CATALYST OR CONSTRAINT? ON THE COMPLEX ROLE OF SOCIAL CAPITAL IN TRANSITIONING RURAL ECONOMIES

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CATALYST OR CONSTRAINT? ON THE COMPLEX ROLE OF SOCIAL CAPITAL IN TRANSITIONING RURAL ECONOMIES

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This dissertation concerns itself with poverty amongst the rural poor, and specifically with contributing to the set of tools and policies that can effectively improve their economic wellbeing. Rural communities in developing countries play host to the majority of the world's poor. Widespread and persistent poverty has led to a growing appreciation of the unique set of obstacles limiting economic growth and progress in rural communities. It is now widely accepted that economic behavior, especially in more traditional communities, is imbedded within a socio-cultural system that circumscribes the space of economic possibilities and outcomes. The dominant view has it that the highly personalized nature of social interaction common to rural communities can be harnessed as productive 'social capital' to support economic interaction in the absence of formal market institutions.

The three papers of this dissertation aim to contribute to the existing literature on the social economics of development that goes beyond the myopic view of social capital as a productive input to economic endeavor. They each emphasize the importance of a nuanced, context-specific understanding of how the set of shared norms, behaviors and expectations characteristic of rural environments interact and co-evolve with an emerging market economy. In three different settings I demonstrate how the naïve and generalized application of social capital as a productive resource

limits welfare growth, supports ineffective institutions and promotes faulty policy instruments.

The first paper shows how spatially-varied returns to human capital that fuel migration may diminish the capacity of social capital to support informal contract enforcement. The second paper demonstrates how microfinance institutions whose design relies on an inadequate characterization of social capital may actually erode the very social forces it hopes to exploit. Finally, the third paper highlights how increasing material incentives coupled with a dysfunctional mix of informal institutions and formal regulations can breed rent-seeking that adversely affects the welfare and productivity of the majority of members in a producer organization.

The contribution of this dissertation is to cast a spotlight on how specific features of the socioeconomic landscape interact to jointly determine the space of economic outcomes and the trajectory of social change. In doing so, it informs the design of appropriate policies and institutions that provides the rural poor with a level-playing field and promotes the set of incentives crucial for effective economic transacting.

BIOGRAPHICAL SKETCH

Born in 1977 in Nairobi, Kenya, Andrew Mude grew up as the children of diplomats often do: in a series of different countries around the world. The seed that eventually blossomed into a passion for development economics was planted during his family's tenure in Addis Ababa from 1989 to 1991. A time of political strife and famine in Ethiopia, Andrew was struck, and confused, by the injustice that allowed fortunate Ethiopians and expatriates to live in an island of abundance and comfort amidst glaring and widespread depravity.

In Gettysburg College, Pennslyvania, where he graduated with a B.A. in Economics in 1999, Andrew's commitment to development was nourished. He drew inspiration from his involvement with the college's Center for Public Service where he worked for two years as a coordinator for service learning projects, organizing trips to feed AIDS patients in New York City, volunteer in homeless shelters in DC, build schools in rural Nicaragua and more. In this capacity, he was exposed to the many dimensions of poverty and became fascinated by the complex set of issues that give rise to poverty and the obstacles that frustrate efforts to alleviate it. Add to this the stimulating courses in core Economic subjects taught by his passionate and committed academic advisor and fellow Kenyan, and Andrew was convinced that a graduate degree in Economic Development was his calling.

Thus, Andrew landed himself at the Department of Economics at Cornell University. He has since been extremely fortunate to receive a first-class education from an institution at the forefront of the development economics frontier.

To all my teachers, throughout the years…

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The doctoral dissertation is daunting task whose path is littered with various obstacles including self-doubt, waning motivation, and frequent setbacks. In such an environment, the support, fidelity, and encouragement of family and friends is priceless and critical. In this regard I have been deeply blessed. You have been the source of unwavering faith, cherished memories, merriment, stimulating conversation and inspiration that has fueled me past all challenges.

