

# Whose incentives? The evolution of inheritance practices, intergenerational conflict, and women's control over land in rural Kenya

Linkow, Benjamin
Miami University of Ohio

2010

Miami University
Farmer School of Business

Department of Economics
Working Paper

# *Whose Incentives? The Evolution of Inheritance Practices, Intergenerational Conflict, and Women's Control Over Land in Rural Kenya*

Benjamin Linkow
Miami University

2010

Working Paper # - 2010-01

# Whose Incentives? The Evolution of Inheritance Practices, Intergenerational Conflict, and Women's Control Over Land in Rural Kenya

Benjamin Linkow
Miami University of Ohio
February 2010

**Abstract**

Land related investment decisions are shaped by both the formal and informal institutions governing land tenure and acquisition. In the case of agricultural Kikuyu households in Kenya, we show that the inheritance practice of uncertain allocation in conjunction with the principle of equal division among heirs reduces long-term investments in land among potential heirs. This apparent inefficiency is explained by intergenerational power dynamics within the household, as the inheritance practice allows parents to shift the investment incentives facing heirs in their favor. This analytical framework is also used to illustrate that despite legislation formalizing women's rights to property, control over land continues to follow the informal traditional patrilineal system in important ways.

# I. Introduction and Context

## Ia. Introduction

The notion that institutions matter is no longer controversial in the development literature. The economic importance of the property rights system, the legal environment, and other "rules of the game" that shape the structure of incentives facing decision-makers has been convincingly and extensively argued both theoretically (e.g. North 1990) and empirically (e.g. Knack and Keefer 1995, Acemoglu, Johnson and Robinson 2001). The process of institutional change, however, has proven a more elusive concept. Theories such as Williamson's (1985) New Institutional Economics emphasize a process driven by efficiency considerations: exogenously changing circumstances such as technology or population growth create incentives for actors to adopt new institutional arrangements that lower their transaction costs, and institutions evolve according to this imperative. Where the interests of the affected actors are not in harmony, however, the story becomes less clear. Institutional changes may impose costs on vested interests that benefit from the existing arrangements, creating the incentives for those interests to resist institutional changes that might reduce transaction costs for others. In such cases, the question of whose incentives matter for institutional change becomes an important consideration. This paper considers one such scenario- the resilience of informal land inheritance practices in the face of formal alternatives in Kenya. We find that in this case, vested interests are effectively able to stave off institutional change at the expense of broader efficiency gains.

An institution of particular importance in agricultural societies is that of property rights over land. For agricultural producers in developing countries, secure access to land is of fundamental importance to livelihoods. Throughout much of sub-Saharan Africa and the rest of the developing world, the land tenure systems that define rights and determine their allocation are an amalgamation of formal and informal practices. Rural communities typically have customary systems of managing land resources based on informal institutions and enforced by traditional means of authority. Meanwhile, property rights are also conferred by the state and enforced by the formal legal system. To the extent that both the state and the traditional order maintain some degree of legitimacy and enforcement capability, both may retain de facto authority to define and assign land rights and adjudicate related disputes in different circumstances.

In some contexts, formal and informal systems coexist in complementary or mutually reinforcing ways- for example, in a number of sub-Saharan African countries legislation explicitly recognizes the authority of local chiefs over certain aspects of land allocation, subject to the oversight of state institutions.[1] In other cases, however, the formal and informal systems come into conflict. Policymakers may seek to override the traditional system for a variety of reasons. For example, they may wish to assert the predominance of state authority over traditional power structures. Traditional property rights systems are sometimes perceived as insufficiently secure and thus a source of productive inefficiency (e.g. Golan 1993). Alternatively, the motivation may be to redress inequities of the informal system by shifting the institutional structure in favor of groups that are disadvantaged under the traditional institutional arrangements. To the

[1] E.g.,, Namibia's Communal Land Reform Act of 2001 recognizes the decisions of traditional chiefs with respect to agricultural and residence land within their jurisdictions.

extent that the state lacks perfect enforcement capability, however, formal legislation may be unable to displace customary institutions to varying degrees (de Soto 2000).

Inheritance processes are one arena in which tensions between formal and informal systems may play out. Traditional communities have established rules governing the evolution of land tenure across generations, while the state provides an alternative legal basis for inheritance that may or may not be consistent. As inheritance remains an important means by which land can be acquired in a variety of contexts, the prevailing system can have important implications for who can access land and how.

One aspect of particular concern in this regard is the role of women in the inheritance process. Gender equity in terms of access to land is increasingly held as an important issue in the broader context of concern over gender inequality in developing countries (World Bank 2007), and legislation often reflects this priority (UNECA 2004). Frequently, however, traditional land tenure systems do not confer equal rights to women and men (Deininger 2003). Gender issues are thus an instance where policy goals may conflict with outcomes under the informal institutional setup.

This paper makes use of an unusual tradition among the Kikuyu in rural Kenya to consider the process of inheritance and the implications for women's access to land in the context of contradictions between the formal and informal systems in rural Kenya. The traditional Kikuyu system restricts the making of wills in such a way that introduces ambiguity and increases instances of intestacy. Under the formal system, these restrictions are eliminated. We will show that despite the apparent efficiency gains under the formal system, the informal system persists, and we argue that this persistence can be explained by conflicting interests across generations. In addition, we will look at the

extent to which legislation has been able to reverse the exclusion of women in land inheritance under the traditional system, both in terms of daughters' inheritance, and the land rights of widows.

Ib. Women's Access to Land and Inheritance

In many cases, women in sub-Saharan Africa face significant difficulties with respect to access to land and security of property rights. Though recent reforms are encouraging, the legal basis for women to control land and operate as independent economic actors is not well established and in some case non-existent. Marital property is typically held by the husband rather than jointly, and women face particular disadvantages under traditional systems (Joireman 2008). Where women do control land, their rights are often insecure- in Uganda, Deininger and Castagnini (2006) find plots farmed by female-headed households are more likely to be under conflict as a result of competing claims. These issues are of concern both from an equity perspective, and also because greater control of resources for women has been observed to lead to increased spending related to the welfare of children within the household (e.g. Fafchamps and Quisumbing 2002).

Unequal access to land extends to inheritance practices as well. Under customary systems, sons are typically privileged over daughters in the inheritance process. Widows' rights to their husbands' land are often limited, insecure, or non-existent (Joireman 2008). As inheritance remains an important means by which rural Africans access land in the context of limited land and credit markets, disadvantages faced by women in process have important implications.

The evolution of gender aspects of inheritance practices have been studied in other parts of the world. Agarwal (1998) analyzes legal reforms in India that expand the rights of daughters and widows in the inheritance process. As we fin here, she finds that legal guarantees have not been sufficient to effectively provide rights in practice. Conversely, in a survey of Latin American countries, Deere and Leon (2003) note a trend towards increasing equality in terms of inheritance, particularly where levels of literacy and education are increasing and the importance of agriculture is decreasing. In the context of a traditionally matrilineal inheritance system in the Philippines, Quisumbing and Otsuka (2001) show that inheritance patterns have evolved significantly towards a more gender balanced system. In particular, they find that inheritance has shifted so that sons and daughters inherit different types of land in accordance with the intensity of its labor requirements (e.g., sons tend to inherit lands that requires clearing). Hence, inheritance practices can be said to have evolved towards greater efficiency in this case. The implication of these papers is that there is scope for inheritance practices to evolve significantly over time. However, attempts to effect change through formalization have shown mixed results.

### Ic. Kikuyu Agriculture and Organization of the Household

The Kikuyu are Kenya's largest ethnic group, and predominate in the fertile central highlands of the country. Agriculture is widespread. A detailed discussion of cropping patterns is provided with our summary statistics in section III, but we note here that the most important crops for Kikuyu agricultural households tend to be maize and beans, as well as a variety of tree crops- it is estimated that 20% of high potential

agricultural land nationwide has either been planted with tree crops or left under woody cover. Tree crops include coffee, tea, various fruit trees, as well as trees planted for timber, fodder, or soil conservation. Trees are relatively labor extensive, and thus may be favored by households facing labor shortages. Trees may also be planted to reinforce informal property rights. (Dewees 1995) Recent evidence suggests that smallholder timber production has become increasingly common as a cash crop. (Carsan 2007)

Relative to other crops, trees crops require a long waiting period before their returns can be reaped- coffee and tea trees typically require three to five years before they yield, while fruit trees often require longer. Common timber species such as *grevillia robusta* often serve multiple uses- for example, they may be used as shade trees or to demarcate boundaries, while at the same time being pruned for timber. (Harwood 1998) Hence, the decision to plant tree crops may be influenced by the value of the returns, or time preferences, as those who discount the future to a lesser extent will be more inclined to plant trees. Concerns over tenure security may also play a role, both planting tree crops can strengthen informal claims, and conversely because weaker tenure security implies a greater risk that the returns may not be realized.

Traditionally, organization of agricultural Kikuyu households follows strict gender and generational divisions of labor. The male household head is responsible for livestock production and the building and maintenance of structures on the property, and has control over all productive resources. Agriculture and food preparation are the responsibility of wives[2], along with their children- a woman and her children are essentially a separate, self-sufficient unit. Fathers contribute to their children's education

[2] Traditionally, Kikuyu households are polygamous, but this practice has become increasingly rare over time.

and health care, while utilizing some of their sons' labor for livestock and building-related activities. (Price 1996)

Id. Kikuyu Inheritance Practices

Traditional Kikuyu inheritance practices are rooted in traditional forms of land tenure. Prior to colonization, the sub-clan was the unit of authority governing land rights, and though the state is now the ultimate authority the sub-clan remains significant. Sub-clan elders are typically the first option in terms of handling boundary or livestock-related land disputes between neighbors, may restrict transactions on certain areas that constitute ancestral lands, and oversee inheritance as well. Rights to plant and harvest trees are vested in the household head, so that with the exception of certain redeemable sale agreements, trees are owned by the landholder. (Dewees 1995) This is in contrast to some other parts of Africa, where tree tenure and land tenure are distinct.

