on these fields arises more from the need to complement a scarce workforce than from the need to supervise the efforts applied by the participating members.

Theoretical prediction and econometric testing of moral-hazard-in-team problem

We now complement the suggestive statistical evidence presented above with the quantitative tests available to us. Testing the presence of MHT problem is *a priori* difficult because a higher number of workers presumably has two simultaneous effects: (i) an additional worker gives rise to a greater dilution of incentives due to the MHT problem; and (ii) for given amounts of complementary production factors, he (she) causes the marginal productivity of labour to decrease. As we show below, this ambiguity cannot be completely surmounted, as theory allows us only potentially to discriminate between situations of first-best efficiency and situations plagued by the MHT problem.

Let us assume that the production technology is described by a Cobb-Douglas (CD) function subject to constant, decreasing or increasing returns to scale.[22] Let us denote by *A* the land amount allotted to collective farming in the household, by *L* the aggregate labour input applied to this land, by *n* the number of workers assumed to be identical, and by *l* the individual amount of effort (in efficiency terms), we write:

if returns to scale are constant: $Y_1 = A^{\beta} L^{1-\beta} \Rightarrow Y_1 = A^{\beta}(nl)^{1-\beta}$

if they are not: $Y_2 = A^{\alpha} L^{\beta} \Rightarrow Y_2 = A^{\alpha}(nl)^{\beta}$ with $\alpha + \beta > or < 1$ for increasing or decreasing returns to scale.

The marginal productivity of aggregate labour input is then, respectively:

$$\frac{\partial Y_1}{\partial L} = (1-\beta)\left(\frac{A}{nl}\right)^{\beta} \text{ and } \frac{\partial Y_2}{\partial L} = \beta A^{\alpha}\left(\frac{1}{nl}\right)^{1-\beta}.$$

As for the effort cost function, it is assumed to be convex (standard assumption). Two alternative specifications are considered, depending on whether the marginal cost of effort is increasing linearly or non-linearly with the amount of effort. We write:

$(i)\ CT(l) = \gamma l^2 \rightarrow Cm(l) = 2\gamma l$

$(ii)\ CT(l) = \gamma l^3 \rightarrow Cm(l) = 3\gamma l^2$

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[22] Note that the results would hold with a general form of the production function, but we use a CD function to derive explicit expressions for the variables of interest.

We then derive the equilibrium amount of individual effort obtained under the two regimes, −the first-best efficiency situation and the situation characterized by the MHT problem−, and under the different combinations of assumptions regarding the shape of the effort cost function and the type of returns to scale. In the corresponding equilibrium condition, the MHT problem is captured by the fact that the worker receives only a share (equal to $1/n$) of his (her) marginal productivity with the consequence that he (she) under-applies effort. After plugging the equilibrium values of effort into the production function, we compute the first derivatives of total output with respect to *n*, the only labour-related data that are available to us. Table 6 shows the equilibrium amounts of effort for all considered cases and Table 7 the values of the first derivatives of total output with respect to *n*.

Table 6: Equilibrium levels of labour effort under the two regimes and for different labour cost functions

		1st best-efficiency	With MHT problem
	Cost of labour effort function	*Equilibrium C°:* $Y'_L = Cm(l)$	*Equilibrium C°:* $\frac{1}{n}Y'_L = Cm(l)$
CONSTANT RETURNS TO SCALE	$(i)\ CT(l) = \gamma l^2 \rightarrow Cm(l) = 2\gamma l$	$l^* = \left(\left(\frac{A}{n}\right)^{\beta} \frac{1-\beta}{2\gamma}\right)^{1/1+\beta}$	$l^* = \left(\frac{A^{\beta}}{n}\frac{1-\beta}{2\gamma}\right)^{1/1+\beta}$
	$(ii)\ CT(l) = \gamma l^3 \rightarrow Cm(l) = 3\gamma l^2$	$l^* = \left(\left(\frac{A}{n}\right)^{\beta} \frac{1-\beta}{3\gamma}\right)^{1/2+\beta}$	$l^* = \left(\frac{A^{\beta}}{n^{1+\beta}}\frac{1-\beta}{3\gamma}\right)^{1/2+\beta}$
INCREASING DECREASING RETURNS TO SCALE	$(i)\ CT(l) = \gamma l^2 \rightarrow Cm(l) = 2\gamma l$	$l^* = \left(\frac{A^{\alpha}}{n^{1-\beta}}\frac{\beta}{2\gamma}\right)^{1/2-\beta}$	$l^* = \frac{1}{n}\left(\frac{A^{\alpha}\beta}{2\gamma}\right)^{1/2-\beta}$
	$(ii)\ CT(l) = \gamma l^3 \rightarrow Cm(l) = 3\gamma l^2$	$l^* = \left(\frac{A^{\alpha}}{n^{1-\beta}}\frac{\beta}{3\gamma}\right)^{1/3-\beta}$	$l^* = \left(\frac{A^{\alpha}}{n^{2-\beta}}\frac{\beta}{3\gamma}\right)^{1/3-\beta}$