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CHAPTER 1

1 INTRODUCTION

1.1 Setting the Stage

This dissertation concerns itself with poverty amongst the rural poor, and specifically with contributing to the set of tools and policies that can effectively improve their economic wellbeing. The rural environment offers a unique challenge to development economists owing to the complex and multifaceted nature of the obstacles limiting economic growth and progress. Rural communities in developing countries often lack formal institutions that have evolved over centuries of market-based exchange to offer an effective enabling environment for modern economic activity. For these traditional rural communities, increasing rural-urban interaction and the globalization of the economic playing-field have forced an accelerated integration of the traditional rural community with the modern economy.

The highly personalized nature of social organization, the lack of established market institutions, the strength of traditional norms and cultural ideology - all features common to rural communities - considerably complicate its transition to a market economy. Consequently, the methodological framework and toolkit with which economic behavior and opportunity are examined must account for the socio-cultural context that sets the stage for economic endeavor. Economists, initially reluctant to acknowledge that the socio-culturally neutral conventional models of the dominant neoclassical framework are not well-suited to examining traditional rural economies, have slowly been shifting their stance.

The discipline of economics, dominated by its affiliation with the neoclassical paradigm whereby the economic exchanges of rational, utility-maximizing agents lead to efficient market outcomes, has had a difficult time reconciling the stringent behavioral, informational and institutional demands of neoclassical assumptions with most real world situations in poor, rural communities. While the elegant simplicity of neoclassical models often serve as a useful benchmark against which to study economic phenomenon and as a beacon to guide the design of efficient systems, their usefulness and the accuracy of their predictions diminishes as their assumptions lose validity. In developing countries, and especially in rural areas, where preferences, social interaction, and the formal and informal institutions that underlie economic activity are still largely embedded in traditional norms of socialization, the deficiencies of the neoclassical model are most evident.

As such, an increasing pool of economists, particularly those concerned with the economics of development, are beginning to acknowledge the fundamental role that socioeconomic, cultural and institutional forces play in circumscribing the space of economic possibilities and determining economic outcomes. A nascent but rapidly growing literature is gradually building consensus that socio-cultural dynamics matter to economic outcomes (See Barrett, 2005a; Durlauf and Young, 2001; and Platteau, 2000 for excellent surveys).

The concept of “social capital”, initially introduced by sociologists James Coleman (1990) and Mark Granovetter (1973) and economist Glenn Loury (1977), spawned a considerable literature that pioneered the integration of socio-cultural parameters into economic models. In short, social capital highlights the productive value of tight-knit social networks common to rural communities, arguing that in the absence of formal institutions, they can be a valuable source of information and services and can support economic activity in the absence of formal market institutions. The general point of departure has been to endow rural communities with a high degree of social embeddeness, where individual behavior and preferences are largely influenced by generally accepted social norms. Such communities are characterized by low information asymmetries whereby personal details are easily accessible and verifiable via dense social networks. Consequently, maintaining social networks has considerable value to individuals in such environments.

Social capital has been used to explain numerous regularities of rural economies as well as to suggest or justify various policies grounded on the instrumental and intrinsic value of social networks or norms (Besley and Coate, 1995; Besley et al., 1993; Braverman and Guasch, 1984; Fafchamps, 1992; Stiglitz, 1990). The importance individuals ascribe to their social standing, for example, allows for the credible threat of social sanctions to act as a powerful deterrent to contract default. In addition to the low informational asymmetries that make detecting malfeasance relatively inexpensive, informal contract enforcement offers rural habitants with access to information, credit, insurance, new technologies etc., that are imperfectly provided by markets or governments.