The Kikuyu kinship system is patrilineal, so that an individual's sub-clan affiliation is determined by their father's or husband's affiliation. In order to maintain the territorial integrity of the sub-clan, land was traditionally bequeathed only to males (as land inherited by women would eventually pass to their heirs, who would be considered members of other sub-clans). Social norms dictate that land and other productive assets are allocated in equal shares to each son, and these norms were codified into law in the 1963 Registered Land Act (Mackenzie 1989). Equal division among male heirs remains the guiding principal in terms of the division of land assets at inheritance. (Kameri-Mbote 1995, Price 1996) The sub-clan maintains significant control over the

inheritance process, as for each estate one of the sub-clan elders performs the function of *muramati*, similar to executorship.

A key feature of traditional Kikuyu inheritance practices for the purposes of the analysis in this paper is that they impose significant restrictions on the circumstances under which wills can be made. Wills must be transmitted orally to the muramati. They can only be given when the testator's death appears imminent; i.e., when the testator is severely ill or injured, or has reached an advanced age. Written wills are prohibited, and the will cannot be communicated to the muramati in advance. In allocating the estate between the heirs, the muramati is compelled to adhere to the principle of equal division among heirs, and to consider the father's wishes to the greatest extent possible. Because of the fact that these wishes cannot be communicated in advance, however, it is common for household heads to die intestate. (Kameri-Mbote 1995) Moreover, the fact that wills are usually given under extreme duress further limits the precision with which the father can communicate wishes concerning the division of his estate to the muramati.

From the perspective on an heir who is awaiting inheritance, these restrictions introduce an element of uncertainty. As discussed, each heir knows that he will inherit an equal share of the estate. However, the heir cannot be certain what form this share will take in advance. In the case where land is the principal household asset, the implication is that heirs do not know what parcel they will inherit in advance. This ambiguity has not been observed in other Kenyan tribes. Shipton (1984), for example, notes the opposite tendency among the Luo (p.125)- allocation of land between heirs is generally made explicit prior to the father's death.

Ie. Inheritance and Womens' Access to Land in Kenya

Traditionally, Kikuyu women do not take part in any aspect of inheritance, as their rights over land are limited and conditional. A woman's right to land is vested in her father, husband, or sons. In the event that the male relative dies or migrates, the rights of the woman are extinguished. Widows may become the de facto household heads in terms of informal decision making authority, but often title over estate land passes directly to the sons upon the father's death (Price 1996). Sons are generally expected to care for their widowed mothers, but a widow's access to land is entirely at her sons' discretion. There is some heterogeneity across tribes, but in general women occupy a similarly weak position in traditional systems of land tenure and inheritance in Kenya (e.g. Henrysson and Joireman 2008).

The process of inheritance and the rights of women under Kenyan law contrast sharply with traditional practices in important ways. The principal piece of legislation concerning inheritance is the Law of Succession Act of 1981, which contains provisions for both testate and intestate succession. All Kenyan citizens are accorded the right to make either oral or written wills at any time. The process is simple and does not impose undue costs or difficulties: a will is valid if it is signed by the testator and two witnesses who will affirm the testator's signature. Section 5(2) of the Act makes specific reference to the rights of women to make wills: "A female person, whether married or unmarried, has the same capacity to make a Will as a male person."

In cases of intestate succession, the Act provides significant protections for widows and daughters in its elaboration of the priority that the court should give to various successors. The Act gives preference to the surviving spouse as the beneficiary

and executor, whether male or female. Women maintain a life interest in their deceased husband's property; this interest is transferable to heirs. In acknowledgement of traditional kinship systems, however, the interest terminates in the event that the widow remarries. Daughters and granddaughters receive the same priority and rights as sons and grandsons. (Kameri-Mbote 1995)

The Law of Succession Act grants a broader scope of rights to testators and women than the Kikuyu traditional system provides. As such, the formal and informal systems come into conflict with one another. The remainder of this paper will examine the extent to which the Law of Succession Act has been able to displace traditional restrictions on the making of wills and on the land rights of women.

## II. Theoretical Framework

### IIa.. The Model

In this section, we develop a theoretical model of intergenerational investment behavior within an agricultural household. The household consists of a Parent and N identical heirs, designated H1 through HN. The infinitely lived heirs' lifetime utility takes an additively separable form, and is described by the utility function:

$$U_{Hi} = \sum_{t=1}^{\infty} \delta^t W(c_t) \qquad (2.1)$$

With U twice differentiable and increasing in all of its arguments.

Each heir is matched with an identical parcel $a_i$ in period 1; there are N such plots in the household's land endowment. Heirs are endowed with L units of labor in each period. They allocate this labor between two separate investment activities I and T,

which can be thought of as planting maize and planting tree crops respectively[3]. Investment in I in a given period generates R(I) units of the consumption good c in that period, while investment in T generates S(T) units of c on the plot on which it was invested in the following period.

As long as the Parent is alive, he appropriates a share of the consumption good from each Heir in each period. This "tax" is an exogenous, socially determined proportion of each Heir's output given by 1-α, so that each Heir keeps the proportion α of the consumption good that he produces in each period during the Parent's lifetime. The Parent's lifespan is finite and described by the hazard function h(t), which gives the probability that the Parent dies in period t given that he is survived to period t-1.

Upon the death of the Parent, the household's land is inherited by the Heirs. As discussed in the previous section, inheritance takes place according to the principle of equal division among heirs, but there is some uncertainty in terms of the particular parcel that each heir inherits. This uncertainty is represented by the bequest rule, which we define as follows: under bequest rule p, all Heirs inherit the parcels they were initially allocated with probability p. With probability 1 – p, the plots are randomly allocated across the Heirs. Thus, the probability that an Heir will inherit the plot he was initially allocated is $p + \frac{1-p}{N}$. The parameter p is exogenous and static, and is known to the Heirs in advance.

[3] As discussed in the previous section, while the father may have ultimate decision-making authority within the household, his involvement in agriculture is limited. Thus, adult sons and daughter can be presumed to have some measure of discretion over how they allocate their labor. In reality, some of the heirs' labor power is liable to be subject to the parents' authority, hence our model can be thought of as reflecting some quantity of residual labor that the heirs can allocate as they choose.

Each period t prior to the Parent's death consists of the sequence of events described in Figure 1. At the start of period t, the Heirs observe whether or not the Parent survives until the next period. If the Parent survives period t, the next step is for the Heirs to make their investment decisions, allocating their L units of labor across the activities I and T. Each Heir then realizes both his instantaneous return to I, and the return to his period t-1 investment in T. This return is given by the technologies R and S in the form of the consumption good c. The Parent appropriates his share, and the Heirs consume the entirety of their allocations of c.

[FIGURE 1]

Alternatively, with probability h(t) the Parent will die in period t; the Heirs will observe this at the start of the period. In this case, the next step is that inheritance takes place as per the bequest rule p. The Heirs then make their investment decisions. As in the previous case, each realizes the instantaneous returns to his period t investment in I. However, the fact that inheritance has taken place implies two differences pertaining to the investment yields. First, Heirs may or may not realize the returns to their own period t-1 investments in T. If an Heir does not inherit the plot that he was initially allocated, he reaps the return of the previous occupant's investment rather than his own; recall that this will occur with probability $1-\left(p+\frac{1-p}{N}\right)$. Secondly, there is no tax imposed by the Parent, so each Heir consumes the entirety of the quantity of c that was produced by the investments in I and T on his parcel.

The anticipation of inheritance thus alters the incentives facing the Heirs to invest in T in any period t prior to the Parent's death in two contrasting ways. First, there is a possibility that the returns to an Heir's investment in T will be shielded from Parental

expropriation, unlike the investment in I which is subject to the Parent's tax α with certainty. In the event that Parent dies in period t+1 and the Heir retains his parcel in the inheritance process, the yield from his investment in T in period t will not be subject to α and he will consumer the entirety of the returns himself. This occurs with probability $h(t+1)\left(p+\frac{1-p}{N}\right)$. We term the increase in the Heir's expected return to T resulting from this possibility the "tax shelter incentive."

Conversely, uncertainty associated with inheritance implies a risk-induced disincentive to investing in T. With probability $h(t+1)\left(1-\left(p+\frac{1-p}{N}\right)\right)$, the Parent will die in the next period but the Heir's parcel we be reallocated to one of the other heirs. This risk that the Heir's investment in T will be lost entirely is termed the "reallocation risk disincentive." This is in effect the result of a coordination problem- each Heir's investment in T generates a positive externality resulting from the possibility that the returns will go to another Heir. However, the incentive for each Heir is to consider only his own private returns.[4]

In order to greatly simplify the analysis, we make three further assumptions. First, we assume that there are no land, labor, or credit markets. Each Heir allocates his entire labor endowment in each period to production on the plot he has been allocated. Second, we assume that Heirs are risk neutral. The analysis does not hinge on these assumption; the key findings hold across a range of assumptions about market conditions and risk preferences. Finally, we make a necessary assumption that the technologies R

[4] If Heirs were able to enter into enforceable agreements with one another, there would be no coordination problem and the disincentive to invest in T would disappear. As we will see, however, such an agreement amounts to collusion against the interests of the Parent, so it is reasonable to assume that this behavior is socially prohibited.

and S are convex, and that this convexity is of sufficient magnitude to guarantee an interior solution.

IIb. The Heir's Problem

Throughout this section, we consider the behavior of a "representative Heir," since each Heir is identical. Note that each Heir behaving as the representative Heir is a Nash Equilibrium; no Heir can improve on his outcome by behaving differently from the other Heirs.

