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## Land allocation in subsistence economies and intra-familial time-use decisions

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# Land allocation in subsistence economies and intra-familial time-use decisions

Nadege Miclanche Azebaze      Thomas Falk      Evelyn Korn\*

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## Abstract

Classical household theory predicts that adolescents facing a developed labour market should invest in formal education. In contrast, it is obvious that adolescents in subsistence economies should choose learning-by-doing approaches to working on the family farm. However, it is unclear what determines optimal education choices among societies in transition from subsistence to labour-market integration.

While education is generally the basic condition to enter the labour market, access to land represents an important asset in subsistence farming. This paper argues that intra-household time use and education – that is, time spent learning outside the family farm – is influenced by the way land is transferred from one generation to the next. We use a dichotomous approach assuming that land is either transferred by bequest or by a formal land board. These two methods represent the extremes of a scale that considers personal relations and reliance on certified abilities as the basis for land allocation.

This paper provides a theoretical analysis of how anticipated bequests and asset transfers from other sources influence trade-offs between work on the family farm and other time-use options. We discuss the effects using a case study from the Okavango.

**Keywords:** Land allocation, inheritance rules, subsistence, intra-household decision making, intergenerational property transfer, education

**JEL Classification:** D13, D91, Q12, Q15, Q21, Q24

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# 1 Introduction

“According to the tradition, I have to give the first born child first, and then the other children will receive. But I will also share it equally among the children, so that no one will have to complain, when I have passed away. Education and vocational training is also important, because it is also inheritance.” This statement of a 42-year old female farmer in the village of Seronga, in the Okavango Delta, is a starting point for this papers’ research question.<sup>1</sup> Inheritance in Sub-Saharan Africa is strongly affected by traditional rules. But, of course, it has also been shaped by recent legal changes as well as the influence of formal labour markets to which the statement alludes.

This paper aims at understanding the influences of modern and traditional (legal) norms on asset transfer and the provision of labour of adolescents to family-farm households. In that it connects a theoretical approach with a case study from the Okavango.

## 1.1 Research question

Starting out from Becker’s (1973, 1974a, 1981 ) seminal work, theoretical models of household economies have centered on the western (industrialized) world’s concept of the family.<sup>2</sup> Household-production functions distinguish between market-oriented labour and household labour where the latter produces commodities directly consumed within the family. Most models of bequests and inter-vivos gifts used to explain intergenerational transfers of resources are also based on this framework (see, for instance, Bernheim et al.(1985) and Bernheim and Severinov (2003)).<sup>3</sup> These models represent a social system which is based on the division of labour as it is found in Western societies. In these cultures, formal education is an important investment in lifetime income and children stay dependent on their parents for a long time during which they do not significantly contribute to household production. In farming societies with high levels of subsistence – which can, for instance,

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<sup>1</sup>The quote is taken from a series of qualitative interviews conducted as part of the research project “The Future Okavango” that will be described in more detail in section 1.2.

<sup>2</sup>Although this connection is explicitly stated only in the introduction to Becker’s “Treatise on the family” (Becker (1981), p. 1), it is the underlying assumption of all his work and most others cited in this paper.

<sup>3</sup>There is a debate on how the existence of bequests fits into the concept of rational decision making. The literature on rational transfers and altruism starts with the rotten kid theorem (Becker (1974b)) and develops the explanation of transfers within a neoclassical context ( Lam (1988), Mare (1991), Zhang (1994), and Jürges (2000)). We are aware of the fact that it is an open question why people should transfer resources to the next generation. However, in the following, we just take the existence of inheritance rules as given and incorporate them into a model of rational decision making.

be found in the rural parts of many Sub-Saharan African Countries – children and adolescents<sup>4</sup> are, at least potentially, a part of the work force, and education may become a costly alternative to household production.

In general, the type of wealth transmitted across generations varies depending on the society’s economic system (Nauck (2010), Mulder et al. (2009)). However, in most rural areas, not only in Sub-Saharan Africa, physical assets like land and livestock are substantial in the formation of new households. The empirical literature shows that young adults in subsistence economies when founding their own family highly depend on the transfer of these assets from their parents’ generation, whether in the form of dowries, inter-vivos gifts, bequests, or, as an alternative to intra-familial allocation, by transfer at the communal level (Fafchamps and Quisumbing (2005), Quisumbing and Otsuka (2001)).

The issue of land transfer connects to household production as, particularly in the African context, children largely contribute to the accumulation of the family’s capital. This capital is also the stock from which bequests, a part of their startup capital when founding their own households, is taken. Therefore, it is important to address the following question: How are these assets built and then transferred to the next generation? Accordingly, a comprehensive model of household decision making in subsistence economies needs to address the interaction between bequests and adolescent contributions to the parental household. This paper provides a model that analyses this relationship from an institutional perspective, that is, we focus on rules that base bequests on general individual characteristics like gender or birth order.

Yet, there are few pure subsistence economies left. Even the most remote groups are somehow connected to product and labour markets. Therefore, a question arises: How does the transition from pure subsistence to full labour-market integration work? Obviously, a full model of this transition has to account for a number of factors like the accessibility and quality of education, general mobility, and the ability of the labour market to include workers at different education levels. In addition to these pull factors of labour markets, there are push factors that are related to changes in the farming sector, for example land allocation institutions. It is the effect of these latter factors that this paper wants to

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<sup>4</sup>In our analysis we focus on adolescents who are at least 16 years old. For one, children of that age are already able to make their own decisions (see Mann et al. (1989), Furby and Beyth-Marom (1992)). In the context of household decision making or education, see for instance Dauphin et al.(2011) or Attanasio and Kaufmann (2014). In addition, children of that age actually have to make important decisions in many countries. In Botswana and Namibia, which cover the area of our case study, this age represents a fundamental transition in the education process of adolescents. The right to ten years of basic education ends at 16. Children then have to decide whether to continue with formal education, to go for vocational training, or to contribute to household production.

address.

A change from subsistence to a more market-integrated production goes along with a change in the legal framework, as is discussed within a case study of the Okavango-abutting regions of Namibia and Botswana in this paper.<sup>5</sup> One aspect of such a change is that inter-generational land transfer sees new regulation. Typically that means that a traditional bequest system, redistributing assets locally (within the family or, more broadly interpreted, within the village), is now accompanied by a more formal process of land allocation.

This paper includes such a two-way asset-distribution mechanism into a subsistence-based household model. In this model adolescents choose between using their time for activities on the family farm or outside of it. Total household time determines household production and, in consequence, the size of individual bequests. In addition, land can be received from sources outside of the household. The model shows that the relative size of family-internal and -external transfers impacts adolescents' decisions to spend time outside the family farm, for instance, to receive formal education.

The paper fits into the general literature on household-labour decisions and bequests. It provides a complementary approach to Goetghebuer (2011), who analyses bequest systems in family farms in a different context, and Quisumbing and Otsuka (2001), who analyse intra-familial labour allocation and asset transfer but consider a society with labour-market integration.

Similar to the classical questions in household economics, the connection between bequests and children's labour and investment decisions is different in industrialized and subsistence-oriented societies. Therefore, there are a number of studies addressing different issues within this field. Baland and Robinson (2000), for instance, model intra-familial altruism to examine how children's labour contribution depends on education, savings, and bequests. Baker and Miceli (2004) concentrate on children's investment in land-specific human capital under different inheritance rules and scale economies. La Ferrara (2007) provides a theoretical model as well as empirical analysis of inter-vivos transfers and bequests in (matrilineal) Ghanaian rural households. Quisumbing and Otsuka (2001), Nauck (2010), as well as Botticini and Siow (2003) focus on gender aspects. Our paper adds to this literature by focussing on land-transfer institutions.

To that end, the paper describes a two-period model of a family-farm household based on neoclassical household theory. In the first period children make a decision on how much time they devote to working on the parental farm and to other activities. In the

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<sup>5</sup>Institutional details on the area and the legal institutions will be provided in the next section.

second period children have turned into adults and have their own farm whose endowment with assets depends on first-period behaviour. This model is enriched by a parameterised inclusion of traditional inheritance rules and new asset- and land-allocation mechanisms. That way the model names trade-offs in time use assuming a strong subsistence context where market prices, as a coordinating mechanism, are missing and the opportunity costs of time determine the optimal allocation of time and resources. The explicit inclusion of asset (land) transfers thus integrates children’s anticipation of the actual mechanism in place into the time-use model.

One main insight is that a more formal land-allocation mechanism moves time use away from the farm to investments in other activities. These results of the theoretical model allow for a discussion of the effects of current land-allocation institutions in subsistence economies as well as in those who are at the verge of market integration. For, although we have not modeled the value of household-external time use, it is obvious that the main alternative way to spend time is formal schooling or training. If formal education is the actual time use, it has two effects. On the one hand, it provides certified knowledge that can be used to prove proficiency in a formal land-allocation process. On the other hand, it provides general abilities that are helpful on a formal labour market. That way, it accelerates development away from pure subsistence. Obviously, the effect of schooling on social dynamics depends on a number of institutional factors like quality of and access to schooling. To show how these aspects might influence the development of a rural society, we use the above mentioned case study of the Okavango region.

## **1.2 Land allocation in the Okavango region**

The above description, of a twofold system of land transfer paralleling a traditional and a post-colonial legal system, particularly applies to the Kavango region of Namibia and Ngamiland (the Okavango Delta) in Botswana. In these two regions – particularly the villages of Mashare in Namibia and Seronga in Botswana – “The Future Okavango” (TFO) conducts an interdisciplinary research project to understand technical as well as political, social, and economic drivers in innovation processes within the context of desired outcomes such as resilience, adaptiveness and sustainability.