Informal financing, whereby collateral-free credit is offered to the poor on the principle of joint-liability of loans, is one crucial service that relies on high degrees of social embeddness to operate. A burgeoning literature identifies several theories explaining the processes that make informal finance mechanisms feasible and successful (See Ghatak and Guinnane, 1999 and Morduch, 1999 for excellent reviews). Most of these explanations rely fundamentally on the existence of strong personal ties to community norms that sustain nonopportunistic behavior and transmit personal information across the community network. The explosion of rotating savings and credit organizations, microfinance institutions and other informal lending mechanisms in the past two decades are evidence of the influence social capital exerts beyond academia and into development practice.

A natural and complementary extension of the positive role that social capital can play to stimulate rural economies fuels the promotion of local community groups and cooperatives as effective mechanisms to exploit social spillovers for the benefit of the poor (Couto and Guthrie, 1999; Craig and Mayo, 1995; Lyon, 2003; Narayan and Pritchett, 1997). The development economics literature explains that beyond the benefits of scale economies, collective organization is effective because low information asymmetries, shared behavioral expectations, and the high personal value of social norms mitigate leakages due to moral hazard and adverse selection. Community organizations allow individuals with shared objectives to coordinate their actions, maximizing the collective benefits of their material and social resources, and minimizing transactions, search and input costs.

Though the social capital literature can largely be credited for demonstrating the various ways in which socio-cultural parameters critically affect economic outcomes and how social capital can be exploited to improve productivity, several key deficiencies exist in their approach. Proponents of social capital have painted an overly optimistic picture of the economically productive value of social embeddness, often overlooking other critical features of social organization in rural communities that serve to stifle the entrepreneurial spirit and are anemic to growth and development. A new strand of the literature identifies numerous instances in which adherence to social norms dampens economic progress, or where emerging economic opportunities erode traditional norms and shift the determinants of social status thereby weakening the returns to social capital (See Barrett 2005a for an excellent survey).

Platteau (2000), for example, describes how egalitarian norms common to small, traditional societies generate powerful pressures against private wealth accumulation via the imposition of considerable social taxes on unacceptable levels of individual material gain. Ingrained cultural practices and spiritual affiliations may also thwart economic progress. As Barrett (2005b) describes, the practice of *famadihana*, whereby Malagasy peasants spend considerable sums of money to exhume and reshroud dead ancestors every 3-5 years, makes it considerably more difficult for the poor to escape their condition of poverty. Along with norms that require households to sacrifice cattle when a family member dies, these traditional practices consume a significant portion of household resources that precludes investment in productive assets which offer a pathway out of poverty. The aim of this new wave of social economics literature, however, is not to argue that social embeddedness is always an obstacle to productivity. Indeed, Barrett (2005b) offers a contrasting example in which weak social ties prevent communities from coordinating their activities so as to avert encroachment of the parasitic weed *Striga* whose nature of infestation requires collective action to control.

Rather, the new wave of research takes a richer more nuanced approach, viewing social systems and economic processes as jointly determined, each endogenously limiting or expanding the set of acceptable behaviors and available opportunities while also changing the cost and benefits associated with pursing the various options. Increasing access to new livelihood options or the infiltration of novel goods and services may change perceptions of status or generate personal incentives for material gain incompatible with existing norms. Depending on the configuration of shared beliefs and expectations, and the relative distribution of power among the likely beneficiaries of change, the emergence of new opportunities may ignite a process of social evolution that discards features of socialization not conducive to economic progress and embraces features that are. Alternatively, as we have seen, strong ties to traditional norms may be impervious to economic incentives while weak social networks may forestall productivity enhancing coordination.

How then can one distinguish between features of social organization that fuel productive economic exchange and those that dampen productivity? What are the critical pathways by which social organization affects economic performance and vice-versa? In what ways does socio-cultural context condition the set of effective policy instruments for poverty alleviation and development? These and similar questions form the core of frontier research on the social economics of development; the common point of departure being the recognition that the social-economic dynamic is often complex and context-specific, requiring careful, methodical investigation to uncover.