Over any two-period horizon, the Heir maximizes his expected utility as follows:

$$\max_{I_t, I_{t+1}, T_t, T_{t+1}} \mathrm{E}\left[W(c_t)\right] + \delta \mathrm{E}\left[W(c_{t+1})\right] \qquad (2.2)$$

In light of our assumption of risk neutrality, we can write this as:

$$\max_{I_t, I_{t+1}, T_t, T_{t+1}} W\left(E(c_t)\right) + \delta W\left(E(c_{t+1})\right) \qquad (2.3)$$

The constraints on the Heir's problem change following inheritance, so we must differentiate between the pre-inheritance and post-inheritance regimes. We suppose that the pre-inheritance regime lasts from period one until some period k, in which the Parent dies. Of course, period k is not known in advance, but since Heirs observe the Parent's hazard function h(t), they can evaluate the probability that the Parent will die at any particular time.

In any given period t such that $1 \le t < k$, the constraints are:

$$i.\ E(c_t) = \alpha\left(R(I_t) + S(T^*_{t-1})\right) \qquad (2.4)$$

$$ii.\ E(c_{t+1}) = \left[\alpha(1-h(t)) + h(t)\right] R(I_{t+1}) + (1-h(t))\alpha S(T_t) + h(t)\left[\left(p + \frac{1-p}{N}\right) S(T_t) + (1-p) S(\bar{T}_t)\right] \quad (2.5)$$

$$iii.\ I_t + T_t = L \quad (2.6)$$

$$iv.\ I_{t+1} + T_{t+1} = L \quad (2.7)$$

Where $\bar{T}$ indicates the average investment made by the other Heirs and $T_{t-1}^{*}$ is the Heir's optimal choice of T in period t-1.

Considering the Heir's problem at time t, constraint i. illustrates that investment in I returns R(I) with certainty, and is subject to the Parent's tax. The return to investment in T, however, is uncertain. If the Parent survives, the investment yields $S(T_{t-1})$, which is subject to the Parent tax; this is shown in the second term on the right hand side of constraint ii. If the Parent does not survive, the Heir does not have the pay the Parent's tax on c, but because of the inheritance process he may not reap any returns at all from his investment, as the next term reflects.

The first order condition equates the marginal returns in terms of expected utility from the two types of investment:

$$\alpha \frac{\partial R}{\partial I_t} \frac{\partial W}{\partial c_t} = \delta \frac{\partial W}{\partial c_t} \left[ \left(1-h(t)\right) \alpha \frac{\partial S}{\partial T_t} + h(t) \left[ p + \frac{1-p}{N} \right] \frac{\partial S}{\partial T_t} \right] \quad (2.8)$$

In order to see how the anticipation of inheritance affects investment decisions, we consider how the optimal investment choice varies with the hazard rate. As the likelihood of the Parent's death increases, the influence of inheritance considerations on the Heir's investment decision is magnified. We can thus identify how inheritance concerns affect investment decisions and how the parameters condition this relationship by looking at the evolution of the optimal investment choice over time. From (2.8), we

see that the return to I is time invariant, which we expect since there is no uncertainty associated with investing in I. In order to see how the optimal rate of tree planting changes with the Parent's hazard rate, we differentiate the return to investing in $T_t$ with respect to h(t) to obtain:

$$\frac{\partial\left(\frac{\partial E(U)}{\partial T}\right)}{\partial h(t)} = \left(\left[p + \frac{1-p}{N}\right]\frac{\partial S}{\partial T_t} - \alpha\frac{\partial S}{\partial T_t}\right) \qquad (2.9)$$

We define the value of (2.9) to be $\Delta T^H$, which is greater than zero iff:

$$p + \frac{1-p}{N} > \alpha \qquad (2.10)$$

The sign of $\Delta T^H$ is ambiguous as (2.9) and (2.10) reflect the conflicting tax shelter and coordination problem incentives. Tree planting will tend to increase over time if $\alpha$ is low- if the Parent appropriates a higher share of the Heirs' output, the Heirs will find T more attractive as a tax shelter. Over time, the potential for the Heirs to experience the tax shelter benefits increases. Similarly, if the probability $p + \frac{1-p}{N}$ that an Heir will retain his parcel is low, then the reallocation risk disincentive is exacerbated. If Heirs are unlikely to reap their returns privately, they will invest less in T as inheritance becomes imminent. The direction in which Heirs adjust their tree planting depends on whether the tax shelter effect or the reallocation risk predominates.

We note one special case in which the sign of $\Delta T^H$ is unambiguous. In the absence of uncertainty over which parcel each Heir will inherit, tree planting must be strictly increasing in the Parent's hazard rate. In this case, the reallocation risk is absent, so that only the tax shelter incentive is at work. Such an absence of uncertainty would

result from a bequest rule specifying that p = 1; it is apparent from (2.10) that if p = 1, then $\Delta T^H > 0$.

Following the death of the Parent in period k, the constraints on the Heir's utility maximization problem are:

$$i.\ c_{k+i} = R(I_{k+i}) + S(T_{k+i-1}) \qquad (2.11)$$

$$ii.\ I_{k+i} + T_{k+i} = L \qquad (2.12)$$

The Heir no longer must surrender $(1-\alpha)$ of his output to the Parent, and also faces no uncertainty associated with investing in T since inheritance has already occurred and there is no further risk that he will lose the parcel. The first order condition is simply:

$$\frac{\partial R}{\partial I_{t+i}} = \delta \frac{\partial S}{\partial T_{t+i}} \qquad (2.13)$$

Thus, following inheritance Heirs readjust their investment behavior. There is no longer a distortionary effect due to the anticipation of inheritance, so Heirs are motivated solely by the discounted returns to the technologies. Eliminating the tax shelter effect leads to a reduction in tree planting in the case where $\Delta T^H > 0$, while if $\Delta T^H < 0$ the implication of inheritance is that the coordination problem no long exists, and tree planting will subsequently increase in response.

These theoretical findings are illustrated in Figure 2. The Heirs will alter their rate of tree planting according to condition (2.9) as the Parent's hazard rate increases. Following the Parent's death in period k, the Heir adjusts his investment decision in the opposite direction, as inheritance issues are no longer a concern.

[FIGURE 2]

IIc Gender Implications and Testable Hypotheses

We turn now to the implications of this analysis for the issues of daughters' inheritance and widows' control over land. The relevance of the foregoing analysis to these issues stems from the fact that the model predicts behavior changes by heirs as they anticipate inheriting land. As illustrated in Figure 2., as the parent ages the heirs in the household should respond by either increasing or decreasing their tree planting, depending on the parameters. In our empirical investigation, we can thus consider the behavior of adult sons resident on the family farm as compared to adult daughters. To the extent that inheritance is not differentiated on the basis of gender, we would expect to see tree-planting behavior evolve in the same way for both sons and daughters.

We can also use this analysis to consider the extent to which the Law of Succession Act has been able to guarantee secure property rights for widows, as opposed to the traditional system in which land passes directly from fathers to sons. If widows do in fact have secure tenure and the right to bequeath land, then the heirs' tree planting should vary with the hazard rate of the last surviving parent, regardless of gender- if the father dies first, then heirs face the same incentive to adjust their investment behavior until the death of the mother. Conversely, if land passes directly from the father to the heirs, then only the father's age should induce a change tree planting. In that case, we would not expect to see the behavior illustrated in Figure 2 in female-headed households.

## III. Empirical Results

### IIIa. Description of the Data and Modelling Approach

The data used in this paper were collected in 2004 in a variety of locations throughout western and central Kenya. The data collection effort was a collaboration

between the National Graduate Institute for Policy Studies (GRIPS), the Tegemeo Institute of Egerton University, the World Agroforestry Center (ICRAF), and International Livestock Research Institute (ILRI). The survey collected a wide array of information on agriculture (including tree planting), demographics, land holdings, and other household characteristics. The number of agricultural households is 516; they occupy a total of 903 plots[5]. Kikuyu are the predominant ethnic group in the sample, comprising just under half of the total, while the remainder are a mix of various other ethnic groups. 115 of the households are classified as female-headed for inheritance purposes.[6]

We also use data from The World Health Organization to measure the Parent's hazard function h(t). The WHO provides estimates of yearly hazard rates by age for Kenyan men and women in 2004. From these, we calculate the probability that a Kenyan man or woman of a particular age will die within the next five years in order to obtain a time horizon similar to that in which tree planting decisions take place. The results are shown in Figure 3.

[FIGURE 3]

Table 1 presents summary statistics for the entire sample, as well as for Kikuyu and non-Kikuyu households by gender of the household head. Overall, the sample tends toward poor smallholders. Mean annual household income is US$842, with an average household size of 7.5 members. The average plot size is 1.94 acres, and 82% of the households farm either one or two plots. The majority of plots were acquired by means

[5] I drop non-agricultural plots, household and plot observations with data irregularities, and outliers in the form of large commercial plantations.

[6] A household is classified as female headed if a woman identifies herself as the head of the household and neither her husband nor her father are resident in the household, or if a male self-identified household head's mother is resident in the household but his father is not.

of inheritance, and have typically been in the household's possession for 21.1 years. In most cases households hold formal title to their plots, and employ some quantity of hired labor to work the plot.

[TABLE 1]

As we would like to compare the heirs' behavior across genders and ethnicities, it is useful consider the differences between the different household types in detail. Thus, below the variable names in Table 1 we indicate where F-tests reject the hypothesis of equality of the means at 5%. A statistically significant difference between the Kikuyu and non-Kikuyu samples is indicated by a *, while + and ++ indicate differences by gender within the Kikuyu and non-Kikuyu samples respectively.

The results indicate significant differences between the sub-samples in a number of cases. Non-Kikuyu households tend to have more male heirs, as well as a correspondingly higher number of total adults in the household, and more children as well. The samples are similar in terms of household income, and the age of the head, as well as mode of acquisition and length of tenure. Some important differences in farm characteristics likely reflect differing agroecological conditions- non-Kikuyu households plant fewer trees overall, and are less likely to have sloped plots or hire labor. They are significantly more likely to have markets in their villages, and less likely to have formal title over their land.