Table 7: Responses of total production to a marginal increase in the number of workers (n) under the two regimes and for different labour cost functions

	Marginal cost of labour effort	1st best-efficiency	With MHT problem
CONSTANT RETURNS TO SCALE	$(i)\ Cm(l) = 2\gamma l$	$\frac{\partial Y}{\partial n} = \left(\frac{1-\beta}{1+\beta}\right) n^{{}^{-2\beta}/{}_{1+\beta}} A^{{}^{2\beta}/{}_{1+\beta}} \left(\frac{1-\beta}{2\gamma}\right)^{{}^{1-\beta}/{}_{1+\beta}}$	$\frac{\partial Y}{\partial n} = 0$
	$(ii)\ Cm(l) = 3\gamma l^2$	$\frac{\partial Y}{\partial n} = 2\left(\frac{1-\beta}{2+\beta}\right) n^{{}^{-3\beta}/{}_{2+\beta}} A^{{}^{3\beta}/{}_{2+\beta}} \left(\frac{1-\beta}{3\gamma}\right)^{{}^{1-\beta}/{}_{2+\beta}}$	$\frac{\partial Y}{\partial n} = \left(\frac{1-\beta}{2+\beta}\right) n^{{}^{-(1+2\beta)}/{}_{2+\beta}} A^{{}^{3\beta}/{}_{2+\beta}} \left(\frac{1-\beta}{2\gamma}\right)^{{}^{1-\beta}/{}_{2+\beta}}$
INCREASING DECREASING RETURNS TO SCALE	$(i)\ Cm(l) = 2\gamma l$	$\frac{\partial Y}{\partial n} = \left(\frac{\beta}{2-\beta}\right) n^{{}^{-2(1-\beta)}/{}_{2-\beta}} A^{{}^{2\alpha}/{}_{2-\beta}} \left(\frac{\beta}{2\gamma}\right)^{{}^{\beta}/{}_{2-\beta}}$	$\frac{\partial Y}{\partial n} = 0$
	$(ii)\ Cm(l) = 3\gamma l^2$	$\frac{\partial Y}{\partial n} = \left(\frac{2\beta}{3-\beta}\right) n^{{}^{-3(1-\beta)}/{}_{3-\beta}} A^{{}^{3\alpha}/{}_{3-\beta}} \left(\frac{\beta}{3\gamma}\right)^{{}^{\beta}/{}_{3-\beta}}$	$\frac{\partial Y}{\partial n} = \left(\frac{\beta}{3-\beta}\right) n^{{}^{-(3-2\beta)}/{}_{3-\beta}} A^{{}^{3\alpha}/{}_{3-\beta}} \left(\frac{\beta}{3\gamma}\right)^{{}^{\beta}/{}_{3-\beta}}$

All the expressions for the first derivatives can be signed unambiguously. Just note that when increasing (or decreasing) returns to scale are posited, a realistic condition limiting the possible value of parameter β needs to be satisfied. The signs corresponding to each case are reported in Table 8.[23] In the same table, we also report the signs that are obtained when the output variable is the productivity per worker per land unit (Y/nA) instead of the aggregate output (the corresponding first derivatives are not shown).

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[23] When productivity per unit of land (Y/A) is considered, the results are obviously identical to those reported for total output (since *A* is constant).