In both countries, historically, customary law regulated the inheritance of land rights. During colonial and apartheid times, traditional authority structures were undermined and exploited by the controlling power through what has been labeled “indirect rule”. This rule left traditional authorities in place, but curbed their decision rights and canal-

ized their legitimation from formerly active community rules to administrative units of the European powers (Mamdani (1996), Adams et al. (2003)). Yet, many traditional authorities maintained their roots in the internalised norm set of their communities as is reflected in the still strong acceptance of customary law and traditional authorities (Hinz (2000)). In consequence, in most domains of social life and in most social settings, more than one legal system has been relevant (Meinzen-Dick and Pradhan (2002)) since colonial times. Legal pluralism, as the coexistence and interaction of customary and statutory law, is common to most Sub-Saharan African countries (Benda-Beckmann (2002)) as it is to Botswana and Namibia (Adams et al. (2003)). However, both customary and statutory law, as well as the relation between the two, are subject to permanent change. They adapt to societal and ecological developments and are the result of permanent negotiations and dynamic power relations (see also Kalabamu (2000)). To cover the effects of these changes on the behaviour of household farms, is the main goal of the theoretical part of this paper. The case study allows to interpret the model results within a real institutional context and the ongoing changes therein.

For, in the context of household decision making, legal pluralism impacts decisions concerning (today's) household production as well as (later) transfer decisions. The above named changes have affected the scheme of intergenerational asset transfer as they have taken away decision rights from familial and village-based authorities to distant units that are supposed to be at arm's length. This shift has been reinforced by additional changes implemented in the last decade (see, for instance, Falk (2008)). Any change in the decision power of family- or village elders concerning asset (particularly, land) allocation influences individual incentives to contribute to household production. In addition, the role of asset allocation at the local level influences the next generation's livelihood options when staying in subsistence. Therefore, it needs to be connected to the analysis of alternative income-generation strategies, specifically the integration into formal labour markets.

For that reason, this paper not only develops a theoretical model to connect land use and education decisions. It also evaluates data from the Namibia Household Income and Expenditure Survey (NHIES) and the Botswana Core Welfare Indicator Survey, both conducted in 2009 /2010 (Republic of Namibia (2013) and Government of Botswana (2013)), and uses quantitative data collected 2011 within the TFO Socio-Economic Baseline Survey (SEBS) as well as qualitative household interviews conducted in 2012. The quantitative survey covered 326 (out of 943) randomly selected households in Seronga and 292 (out of 518) in Mashare. The interview partners in the qualitative survey came from 16 households



randomly drawn from the baseline-survey households in each site. This survey included questions on individual perceptions of subsistence farmers concerning asset-distributing institutions and new income-generation options. We combine the quantitative surveys and the qualitative study to build the connection between land allocation and education in our case study.

With respect to asset allocation, our analysis focusses on a particular change in land-governing institutions. In the Okavango region of Namibia as well as in Botswana, headmen and headwomen, as authorities in the land-allocation process, have been replaced by land boards whose members are mostly non-members of the villages whose land they are supposed to administrate. The consideration of the Namibian Kavango region and the Ngamiland District of Botswana, is helpful to evaluate the effect of such a change as the magnitude of the shift in governing rights is different across the two sites while, as section 4 will lay out in more detail, the arm's-length idea has been implemented more comprehensively in the Botswana.

The model argues that a more formal asset-distribution mechanism will bring adolescents to spend their time outside the household. So, the prediction would be that adolescents from the study site in Botswana choose formal education to a larger extent. This is actually the case as our data will show. To separate the effect of the asset-distribution mechanism from other aspects that might impact educational decisions, it is necessary to have a closer look at the educational system in the two regions – which we will do in the application section.

The model as well as the case study are based on the assumption that asset transfer is mainly regulated by general social norms and not by individual aspects like affection for a particular child or rewards for household contributions. While we do not deny that these aspects play a role, the qualitative interviews we have conducted in the Kavango region as well as the Okavango Delta suggest that parental behaviour is actually rather norm-oriented. A personal factor that influences asset-transfer decisions, is the staying-or-moving decision. A child's decision to stay in the village, has occasionally been mentioned as a determinant for the transfer of assets. This aspect, however, is perfectly in line with our model perspective. To back up our approach, exemplary statements from the same set of interviews as the quote on page 2 might help:

Children remaining the family home will use and share the asset together, while those leaving the parental household or community receive less or no asset. This feature shows in the statement of the 42-year old woman quoted earlier and other respondents in Seronga.

For instance, a 44-year old self-made business woman declared: “If I have got 4 children, I got 20 cows; each child is going to have 5. They will all use the residential land and the field. They will build their houses on that land. If a daughter marries, she will not build her house on my plot. She cannot take a cattle to the family of her husband. Her cattle will remain here. If she wants to sell it or eat, she has to come here to do it.”

This declaration is supported by the statement of a 39-year old female farmer: “The children will use the household assets together. Children who leave the household will not get anything, only those staying in the house will use the fields, the residential land and the household assets. (...) If a girl gets married, her husband will take care of her. She will not use the property here anymore.”

Similar opinions can be found in our research site in the Kavango Region of Namibia. A 30-year old widow in Mashare said: “I would share the goats, the cattle and the chicken equally. I would give the house to the son or the daughter who I know is the one who will stay at home and work and not walk too much.” A 53-year old female respondent named “cattle, money, compound” as very important inheritable assets.

None of the respondents named personal reasons as decisive for inheritance decisions.

The assumptions of the model presented in the next section are designed to reflect these threads of decision making. An interpretation of the model results and the application to the Okavango case study will follow.

## 2 Basic Model

The core argument of this paper is that the introduction of new land-allocation mechanisms influences the decision making of the “next” generation in a number of ways: Family-external land-allocation mechanisms are an alternative to intra-familial bequests and inter-vivos transfers. Thus, they reduce the relative importance of bequests. In addition, allocation will be based on a different set of qualifications if done within the family or by family-external institutions. To cover these different incentives, this section provides a model of the production, consumption, and bequest options of a subsistence-farming household.

The decision makers in the focus of interest are the children (adolescents) of the household. The model describes their decision to invest in within-family activities or activities outside the parental household, in anticipation of different land-allocation schemes. The approach extends Becker’s (1981) classical household-decision-making model. To stress the subsis-

tence aspect, we make the extreme assumption that the household cannot buy consumption goods, but has to produce them itself by using labour of the household members as the main input. We assume the household to be self-sufficient, that is, we exclude trade or exchange with other households. A major consequence of this approach is that trade-offs between alternatives cannot be expressed by (market-)price ratios or wages, but need to be determined by marginal products and marginal utility, directly.

### *Household Production*

To be able to cover different norms on asset transfer – birth order, gender, age, staying or moving, etc – by model parameters, but to keep the setup simple, we choose the smallest possible household size: We assume that a household consists of two children and the parent generation. Why is such a small frame reasonable? We are not interested in fertility; therefore, the number of children can be fixed at the smallest number that still allows for differences and interactions. Furthermore, the model wants to address the impact of institutions rather than the private decisions of the parents; therefore, the latter are not explicitly modeled. For notational simplicity, throughout the model we will assume that there is a single parent.

In order to analyse the effect of (anticipated) land transfer on individual behaviour, the model covers two periods: In period 1, the old generation (the parent) is head of the household which is the productive unit, while in period 2, each child is head of her own household. We assume that the parent lives in the first period only. In period 1, the household produces a single consumption commodity  $Q$  from material assets  $X^1$  and labour  $L^1$ . The production function is strictly concave in  $L^1$  and  $X^1$ , with a positive marginal productivity. Period-1 endowment of the parent household with material assets is exogenously given, while the period-2 endowment for the next generation depends on this period's production and external transfer.

Total labour input in the parent household consists of the parent's as well as the children's provision of labour. The parent provides  $L_p^1$  units of labour. Each child decides autonomously how to spend her total time in period 1 (denoted by  $T_i^1$ ). She can choose between provision of labour for the parental household  $L_i^1$  or out-of-household activities like formal learning  $l_i^1$ .<sup>6</sup> Thus, the total production time of the parent household is  $L^1 = L_p^1 + \sum_{i=1}^2 L_i^1$ . We assume that out-of-household activities provide direct utility for the child; in a consumption-oriented interpretation of the model, this time use would be

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<sup>6</sup>This formulation allows to include gender differences in time constraints like gender- or age-specific (compulsory or voluntary) schooling.

considered as leisure. However, we would like to include the possibility of formal education or other learning activities. That way the model allows for connecting the family-farm perspective with the inclusion of the next generation into a formal labour market, as the time spent on learning out of the household will change next period's livelihood options.

### *Consumption and Bequests*

The commodity produced is either directly consumed by the household members or transferred to the next generation by bequests. The parent saves a fixed share  $s$  of the household product to be bequeathed, while the share  $(1 - s)$  will be used for today's consumption. Thus,  $B = sQ(X^1, L^1)$  is the total bequest that will be handed down to the next generation, while  $C = (1 - s)Q(X^1, L^1)$  denotes the total consumption of all household members in period 1. Each member of the household receives a fixed share of the total consumption. We denote child  $i$ 's share by  $c_i$ .<sup>7</sup>

There are two ways for children to receive land as part of their asset endowment for period 2: One way is a bequest share  $b_i$  of parental savings. The other way is a communal land-allocation mechanism. The amount of resources a child receives by the latter way is denoted by  $A_i$ . The magnitude of this allocation is not directly related to the size of the bequest; however, both entities are related, as children will adjust their time-use decision to the relative sizes of the land plots to be expected.