In terms of gender differences, for both ethnicities female heads of household tend to be less educated. Among the non-Kikuyu households, the only other significant difference is that female-headed households are overwhelmingly located in villages with markets. More substantial differences exist in the Kikuyu sample- male-headed

households have slightly more adults and children in the household, though the difference in the number of adult potential heirs is not significantly different. Additionally, female-headed households tend to be somewhat older and to have had longer tenure. The difference in age is not reflected in mortality risk, which is equal across Kikuyu households. We return to discussion of what these differences might imply for our results in the next section.

Tree stocks for producing households are shown in table 2. Production of tea tends to take place on a large scale, with over 1,000 trees on average. Households that grow coffee and timber also tend to maintain substantial stocks of trees as well, while production of fruit is on a smaller scale, with fruit producers averaging 18.5 trees. Looking at tree production across our sub-samples, we note some important differences. Coffee is more prevalent in Kikuyu areas, with 56% of Kikuyu plots producing coffee as compared to 34% of non-Kikuyu plots, while tea is nearly twice likely to be grown in non-Kikuyu areas. Both coffee and tea are grown on a larger scale by Kikuyu, as the stocks are significantly larger for both crops. This may be due to the fact that the Kikuyu households face more limited market access, creating economies of scale in transportation and marketing of cash crops. Female-headed households plant fewer timber trees, but more for fodder and conservation.

[TABLE 2]

The empirical strategy is to test for whether the investment behavior of heirs changes in anticipation of inheritance in accordance with the predictions of the theoretical model and to compare the changes across ethnicity, gender of the potential heir, and gender of the household head. Recall that non-Kikuyu households do not face

uncertainty with regard to inheritance, as the division of the estate is generally specified in advance. In terms of the theoretical model in the previous section, this corresponds to a bequest of rule p = 1. Non-Kikuyu face only the tax shelter incentive and not the reallocation risk coordination problem, as returns to trees are always reaped privately. The model thus yields the unambiguous prediction that $\Delta T^H > 0$ and non-Kikuyu heirs will increase tree planting as they anticipate inheritance. For the Kikuyu, the uncertainty caused by the restrictions on will-making under the traditional system introduces the reallocation risk disincentive. The sign of $\Delta T^H$ is ambiguous and depends on the parameters, but we can predict that as a result of the coordination problem $\Delta T^H$ will be smaller in the Kikuyu case than in the non-Kikuyu case to the extent that the traditional restrictions on making wills persist.[7]

Similarly, we can test hypotheses related to the extent to which the Law of Succession Act has been able to displace traditional inheritance practices that disadvantage women. If adult daughters show the same investment response in anticipation of inheritance as their brothers do, the implication is that they are inheriting land as well. Additionally, if female heads of households have the right to bequeath land, we would not expect the heirs' behavior to differ between male and female-headed households.

IIIb. Model and Estimation

[7]Assuming that there is no systematic difference in α across ethnicities.

We divide the sample into Kikuyu and non-Kikuyu owned plots and undertake separate estimations for each subsample. Our dependent variable is the square root of the density of trees on the plot. The empirical model is thus:

$$T_{ij}^{*} = \begin{cases} \beta_0 + \beta_1 X_{ij} + \beta_2 Y_j + \beta_3 Z_{ij} + e_{ij}, \text{j} \in A \\ \gamma_0 + \gamma_1 X_{ij} + \gamma_2 Y_j + \gamma_3 Z_{ij} + e_{ij}, \text{j} \in B \end{cases}$$

$$T_{ij} = 0 \text{ if } T_{ij}^{*} \leq 0$$

$$T_{ij} = T_{ij}^{*} \text{ if } T_{ij}^{*} > 0$$

Where the Kikuyu and non-Kikuyu subsamples are denoted by A and B respectively, $X_{ij}$ is a vector of plot specific characteristics, $Y_j$ is a vector of household specific characteristics, and $Z_{ij}$ is a measure of behavior in anticipation of inheritance, while $e_{ij}$ is the disturbance term.

Our theoretical model shows that a household's inheritance anticipation response at a given time depends on the parent's hazard rate h(t), the number of heirs N, the bequest rule p, and the share α that the parent appropriates for his own consumption. We do not observe p or α, hence we rely on h(t) and N. The density of trees should be decreasing in N provided $p < 1$ because of the heirs' coordination problem implied by the reallocation risk. However, if there is no uncertainty associated with the bequest rule, then in the non-Kikuyu case there should be no relationship between N and the density of trees. The theory also predicts a significant relationship between h(t) and tree density; the direction of this effect depends on p and α cannot be signed a priori.

In order to look at the gender differences, we differentiate between male and female heirs. In addition, we interact our inheritance anticipation measure with dummy variables corresponding to the gender of the household head, allowing the coefficients on

this measure to vary with gender of the household head. Thus our vector of inheritance anticipation variables is as follows:

$$Z_{ij} = \begin{bmatrix} N_M * h(t)d_1 \\ N_F * h(t)d_1 \\ N_M * h(t)d_2 \\ N_F * h(t)d_2 \end{bmatrix}$$

Where the subscript M or F indicates the number of male or female potential heirs respectively, $d_1$ is a dummy variable that equals one if the household head is male, and $d_2$ is a dummy variable that equals one if the household head is female.

Note that this specification implies two assumptions- first, our choice to disaggregate the sample and perform separate estimations implies that the coefficients on the control variables are not equal across ethnicities; otherwise we could estimate a single model and employ dummy variables to distinguish between the effects of ethnicity on the inheritance measures. Conversely, the way we specify the inheritance measure implies that we can in fact estimate a single equation for both genders of household heads within the same ethnic group. That is, for both ethnic groups, we impose the constraint that the coefficients on the control variables are equal for male and female household heads. We explore the validity of these assumptions in the appendix.

One important concern in terms of our selection of control variables is the relationship between tree planting decisions and labor availability. As discussed, Dewees (2005) hypothesizes that tree crops in Kenya tend to require less labor than other crops, and as a result households may opt for tree crops to cope with labor shortages. This presents a potential problem for our analysis, as the number of heirs in the household could be a proxy for labor availability. To account for this possibility, we include a

dummy variable set equal to one if the household employs hired labor on the plot in question, and also control for both the total number of adults in the household, including heirs, parents, laborers, and other relatives, as well as the number of children.

IIIc. Results

The results are presented in Table 3. The relationships between the control variables and tree density are intuitively plausible and largely conform to expectations. In both subsamples, tree density is positively associated with the number of years since the plot was acquired, and negatively associated with the size of the plot. Kikuyu households with formal titles appear to feel more secure in making long term investments and thus plant more trees than those with informal tenure. Kikuyu households are also more apt to plant trees on plots that are sloped, while inherited plots tend to have a higher tree density than those acquired by other means. Among non-Kikuyu households, the education level of the household head is positively associated with tree planting.

[TABLE 3]

In terms of the labor constraint measures, for the non-Kikuyu households more adults in the household are associated with fewer trees. This is consistent with the presence of a labor constraint. Conversely, for the Kikuyu households with more adults plant more trees, though the significance of the coefficient is weak. All of the other measures of labor availability are insignificant. It is also worth noting that hired labor is employed on 81% of the plots in the sample; the lack of significance of the coefficient on the associated variable shows that the availability of hired labor is not related to tree

density. Overall, our results suggest that tree-planting decisions are not significantly affected by labor constraints.

Finally, we look at the results concerning the effects of anticipation of inheritance. For both the Kikuyu and non-Kikuyu subsamples, the coefficient for male heirs in male headed households is significant. The estimate of the coefficient for the non-Kikuyu subsample is positive. In the absence of uncertainty related to which plot they will inherit, non-Kikuyu heirs who anticipate inheriting land will tend to plant more trees in order to take advantage of the tax shelter incentive. Meanwhile, the coefficient for the Kikuyu subsample is negative. The implication is that the reallocation risk disincentive dominates the tax shelter incentive. A likelihood ratio test rejects the hypothesis that the Kikuyu and non-Kikuyu coefficients are equal at $p < .01$. As our model predicts, the reallocation risk disincentive created by the traditional restriction on will-making plays a significant role in determining investment choices.

The evidence of gender differentiation again differs between Kikuyu and non-Kikuyu households. For the Kikuyu households, the presence of female potential heirs in the household does not impact tree density. The coefficients on the inheritance variables are also insignificant in female headed households. Conversely, sons in non-Kikuyu female headed households exhibit similar behavior as in male headed households. For non-Kikuyu female potential heirs, the coefficient is insignificant in male headed households, and weakly significant in female headed households. It is important to note that though these results strongly suggest that in the Kikuyu case sons behave differently in male-headed as opposed to female-headed households, we cannot conclusively reject

the hypotheses of equality of the coefficients across genders because of the high standard errors on the insignificant coefficients.

Overall, then, our results support the assertion that in the case of Kikuyu inheritance practices, formal legislation has been unable to displace informal practices. We find strong evidence that uncertainty associated with the restrictions on making wills influences investment behavior on the part of the Kikuyu heirs. The findings in terms of gender are more suggestive than conclusive, but nonetheless are consistent. Adult daughters do not seem to make decisions in terms of tree planting with inheritance in mind. This may be because they do not inherit land, although there are other plausible explanations here: there may be a gender division of labor whereby daughters are not involved in tree planting, or daughters may simply have less discretionary power over their labor than sons. More compellingly, the inheritance incentives we observe in male headed households do not appear to be at work in female-headed households. The implication is that sons inherit land upon the death of their fathers, hence the aging of their mothers is immaterial to their investment decisions.