<u>Table 8</u>: Comparative signs of the effects of a marginal increase in the number of workers on total production and on productivity per person per hectare, distinguishing between first-best situation and situation characterized by the MHT problem

	Marginal cost of labour effort	1st best-efficiency		With MHT problem	
		(1) Y	(2) Y/nA	(3) Y	(4) Y/nA
CONSTANT RETURNS TO SCALE	$(i)\ Cm(l) = 2\gamma l$	$\frac{\partial Y}{\partial n} > 0$	$\frac{\partial Y/nA}{\partial n} < 0$	$\frac{\partial Y}{\partial n} = 0$	$\frac{\partial Y/nA}{\partial n} < 0$
	$(ii)\ Cm(l) = 3\gamma l^2$	$\frac{\partial Y}{\partial n} > 0$	$\frac{\partial Y/nA}{\partial n} < 0$	$\frac{\partial Y}{\partial n} > 0$	$\frac{\partial Y/nA}{\partial n} < 0$
INCREASING/ DECREASING RETURNS TO SCALE	$(i)\ Cm(l) = 2\gamma l$	$\frac{\partial Y}{\partial n} > 0\ if\ \beta < 2$	$\frac{\partial Y/nA}{\partial n} < 0$	$\frac{\partial Y}{\partial n} = 0$	$\frac{\partial Y/nA}{\partial n} < 0$
	$(ii)\ Cm(l) = 3\gamma l^2$	$\frac{\partial Y}{\partial n} > 0\ if\ \beta < 3$	$\frac{\partial Y/nA}{\partial n} < 0$	$\frac{\partial Y}{\partial n} > 0\ if\ \beta < 3$	$\frac{\partial Y/nA}{\partial n} < 0$

A glance at Table 8 reveals that the response of aggregate output to a change in the size of the workforce is always positive in the first-best situations yet can be nil in the presence of the MHT problem if the marginal cost of effort increases linearly in *l* (cases (i) in Table). Whether returns to scale are decreasing, constant, or increasing does not modify this contrast. Moreover, when we look at columns (2) and (4), we note that the signs of the derivative of the productivity per person per hectare with respect to *n* are consistently negative in all the cases examined: with such a measure of productivity, it is therefore impossible to detect empirically the possible presence of a MHT problem.

The results shown in the above table enable us to derive two predictions to empirically test the presence of MHT problem on collective fields. First, if total output (or output per hectare) can be shown to be unresponsive to a marginal increase in the number of workers, we could safely conclude that the MHT problem exists. The second prediction exploits the difference between subsistence and care intensive crops. Recall the finding obtained in Section 4 according to which land productivity is not significantly different between male private plots and collective plots devoted to cultivation of traditional (subsistence) crops which are easy to monitor. Our idea is to use subsistence crops as counterfactual to which we compare care-intensive crops where MHT problems should be more acute. A test of the MHT hypothesis would consist of showing that, either the coefficient of the workforce size in the regression for care-intensive crops is not significant while the same coefficient is significantly positive for subsistence crops, which are easy to monitor; or that this coefficient in the former regression is also significantly positive but nevertheless smaller than the same coefficient in the latter regression.[24]

The critical differences between the present and the previous econometric exercises are that the sample is now restricted to collective fields and that a labour variable, the number of workers (*nr_workers*) engaged in collective family production is included in the list of the explanatory variables and that we control for village fixed effects (instead of household fixed effects). We first estimate a simple OLS model in which the dependent variable is the total monetary output, Y_{ih} , obtained on a collective plot *j* of a household *h*:

$$Y_{ih} = \alpha + \beta nr\_workers_h + \gamma plot\_charact_{ih} + \chi complementary\_inputs_{ijh} + \rho head\_charact_h \\ + \delta_c CROP_{ih} + \lambda VILLAGE_h + \varepsilon_{ih}$$

We control for plot characteristics, complementary inputs, household head characteristics, crop and village fixed effects in the same way as we have done in the previous section. Moreover, in the vector of the plot characteristics, we have available a proxy for the use of organic fertilizers (labeled *manure)*, which is measured by the total number of cattle heads owned by the household, and a dummy indicating whether the household owns a *plough*. The results are presented in column (1) of Table 9 where no distinction is made between care-intensive (rice, groundnuts, maize, cotton and onions) and traditional subsistence crops (millet and sorghum). In columns (2) and (3), the model is re-estimated successively for the former and the latter crops considered separately.

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[24] We can easily show that $\partial Y / \partial n$ under the 1st best efficiency is higher than $\partial Y / \partial n$ obtained with the MHT problem (see Table 7, cases (ii)).