The parameters  $b_i$  and  $A_i$  are fixed and determined by laws or social norms in the given society. They depend on behaviour-independent individual traits like birth order or sex. Modelling these parameters as exogenous to household decisions, has the advantage that it allows for a discussion of the effects of institutions on family decisions. Changes in the legal or social system can thus be covered by a comparative-statics analysis that will be part of section 3. The downside of this approach is that it does not cover parental discretion or reactions to particular effort on the children's side. These options would come on top of the social norms that apply as a kind of "noise" to the basic rules. To focus on the underlying thread, we have abstained from including the additional decision level.

Children make their time-use decisions based on the institutional parameters .

### *Individual Decisions*

Each child lives in period 1 as well as in period 2, when she will form her own household

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<sup>7</sup>A discussion that is outside the scope of our paper, but could be addressed with a similar model, addresses the question of which rules affect today's shares in consumption. Pitt et al. (1990), for instance, have provided examples where sizes of individual consumption shares depend on individual contribution to household production. Other studies provide evidence for a gender bias in household consumption.

and use the assets transferred as startup capital. We assume that first-period utility  $u_i^1$  depends on consumption  $c_i^1$  and private time-use  $l_i^1$  (which cover out-of-household learning or leisure). Second-period utility also depends on consumption and leisure. However, first-period behaviour affects second-period wellbeing by the transfer-decision only. Therefore, we use a utility representation for period 2 based on indirect utility  $v_i^2$  from capital endowment  $X_i^2$ . This endowment, in turn, consists of assets transferred from period 1, that is, inheritance  $B_i = b_i s Q(X^1, L^1)$  and capital from other sources  $A_i$ .

Utility functions are well-behaved. That is, consumption, private time-use, and child's assets endowment provide positive but diminishing marginal utility and show positive cross derivatives. In the first period, consumption opportunities depend on the asset endowment as well as household members' labour decisions. As the household produces the consumption commodity itself, individual consumption can be expressed as a function of all household members' labour decisions once the level of household assets is given. Therefore, we model utility maximization in terms of time use where  $T_i^1 - L_i^1 = l_i^1$ .

In addition, children account for the future, but they put a higher emphasis on current wellbeing. Thus, they discount their future utility with a discount factor  $\delta \in (0, 1)$ . Thus, in period 1 each child faces the following constrained maximization problem:

$$\begin{aligned}
\max_{L_i^1} \quad & U_i = u_i^1(C_i^1, T_i^1 - L_i^1) + \delta v_i^2(X_i^2) \quad i = 1, 2 & (1) \\
s.t. \quad & T_i^1 = L_i^1 + l_i^1 \quad i = 1, 2 \quad t = 1, 2 \\
& C_i^1 = c_i(1 - s)Q(X^1, L^1) \quad i = 1, 2 \\
& L^1 = L_p^1 + \sum_{i=1}^2 L_i^1 \\
& X_i^2 = b_i s Q(X^1, L^1) + A_i
\end{aligned}$$

### 3 Equilibrium Analysis

In solving problem (1), each child reacts to institutions, that is, the fixed part determining savings  $s$ , her share in today's consumption  $c_i$ , her share in bequests  $b_i$ , as well as the household-external option to receive land as an adult  $A_i$ .

To prepare for the interpretation of actual land-allocation institutions in Botswana and Namibia and their relation to other socio-economic parameters, the analysis focusses on the effect of different magnitudes of intra- and extra-familial land transfers. To be able to

later discuss a broader range of policies, we also analyze the effect of children's time-use decisions on the wellbeing of the household .

To simplify the maximization problem, we substitute all arguments in each child's utility function by expressions based on labour using the constraints named in (1). That way we turn the constrained optimization problem into an unconstrained one (see the appendix, page 36 for details). The first-order condition for an interior maximum of child  $i$ 's decision problem then takes the following form:

$$\begin{aligned} \frac{\partial U_i}{\partial L_i^1} &= u_{i,C_i^1}^1 c_i(1-s)Q_{L^1} - u_{i,l_i^1}^1 + \delta v_{i,X_i^2}^2 b_i s Q_{L^1} \\ &\stackrel{!}{=} 0 \end{aligned} \quad (2)$$

To analyze child  $i$ 's reaction to a change in her decision environment, we use a comparative-statics analysis. Thus, we will calculate the second derivatives of (2) and use them within a total-differential approach. A utility-maximizing child will account for the fact that the size of her inheritance is influenced by the parameters as well as her decision: That is, land-transfer parameters  $b_i$  and  $A_i$  on the one hand and her choice of labour  $L_i$  – which accounts for  $b_i$  – on the other hand. The latter, however, also influences the household's, and thus the child's, consumption options in the first period. In analyzing the reaction in labour choice, that is, in calculating and analyzing  $\frac{dL_i}{db_i}$  we need to consider these different effects of labour choice. They are covered by the trade-off the child faces between consumption today and consumption tomorrow.

A reasonable measure to evaluate this trade-off is the elasticity of the child's marginal utility of  $b_i$ . The bequest is a main part of the child's next period asset endowment and, consequently, its income. It therefore influences her (indirect) utility in period 2. Thus, the bequest is a measure for the next period's consumption. As has been shown by Blundell et al. (1994) and Cowell and Gardiner (1999), the elasticity of marginal utility from consumption can be seen as the inverse of the intertemporal rate of substitution of consumption. Thus, the elasticity of the marginal utility of the bequest  $\alpha_{b_i}$  is a measure of the individual willingness to delay consumption from today to the next period. A change in  $b_i$  influences the transfer of consumption options from this period to the next period. Accordingly, the relation between individual rates of intertemporal substitution ( $\alpha_{b_i}$ ) and the option to do so given by the institutional frame (here,  $b_i$ ) impacts a child's willingness to work. This effect is described in

**Proposition 1.** *Child  $i$  will increase her household labour supply in reaction to an increase in bequest size if the elasticity of her marginal utility from the bequest is smaller than 1. That is,*

$$\frac{dL_i}{db_i} > 0 \quad \text{if } \alpha_{b_i} < 1$$

where

$$\alpha_{b_i} = -\frac{b_i}{\frac{\partial v_i^2}{\partial b_i}} \cdot \frac{\partial \frac{\partial v_i^2}{\partial b_i}}{\partial b_i}.$$

**Proof:** For all proofs see the appendix.

The elasticity of the marginal utility of the bequest is identical to the Arrow-Pratt measure of relative risk aversion with respect to the bequest (next period's consumption). Thus, the reaction of child  $i$ 's labour supply to changes in her bequest share depends on the exact form, in particular the degree of concavity, of her utility function. In principle, the elasticity of the marginal utility of the bequest (consumption) can take any value between zero and infinity. Thus, an increase in the anticipated bequest may lead to an increase as well as a decrease in labour supply.<sup>8</sup> But, which effect is likely to be expected within the context under consideration? Here, empirical evidence on the elasticity of the marginal utility of consumption would be helpful to understand reactions to changes in the bequest.<sup>9</sup> As the value of this elasticity is the inverse of the intertemporal rate of substitution in consumption, it is relevant for the long-run welfare effect of social policies. It has, therefore, received some attention in the empirical literature (see, for instance, Blundell et al. (1994), Cowell and Gardiner (1999), and Evans (2005)). This literature is focussed on consumption behaviour in industrialized countries, such that a direct transfer of the results needs careful consideration. However, the literature agrees on the observation that the elasticity of marginal utility of consumption is income dependent with lower-income groups showing a lower elasticity, i.e. poorer people are more focused on present-day consumption. It is reasonable to assume that this feature also holds true for people in subsistence economies. Evans (2005) shows that people in the poorest quintile in an OECD comparison – which

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<sup>8</sup>Baker and Miceli (2005) provide a similar result concerning the heirs' willingness to invest into farm-specific abilities in reaction to the size of the bequest. However, they consider a scenario with labour-market integration.

<sup>9</sup>The question can, of course, also be addressed from a theoretical perspective. Predictions concerning individual reactions can be classified by means of classes of utility functions. If the child's utility takes the form of a Constant-Elasticity-of-Substitution (CES) function or equivalently a Constant-Relative-Risk-Aversion (CRRA) function, household-labour supply will increase if the bequest increases. If the child has a utility function with increasing relative risk aversion, she will increase her labour supply until the anticipated bequest reaches a turning point from where on she will reduce her labour supply.

would be the comparison group for our study – show an elasticity of marginal utility from consumption that is clearly below one. Thus, empirical evidence suggests that a higher bequest will actually lead to a higher supply of household labour.