Among the non-Kikuyu households, reforms related to gender reforms seem to have been more effective. Heirs exhibit an inheritance response in female as well as male headed households, suggesting that bequest decisions are made by the last surviving parent, rather than exclusively the father. Two potential explanations for this discrepancy relate to the fact that as noted, the Kikuyu sample is significantly more rural than the non-Kikuyu sample. Women living in less rural areas may have more knowledge about, or access to, the formal system. Additionally, the Kikuyu areas are more likely to be on the traditional territory of the sub-clan. Women's control over land has been limited

historically at least in part to maintain the territorial integrity of the patrilineal sub-clan. The heirs of a widow or daughter who marries outside the sub-clan would then be members of that sub-clan, hence land they inherit would transfer to their sub-clan. Concerns over these traditional boundaries still persist in certain areas. We cannot observe this effect directly, but because of the nature of our sample, it seems more likely that Kikuyu households would be found in areas where these issues arise than the more dispersed and less rural non-Kikuyu households.

The overall implication is that informal institutions generate important differences between Kikuyu and non-Kikuyu experiences with inheritance. For male heirs, the non-Kikuyu arrangements are more advantageous. The absence of uncertainty pertaining to will-making allows them to take advantage of the tax shelter incentive without concern for the countervailing reallocation risk. Conversely, Kikuyu fathers benefit from absence of formal wills in that the resultant uncertainty shifts investment patterns in a matter that is more consistent with their time preferences than those of the heirs. Our evidence suggests that daughters and widows tend to have stronger inheritance rights in the non-Kikuyu setting, though these findings are not conclusive. Why this might be the case is a topic for further research.

## IV. Conclusions

Our results in previous section confirm that the prohibition on will-making among the Kikuyu creates a disincentive for heirs to plant trees that alters their investment choices. Moreover, women's control over land in the inheritance process remains limited. Despite the formal changes mandated by the Law of Succession Act, the informal system

persists. In this section, we discuss some reasons why this might be the case, and consider the broader implications.

From the standpoint of total output, the investment distortions induced by the reallocation risk are a source of productive inefficiency. By eliminating a source of inefficiency, then, the formal system would appear to Pareto dominate the informal system. Introducing a stronger mechanism to precommit to wills reduces or eliminates the heirs' coordination problem, improving the efficiency of their investment choices with no apparent welfare loss. From this perspective, the persistence of the informal system would seem to be a result of failure to make the formal alternative available to willing users- perhaps information dissemination has not been sufficient, or there is some hidden cost associated with using the formal system.

Consideration of the interests of the parent, however, suggests an alternative explanation. Both theory and empirical evidence indicate that in the absence of uncertainty, i.e., when $p = 1$, heirs will plant more trees as they anticipate inheritance in order to shield their output from parental expropriation. It can be shown that for even an altruistic parent, under a range of conditions there is some $p < 1$ (i.e., a non-zero reallocation risk) that produces an outcome that is preferable to the case where $p = 1$. We omit the details here, but the intuition is straightforward. Increasing p reduces the heirs' incentive to invest in T. This is efficiency enhancing in terms of total output, since it reduces the distortion that the tax shelter incentive introduces. By reducing T in the period prior to the parent's death, this also increases the parent's relative share of total consumption, since the heirs now shied less of the consumption good than they do in the $p = 1$ case. By effectively shortening the heirs' time horizon, uncertainty associated with

inheritance induces the heirs to invest in such a way that more is produced during the parent's lifetime.

Hence, another explanation for the persistence of the informal system is that parents are able to effectively resist institutional change in order to defend their interests. As in Becker's (1974) "rotten kid theorem," the prevailing institutional set-up compels otherwise selfish heirs to act more in accordance with their parents' interests. Power dynamics within the household and the informal order allow the older to generation to maintain the status quo.

A similar finding is reported by La Ferrara (2007). She examines the case of inheritance rules in Ghana in the context of matrilineal descent rules whereby nephews inherit their uncles' property. She finds evidence that when this norm is strongly enforced, parents are able engage in strategic behavior by making or withholding inter vivos transfers to their migrant sons in exchange for transfers. The interpretation is that a stronger norm makes the threat of disinheritance more credible, as the sons will have no claim to the family's land after the father's death. Thus, the traditional norm of nephew inheritance may persist because it allows parents to shape the incentives facing their children to secure outcomes that they prefer.

Institutions that compel heirs to behave in a way that suits their parents' needs may also benefit parents in that they obviate the need for strategic behavior. In the absence of such institutions, threats of disinheritance or favoritism may be the only way to compel the heirs to guarantee old age security. Such behavior could create social tensions, and may also be psychically costly to parents. From this standpoint, the kind of

inheritance institution described here can be thought of as a means of achieving outcomes that might otherwise require costly strategic behavior to generate.

It is important to note also that despite the fact that inheritance institutions such as these may reduce productive efficiency, they may serve an important social function. In an environment of rapid social change, informal institutions come under stress. As urbanization continues and more and more of their children migrate, parents may find their traditional claims over resources weakened. As such, inheritance institutions such as those described may play an important role in helping to ensure old age security. In this sense, Kikuyu inheritance practices may be thought of less as powerful parents imposing their will, and more as an instance of the older generation utilizing its comparative advantage in the informal order as a survival strategy.

This analysis also suggests that women's control over and access to land in rural Kenya remains limited. Again, legislation has not been sufficient to reverse traditional practices. Daughters do not appear to inherit land, and male heirs anticipate inheritance prior to their father's death only. This issue is particularly pertinent in light of the HIV/AIDS pandemic, as access to land for AIDS widows is often a crucial aspect of survival strategies (Drimie 2003). For policymakers, an understanding of the local institutional environment and attention to policy implementation are of crucial importance.

Finally, this analysis highlights the importance of a broad conceptualization of institutional change. As discussed, the New Institutional Economics tends to take a narrow focus on technology and resources as driving institutional change. The story here, however, illustrates the importance of a complex interplay of factors. Economic

development spurred by technological and institutional changes has led to increasing migration and a weakening of traditional means of old age security. As a result, cultural factors become increasingly important in determining institutional change with respect to inheritance practices, as the older generation seeks to protect its interests. While the NIE can provide useful insights, in some cases the process of institutional change is best understood as a more complex, contested process.

Appendix: Robustness checks and alternative modeling approaches

To investigate the robustness of these findings, we undertake further empirical analysis in this section to address a number of potential concerns. An important issue to bear in mind throughout the discussion is the relative importance of our findings from the previous section in terms of the overall analysis. The key hypothesis of this paper is that Kikuyu heirs face uncertainty due to prohibitions on will-making, and as a result tend to under-invest in tree crops as their parents age. Given that our results suggest that land passes directly from fathers to sons, the most important empirical result is that the coefficient on male heirs in male-headed Kikuyu households is negative and significant. The findings for the non-Kikuyu households are properly viewed as providing additional support for this key hypothesis, but they are not central to the main conclusions.

One potential econometric concern is in the way that we have disaggregated the sample- recall that we estimate the model twice, once for each ethnicity, with dummy variables reflecting the gender of the household head. Thus, we have assumed that the coefficients on control variables are equal across gender, but we allow the coefficients to differ across ethnicities. The data justify this approach- a likelihood ratio test strongly rejects the hypothesis that the coefficients on the control variables are equal across ethnicities, suggesting that it is appropriate to disaggregate the sample by ethnicity as we have done. Meanwhile, within each of the two ethnic groups likelihood ratio tests fail to reject the hypotheses that the control variable coefficients differ on the basis of the gender of the household head.

As a check, however, in Table 4 we report results[8] using specifications where we constrain all coefficients on the control variables to be equal across gender and ethnicity, as well as the case where we allow all coefficients to vary. Our previous findings are not robust to the specification where we constrain the coefficients to equality- all coefficients lose significance, with the exception of an apparently anomalous case of Kikuyu female heirs in male headed households. Conversely, when we estimate the model separately for each of the four subsamples, the results are consistent with our findings in terms of the male-headed households- the coefficients on the number of male heirs interacted with the households head's age are significant and of the expected sign. We do not obtain significant coefficients for the female headed households; in the non-Kikuyu case this is likely because the sample size is limited to 100 observations.

[TABLE 4]

The implication of the results in table 4 is that there are important differences between the Kikuyu and non-Kikuyu in terms of the factors that affect tree planting decisions. Another potential objection is thus that the difference in the findings for the two sub-samples under the preferred specification could reflect some other structural difference, rather than inheritance anticipation behavior. One possible source would be varying agroclimactic conditions, as was suggested by our summary statistics. To partly account for this, we re-estimate the model using dummy variables for each of the 68 villages. The results appear in table 5. For the Kikuyu subsample, male heirs in male-headed households remains negative and significant at 5%, though we now obtain weakly significant results of the opposite sign for the coefficient on female heirs in female

[8] For clarity, throughout this section we report the coefficients and p-values on our inheritance anticipation measures only. In general, the coefficients on the control variables behave similarly to our preferred specification.

headed households. Most of the coefficients in the non-Kikuyu lose significance, though they remain of the expected sign. Thus, while our previous findings are somewhat muted, they are not contradicted by the inclusion of village-level controls.

We cannot completely rule out the possibility that our results are driven by some unobservable structural difference. However, this possibility seems unlikely- there is no apparent alternative theoretical or intuitive explanation as to why the presence of heirs interacted with the household head's mortality risk would show a statistically significant effect on tree planting in opposite directions across the two sub-samples.

Another potential concern relates to the fact that our variable of interest in the preferred specification is an interaction term. Our measure of inheritance anticipation is the number of heirs interacted with the mortality risk and gender of the household head, and while we did include a gender dummy, we did not include the number of heirs or mortality risk as separate variables. Hence, a potential concern is that the significance of the coefficients could be driven by one or the other variables, but not both. In table 6, we estimate the model including these non-interacted variables separately and together with the interaction terms. While our coefficients lose significance, the results for the Kikuyu subsample suggest that both mortality risk and the number of male heirs drives our previous findings- the signs are consistent, and both coefficients are significant in the final specification. The results are less clear cut for the non-Kikuyu sample, but we do not see evidence that one of the two interaction terms predominates.