<u>Table 9</u>: Estimating the effects of the number of workers on total output value for all type of crops and distinguishing between care-intensive and subsistence crops

Dependant Variable: Plot output in value terms (FCFA)			
Explanatory variables	(1) All crops	(2) Care-intensive crops[a]	(3) Subsistence crops[b]
Nr of workers	-366.9	-4469.7	6296.4*
	(3536.5)	(3603.2)	(3335.9)
Area	79166.3***	109.37.4***	29634.7***
	(8407.3)	(11020.2)	(6029.6)
Bottom land	108168.4**	-12538.3	121659.1*
	(46825.5)	(51880.1)	(70743.3)
Fallow_5years	-45882.2	10376.9	-44324.7***
	(35883.0)	(38223.5)	(16400.6)
Location	-368.4	263.8	-779.4
	(480.8)	(545.4)	(537.1)
Land rights	-54402.3	-26641.3	-18736.3
	(41167.9)	(47584.2)	(38709.3)
Chemical inputs	1.5***	1.1**	0.2
	(0.4)	(0.5)	(0.6)
Hiring labour	18368.8	44203.9	-19255.1
	(33818.3)	(31536.0)	(25392.5)
Renting material	-69279.9	-120014.9**	-10790.9
	(44023.4)	(49270.0)	(26576.1)
Plough dummy	15121.7	62117.9	26302.3
	(33147.2)	(38343.2)	(18393.1)
Manure	8401.1**	9138.7**	179.4
	(4275.9)	(4067.1)	(1722.9)
Age of the farmer	904.4	980.8	-631.1
	(1149.5)	(1193.5)	(948.6)
Education of the farmer	38755.5	-67.0	-2612.0
	(46423.3)	(65511.1)	(33508.5)
Constant	-19201.7	13518.5	194014.9
	(97379.6)	(79990.3)	(192019.7)
Crop FE	*Yes*	*Yes*	*Yes*
Village FE	*Yes*	*Yes*	*Yes*
Nr of observations	455	286	345
Nr of clusters	201	201	201
R-squared	77.2	86.1	30.9

Significant at ***1%, **5%, *10%; robust standard errors clustered at household level in parenthesis

[a] Cotton, maize, rice, onion, groundnuts

[b] Sorghum and millet

The findings strongly suggest the presence of a MHT problem on the collective fields. As a matter of fact, the coefficient of the workforce variable is not significantly different from zero, and is quite small, in the first two regressions while it is significantly positive in the third regression where subsistence crops are isolated. Note that when the model is re-estimated using output per person per hectare as the dependent variable, we find that, as expected (see Table 8, columns 2 and 4, supra), the coefficient of the workforce variable is negative and significant (at 1 percent level) in the three cases examined (results shown in Appendix B).

It might seem strange that household heads would allow such a large workforce to operate on the collective fields that their marginal productivity comes down to zero. The oddity vanishes, however, once we realize that the logic of traditional subsistence economies differs from the logic of so-called ‘commercialized’ economies. As argued by Lewis (1954), Cohen and Weitzman (1975), and Platteau (1991), the former type is characterized by specific employment and remuneration rules: each member of the social unit (typically a family) enjoys a guaranteed access to employment on the collective farm, and receives the average product as reward for participation in productive activities. Since the number of claimants is thus fixed, optimal production corresponds to its maximum level (marginal productivity is zero). The same conclusion obviously obtains if members receive an institutional, customary wage and the family head appropriates a rent that he seeks to maximize.

It could be objected that the effect of the number of workers is spurious in so far as the size of the workforce is positively correlated with the number of women working on the field who are usually shown to be less productive than men (results usually obtained in the literature but not supported by our data analysis, see Table 4 and 5, supra). In order to check for this possibility, we have re-estimated the model taking the number of male and female workers instead of the total number of workers. Our results stand: the number of workers, whether male or female, does not significantly influence monetary output. As an additional check, we re-estimated the model by introducing a variable measuring the ratio of men to women. The results continue to hold and the coefficient of the gender ratio is negative and significant whereas it should have been positive if men were more productive than women.

As an additional robustness check, we measure the size of the workforce by the number of married male members or the number of workers weighted by using the Hamilton rule. We again find that this variable has no significant impact on the value of collective output for care-intensive crops whereas the influence is significantly positive for subsistence crops.

Interestingly, if we introduce dichotomous variables capturing the strength of the time allocation rule imposed by the household head on the individual plot holders, we find that the stricter the rule, the higher the production on the common plot and that the main results continue to hold. This suggests that when the head is able to limit the competition for labour effort between collective and individual plots, he is able to encourage collective production[25]. In the same line, we test whether, ceteris paribus, families in which workers are close relatives are less affected by incentive problems. This is done by adding the index of family cohesion in our list of explanatory variables. The index never turns out to have a significant impact on production, but the other results remain. It thus seems that the MHT problem is as severe in families with close blood ties as in more extended families.