While the effect of an increase in inherited assets needs a closer examination, the effect of an increase family-external asset transfers  $A_i$  is unambiguous. If institutional change opens new income options or enhances family-independent land-allocation rules, children’s willingness to supply labour to the parental household unambiguously decreases. This effect is stated in

**Proposition 2.** *If child  $i$  anticipates an increase in the provision of external assets, she will reduce her labour supply to the parental household. That is,*

$$\frac{dL_i}{dA_i} < 0.$$

The result formulates the potential conflict between parents and children arising from institutions that make grown-up children more independent from their families. This conflict shows in the classical experience that the older generation is typically reluctant to accept new institutional setups.<sup>10</sup>

Propositions 1 and 2 have addressed the effects of changes in asset transfer methods on the individual labour supply. The total effect of a change on household-labour supply, in addition, depends on the interaction between siblings. From the parents’ perspective the question is: Will household labour supply be bigger under an inheritance rule that assigns the whole bequest to one child (unigeniture) or under an inheritance rule that splits the estate? As in the household-production function, the labour inputs from both children are perfect substitutes, *ceteris paribus* each child would decrease her labour supply if the other child would increase hers (see pages 37 to 38 in the appendix).<sup>11</sup> To evaluate the total effect, however, it is necessary to include the mutual bequest interaction, that is, to analyse the curvature of the individual labour-supply as a function of the bequest. If this function is convex, total labour under unigeniture is bigger than under a splitting rule (and

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<sup>10</sup>Gibson and Gurmu (2011) explore the effect of new land allocation institutions – in their case, a change from governmental land transfer to an inheritance-based system – on competition between siblings in an agropastoralist Ethiopian society. They find out that, with increasing land scarcity and in the absence of external land transfer male children marry later, therefore, spending more time in the parental home that will provide them with land for their new household.

<sup>11</sup>This property of the model is in line with the findings of Botticini and Siow (2003) who argued that sons will free-ride and supply less effort in the production of bequests, if they exert effort to produce the household wealth and married daughters share the family bequest.



vice versa).

**Proposition 3.** *The amounts of labour provided by both children are strategic substitutes, thus,*

$$\frac{dL_i}{dL_j} < 0.$$

*The curvature of the individual labour supply depends on the elasticity of the marginal utility of the bequest  $\alpha_{b_i}$ . If the elasticity of the marginal utility of the bequest is increasing in the bequest, child  $i$ 's labour supply is concave in the bequest, that is*

$$\frac{d^2 L_i}{db_i^2} < 0.$$

*Note that,*

$$b_i = 1 - b_j.$$

Thus, a higher bequest leads to an increase in labour provision, but at a decreasing rate. As Figure 1 shows, this concavity of the labour-supply function implies that total labour input in a household is highest if parents follow a mixed inheritance rule where all children inherit a positive amount of land. Parents choose that combination of bequest shares that balances marginal increases in labour provision between both children (the dashed lines in the Figure). A bequest share for child 1 that is higher than  $b_1^*$  would increase the amount of labour provided by child 1; however, this increase would be outweighed by the loss in labour provided by child 2 (as child 2's bequest share would shrink). Therefore, in the given setting  $(b_1^*, 1 - b_1^*)$  is the combination of the bequest that maximizes total labour input  $L_1 + L_2$ .

With respect to our original question of how institutional change might influence household decision making, our results allow for an interpretation concerning new land-distribution mechanisms as well as the emergence of new technical and market options. Such an interpretation that includes actual institutions from the Okavango region is given in the next section. The model would allow for a discussion of gender concerns and birth-order considerations – and the statements provided in the introduction section show that these aspects do play a role in parental decision making. However, in our analysis we will focus on gender-independent effects of land-transfer mechanisms on education and in consequence on staying and moving.

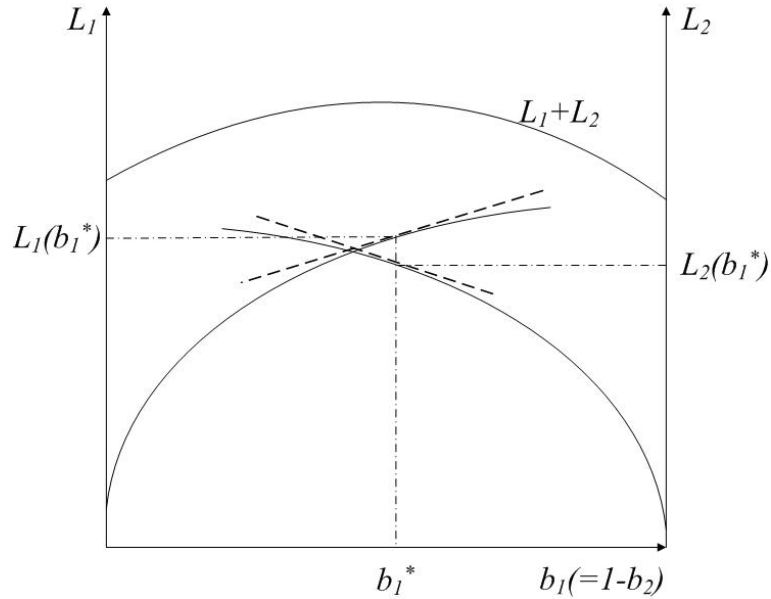


Figure 1: Labour maximising choice of bequest shares

## 4 Application

The model has shown that land transfer to the next generation by means of intra-familial inheritance has a different effect on labour decisions than transfers from an allocation mechanism outside the family. The model results can be interpreted in a two-level approach. First, they can be used in a narrow sense to measure how important land inherited from parents is for starting a new family farm compared to land that has been allocated by the village authorities (like a headman or headwoman). Second, land that comes from intra-village allocation can be compared to land from a distant allocation agent like a land board. In this interpretation the labour provision would be considered as part of a village production function where the village headpeople balance interests of all village inhabitants and members of the “next” generation build their reputation as responsible village members by providing labour to the community.

This latter perspective is the one taken in our application to the Okavango region. Thus, the institutional change to be discussed covers the movement of asset-allocation rights from parents and village headpeople to village outsiders. In this scenario, the time-allocation decision of the children covers two aspects: Children can spend their adolescent years within the village and gain knowledge and reputation within their community. Or, they can use their time outside the village community.

The model suggests that an asset-transfer mechanism outside the close community will lead to a time use that also takes place outside this community. To obtain this result, we need very few assumptions on the quality of this external time use. In the model it spends positive marginal utility at a decreasing rate. This property is met by any leisure-connected time use. In what follows, we will argue that this structure also applies to schooling or otherwise formal education or to other learning activities outside the family-farm context. Thus, an increase in village-external asset transfers makes it more attractive to obtain education. The discussion of the institutional change in the Okavango region shows that such an effect can actually be observed. The differences in the institutional frames in the Namibian Kavango – which still gives a lot of power to village headpeople – and Ngamiland in Botswana – which makes ample use of land boards – will be used to compare explorative empirical evidence with our model results. In line with the theoretical prediction, formal schooling is much more prevalent in Botswana than in Namibia. To back the claimed connection between schooling choices and asset (land) allocation, we need to include the schooling system itself into our considerations. For, it needs to be shown that it is not a particular difference between the schooling systems that drives differences in behaviour. Therefore, we will provide a detailed description of the two schooling systems. It shows that, with respect to those factors relevant for our questions, both systems are pretty similar.

The discussion of different land-allocation mechanisms will be based on the distinction between inherited and otherwise received land that was covered by the parameters  $b_i$  and  $A_i$  in the model. While the model used absolute values, what follows will be based on relative measures. An increase in  $A_i$  will be read as a new land-allocation mechanism that reduces the importance of inherited land.

The institutional analysis will have two parts. First, we lay out the current land-allocation institutions of Namibia and Botswana in some detail. Second, the influence of these institutions on children's decision making will be analyzed using the already mentioned document analysis as well as qualitative empirical fieldwork in the settlements of Mashare/Namibia and Seronga/Botswana.

## **4.1 Rules of land administration in the Okavango Basin in Namibia and Botswana**

Pre-colonial inheritance rules varied across southern Africa. However, they were similar across ethnic groups, and within each jurisdiction there were clear patterns that were

predictable for potential heirs, in particular children. In addition, these rules were enforced by traditional authorities who were in charge of solving conflicts that arose in inheritance questions (see, for instance, Garey and Townsend (1996), Hinz (1997, 2011)). Parents had, however, some discretion in handing down land and cattle using inter-vivos transfers. It is important to note that inheritance was linked to the widespread Right to Avail which determined that land rights were linked to membership to the community (Kalabamu (2000)). Leaving the community permanently, therefore, resulted in a total loss of bequest. Another typical feature of pre-colonial southern African communities was that the administration of communal land was vested in the traditional authorities of each community. Their duties were to assign as well as withdraw land rights for cultivation, grazing, and residential land. Furthermore, they were responsible for coordinating the implementation of (new) institutional arrangements concerning land management (Schapera (1994)). Land size and land-use rights were likely to be the subject of community discussion and negotiation. Being a member of a community was an important precondition for being granted access to land (Kalabamu (2000)).

The restriction of the right to avail to community members supported community coherence in two ways. By granting inheritance to community members only, it reduced incentives to leave and by allocating new land, preferably to villagers, it protected the community from losing resources to outsiders. Of course, the latter also helped to keep people in the village, as a generally low probability to get land in other villages resulted in low incentives to leave the community. This absolute tie to the community of origin was a strong means in making adolescents obedient to their parents and the village elders. Such a system has many consequences. This paper focusses on the effect that it makes children contribute to the parental household and keeps them from investing in activities outside the village.

Colonial and post-colonial times brought various reforms of institutions in land administration. Different patterns of legal pluralism emerged as the result of these reforms. They have in common that they combine customary and statutory law. We will now summarize the current land transfer rules for smallholding agriculture in Botswana and Namibia.

## **Namibia**

In the Namibian Kavango region the allocation of land rights for residential, grazing and subsistence cultivation purposes is done by traditional authorities. Based on the traditional right-to-avail, principle application for land-use rights is a simple process for people living in the community. The villager identifies a piece of land in coordination with her neighbours.

She requests the local headwoman or headman to be permitted access to this land. The traditional authority in most cases approves such requests, taking other villagers interest into account.