[TABLE 6]

Under our preferred specification, our dependent variable was overall tree density, which we calculated by aggregating timber, fruit, coffee, tea, and fodder or conservation trees. However, these tree crops have some important differences in terms of gestation period, value, and other characteristics. It is thus of interest to estimate the model using the individual types of tree crops as our left-hand side variable. These results are presented in tables 7 and 8. Overall, they are consistent with our results under the preferred specification- of the twelve significant coefficients in these models, ten are of the expected sign, while both of the exceptions are with respect to fodder or conservation trees. As fodder and conservation species are relatively uncommon, the findings suggest that aggregating the total number of trees is a valid approach.

[TABLE 7]

[TABLE 8]

Finally, our theoretical predictions in section II provide a second empirically testable hypothesis that we can investigate to potentially corroborate our findings. Recall that the condition for tree-planting to be increasing the mortality risk of the household head was $p + \frac{1-p}{N} > \alpha$, where p is the bequest rule, α is the proportion that the parent taxes, and N is the number of heirs. Note that where N = 1, the left hand side is equal to one and thus tree planting will always increase. This is because a single heir does not face uncertainty in terms of what plot he will inherit. Thus, in anticipation of inheritance, his sole motivation is to shield his investments from his parent's expropriation.

Additionally, in households where no heirs are present, we should find no relationship between the household head's mortality risk and tree-planting behavior. We thus estimate a similar specification to model one but with an alternative inheritance

anticipation measure- we interact the household head's mortality risk with dummy variables corresponding to zero, one, or multiple heirs. As before, we allow the inheritance anticipation coefficients by gender, and estimate the model separately for the Kikuyu and non-Kikuyu samples. Our expectation is that the coefficient should be positive in single heir case for both subsamples, positive and of greater magnitude in the non-Kikuyu sample for the multiple heir case, and negative for the multiple heir Kikuyu case. For the zero heir cases, the coefficients should be insignificant.

Table 9 shows the results of this estimation. In the Kikuyu case, none of the coefficients are significant, and contrary to our predictions the coefficient on single heir male headed households is negative. However, the fact that the multiple heir coefficient for male-headed households is negative, of greater magnitude, and nearly significant is encouraging. The only coefficient in the non-Kikuyu case that is significant is in the single-heir case in female headed households. Though the remaining coefficients are insignificant, all are of the expected sign. Overall, these results neither lend support to, nor contradict, our previous findings. The likely explanation for this ambiguity is that there are important differences between zero, single, and multiple heir households that we are not able to adequately control for. As a result, we cannot obtain strong results from this model.

[TABLE 9]

As a whole, our alterative specifications suggest that our findings with regard to the Kikuyu households are quite robust to range of alternative specifications. In almost all cases, the coefficient on male heirs in male-headed households was negative and significant, while we did not obtain significant coefficients for female heirs or female

household heads. Our assertion that sons plant fewer trees in anticipation of their father's death is thus strongly supported. The results for the non-Kikuyu sample tended to be weaker. While the coefficients remained of the expected sign and maintained reasonable standard errors, they tended to drop below conventional levels of significance. One possibility here is that the fact that non-Kikuyu live in less remote areas results in non-Kikuyu households having better access to credit and insurance markets, as well as non-farm opportunities. As a result, these relationships are weaker than what we find in the more market-constrained Kikuyu environment.

The fact that these different specifications produce consistent results also argues against the possible alternative interpretation that the key findings are driven by something other than inheritance anticipation behavior. In addition, the nature of our variable of interest also reduces the potential that the results are driven by some unobserved factor. For that to be the case, there would have to be some explanation that accounted for the fact that more heirs in conjunction with older household heads reduce tree planting in the Kikuyu case, but increase it in the non-Kikuyu case. No such explanation suggests itself.

## -BIBLIOGRAPHY-

Acemoglu, Johnson, Simon, and Robinson, James. 2001. The Colonial Origins of Comparative Development: An Empirical Investigation. American Economic Review 91 (5), 1369-1401.

Agarwal, Bina, 1998. Widows versus Daughters or Widows as Daughters? Property, Land, and Economic Security in Rural India. Modern Asian Studies 32(1), 1-48.

Becker, Gary, 1974. A Theory of Social Interactions. Journal of Political Economy 82 (6), 1063-1093.

Carsan, Sammy, 2007. Sustainable Timber for Smallholder Cropping Systems Unpublished Masters' Thesis, University of the Free State, South Africa

Deere, Carmen Diana and Leon, Magdalena, 2003. The Gender Asset Gap: Land in Latin America. World Development 31 (6), 925–947

Deininger, Klaus 2003. Land Policies for Growth and Poverty Reduction. World Bank Policy Research Report.

Deininger, Klaus, and Castagnini, Rafaella 2006. Incidence and Impact of Land Conflict in Uganda. Journal of Economic Behavior and Organization 60 (3), 321-345

Dewees, Peter, 1995. Social and Economic Incentives for Smallholder Tree Growing: A Case Study from Murang'a District, Kenya. Food and Agricultural Organization Community Forestry Case Study Series.

Drimie, Scott, 2003. HIV/AIDS and Land: Case Studies from Kenya, Lesotho, and South Africa. Development Southern Africa 20, 647-658

Fafchamps, Marcel and Quisumbing, Agnes, 2002. Control and Ownership of Assets within Rural Ethiopian Households. Journal of Development Studies 38 (6), 47-82

Golan, Elise, 1994. Land Tenure Reform in the Peanut Basin of Senegal. In: Bruce, John and Migot-Adholla, Shem. Searching for Land Tenure Security in Africa. Dubuque, Iowa: Kendall/Hunt Publishing Co.

Harwood, C.E., 1998. Grevillea Robusta- A Versatile and Popular Tree for Farm Forestry. Forest, Farm, and Community Tree Network FACT Sheet 98-05.

Henrysson, Elin and Joireman, Sandra, 2008. Property Rights Adjudication in Kisii, Kenya. Unpublished Working Paper, cited by permission of authors

Joireman, Sandra, 2008. The Mystery of Capital Formation in Sub-Saharan Africa: Women, Property Rights, and Customary Law. World Development 36 (7), 1233–1246

Kameri- Mbote, Patricia, 1995. The Law of Succession in Kenya: Gender Perspectives in Property Management and Control. International Environmental Law Research Centre Working Paper

Knack, Stephen., and Keefer, Philip, 1997. Does Social Capital Have an Economic Payoff? A Cross-Country Investigation. Quarterly Journal of Economics 112 (4), 1251-1288

La Ferrara, Eliana, 2007. Descent Rules and Strategic Transfers: Evidence from Matrilineal Groups in Ghana. Journal of Development Economics 83 (2), 280-301

Mackenzie, Fiona, 1989. Land and Territory: The Interface between Two Systems of Land Tenure, Murang'a District, Kenya. Journal of the International African Institute 59 (1), 91-109

North, Douglass, 1990. Institutions, institutional change, and economic performance Cambridge University Press: Cambridge Mass.

Price, Neil 1996. The Changing Value of Children Among the Kikuyu of Central Province, Kenya. Journal of the International African Institute 66 (2), 411-436

Quisumbing, Agnes, and Otsuka, Keijiro, 2001. Land Inheritance and Schooling in Matrilineal Societies: Evidence from Sumatra. World Development 29 (12), 2093-2110

Shipton, Parker, 1984. Lineage and Locality as Antithetical Principles in East African Systems of Land Tenure. Ethnology 23 (2), 117-132

United Nations Economic Commission for Africa, 2004. Land Tenure Systems and Their Impacts on Food Security and Sustainable Development in Africa. Addis Ababa: UNECA

Williamson, Oliver 1985. The Economic Institutions of Capitalism. New York: Free Press

World Bank 2007. World Development Report 2008: Agriculture for Development Washington: The World Bank

Yamano, Takeshi, Otsuka, Keijiro, Place, Frank, Kijima, Yoko and Nyoro, James, 2005. The 2004 REPEAT Survey in Kenya (First Wave): Results. Mimeo

**Table 1. Summary Statistics**

| | All | | KIKUYU | | | | NON-KIKUYU | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Male Headed | | Female Headed | | Male Headed | | Female Headed | |
| | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. |
| Per Capita Income, $US | 842 | 2765 | 877 | 1498 | 666 | 673 | 925 | 4003 | 594 | 591 |
| No. of Female Heirs | 0.78 | 1.03 | 0.80 | 0.98 | 0.71 | 0.87 | 0.79 | 1.12 | 0.75 | 0.96 |
| No. of Male Heirs | 1.14 | 1.02 | 1.10 | 1.01 | 0.82 | 1.19 | 1.22 | 0.97 | 1.23 | 1.00 |
| Total Adults | 4.85 | 2.33 | 4.50 | 1.93 | 3.96 | 2.57 | 5.24 | 2.35 | 5.32 | 2.80 |
| Children Under 16 | 2.64 | 1.99 | 2.03 | 1.74 | 1.75 | 1.72 | 3.28 | 2.07 | 3.03 | 1.83 |
| HH Head Years of Education | 6.53 | 4.82 | 7.62 | 4.27 | 2.79 | 3.68 | 7.74 | 4.63 | 2.17 | 3.67 |
| Age of HH Head | 56.0 | 13.4 | 56.05 | 12.88 | 59.14 | 13.31 | 55.25 | 13.95 | 55.37 | 12.77 |
| 5-Year Mortality Risk of HH Head | 0.26 | 0.20 | 0.26 | 0.20 | 0.26 | 0.20 | 0.26 | 0.19 | 0.29 | 0.25 |
| | | | | | | | | | | |
| Size, Acres | 1.94 | 2.23 | 2.04 | 2.53 | 1.90 | 2.00 | 1.91 | 2.12 | 1.78 | 1.85 |
| Years Since Acquisition | 21.11 | 16.58 | 18.34 | 14.56 | 25.30 | 18.61 | 21.38 | 16.54 | 24.63 | 19.06 |
| Trees | 213 | 375 | 285 | 432 | 227 | 353 | 172 | 337 | 142 | 319 |
| | | | | | | | | | | |
| % Inherited | 57.6% | | 56.4% | | 52.7% | | 58.3% | | 63.0% | |
| % Sloped | 30.5% | | 42.7% | | 37.6% | | 20.6% | | 26.0% | |
| % Titled | 67.4% | | 71.7% | | 73.1% | | 62.8% | | 68.0% | |
| % Labor Hired | 80.8% | | 84.0% | | 87.1% | | 76.7% | | 82.0% | |
| % Market in Village | 68.1% | | 43.0% | | 40.9% | | 86.4% | | 97.0% | |
| | | | | | | | | | | |
| No. of plots | 903 | | 307 | | 93 | | 403 | | 100 | |
| No. of households | 516 | | 183 | | 56 | | 218 | | 59 | |