5. Conclusion

This paper has clearly established, on the basis of first-hand data collected in Mali, that significant productivity differentials exist between collective fields managed by the household head for the sake of the family as a whole, on the one hand, and private plots managed by individual male members for their own benefit, on the other hand. Moreover, there is strong evidence that these differentials can be attributed to substantial variations in the labour effort applied to cultivation, which we do not measure directly. This conclusion is inferred from the fact that productivity differences subsist after controlling for plot and farmer characteristics, the use of non-family labour inputs, and for crop and household fixed effects. By using crop fixed effects, we do not only control for the possible differences in crop choices between (male) members and the household head, but we also mitigate the effect of possible quality variations that are not well captured by our rather rough distinction between low and high quality (dry and bottom) lands.

The cropwise distinction has yielded an interesting finding: the productivity advantage of private (male) farming exists for care-intensive crops yet not for the two traditional subsistence crops (millet and sorghum). A plausible explanation for the observed superiority of private plots in terms of effort intensity is the presence of the moral-hazard-in-team problem which distorts labour incentives on collective fields devoted to the cultivation of care-intensive crops. This hypothesis has been confirmed by an empirical test of the effect on

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[25] Collective production is on average higher when the prevailing rule is one or two day(s) per week than when individual farmers are allowed to work on their private plots every day during the coolest hours (before sunrise and after sunset).

land productivity of the number of individuals engaged in collective production. Our results therefore support the theory of the family farm proposed by Guirkinger and Platteau (2011a). According to them, indeed, collective farming in the context of extended family farms is vulnerable to efficiency losses precisely because of the above incentive problem.

From an efficiency point of view, purely collective family farms are thus at disadvantage compared with mixed farms in which private plots coexist with common ones. Why do household heads accept such inefficiency losses of which they seem to be quite aware? The answer provided by Guirkinger and Platteau (2011a) is rent capture by the heads. Since their own incomes are essentially obtained from collective farming, there exists an obvious trade-off between efficiency and rent capture considerations. When land becomes sufficiently scarce, the head's income is maximized by awarding private plots to members. Another plausible explanation refers to risk considerations. To the extent that common fields act as a risk-pooling mechanism, their lower productivity is at the root of an efficiency-insurance trade-off. At equilibrium, therefore, risk-averse members are expected to choose a mix of collective and private plots –as some agricultural producer cooperatives do- (Carter, 1987; Delpierre, Guirkinger, and Platteau, 2011). To the extent that agricultural production remains plagued by risk, such an explanation accounts for the persistence of mixed farms but not for its emergence in places where collective farms were initially predominant.

Appendix A

Table A.1 : *Crop's allocation (frequencies and average cultivated area) during the rainy season*

Crop	All plots		All collective plots		All individual plots		*Male individual plots*		*Female individual plots*	
	Nr. of plots	Average area of the plot	Nr. of plots	Average area of the plot	Nr. of plots	Average area of the plot	*Nr. of plots*	*Average area of the plot*	*Nr. of plots*	*Average area of the plot*
Cotton	122	3.67 (3.63)	114	3.79 (3.72)	8	2.03 (1.26)	*7*	*1.89* *(1.29)*	*1*	*3.00*
Millet	221	2.19 (1.75)	205	2.33 (1.74)	16	0.46 (0.29)	*5*	*0.57* *(0.42)*	*11*	*0.41* *(0.22)*
Sorghum	351	2.23 (2.29)	264	2.79 (2.35)	87	0.55 (0.89)	*21*	*1.31* *(1.35)*	*66*	*0.31* *(0.49)*
Maize	205	1.79 (1.71)	182	1.94 (1.74)	23	0.60 (0.50)	*15*	*0.69* *(0.55)*	*8*	*0.43* *(0.37)*
Rice	171	0.54 (0.75)	29	1.01 (1.61)	142	0.44 (0.32)	*14*	*0.54* *(0.58)*	*128*	*0.43* *(0.28)*
Groundnuts	254	0.57 (0.83)	97	0.97 (1.06)	157	0.32 (0.51)	*39*	*0.58* *(0.95)*	*118*	*0.24* *(0.18)*
Niebe	68	2.00 (2.94)	47	2.75 (3.26)	21	0.32 (0.42)	*8*	*0.42* *(0.65)*	*13*	*0.26* *(0.18)*
Gombo	47	0.14 (0.13)	2	0.50 (0.35)	45	0.12 (0.10)	*2*	*0.15* *(0.00)*	*43*	*0.12* *(0.10)*
Beens	41	0.41 (0.30)	29	0.48 (0.32)	12	0.23 (0.15)	*0*	*0*	*12*	*0.23* *(0.15)*
Chili	103	0.18 (0.19)	3	0.50 (0.00)	100	0.17 (0.18)	*36*	*0.17* *(0.16)*	*64*	*0.16* *(0.19)*
Ginger	37	0.29 (0.31)	11	0.63 (0.38)	26	0.15 (0.10)	*9*	*0.19* *(0.10)*	*17*	*0.12* *(0.09)*
Other crops[a]	122	0.68 (1.02)	72	1.03 (1.21)	50	0.18 (0.24)	*21*	*0.29* *(0.33)*	*29*	*0.10* *(0.07)*