In a similar fashion, it is also relatively simple for a community member that holds rights on residential and cropping land to transfer his rights to another resident – which includes the possibility of inter-vivos gifts and bequests within families. This feature also shows in the statements of residents of Mashare that have been quoted in the introduction: While individuals have a clear plan how to deal with their inheritance that is influenced by general norms, they feel absolutely free to dispose of it as they wish without asking for permission from village (or other) authorities. However, the process is recorded by the headperson who is also in charge of solving potential conflicts.

Allocation of new land, as well as, inheritance is clearly a closed-shop issue within villages as entry and exit costs are high. For people not belonging to the particular settlement, customary law follows a complex registration procedure. Newcomers need a letter of personal record from the place where they lived before. These letters explain why the person left or had to leave the place. The headwoman/headman of the preferred residency might then grant a piece of land; however, this decision is subject to the agreement of the residents (Yaron et al. (1992), Hinz (1995), Mendelsohn and Obeid (2003)). In this way the rights of established residents shall be protected and possible externalities avoided. Any such land allocation is approved by the highest traditional authority, the Hompa (Falk (2008)).

In the same style, the customary inheritance system in Namibia is still strongly influenced by the community-focussed rights-to-avail principle. Under customary law, land rights can only be inherited by people who were already living on the land when the right holder passed away. Relatives who were not living at the place of the deceased are considered as outsiders and have to apply for residency following the above described procedures.

Since Namibian independence in 1990 there has been a tendency to weaken the powers of traditional authorities. In particular the Communal Land Reform Act of 2002 aims at establishing Land Boards as a control mechanism for customary land administration (Republic of Namibia (2002)). Any allocation of customary land rights by traditional authorities is supposed to be approved and registered by the Land Board. However, enforcement of the new regulation faces major obstacles. One purpose of the new rules is to restrict the accelerating deforestation in the Kavango region and to encourage investments in land improvements (see also Kalabamu (2000)). Yet, this aim is in conflict with the interests of the farmers who complain that the new statutory rules do not match the struc-

ture of the farming system in the Kavango region where fields are frequently shifted due to a fast loss in soil fertility (Falk (2008)). Amongst other reasons, the implementation of the new land allocation procedures under the act is boycotted by farmers and traditional authorities. In consequence, in the Kavango region – and here it differs from other parts of the country – the allocation of land rights for residential, grazing and subsistence cultivation purposes is still in the hands of traditional authorities. With regard to land inheritance, the Communal Land Reform Act reinforces customary law by stipulating that children can inherit land rights in accordance to customary law only.

We draw the conclusion that the customary Namibian system still supports community cohesion, is protecting resources against outsider, appropriation and provides little incentives for those who once left the local community to still invest in the farming business.

## **Botswana**

Botswana made more radical changes in its land administration. It was the explicit objective of the Tribal Land Act of 1968 to move the powers of land administration from traditional authorities to land boards (Kalabamu (2000)). Land boards are composed of people appointed by the Minister out of a group which was elected by the community. Subordinate Land Boards consist of ten members, six of them being appointed by the government and four being elected by the community. Land Boards and Subordinate Land Boards are impersonal structures which free up land administration from social networks and community ties (Kalabamu (2000)). Their main duties are to allocate, cancel, and change land rights for residential, grazing, cropping and business purposes. Customary land rights included, and still include, the rights to access, develop, and appropriate the benefits from the land and to exclude others from its use (Mmopelwa (2011)). The Subordinate Land Boards Order of 1973 stipulates that land boards have to decide on conditions for the allocation of land (Government of Botswana (1973)). Any changes in use or changes in ownership must be approved by the land board. That implies that any inter-vivos or post-mortem transfer (gift, inheritance, or exchange) of land has to be authorized by the land board.

In consequence, land transfers within the community are subject to a more formal process in Botswana than in the traditional system in Namibia. While this detachment of land transfer from personal ties makes transfers more expensive within a village, it simplifies land transfers outside the community as it produces transparent and reliable rules. It was the intention of the 1993 amendment of the Tribal Land Act of 1968 to ease the access to

land of any Botswana citizen anywhere in the country. Therefore, the previous restriction of land being allowed to be allocated only to tribesmen was changed to include citizens of Botswana (Adams et al. (2003)). Ethnic origin is not supposed to affect land allocation (Kalabamu (2000)).

New applications for gaining access to land are evaluated based on the applicant's personal land-use record that includes number and type of land plots the person already owns as well as proof of land-use abilities. There are no explicit limitations on the maximum number of plots or size of total land holdings, but the more land one owns the more difficult it becomes for a person to increase their land holdings. Since land allocations are permanent, this increasing difficulty also applies when the original field has lost its fertility. Formally, the land boards have the authority to refuse land allocation even though applications are normally accepted (Adams et al. (2003)).

The procedures for granting customary land rights under the Subordinate Land Boards Order of 1973, include the requirement that the applicant has to provide written confirmation from the head of the ward that the land allocation would not conflict with other peoples rights or land uses. It is also common practice that a meeting with local leaders, neighbours and interested parties is held at the place of the plot to be allocated. Nevertheless, objections against land allocation can only be based on relatively transparent criteria (Kalabamu (2000)).

One important motive for moving the land administration responsibility from traditional authorities to land boards was to implement a transparent system that is based on objective criteria. It should replace the rule of headmen as they were perceived to be undemocratic, conservative, and as colonial organisations (Hope (2000)). However, the new system does not reach this goal perfectly since there are reports of corruption in the land-allocation process of the land boards (Kalabamu (2000), Adams et al. (2003)).

In addition, while the more formalized system has the advantage of a higher level of transparency, it comes at a cost in terms of accessibility. In the traditional system, there was a traditional authority responsible for land administration in each settlement. Now, in Botswana there are 12 Land Boards and 37 Subordinate Land Boards responsible for fulfilling this task. For one, the resources required to fulfil this task were grossly underestimated (Kalabamu (2000), Adams et al. (2003)). Therefore, applicants face capacity constraints that impede the land-transfer process. In addition, the spatial distance to the next land-administration agency has increased. Last but not least, it is reported that in particular the poor and less educated are discriminated against by the public servants

(Adams et al. (2003)). Thus, instead of preventing outsiders from land use, as it is still the case in Namibia, the Botswanian system is prone to discrimination of the poorly educated. With respect to inheritance, Griffiths (2011)) observes a modernisation and increasing flexibility in Botswana. Statutory inheritance laws of land rights are gender neutral. They also allow for more freedom in sharing rules with regard to other aspects such as the child's place of residence (see also Kalabamu (2009)). In contrast to the traditional Namibian system, it becomes more likely that even a child who left the parents' village still inherits a share of the land. Thus, building ties within the village of origin by staying and offering long-term provision of labour is less important for being able to keep access to family land in Botswana.

## **4.2 Access to schooling in both regions**

As has been argued before, land-administration rules are only part of a bigger set of institutions that frame livelihood options and decisions. Availability of education is another important factor. To show that differences in time-use and later on occupational decisions of the adolescents are rather caused by different land-transfer mechanisms than by differences in the schooling system, we describe fundamental properties of the school system in both regions.

### **Namibia**

The Namibian school system sees compulsory schooling for all kids until grade 12. Compulsory schooling was introduced directly after independence in 1990; in a first step, legislation stated a right to free basic education which covered schooling at the primary level, at least until age 16. With the Education Act of 2001 (Republic of Namibia (2001)), this right was extended to 12 years of schooling. The supervision of school attendance is the duty of the parents while the enforcement is in the hand of the Ministry of Education – which covers rules for repetition of failed classes and the provision of alternative school forms for those children, adolescents, and young adults who did not succeed in the regular system.

Registration for primary (grade 1-7) and secondary (grade 8-12) schooling is free of charge. However, parents have to contribute to a so-called school-development fund for secondary schools. Until 2012 such a fund also existed for primary schools, but this part of the fees has been waived and is now government financed. The school-development-fund fees range from USD 14.7 to USD 21.4 per year where a replacement by contribution in kind as well



as an exemption is possible. Parents have to finance school uniforms while school books, education materials, tuition, and some of the stationeries are provided from government funds. In addition, there is a feeding program for kids attending school (Personal communication with principals of pre-primary, primary, and junior secondary schools in Mashare which was part of the interview series conducted in 2011).

Thus, since independence, Namibia has seen a strict development towards extensive public schooling. This development is also an important part of the Vision 2030 that was launched in 2004. However, the country sees a high level of inequality where the Kavango region, in particular, is one of the poorer parts of Namibia. For parents in this part of the country, the school development funds as well as the price of a school uniform might pose a relevant obstacle to sending kids to school. The possibilities of being exempted from the school-development fund or to pay it in kind, is one way to overcome these obstacles.

## **Botswana**

The schooling system in Botswana has been based on the idea of a right to basic education since 1977. In that respect, Botswana had a head start compared to Namibia due to its earlier independence. However, a right to *free* basic education is not much older than that in Namibia as it was only installed in 1987. Currently, children have a right to receive 10 years of schooling without fees (UNESCO (2010)). Attending grades 11 and 12 in secondary school calls for registration fees amounting to USD 41 per year in grade 11 and USD 61 per year in grade 12. In addition, in Seronga parents need to pay USD 8 per year for a school-development fund. Exemptions from the school-development fund are possible, but restrictions are harder than in Namibia (Personal communication with principals of different schools in Seronga which was part of the interview series conducted in 2011). School books, education materials, tuition, a feeding program, and stationery are provided from government funds.