The three papers of my dissertation aim to contribute to the existing literature on the social economics of development that goes beyond the myopic view of social capital as a productive input to economic endeavor. In this sense, each of the three papers present a specific critique of the pioneering social capital literature. In different contexts, all set in the rural environment, I show how a naïve reliance on social capital as a catalyst for growth can support poorly designed interventions (or preclude the implementation of effective policies) that slow or even reverse welfare gains associated with economic growth. The papers highlight various channels through which certain social configurations generate perverse economic outcomes, and, conversely, how emerging economic opportunity can fundamentally alter social interactions.

1.2 Summary of Chapters

The first chapter, *Educational Investments in a Dual Economy,* presents a simple two-period, dual economy model in which migration may affect the informal financing of educational investments. Coauthored with Chris Barrett, John McPeak, and Cheryl Doss, we show how migration options resulting from spatially varied returns to human capital choke off the informal finance on which poorer rural households may depend for long-term, lumpy investments like children's education. Contract enforcement of informal financing mechanisms relies on the credible threat of social sanctions. However, when borrowers migrate, they may sever community ties that no longer yield benefits and are costly to maintain. As individuals discount the value of their social connection, sanctions lose their effectiveness. Prospective rural lenders, aware of this, refuse to extend educational loans to children who may subsequently migrate. Innately talented, but poor children are especially disfavored in this setting.

Educational Investments in a Dual Economy highlights the jointly determined trajectory of economic development, spatial integration and social change. In a social economics analogy to the "Lucas critique", it shows how expanding livelihood opportunities along with rising spatial mobility can fundamentally change the structural relationship between social interactions and economic activity. The value of social capital is based on shared proximity and highly personalized relationships, the expectation of repeated interaction and a commonly accepted and respected chain of authority. When formal education emerges as a claim to wealth and social prestige, and when the returns to education are spatially varied and trigger rational migration, allegiance to traditional norms of socialization, upon which the functioning of informal contracts depends, weakens.

The second chapter draws attention to a different feature of social networks that may render informal finance institutions ineffective. *Making Loans to Make Friends: Explaining the Dismal Financial Performance of Financial Service Associations*, investigates the ways in which microfinance provision, an idea with great potential, can unravel and yield perverse outcomes that run counter to its stated objective. The chapter presents a theoretical challenge to the notion that large endowments of social capital, a common feature of small rural communities, induce inexpensive peer monitoring efforts that render jointly-liable contracts efficient. It shows that a reliance on a specific set of assumed community characteristics that often do not adequately represent the incentive structure facing borrowers and lenders, grossly overestimates the efficiency of informal finance institutions. In particular, by focusing on Financial Service Associations (FSAs), a specific form of microfinance institution, we show that the effectiveness of such institutions is very sensitive to the behavioral motivations of both clientele and provider, which are determined by the intersection of prevailing social norms and material incentives.

The insight of this chapter is to show how strong social ties can breed incentives that are counter-productive for the group at large. Unlike canonical models that paint an overly optimistic picture of the potential of MFIs to thrive in traditional communities by exclusively highlighting their informational advantages, I introduce the common features of patronage and favor-peddling to explain the demonstrated dismal financial performance of FSAs in Kenya. Where individuals known to be in positions of privilege will invite costly retribution from friends and neighbors if they neglect to share the benefits, or could provide favors that may yield future dividends, the advantages of low information asymmetries are likely to be dampened. The irony is that the same high degree of socialization that confers informational advantages on traditional societies also breeds incentives for patronage and favor-peddling.

I focus on FSAs to highlight the key role that social behavioral influences play in determining the effectiveness of institution design. The structure and design of FSAs make them particularly vulnerable to the influences of patronage and favor-peddling. The organizational structure of the FSA is such that a small, elected credit committee bears the full social cost of screening and rejecting applications, but only share in a fraction of the financial benefit, which is distributed across all members.

Consequently, the credit committee has incentives to relax their screening and enforcement intensity to the financial detriment of the organization.