[a] onion, potato, sweet potato, fonio, tomato, bissam, salad, cabbage, cashewnuts, sesam

Table A.2: *Crop's allocation (frequencies and average cultivated area) during the dry season (on bottom land only)*

	All plots		All collective plots		All individual plots		*Male individual plots*		*Female individual plots*	
Crop	Nr. of plots	Average area of the plot	Nr. of plots	Average area of the plot	Nr. of plots	Average area of the plots	*Nr. of plots*	*Average area of the plot*	*Nr. of plots*	*Average area of the plot*
Onion	109	0.14 (0.13)	8	0.23 (0.15)	101	0.13 (0.13)	*35*	*0.13* *(0.11)*	*66*	*0.13* *(0.14)*
groundnuts	26	0.19 (0.16)	2	0.29	24	0.18 (0.17)	*3*	*0.15* *(0.04)*	*21*	*0.18* *(0.18)*
Sweet potato	35	0.23 (0.17)	4	0.33 (0.12)	31	0.22 (0.17)	*9*	*0.29* *(0.20)*	*22*	*0.19* *(0.16)*
Other crops[a]	48	0.31 (0.32)	15	0.53 (0.43)	33	0.21 (0.19)	*18*	*0.25* *(0.20)*	*15*	*0.16* *(0.16)*

[a] potato, chili, tomato, salad, cabbage

Table A.3: Crop's allocation between dry and bottom land during the rainy season.

Type of Crop	Dry land		Bottom land	
	Nr. of plots	Average area of the plot	Nr. of plots	Average area of the plot
Cotton	122	3.67 (3.63)	0	0
Millet	219	2.21 (1.75)	2	0.4 (0.00)
Sorghum	351	2.23 (2.29)	0	0
Maize	194	1.86 (1.72)	11	0.66 (0.84)
Rice	25	0.64 (0.57)	146	0.52 (0.77)
Groundnuts	244	0.59 (0.84)	10	0.21 (0.37)
Niebe	65	2.08 (2.98)	3	0.21 (0.25)
Gombo	29	0.17 (0.14)	18	0.08 (0.10)
Beans	41	0.41 (0.30)	0	0
Fonio	36	0.79 (0.50)	0	0
Chili	62	0.21 (0.20)	41	0.13 (015)
Ginger	37	0.29 (0.31)	0	0
Other crops[a]	100	0.78 (1.10)	22	0.23 (0.32)

[a] onion, potato, sweet potato, fonio, tomato, bissam, salad, cabbage, cashewnuts, sesam