Thus, the overall structure is similar to the Namibian system. Thus, the incentive to leave the labour force in favour of education is the same in both regions. A difference might be that in Botswana compulsory schooling – even if not free – has a longer tradition than it has in Namibia. However, similarly the change in land-allocation rights began at the same time as changes in the schooling system for each country. Therefore, the argument that changes in land-allocation rights influence schooling decisions at a societal as well as an individual level remains intact. This argument will be the thread of the next section.

### 4.3 Linkages between land-administration systems, schooling, and time use

The institutional details named in the last sections can now be ordered using the structure provided by the theoretical model. That way we will identify the incentives that determine how the younger generation use their time: to stay in their village of origin adopt traditional technologies, and build a reputation there or to invest in more formal education. As formal education enhances access to formal labour markets and thus facilitates moving, these two sets of decisions do not only influence individual development but might also change long-term village structure.

Getting access to new land within the community is simple under the traditional system still applied in the Kavango region as long as the applicant lives within the community. In Botswana, no difference is made between community members and outsiders. Here, land allocation is a bureaucratic process which potentially discriminates against the poor and less educated. This difference is highly relevant as the traditional subsistence agricultural practices are extensive in nature. Thus, whenever the fertility of a field is becoming too low a new field would be cleared. Upholding this pattern is much easier under the Kavango land-allocation system than in Botswana. The higher costs for getting new plots provide incentives to invest in the productivity of the already allocated land plots. This difference alone makes the Botswanian system more permeable for innovations – which are needed for enhancing long-term soil fertility. Now, on the one hand, the younger generation is more willing to acquire and use innovative technologies. On the other hand, formal schooling provides easier access to new technological knowledge which is, in addition, appreciated by a land-allocation process that is based on formal qualifications. In consequence, even if people stay their whole life within a village community, the Botswanian regulation encourages formal education.

This effect is amplified by the fact that gaining access to land outside the community of origin is relatively difficult and costly in our Namibian site compared to the land-allocation mechanism in Botswana which does not pay attention to the place of residence. Thus, knowledge obtained outside the village community, that can be proven by certificates, is less valuable in Namibia as there is only a small chance to use it anyway. In Botswana, in contrast, moving and buying land in another community – i.e. still staying in the farming business but leaving the community of origin – is possible and formal qualifications are helpful in moving. If this possibility is known to all decision makers, adolescents in Botswana have more incentives to acquire formal schooling as it is valuable within

their village of origin and, in addition, enriches their set of options outside their original community. So, for one, they are more independent of their parents' attitude towards schooling; at the same time, parents' and children's attitudes towards formal education are more aligned in Botswana than in Namibia as everyone knows that keeping the family farm for the next generation depends on mastery of new technologies.

The argument so far has focussed on the young generation's perspective. From the *parental* perspective the Botswanian inheritance rules tend to align the interest between parents and children and to support education decisions. The decision to detach the right to avail from residency, has relaxed parental fear of loosing children altogether once they have entered the formal labour market in a distant city. Therefore, investing in children's education enriches their set of options without opportunity costs in terms of foregone farming options as it does not exclude the possibility of returning to the family farm. The situation is totally different in Namibia. Here, land can only be inherited by children who live in the community where the land is located. Once children have left the community, there is almost no way back. Thus, a child that has started to move has no incentives to invest in the parental household anymore. In consequence, parents' and children's interests in education are not aligned. For, if formal education increases the probability of moving (because the qualification helps to enter the labour market in distant places) and parents want to keep the farm within the family, formal education is a threat to the parents' plans. Accordingly, the likelihood that parents do not support adolescent schooling and enforce labour provision on the family farm is much higher in the Namibian system than in Botswana.

The assessment of land transfer rules, in the framework of our theoretical model, leads us to the prediction that in the Namibian system incentives for adolescents to stay within their village, invest in the parental farm, and found a family within their community, are higher. In contrast, the Botswana system treats each bequest as a new ownership and thus makes it easier for adolescents to use their time for different purposes than household production and to develop new career paths.

In consequence, education levels and labour-market integration should be higher in Botswana than in Namibia. These expectations are actually matched by the findings in our case study. We use data from National surveys undertaken in both countries in the years 2009/2010 (see Table 1) and disaggregated numbers on years of schooling collected by "The Future Okavango" at the two research sites Mashare/Kavango and Seronga/Ngamiland (see Table 2).

Table 1 shows that fewer people in Namibia never attended school than in Botswana. This

Botswana	North West incl.	
	All	Seronga
Never attended	23%	23.9%
Primary Ed.	23%	21.5%
Secondary Ed.	32%	30.2%
Tertiary ed.	17%	20.5%
Not stated	0%	0.2%
Non formal	3%	3.2%
Some ed.	2%	0.4%

Namibia		
	All	Kavango
Never attended	13.2%	18.8%
Primary Ed.	27.4%	35.1%
Secondary Ed.	51.2%	41%
Tertiary ed.	6.4%	3.7%
Not stated	1.9%	1.5%

Table 1: Education levels in Botswana and Namibia

Data on Botswana are from the “Core welfare survey” 2009/2010 undertaken by the government of Botswana (Government of Botswana (2013)). The categories “non formal” and “some education” are part of the survey but lack closer definition. Data on Namibia are from the “Household income and expenditure survey” 2009/2010 undertaken by the government of Namibia (Republic of Namibia (2013)).

feature also holds if attention is restricted to the Kavango region and the North West of Botswana which include our research sites. This difference is partly due to a different age structure in schooling. The fact that schooling at the primary level in Botswana started to be free of charge as late as 1987 obviously deterred the generation now older than 35 years from starting school.<sup>12</sup> If we omit these cohorts and focus on qualification levels, the picture changes. In line with the theoretical prediction, more people in Botswana opt for schooling beyond the compulsory level. The evaluation of education decisions at the national and regional level show an interesting pattern. Much less people decide on tertiary education in Namibia than they do in Botswana. This effect is even more prominent in the Kavango compared to the North West of Botswana. Table 2 focusses on the adolescents in the two villages under consideration and shows that the differences are even bigger and extend to secondary education. This latter difference matches an observation at the regional level. Secondary and tertiary education levels are much lower in the Namibian Kavango than in the rest of Namibia, while the North West of Botswana is similar to the rest of the country.<sup>13</sup> The difference between the Kavango and the rest of Namibia

<sup>12</sup>The survey conducted in Mashare and Seronga shows that 65.9% of people aged 35 and older did never attend school in Botswana compared to only 53.2% in this age group in Mashare.

<sup>13</sup>To understand schooling incentives, all features of the labour market need to be taken into account. Obviously, pull factors like the capacity of the labour market to accept people with different education levels play a crucial role here. However, focussing on the North West of Botswana and the Kavango region and, in particular, the case study provided by the TFO survey is helpful here as the economic situation in

Seronga	14-18	19-24	Mashare	14-18	19-24
No formal ed.	0.0%	6.0%	No formal ed.	6.1%	6.8%
Started school	8.1%	6.0%	Started school	26.5%	10.6%
Primary school	45.3%	20.2%	Primary school	57.1%	49.1%
Jun. sec. school	39.5%	39.3%	Jun. sec. school	6.1%	16.8%
Sen. sec. school	7.0%	27.4%	Sen. sec. school	4.1%	14.3%
Tertiary ed.	0.0%	1.2%	Tertiary ed.	0.0%	2.5%

Table 2: Education levels in Mashare and Seronga from “The Future Okavango – Baseline Survey” 2011, covering 326 (out of 943) randomly selected households in Seronga and 292 (out of 518) in Mashare.

hints at a factor that is idiosyncratic to the Kavango region and that creates incentives that dissuades adolescents from pursuing formal education. It shows a repercussion in the low secondary-school-attendance rates at the village level in Mashare. Both observations provide a case in point of our study. For, land-transfer and inheritance rules that keep children dependent on local elders have been shown to be a factor that discourages formal education. As section 4.1 has argued, farmers in the Kavango region have impeded the implementation of new land-governing institutions such that the area is specifically different from the rest of the country (including the other northern parts of Namibia) in this single respect.

In addition to education levels, we collected employment data – which is, of course, a weak indicator in systems which are strongly subsistence-oriented. Again, as both sites are similar in structure, the misrepresentation of employment rates due to subsistence is the same such that the data are comparable within this setting. In Mashare, only 6 percent of the people stated that they were employed compared to 19 percent of the sample in Seronga. With 38 percent of the respondents having reached an education level beyond primary school, the human capital in Seronga is significantly higher than in Mashare where only 18.5 percent attended secondary school.

The results show that when comparing the two research sites, there is a clear difference in incentives for pursuing formal education. Thus, the inclusion of land-transfer and inheritance issues draws attention to a potentially important, yet so far disregarded driver in education choices that needs to be taken into account when designing innovation- or education-oriented policies.

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these two regions is similar. Therefore, it is reasonable to assume that the pull factors in both regions are comparable.

The introductory statements have shown that children's willingness to attend school and parents' willingness to let them do so go hand in hand with a positive attitude towards the young generation's moving and possible return in Botswana. This view is also reflected in the regulatory framework which explicitly allows inheritance and land-allocation to people who currently do not live in the village. The interpretation our model suggests is that the mobility-enhancing institutions and decisions to obtain more education enforce each other. It is hard to measure if the right to free basic education that extended to secondary schooling in 1987 or the 1993 amendment of the Tribal Land Act that enlarged the group of people entitled to gain access to land was the first important step towards an education-friendly system in Botswana. However, the fact that the high enrollment rates to secondary and tertiary education survived the reintroduction of school fees for secondary schools supports the view that factors outside school matter. Of course, there could be other relevant factors that explain the difference in attitudes towards schooling and letting children move away from home between Namibia and Botswana.