The third and final chapter of my dissertation is titled *Imperfections in Membership Based Organizations for the Poor: An Explanation for the Dismal Performance of Kenya's Coffee Cooperatives*. In this chapter I focus on the informal and formal institutions that underlie the smallholder coffee sub-sector in Kenya to demonstrate how a nuanced understanding of the interplay between material incentives, sociopolitical landscape, and organizational and regulatory structure lead to predictable sub-optimal outcomes. I model the susceptibility of Kenyan coffee cooperatives to capture by corrupt and opportunistic members and identify certain features of the underlying institutional environment that facilitates rent-seeking behavior. The lack of a formal regulatory structure with credible enforcement mechanisms, the presence of informal electoral practices conducive to vote-buying, and the legal support for local monopsonies that facilitates exploitive pricing all contribute to the dismal performance of Kenya's coffee cooperatives. Using an original data set of more than 200 coffee farmers representing nine cooperatives, I find a statistically significant relationship between cooperatives empirically determined to be corrupt and high levels of technical inefficiency in coffee production among its members.

In this chapter, I show that despite the complexity that characterizes the confluence of social configuration and economic incentives, it is possible to identify the parameters that determine actions and outcomes. This information can then guide the design of effective institutional frameworks tailored to nurture the desired outcomes within the socio-cultural context they operate.

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CHAPTER 2

2 EDUCATIONAL INVESTMENTS IN A DUAL ECONOMY[1]

2.1 Introduction

The positive relationship between education and expected future income is well established (Schultz 1988, Psacharopoulos 1994, Strauss et al. 1995, Barro and Sala-i-Martin 1995). Yet, despite clear evidence of strong returns to education, many communities exhibit low rates of educational attainment, especially in rural areas of the developing world (Singh 1992, Psacharopoulos 1994). One reason for the apparent underinvestment in children's education is imperfect financial markets that ration poorer households out of the formal market for long-term loans. As Loury (1981) showed, when formal financial markets fail, the logical consequence is not only underinvestment in education but also, derivatively, the propagation of poverty from one generation to the next. Credit market failures, coupled with costly education, limit the poor’s ability to purchase optimal levels of education. The relationship between education and income is thus reversed, generating a poverty trap whereby the poor attain low levels of education due to financial constraints and consequently earn low incomes.

Why, however, don't informal financial markets spring up to fill the educational financing gap when formal markets fail? Elaborate informal credit and insurance mechanisms exist between households, providing finance not available through formal financial institutions (Udry 1993, Townsend 1994, Besley 1995, Morduch 1995). Given the high apparent returns to education and widespread

[1] This chapter, co-authored with Christopher Barrett, John McPeak and Cheryl Doss, has been accepted for publication in the journal *Economica* and is forthcoming in 2006/2007.

anecdotal evidence of informal financing of others' education, one naturally wonders why informal financial transactions do not resolve the educational investment problem in rural areas of developing countries.

This paper offers an answer to that puzzle. We show that in the presence of financial market imperfections associated with imperfect credit contract enforcement, spatial variation in the returns to education can induce migration decisions that rationally choke off the informal financing of education in relatively disadvantaged areas. When financial markets are complete and perfect, spatially varied returns to human capital have no effect on educational investment patterns. But when formal financial markets are incomplete and credit contracts must be self-enforcing, spatial inequality in infrastructure and other attributes that increase the returns to education create spatial differentials in educational lending and, consequently, increase geographic and wealth-based variation in educational attainment.

The important innovation of this paper is to link the literature on spatially varied productivity and migration with that on informal finance. The extensive literature on migration emphasizes how spatially varied infrastructure, law enforcement, access to lucrative markets and other attributes creates a gradient across space in real returns to education (Stark 1984, Williamson 1988, Todaro 1997, Banerjee et al. 1998). Educated persons living in relatively disadvantaged rural areas with few opportunities for skilled employment find that migration is an especially attractive option (Barnum and Sabot 1975, Schultz 1988). A consistent finding in this literature is of the positive relationship between educational attainment and rural-urban migration (Todaro, 1997).