Table A.4: *Descriptive statistics of the main variables.*

	Total		Collective Plot (CP)		Individual Plot (IP)		P-Val CP><IP	*Male individual Plot (MIP)*		*Female individual Plot (FIP)*		P-Val MIP><FIP	P-Val CP><MIP
	Average (std. dev)	Nr obs	Average (std dev)	Nr obs	Average (std. dev)	Nr obs		*Average (std. dev)*	*Nr obs*	*Average (std. dev)*	*Nr obs*		
(1) Monetary Yields (FCFA/ha)													
Total yield	243 110.4 (21 654.4)	979	85 564.1 (6 511.0)	459	382 175.3 (39 383.8)	520	0.000	*520 687* *(91 134.1)*	*149*	*326 546.3* *(41 061)*	*371*	0.013	0.000
Yield net of fertilizer cost	218 284.2 (20 839.8)	979	67 366.0 (5 823.2)	459	351 498.4 (37 966.1)	520	0.000	*474 883.1* *(87 333.9)*	*149*	*301 945.0* *(39 816.4)*	*371*	0.020	0.000
Yield for dry land	94 636.6 (5 572.7)	672	65 559.3 (2 657.3)	414	136 527.2 (13 211.1)	258	0.000	*183 926.5* *27 923.4)*	*79*	*115 607.7* *(14 296.3)*	*179*	0.008	0.000
Yield for bottom land	572 115.8 (64 181.7)	307	269 608.2 (55 176.1)	45	624 073.2 (74 165.3)	262	0.025	*900 745.3* *(181 594.3)*	*70*	*523 203.1* *(75 591.4)*	*192*	0.012	0.000
Yield for care intensive crops[a]	218 762.2 (23979.9)	680	100 691.9 (6 289.9)	287	304 986.6 (40 711.6)	393	0.000	*499 738.1* *(144 465.2)*	*94*	*243 760.4* *(27 666.9)*	*299*	0.004	0.000
Yield for subsistence crops[b]	47 879.7 (2 989.3)	447	47 959.2 (2 927.7)	348	47 600.2 (8 770.9)	99	0.480	*57 518.5* *(12 236.0)*	*23*	*44 598.6* *(10 822.9)*	*76*	0.268	0.209
(2) Physical Yields (kg/ha)													
Cotton	896.87 (44.13)	122	887.55 (46.55)	114	1029.76 (79.78)	8	0.214	*1057.82* *(85.98)*	*7*	*833.33 (0)*	*1*	/	0.187
Millet	691.91 (50.82)	221	692.75 (53.31)	205	681.74 (169.95)	16	0.477	*746.66*	*5*	*654.69*	*12*	0.407	0.438
Sorghum	586.09 (42.73)	351	593.73 (46.14)	264	563.16 (100.72)	87	0.379	*755.17* *(176.23)*	*21*	*502.97* *(119.94)*	*67*	0.144	0.173
Maize	1100.41 (56.78)	205	1080.20 (59.58)	182	1260.33 (184.46)	23	0.159	*1437.78* *(255.86)*	*15*	*927.60* *(194.15)*	*8*	0.097	0.053
Rice	2 243.27 (279.91)	171	1 280.38 (430.13)	29	2 439.92 (323.48)	142	0.060	*2369.05* *(873.23)*	*14*	*2447.67* *(346.90)*	*128*	0.471	0.107
Onion	3115.50 (481.42)	109	1912.88 (70.61)	8	3210.76 (515.88)	101	0.243	*4150.44* *(1155.16)*	*35*	*2712.45* *(495.36)*	*66*	0.093	0.184
Groundnuts (kg/ha)	507.3 (36.6)	254	384.2 (31.8)	97	583.4 (54.2)	157	0.004	*729.52* *(126.88)*	*39*	*530.47* *(58.56)*	*119*	0.057	0.000

(3) Farming areas (ha)													
Cultivated area	2.35 (0.12)	1023	4.43 (0.23)	488	0.44 (0.03)	535	0.000	*0.66* *(0.10)*	*154*	*0.35* *(0.02)*	*381*	0.000	0.000
Dry land cultivated area	3.38 (0.18)	672	5.11 (0.26)	414	0.60 (0.07)	258	0.000	*1.03* *(0.18)*	*79*	*0.41* *(0.05)*	*179*	0.000	0.000
Bottom land cultivated area	0.42 (0.04)	307	1.06 (0.26)	45	0.31 (0.02)	262	0.000	*0.30* *(0.04)*	*70*	*0.32* *(0.02)*	*192*	0.316	0.001
Care intensive crops[a] area	1.57 0.12)	680	3.17 (0.24)	287	0.40 (0.12)	393	0.000	*0.62* *(0.12)*	*94*	*0.33* *(0.02)*	*299*	0.000	0.000
Subsistence crops[b] area	2.83 (0.13)	447	3.45 (0.15)	348	0.57 (0.09)	99	0.000	*1.32* *(0.27)*	*23*	*0.34* *(0.05)*	*76*	0.000	0.000
(4) Inputs													
Fertilizer from CMDT (kg/ha)	15.78 (1.42)	979	29.85 (2.63)	459	3.36 (1.09)	520	0.000	*9.76* *(3.64)*	*149*	*0.79* *(0.37)*	*371*	0.000	0.000
Fertilizer from traders (kg/ha)	63.73 (8.51)	979	29.63 (4.54)	459	93.83 (14.40)	520	0.000	*149.53* *(30.60)*	*149*	*71.46* *(17.64)*	*371*	0.011	0.000
Total Fertilizer (FCFA/ha)	20 617.6 (2 257.7)	979	14 803.5 (1232.17)	459	25 749.8 (4 097.9)	520	0.007	*42 470.5* *(8 308.4)*	*149*	*19 034.4* *(4 637.01)*	*371*	0.005	0.000
Herbicide (FCFA/ha)	4 208.5 (523.3)	979	3 394.5 (406.0)	459	4 927.1 (917.1)	520	0.072	*3 333.3* *(1 520.5)*	*149*	*5 567.1* *(1 130.6)*	*371*	0.135	0.478
Total chemical inputs (FCFA/ha)	24 826.2 (2 445.1)	979	18 198.0 (1 376.2)	459	30 676.8 (4 426.6)	520	0.005	*45 803.9* *(9 020.8)*	*149*	*24 601.6* *(5 010.3)*	*371*	0.015	0.000
Hiring labour (%)	27.8	1016	28.4	486	27.4	530	0.713	*19.1*	*152*	*30.7*	*378*	0.007	0.023
Rent in equipment (%)	10.2	/	6.0	/	14.1	/	0.000	*6.6*	*/*	*17.2*	*/*	0.002	0.783
Right to plant a tree (%)	65.3	/	84.3	/	47.9	/	0.000	*69.7*	*/*	*39.1*	*/*	0.000	0.000
Localization of the plot (min)	23.6 (0.9)	1001	22.9 (1.3)	487	24.2 (1.2)	514	0.440	*16.78* *(1.71)*	*154*	*27.42* *(1.59)*	*360*	0.000	0.007
Farmer's age (years)	48.5 (0.5)	985	56.2 (0.6)	487	41.04 (0.7)	498	0.000	*38.66* *(1.23)*	*117*	*41.77* *(0.88)*	*381*	0.036	0.000