One possible explanation is that both relocating the land-allocation decision and letting children be more educated and move to distant cities are impacted by a joint latent variable like trust. In that case the explanation would be that Botswana (Ngamiland) has higher trust levels than Namibia (the Kavango region); because of the generally higher trust levels the elder generation in Botswana is willing to accept outsiders to be involved in village decisions *and* to let children go away (as they will come back anyway). A reason for such a difference in trust between otherwise similar societies could be a (long) past exogenous shock (see Nunn and Wantchekon (2011)). We are not aware of such an event. Tests of trust levels are currently undertaken within "The Future Okavango". So far, there is no evidence for differences in trust.

Another explanation for the Botswanian parents' positive attitude towards mobility of the young generation could be that labour income is an important part of the family income and that remittances from employees working at distant places are higher in Botswana than in Namibia. Within our baseline survey we have checked this hypothesis for Mashare and Seronga. Contrary to expectations resulting from the hypothesis, local salaries in Botswana make up for a higher and remittances for a lower fraction of household incomes than in Namibia. In the Mashare 33% of the total household income is based on local salaries and 12% on remittances; in Seronga 51% of the household income comes from local salaries and 10% from remittances. Therefore, we do not consider high levels of remittances as a driver in the positive attitudes of Botswanian parents towards labour mobility.

## 4.4 Policy Implications

“The Future Okavango” is part of a project that aims at developing economically as well as ecologically sustainable land-management options for the Okavango-abutting countries, Botswana and Namibia (and Angola). This goal is in line with the policy objectives of the two countries. In general, development in the Okavango region is intended to be achieved both by increases in agricultural productivity and creating non-agricultural livelihood strategies. The development of a market for skilled labour and of institutions that train future workers is a high priority in the region. One of the key goals of Namibia’s Vision 2030 is to reduce the unemployment rate to under 5 per cent from over 50 percent in 2008 (Republic of Namibia, National Planning Commission (2013)). It further envisions, amongst a long list of targets, to eliminate illiteracy and gender disparities in primary and secondary education. The National Development Plan 2010 of Botswana aims at creating sustainable jobs, both in the rural and urban areas, by supporting a political and economic environment which enables economic development. In reference to the second millennium development goal, the Government of Botswana commits itself to achieve universal primary education by 2015 in order to provide an adequate supply of qualified, productive and competitive human resources (Government of Botswana (2010)).

In addition to the improvement of education and employment opportunities, policy makers, in cooperation with various stakeholders, intend to improve land management and farming technologies. This paper claims that changes in land-transfer or inheritance rules affect individual education decisions. If this claim is actually true, there are two kinds of implications for institutional change that aim at improving land use.

One implication focusses on decisions within local communities. As has been argued in this paper, a system like the one in Botswana that encourages formal certified education and curbs the possibility of handing down family land, leads to aligned interests between the older and the younger generation concerning innovations. In that case knowledge of technological improvements and more sustainable agricultural techniques can be dispersed via schools. In this system, chances are high that the new information reaches a relevant share of the younger generation and that the older generation is willing to accept these changes.

The situation is different in a system like the one in Namibia where formal education is rather discouraged and parents’ and children’s interests, with respect to education, are more likely to be conflicting. Due to the younger generation’s need for reputation building within their community of origin, that is, among the elders of the community, technologies

in use will be those that are accepted by the older generation. Thus, any policy change needs to address the older generation. Dispersal of innovations needs to be designed in a way that addresses and convinces headpeople and their contemporaries.

The second set of implications focusses on the effect of staying or moving decisions. A system that encourages education and makes it easy to gain access to land in the village of origin for people who have moved to a distant place, has to account for the effects on those left behind. A government that wants to encourage the younger generation to aspire for careers outside of farming not only has to provide labour-market enhancing policies; it also needs to make sure that parents are actually supportive of their children's education. Part of such a policy would be the preservation of traditional knowledge in a structured way. Raising awareness of the connection between traditions and new options is another part. Here the already quoted statement of one of the interviewees in Seronga might serve as a concluding sentence. "Education and vocational training (...) is also inheritance."

## 5 Conclusion

This paper has addressed the question of how a transfer of assets, in particular land, that is based on a combination of inheritances and communal land allocation, influences the younger generation's time use. A focus of the analysis has been on the effect of land-allocation institutions on education decisions. To that end, the paper has developed a subsistence production-and-consumption model that combines the neoclassical approach to household decision making with an institutional frame of intergenerational asset transfer. It has put special emphasis on children's willingness to contribute to the parental household if the bequest of productive assets is the only way to transfer wealth from one generation to the next and a formal labour market does not exist.

The theoretical analysis has shown how children adapt their household-labour supply to anticipated asset transfers from different sources. That way the effect of parental bequests as well as land allocation by communal authorities could be analysed. A crucial factor in children's reaction to anticipated bequests is the elasticity of the marginal utility from future consumption that can be interpreted as the inverse of the intertemporal rate of substitution in consumption.

Although technological change and the introduction of a formal labour market are not explicit parts of the model, the results of the analysis can be used to analyse the willingness of adolescents in a subsistence economy to adopt these innovations. Adoption crucially



depends on the design of extra-familial land-allocation mechanisms and their integration with other innovation-enhancing institutions.

The model results are used to interpret observations from a case study in the Okavango region in Namibia and Botswana. The study discusses the structure of the land-allocating bodies in the communities of Mashare (Namibia) and Seronga (Botswana) who are equipped with different rights to interfere with the inheritance decisions of the villagers. Our study highlights the important impact of land-allocation institutions on a communities' susceptibility to new technologies.

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# Appendix

## First order condition

In order to determine the child's reaction to the set of institutional parameters  $c_i, b_i$ , and  $A_i$  as well as the other child's choice, we take a total-differential approach. To that end, we first reformulate the problem as an unconstrained optimization problem; then, we state the first-order condition and analyse the total differential with respect to the parameters of interest.

As each individual can spend its total time  $T_i$  either on labour or on learning, i.e.,  $L_i = T_i - l_i$ , the demand for learning is perfectly determined by willingness to work (with opposite sign). Thus, as we are more interested in children's labour contribution to the parental household than in their demand for learning, we formulate the problem as a labour-decision problem. Using the constraints named in (1), we can substitute all arguments of the utility function by expressions based on  $L_i$ .

Accounting for the household's production function and the time constraint, we can therefore reformulate child  $i$ 's optimization problem in (1) as

$$\begin{aligned} \max_{L_i^1} U_i = & \hspace{20em} (3) \\ u_i^1(c_i(1-s)Q(X^1, (L_p^1 + L_i^1 + L_j^1)), (T_i^1 - L_i^1)) + \delta v_i^2(b_i s Q(X^1, (L_p^1 + L_i^1 + L_j^1)) + A_i) \end{aligned}$$

where the index  $j$  labels the other child in the parent's household.

The first-order condition thus is

$$\begin{aligned} \frac{\partial U_i}{\partial L_i^1} &= \frac{\partial u_i^1}{\partial C_i^1} \frac{\partial C_i^1}{\partial L_i^1} + \frac{\partial u_i^1}{\partial l_i^1} \frac{\partial l_i^1}{\partial L_i^1} + \delta \frac{\partial v_i^2}{\partial X_i^2} \frac{\partial X_i^2}{\partial L_i^1} \\ &= u_{i,C_i^1}^1 c_i (1-s) Q_{L^1} - u_{i,l_i^1}^1 + \delta v_{i,X_i^2}^2 b_i s Q_{L^1} \\ &\stackrel{!}{=} 0. \end{aligned} \tag{4}$$

To determine the change in child  $i$ 's labour supply in reaction to a change in  $b_i, L_j^1$ , and  $A_i$ , we need to take the second derivatives with respect to all these parameters and with respect to  $L_i^1$  and use them for the corresponding differentials.

## Comparative statics

To determine children's reaction to changes in institutional parameters we use a total-differential approach. Thus, as a first step, second-order derivatives (and, if possible, their signs) are determined. For evaluation of the signs it is helpful to recall that all functions are well-behaved.

The production function  $Q(X, L)$  is increasing and concave in both arguments with positive cross-effects, that is,  $Q_{L^1} := \frac{\partial Q}{\partial L^1} > 0$  and  $Q_{L^1, L^1} := \frac{\partial^2 Q}{\partial L^1} < 0$ . A similar structure applies to the direct utility function  $u_i$  as well as to the indirect utility  $v_i$ , that is,  $u_{i, c_i} := \frac{\partial u_i}{\partial c_i} > 0$ ,  $u_{i, l_i} := \frac{\partial u_i}{\partial l_i} > 0$ ,  $u_{i, c_i c_i} := \frac{\partial^2 u_i}{(\partial c_i)^2} < 0$ ,  $u_{i, l_i l_i} := \frac{\partial^2 u_i}{(\partial l_i)^2} < 0$ ,  $u_{i, c_i l_i} = u_{i, l_i c_i} := \frac{\partial^2 u_i}{\partial c_i \partial l_i} \geq 0$ ,<sup>14</sup>  $v_{i, X_i^2} := \frac{\partial v_i}{\partial X_i^2} > 0$ ,  $v_{i, X_i^2 X_i^2} := \frac{\partial^2 v_i}{(\partial X_i^2)^2} < 0$ .