On the other hand, the literature on informal finance identifies the close-knit associations of traditional communities as the 'social capital' that allows for the informal provision of financial services (Stiglitz 1991, Besley et al. 1993). Lenders can access relatively cheap information on potential borrowers due to highly personalized intra-community relationships. They can also assure repayment by the credible threat of social sanctions: a borrower who is visibly able to pay but neglects his loan commitment will signal dishonesty, thereby eroding his stock of social capital within the community.

Contract enforcement, however, becomes more difficult the farther the contracting parties are from each other. Tracking down debtors becomes costly and the threat of social sanctions loses some of its power as their interaction with the community is diminished. Prospective rural lenders would thus consider borrowers' migration options when deciding whether to extend educational loans. Put differently, informal financial market equilibria depend on migration incentives. As a consequence, an increase in the spatial differential in the returns to human capital may choke off informal financing of education in rural areas as lenders increasingly expect borrowers to migrate, making them greater risks for default. In this paper, we develop a theoretical model that demonstrates this explanation for the apparent underinvestment in rural education.

The rest of the chapter is structured as follows: Section 2.2 builds the general structure of a simple two-period, dual economy model that parsimoniously captures the essence of the problem. In section 2.3, we explore the implications of the model for patterns of educational investment and migration and examine the inefficiencies resulting from credit conditions that deviate from the first best world. Section 2.4 discusses the policy implications of our findings and concludes.

2.2 The Model

Consider a two period dual economy. In period one, the adult household head makes educational investments in the children in the community (no one invests in children outside their own community). Then, in period two, the (now grown) children decide where to live and work conditional on the their human capital accumulated in period one.

The economy consists of two locations: A rural area with weak productive infrastructure that represents a more traditional mode of production and an urban area with better communications, power, transport and public services that underpin modern industrial and service economies. As such, returns to education are higher in the urban area. We treat the differences in productive infrastructure across locations as exogenous and assume that human capital productivity is increasing in infrastructure. This spatial variation in the returns to education generates incentives to migrate and geographic variation in private investments in education, especially in the absence of perfect credit contract enforcement.[2]

Assume there are $j = 1,...,N$ households in the rural village, each with one adult decision maker and one child. Each adult decision maker is endowed with wealth w_j and each child is endowed with a random assignment of innate ability α_j, where $\alpha \in [0,1]$. We assume that the distribution of abilities across children in the village is common knowledge.[3] In period one, adults choose whether to educate their

[2] We focus on the rural economy and use the urban area only as a magnet for migrant laborers from the village. In our framework, it would never be rational for an urban dweller to migrate to the rural area, given the decreased return on their human capital that would result.
[3] By this assumption, we evoke a rural village with low informational asymmetries arising from the high degree of socialization common in traditional communities. Similar assumptions are standard in the large literature on rural traditional economies. See Platteau (2000) for an excellent review.

own children, invest in the education of other children in the village at a given net interest rate *r*, or hold their wealth in the form of a composite, alternative asset that pays marginally less than r.[4] At the outset of period two, each grown child decides where to live and work.

We are mainly concerned with demonstrating how migration induced by spatial differences in the returns to education leads to rural underinvestment in education, especially for children with high latent ability, by hindering informal finance mechanisms. Thus, we make some strong simplifying assumptions. Following Banerjee and Newman (1998), we assume that once individuals migrate, they free themselves entirely of their obligations to non-kin in their original, rural community. This assumed distinction between kin and non-kin derives from an observed, qualitative difference between taking advantage of distance and relative anonymity to default on informal loans provided by non-kin community members and the breaking of ties or responsibility to family. In a comprehensive survey of the relevant literature, Remple and Lobdell (1978) find that a substantial majority of urban remittances go to the household of the migrant. Village elders are the only non-kin that receive a significant share of remittances. We incorporate this distinction by modeling households as receiving benefits from their own child's income whether or not the child migrates.[5]

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[4] This composite alternative asset serves just as a benchmark against which educational investments are measured. Setting the returns to this asset at marginally less than *r* is a simplifying assumption allowing us to focus on a household's educational investments. The implication that the returns to education dominate the returns to other available investment options does not undermine our model. Rather, it simply underscores the puzzle this paper investigates: Given empirical evidence of high returns to education (Psacharoupoulos, 1994), what explains the apparent underinvestment in education that often characterizes rural communities?