**Table 2. Tree Planting by Household and Tree Type**

| | Average no. of trees among planting households | | | | |
|---|---|---|---|---|---|
| | All | Kikuyu | Non-Kikuyu | Male Headed | Female Headed |
| Timber | 130.6 | 102.6 | 149.1 | 139.0 | 98.0 |
| Fruit | 18.5 | 21.2 | 16.5 | 18.6 | 17.9 |
| Coffee | 309.7 | 373.2 | 227.5 | 307.2 | 319.5 |
| Tea | 1407.9 | 2281.7 | 1031.2 | 1404.6 | 1423.5 |
| Fodder/ Conservation | 47.4 | 45.4 | 50.5 | 41.5 | 70.7 |

**Table 3. Results**

*** significant at 10%; ** significant at 5%; * significant at 1%

| | Kikuyu | Non-Kikuyu |
|---|---|---|
| Education of HH head | 0.099<br>(-0.71) | 0.271<br>(1.96)*** |
| HH used hired labor | 0.011<br>(-0.03) | 0.127<br>(-0.43) |
| Children under 15 in HH | 0.423<br>(-1.30) | -0.88<br>(2.77)* |
| Total no. of adults in HH | -1.364<br>(-0.90) | 0.392<br>(-0.28) |
| Other trees on plots owned by HH | 0.001<br>(2.05)** | -0.001<br>(-1.16) |
| Log of years since acquisition | 2.279<br>(3.66)* | 2.347<br>(4.05)* |
| Market in village | 1.124<br>-1.02 | -3.279<br>(1.82)*** |
| Plot size | -0.8<br>(3.36)* | -0.89<br>(3.14)* |
| Plot sloped | 2.954<br>(2.66)* | 2.821<br>(2.05)** |
| Title deed | 4.961<br>(3.35)* | 1.886<br>(-1.42) |
| Plot inherited | 5.356<br>(3.80)* | 1.723<br>(-1.24) |
| Female-headed household dummy | -2.64<br>(-1.39) | -2.507<br>(-1.00) |
| Male Heirs X Mortality risk of HH head, Male-headed HH | -6.705<br>(2.95)* | 5.606<br>(2.22)** |
| Female Heirs X Mortality risk of HH head, Male-headed HH | 3.255<br>(-1.09) | 1.826<br>(-0.72) |
| Male Heirs X Mortality risk of HH head, Female-headed HH | -0.514<br>(-0.15) | 9.528<br>(2.01)** |
| Female Heirs X Mortality risk of HH head, Female-headed HH | -1.632<br>(-0.28) | 11.653<br>(1.74)*** |
| Constant | -3.901<br>(-1.44) | 1.839<br>(-0.59) |
| Observations | 400 | 503 |
| Pseudo R-squared | .047* | .022* |

**Table 4. Alternative Aggregations of the Sub-Samples**

| | All | Kikuyu Male-Headed Households | Non-Kikuyu Male-Headed Households | Kikuyu Female-Headed Households | Non-Kikuyu Female-Headed Households |
|---|---|---|---|---|---|
| Male Heirs X Mortality risk of HH head, Male-headed Kikuyu HH | -1.907 (0.200) | | | | |
| Female Heirs X Mortality risk of HH head, Male-headed Kikuyu HH | 6.019 (0.031)** | | | | |
| Male Heirs X Mortality risk of HH head, Female-headed Kikuyu HH | 3.870 (0.266) | | | | |
| Female Heirs X Mortality risk of HH head, Female-headed Kikuyu HH | 5.959 (0.214) | | | | |
| Male Heirs X Mortality risk of HH head, Male-headed non-Kikuyu HH | 0.981 (0.687) | | | | |
| Female Heirs X Mortality risk of HH head, Male-headed non-Kikuyu HH | 0.426 (0.830) | | | | |
| Male Heirs X Mortality risk of HH head, Female-headed non-Kikuyu HH | 3.358 (0.265) | | | | |
| Female Heirs X Mortality risk of HH head, Female-headed non-Kikuyu HH | 8.321 (0.273) | | | | |
| Male Heirs X Mortality risk of HH head, Male-headed HH | | -4.359 (0.004)* | 5.851 (0.040)** | | |
| Female Heirs X Mortality risk of HH head, Male-headed HH | | 3.622 (0.165) | 2.221 (0.238) | | |
| Male Heirs X Mortality risk of HH head, Female-headed HH | | | | -1.523 (0.324) | 4.471 (0.363) |
| Female Heirs X Mortality risk of HH head, Female-headed HH | | | | -2.544 (0.485) | 11.383 (0.140) |
| Pseudo log-likelihood | -2884.15 | -992.81 | -1285.4 | -272.5 | -294.1 |
| Observations | 903 | 307 | 403 | 93 | 100 |

Robust p-values in parentheses
*** significant at 10%; ** significant at 5%; * significant at 1%
Specification of control variables as in Table 3, results omitted

**Table 5. Specification with Village-Level Dummy Variables**

| | Kikuyu | Non-Kikuyu |
|---|---|---|
| Male Heirs X Mortality risk of HH head, Male-headed HH | -3.532 (0.049)** | 4.604 (0.102) |
| Female Heirs X Mortality risk of HH head, Male-headed HH | 2.187 (0.333) | 1.734 (0.331) |
| Male Heirs X Mortality risk of HH head, Female-headed HH | -2.550 (0.100) | 4.096 (0.363) |
| Female Heirs X Mortality risk of HH head, Female-headed HH | 5.032 (0.079)*** | 10.330 (0.039)** |
| Pseudo log-likelihood | -1220.6 | -1539.4 |
| Observations | 400 | 503 |

Robust p-values in parentheses
*** significant at 10%; ** significant at 5%; * significant at 1%
Specification of control variables as in Table 3, results omitted

**Table 6. Alternative Inheritance Anticipation Measures**

| | Kikuyu | Non-Kikuyu | Kikuyu | Non-Kikuyu |
|---|---|---|---|---|
| Male head X mortality risk | -4.839<br>(0.110) | 5.029<br>(0.170) | -7.172<br>(0.057)*** | -6.795<br>(0.322) |
| Female head X mortality risk | 0.015<br>(0.997) | 10.017<br>(0.035)** | 5.832<br>(0.292) | -6.853<br>(0.466) |
| Female heirs X female head | 0.804<br>(0.476) | 1.488<br>(0.312) | 1.821<br>(0.241) | 0.359<br>(0.830) |
| Male heirs x male head | -0.106<br>(0.892) | 0.074<br>(0.953) | 0.625<br>(0.617) | -3.004<br>(0.210) |
| Female heirs X male head | 0.103<br>(0.900) | 0.079<br>(0.901) | 0.154<br>(0.907) | -0.319<br>(0.718) |
| Male heirs X male head | -1.876<br>(0.001)* | -0.220<br>(0.720) | -2.353<br>(0.000)* | -2.280<br>(0.089)*** |
| Male Heirs X Mortality risk of HH head, Male-headed HH | | | 2.615<br>(0.123) | 11.489<br>(0.043)** |
| Female Heirs X Mortality risk of HH head, Male-headed HH | | | -0.355<br>(0.929) | 2.444<br>(0.321) |
| Male Heirs X Mortality risk of HH head, Female-headed HH | | | -3.102<br>(0.259) | 15.430<br>(0.090)*** |
| Female Heirs X Mortality risk of HH head, Female-headed HH | | | -6.366<br>(0.323) | 12.161<br>(0.225) |
| Pseudo log-likelihood | -1275.2 | -1587.2 | -1274.6 | -1583.2 |
| Observations | 400 | 503 | 400 | 503 |

Robust p-values in parentheses

*** significant at 10%; ** significant at 5%; * significant at 1%

Specification of control variables as in Table 3, results omitted

**Table 7. Differentiated Tree Crops, Kikuyu Households**

| | Timber | Fruit | Coffee | Tea | Fodder |
|---|---|---|---|---|---|
| Male Heirs X Mortality risk of HH head, Male-headed HH | -3.523 (0.106) | 0.385 (0.417) | -3.768 (0.079)*** | -31.823 (0.089)*** | -1.880 (0.015)** |
| Female Heirs X Mortality risk of HH head, Male-headed HH | -2.697 (0.411) | 0.442 (0.506) | 2.282 (0.605) | 16.861 (0.425) | 1.247 (0.357) |
| Male Heirs X Mortality risk of HH head, Female-headed HH | -1.722 (0.522) | -0.376 (0.361) | 2.130 (0.479) | -142.437 (0.052)*** | 2.349 (0.024)** |
| Female Heirs X Mortality risk of HH head, Female-headed HH | 2.336 (0.489) | 0.394 (0.710) | -7.752 (0.418) | 39.623 (0.107) | -0.699 (0.797) |
| Pseudo log-likelihood | -871.1 | -669.6 | -750.7 | -199.1 | -641.3 |
| Observations | 400 | 400 | 400 | 400 | 400 |