The second derivatives of child  $i$ 's utility, with respect to labour input (own and from the other child) and household-external resource provision, takes the following form

$$\begin{aligned} \frac{\partial^2 U_i}{(\partial L_i)^2} &= Q_{L^1 L^1} (c_i(1-s)u_{i, c_i}^1 + \delta b_i s v_{i, X_i^2}^2) \\ &\quad + (Q_{L^1})^2 ((c_i(1-s))^2 u_{i, c_i c_i}^1 + \delta (b_i s)^2 v_{i, X_i^2 X_i^2}^2) \\ &\quad - 2Q_{L^1} c_i(1-s)u_{i, c_i l_i}^1 + u_{i, l_i l_i}^1 \end{aligned} \quad (5)$$

$$< 0$$

$$\begin{aligned} \frac{\partial^2 U_i}{\partial L_i \partial L_j} &= Q_{L^1 L^1} (c_i(1-s)u_{i, c_i}^1 + \delta b_i s v_{i, X_i^2}^2) \\ &\quad + (Q_{L^1})^2 ((c_i(1-s))^2 u_{i, c_i c_i}^1 + \delta (b_i s)^2 v_{i, X_i^2 X_i^2}^2) \\ &\quad - Q_{L^1} c_i(1-s)u_{i, l_i}^1 C_i^1 \end{aligned} \quad (6)$$

$$< 0$$

$$\begin{aligned} \frac{\partial^2 U_i}{\partial L_i \partial A_i} &= \delta s b_i v_{i, X_i^2 X_i^2}^2 Q_{L^1} \end{aligned} \quad (7)$$

$$< 0$$

### Proof of Proposition 1:

From derivatives (5) and (6) it is easy to see that an increase in labour supply of child  $j$  leads to a decrease in labour supply of child  $i$ . For, from application of the total differential

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<sup>14</sup>The partial derivatives denote the derivative with respect to the first argument if consumption is addressed and the derivative with respect to the second argument if labour is addressed. As demand opportunities depend on the labour decision, the full derivative of the utility function, with respect to labour, has to address the first and the second argument. If needed we will denote this derivative by  $\frac{du_i}{dL_i}$ .

to  $L_i$  and  $L_j$  it follows that

$$\frac{dL_i^1}{dL_j^1} = -\frac{\frac{\partial^2 U_i}{\partial L_i \partial L_j}}{(\frac{\partial^2 U_i}{\partial L_i^2})}. \quad (8)$$

The sign of (8) is negative as following from (5) and (6) both the numerator and the denominator are negative. Labour supplies of both children are perfect substitutes in household production which leads to a free-rider problem within the parental household. The second derivative with respect to the bequest share  $b_i$  takes the following form:

$$\begin{aligned} \frac{\partial^2 U_i}{\partial L_i \partial b_i} &= Q_{L^1} \delta s (v_{i,X_i}^2 + b_i s Q v_{i,X_i^2 X_i^2}^2) \\ &\begin{aligned} &\leq \\ &\geq \end{aligned} 0 \text{ (depends on properties of } u_i) \end{aligned} \quad (9)$$

The second-order derivatives (5) and (9) are used to determine the change of the utility-maximizing amount of labour child  $i$  will choose in reaction to a change in  $b_i$ . given that all other parameters stay constant. Using the total differential we know that

$$\frac{dL_i^1}{db_i} = -\frac{\frac{\partial^2 U_i}{\partial L_i^1 \partial b_i}}{(\frac{\partial^2 U_i}{\partial L_i^1})^2}. \quad (10)$$

Child  $i$  will increase her household-labour supply if the fraction itself is negative, that is, if numerator and denominator have opposite signs. From (5) we know that the denominator of this fraction is negative while (9) states that the sign of the numerator depends on properties of the utility function. As  $Q_{L_i}$ ,  $\delta$ , and  $s$  are positive, the numerator will be positive (and thus labour supply will increase in reaction to an increase in the bequest) if

$$\begin{aligned} v_{i,X_i}^2 + b_i s Q v_{i,X_i^2 X_i^2}^2 &> 0 \\ \Leftrightarrow \frac{1}{v_{i,X_i^2}^2} (v_{i,X_i}^2 + b_i s Q v_{i,X_i^2 X_i^2}^2) &> 0 \\ \Leftrightarrow 1 - \alpha_{b_i} &> 0 \end{aligned} \quad (11)$$

where

$$\alpha_{b_i} = -\frac{b_i}{\frac{\partial v_i^2}{\partial b_i}} \cdot \frac{\partial \frac{\partial v_i^2}{\partial b_i}}{\partial b_i} = -\frac{b_i s Q}{v_{i,X_i^2}^2} v_{i,X_i^2 X_i^2}^2$$

is the elasticity of marginal utility from bequest. This elasticity is negative due to the assumptions on  $v_i^2$ . Therefore (11) holds true if  $\alpha_{b_i} < 1$  which proves the statement.

**Proof of Proposition 2:**



Using the second-order derivatives in  $L_i$  and  $A_i$  we know that

$$\frac{dL_i^1}{dA_i} = -\frac{\frac{\partial^2 U_i}{\partial L_i \partial A_i}}{\frac{\partial^2 U_i}{(\partial L_i^1)^2}}.$$

From (5) and (7) we know that both numerator and denominator are positive. Thus the derivative is negative which proves the statement.

**Proof of Proposition 3:**

To determine the curvature of child  $i$ 's labour supply function we need to determine the sign of  $\frac{d^2 L_i}{(db_i)^2}$ . Using equation (10) we can state that

$$\frac{d^2 L_i}{(db_i)^2} = -\frac{\frac{\partial U_{i,L_i b_i}}{\partial b_i} U_{i,L_i L_i} - U_{i,L_i b_i} \frac{\partial U_{i,L_i L_i}}{\partial b_i}}{U_{i,L_i L_i}^2} \quad (12)$$

where  $U_{i,L_i L_i} = \frac{\partial^2 U_i}{(\partial L_i)^2}$  and  $U_{i,L_i b_i} = \frac{\partial^2 U_i}{\partial L_i \partial b_i}$ .

Under the assumption that the absolute elasticity of marginal utility of the bequest  $\alpha_{b_i}$  is smaller than one, we know from (5) and (9) that  $U_{i,L_i L_i}$  and  $U_{i,L_i b_i} < 0$ . Thus, to determine the sign of (12) we need to determine the signs of  $\frac{\partial U_{i,L_i b_i}}{\partial b_i}$  and  $\frac{\partial U_{i,L_i L_i}}{\partial b_i}$ . The former takes the following form:

$$\frac{\partial U_{i,L_i b_i}}{\partial b_i} = \frac{\partial}{\partial b_i} [Q_{L^1} \delta s (v_{i,X_i^2}^2 + b_i s Q v_{i,X_i^2 X_i^2}^2)] \quad (13)$$

From (11) we know that  $v_{i,X_i^2}^2 + b_i s Q v_{i,X_i^2 X_i^2}^2 = v_{i,X_i^2}^2 (1 - \alpha_{b_i})$ . Taking the derivative with respect to  $b_i$  of the right-hand side we obtain

$$\begin{aligned} \frac{\partial}{\partial b_i} [v_{i,X_i^2}^2 (1 - \alpha_{b_i})] &= s Q v_{i,X_i^2 X_i^2}^2 (1 - \alpha_{b_i}) - v_{i,X_i^2}^2 \frac{\partial \alpha_{b_i}}{\partial b_i} \\ &< 0 \quad \text{if } \frac{\partial \alpha_{b_i}}{\partial b_i} > 0 \end{aligned} \quad (14)$$

Thus using (14) to evaluate (13) we get that

$$\frac{\partial U_{i,L_i b_i}}{\partial b_i} < 0 \quad \text{if } \frac{\partial \alpha_{b_i}}{\partial b_i} > 0. \quad (15)$$

For the derivative of  $U_{i,L_iL_i}$  with respect to  $b_i$  we get

$$\begin{aligned} \frac{\partial U_{i,L_iL_i}}{\partial b_i} &= Q_{L_iL_i} \delta s (v_{i,X_i^2}^2 + b_i s Q v_{i,X_i^2 X_i^2}^2) \\ &\quad + (Q_{L_i}) \delta s^2 (2b_i v_{i,X_i^2 X_i^2}^2 + (b_i)^2 s Q v_{i,X_i^2 X_i^2 X_i^2}^2) \end{aligned} \quad (16)$$

which yields by substitution from (11) and (14)

$$\begin{aligned} \frac{\partial U_{i,L_iL_i}}{\partial b_i} &= Q_{L_iL_i} \delta s v_{i,X_i^2}^2 (1 - \alpha_{b_i}) \\ &\quad + (Q_{L_i}) \delta s^2 b_i (s Q v_{i,X_i^2 X_i^2}^2 (1 - \alpha_{b_i}) - v_{i,X_i^2}^2 \frac{\partial \alpha_{b_i}}{\partial b_i}) \\ &< 0 \quad \text{if } \frac{\partial \alpha_{b_i}}{\partial b_i} > 0 \end{aligned} \quad (18)$$

Thus, under the assumption that  $\frac{\partial \alpha_{b_i}}{\partial b_i} > 0$  the sign of (12) can be determined by help of (5), (9), (15), and (18) as

$$\frac{d^2 L_i}{(db_i)^2} = - \frac{\overbrace{\frac{\partial U_{i,L_i b_i}}{\partial b_i}}^{<0} \underbrace{U_{i,L_i L_i}}^{<0} - \overbrace{U_{i,L_i b_i}}^{>0} \overbrace{\frac{\partial U_{i,L_i L_i}}{\partial b_i}}^{<0}}{\underbrace{U_{i,L_i L_i}^2}_{>0}} < 0$$

which proves the claim.