[a] Cotton, maize, rice, onion, groundnuts; [b] Millet, sorghum

Table A.5: Distinction between plots which were lying fallow at least one year over the last five years and those which have been cultivated every year.

Fallow_5years	Nr of plots (%)	Nr of Collective Plots (%)	Nr of Individual Plots (%)	Monetary yields for CP (FCFA)
Plots cultivated every year over the last 5 years	931 (91.6)	401 (82.5)	530 (100.0)	89210.7
Plots which were lying fallow at least one year over the last 5 years	85 (8.4)	85* (17.5)	0 (0)	66799.1
Means difference test: P-value				0.107

*86% of the collectives plots belong to the household head

Appendix B

Table B.1: Estimating the effects of the number of workers on yield per worker in value term for all type of crops and distinguishing between care-intensive and subsistence crops

Dependant Variable: Plot output per person per ha in value terms			
Explanatory variables	(1) All crops	(2) Care-intensive crops[a]	(3) Subsistence crops[b]
Nr of workers	-1620.2*** (327.2)	-2058.9*** (419.3)	-655.1*** (181.5)
Land area	104.9 (218.2)	41.2 (286.7)	-524.9*** (195.1)
Bottom land	34928.9*** (9859.4)	14425.7** (6692.0)	4136.6 (4242.3)
Fallow_5years	-765.9 (4099.4)	-2759.6 (3339.1)	-2998.2** (1188.8)
Location	1.1 (32.3)	34.3 (44.5)	-13.5 (21.3)
Land rights	1618.6 (2943.2)	-472.4 (4181.9)	2464.1** (1266.9)
Chemical inputs	0.5*** (0.2)	0.3** (0.1)	0.1 (0.1)
Hiring labour	-4466.2* (2603.4)	899.7 (2727.1)	-644.9 (1345.1)
Renting material	-8132.7** (3326.1)	-1046.9 (3802.9)	-2406.6 (2222.3)
Plough dummy	9082.6** (3524.1)	-2874.1 (4143.6)	-54.7 (1270.2)
Manure	-25.7 (98.9)	-40.0 (115.4)	11.8 (47.5)
Age of the farmer	-50.5 (124.6)	51.5 (126.6)	-81.7 (57.5)
Education of the farmer	-2838.7 (4043.5)	-4424.7 (5140.5)	-2936.6 (2192.9)
Constant	25939.9*** (8231.5)	31049.9*** (10258.7)	19868.8*** (5642.2)
Crop FE	*Yes*	*Yes*	*Yes*
Village FE	*Yes*	*Yes*	*Yes*
Nr of observations	455	286	345
Nr of clusters	201	190	195
R-squared	45.6	35.8	23.6

Significant at ***1%, **5%, *10%; robust standard errors clustered at household level in parenthesis

[a] Cotton, maize, rice, onion, groundnuts

[b] Sorghum and millet

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