Robust p-values in parentheses
*** significant at 10%; ** significant at 5%; * significant at 1%
Specification of control variables as in Table 3, results omitted

**Table 8. Differentiated Tree Crops, Non-Kikuyu Households**

| | Timber | Fruit | Coffee | Tea | Fodder |
|---|---|---|---|---|---|
| Male Heirs X Mortality risk of HH head, Male-headed HH | 2.153 (0.207) | 0.306 (0.575) | 9.454 (0.082)*** | 5.896 (0.644) | -0.766 (0.671) |
| Female Heirs X Mortality risk of HH head, Male-headed HH | 0.019 (0.988) | 0.629 (0.226) | 7.749 (0.038)** | -5.083 (0.793) | 4.408 (0.022)** |
| Male Heirs X Mortality risk of HH head, Female-headed HH | 5.004 (0.168) | 0.773 (0.424) | 12.389 (0.072)*** | -1.116 (0.961) | 1.810 (0.608) |
| Female Heirs X Mortality risk of HH head, Female-headed HH | 6.593 (0.011)** | 0.485 (0.667) | -6.811 (0.608) | 41.198 (0.063)*** | -15.177 (0.064)*** |
| Pseudo log-likelihood | -1190.7 | -873.4 | -491.3 | -374.5 | -442.2 |
| Observations | 503 | 503 | 503 | 503 | 503 |

Robust p-values in parentheses
*** significant at 10%; ** significant at 5%; * significant at 1%
Specification of control variables as in Table 3, results omitted

**Table 9. Zero/Single/Multiple Heirs Inheritance Anticipation Measure**

| | Kikuyu | non-Kikuyu |
|---|---|---|
| Education of HH head | 0.061 | 0.299 |
| | (0.677) | (0.062)*** |
| Children under 15 in HH | 0.092 | 0.160 |
| | (0.780) | (0.604) |
| Total no. of adults in HH | 0.379 | -0.597 |
| | (0.189) | (0.030)** |
| HH used hired labor | -1.317 | 0.173 |
| | (0.443) | (0.893) |
| Other trees on plots owned by HH | 0.001 | -0.001 |
| | (0.284) | (0.373) |
| Log of years since acquisition | 2.382 | 2.420 |
| | (0.001)* | (0.000)* |
| Market in village | 1.126 | -3.351 |
| | (0.426) | (0.270) |
| Plot size | -0.765 | -0.944 |
| | (0.002)* | (0.000)* |
| Plot sloped | 2.865 | 2.753 |
| | (0.013)** | (0.100)*** |
| Title deed | 5.176 | 1.508 |
| | (0.007)* | (0.317) |
| Plot inherited | 4.848 | 2.162 |
| | (0.003)* | (0.080)*** |
| Female-headed household dummy | -3.476 | -1.406 |
| | (0.097)*** | (0.640) |
| Zero Male Heirs Dummy X Mortality Risk of HH Head, Male-headed HH | 1.870 | -1.344 |
| | (0.572) | (0.822) |
| Single Male Heir Dummy X Mortality Risk of HH Head, Male-headed HH | -4.016 | 5.274 |
| | (0.203) | (0.121) |
| Multiple Male Heirs Dummy X Mortality Risk of HH Head, Male-headed HH | -9.411 | 6.748 |
| | (0.134) | (0.410) |
| Zero Male Heirs Dummy X Mortality Risk of HH Head, Female-headed HH | 1.429 | -3.612 |
| | (0.833) | (0.694) |
| Single Male Heir Dummy X Mortality Risk of HH Head, Female-headed HH | -0.546 | 9.938 |
| | (0.924) | (0.005)* |
| Multiple Male Heirs Dummy X Mortality Risk of HH Head, Female-headed HH | 5.506 | 7.415 |
| | (0.638) | (0.570) |
| Constant | -3.722 | 0.388 |
| | (0.331) | (0.936) |
| Pseudo log-likelihood | -442.2 | -1278.2 |
| Observations | 400 | 503 |

Robust p-values in parentheses
*** significant at 10%; ** significant at 5%; * significant at 1%

**Figure 1. Sequence of Period t Prior to Parent's Death**

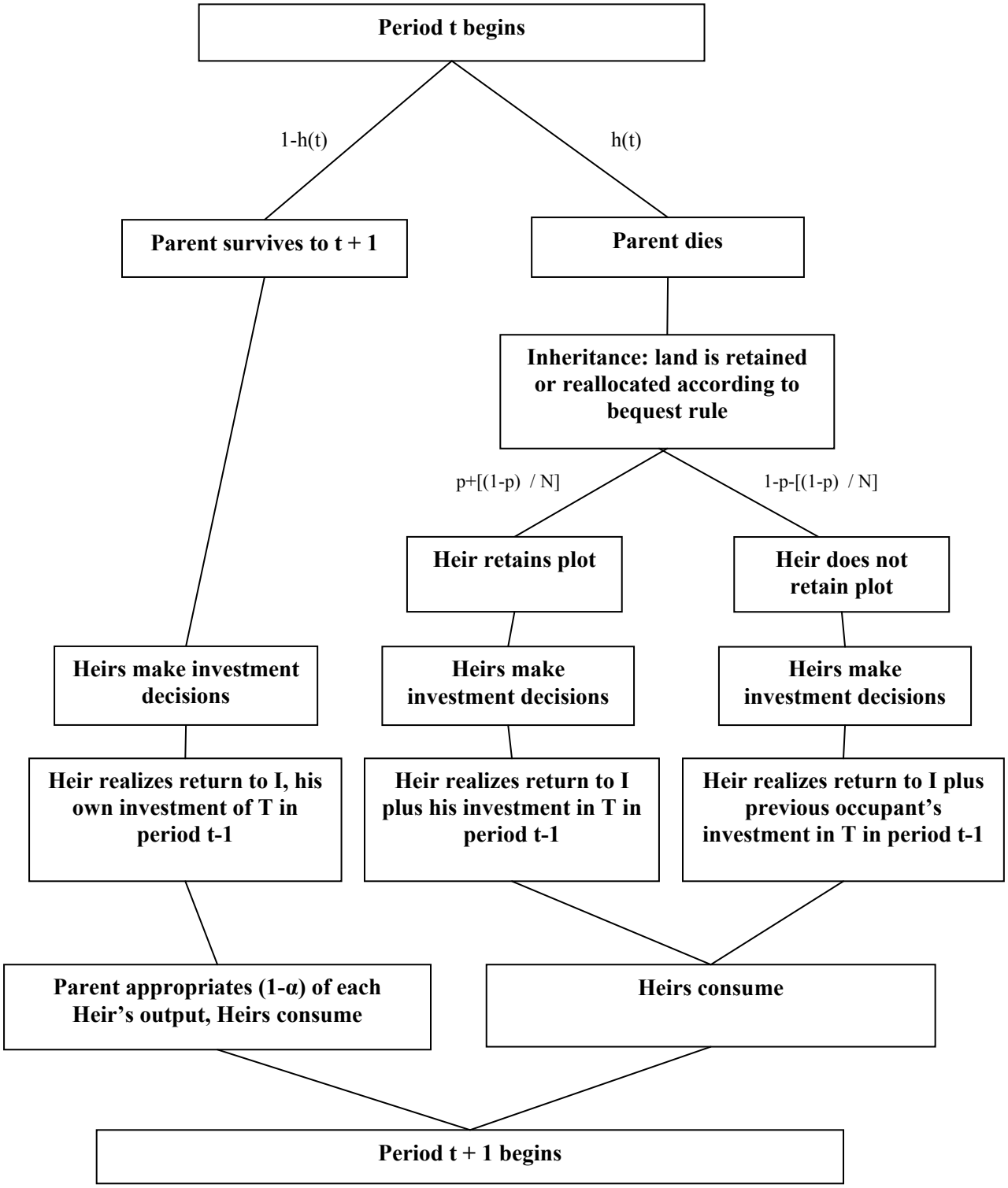

**Figure 2. Inheritance Concerns and Investment Decisions**

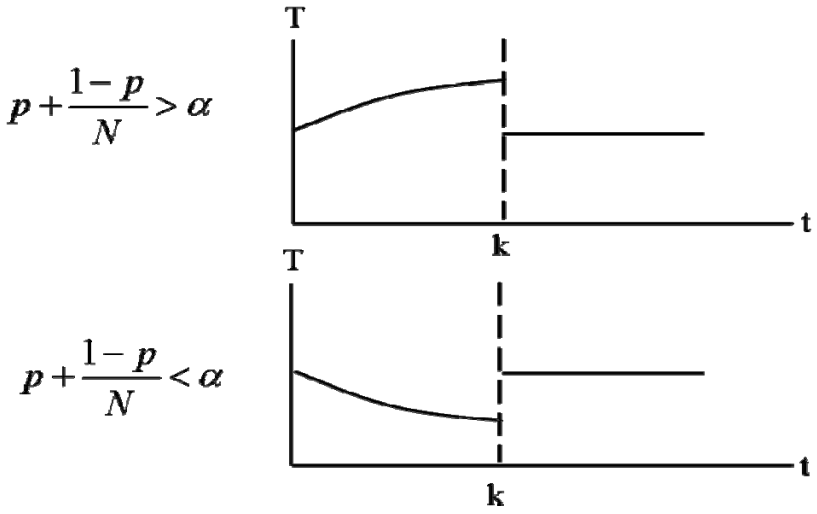


**Figure 3. Kenyan Hazard Rates.**