[5] Non-family community members can assure returns to their investment by tracking down emigrants in urban areas and demanding repayment or reciprocity, such as using their home as a base for developing their own ties in the urban area. While emigrants might default on their loan commitment, it is more difficult for them to completely escape traditional norms that call for hospitality and the provision of food and shelter to natal community members who request it. In this way, emigrants can act as 'beachheads' for the rural community, establishing a foundation that facilitates greater rural-urban interaction. By utilizing emigrants for this purpose, natal community lenders can recoup some of their

2.2.1 The Child's Migration Decision

We follow the standard solution technique of backward recursion, solving the child's period two migration decision first, then solving the adults' first period educational investment decision conditional on the child's subsequent best response. Let $E_j \equiv [E_{1j},...E_{Nj}]$ be the vector of educational units provided to each child $i = [1,...,N]$ in the community by household j, and $E^j \equiv [E_{j1},...E_{jN}]$ be the vector of all educational units received by child *j* from each household $i = [1,...,N]$. Note that the first subscript indexes the recipient (child) and the second the financier (household).

To simplify notation and make the model more analytically tractable, we do not attempt to analyze complex exchanges that allow any households to offer education loans to specific non-kin children in the community. Instead, we model a community fund financed by the contribution of households wishing to invest in the education of community children. Any child from the community can then apply for educational funds from this community pot.[6] We can now write $E_j \equiv [E_{jj} + E_{cj}]$ and $E^j \equiv [E_{jj} + E_{jc}]$ where E_{cj} denotes household *j*'s contribution to the community pot and E_{jc} represents that portion of child *j*'s education financed through community funding.

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otherwise lost investment. But while lenders can tap into the benefits emigrants provide to recover part of their loans, the 'beachhead' effect alone does not alter a potential lender's loan decision *ex ante* because community norms generally require the emigrant to oblige *any* natal community member who requires assistance in the city, not just those who have extended him credit in the past. So long as emigrants cannot exclude any community members from assistance, then each potential lender in the rural community has an incentive to free ride on the 'beachhead' opportunity sponsored by some other lender since the service is non-exclusive. In the interests of simplicity, we therefore assume away 'beachhead' effects in our model, as they do not affect the qualitative results.

[6] As the return on educational investments is set at (1+*r*) and is thus independent of the child, and as children are similarly indifferent as to who in the community provides the loans, our qualitative results are robust to this simplifying abstraction.

Let $h_j = \alpha_j E^j$ be the level of human capital attained by child *j*. The labor productivity of a child with human capital h_j is then given by the strictly concave, monotone and twice differentiable function $\rho(h_j)$. An individual whose productivity is $\rho(h)$ in the village has an increased productivity level $\lambda\rho(h)$ in the city, where $\lambda > 1$ and reflecting the higher returns to human capital in urban areas.

In the event that a parent's wealth is insufficient to cover their optimal level of education, a child may seek educational loans in period one from the community. In the absence of credit markets with perfect, exogenous contract enforcement, children are able to renege on these loans in period two. For the sake of simplicity in the model, we assume that the child tries to renege on any loans received from the community if and only if he migrates to the city. The lenders can respond and, following Banerjee and Newman (1998), we model their retribution as the power to seize the full value of a migrated child's income if they are caught.[7] We denote as $1-\pi$ the probability of catching a reneging child. Educated children will rationally migrate and renege on their educational loan contracts when there is significant spatial variation in the returns to education λ, the costs of migration *c* are low and enforcement of loan contracts is weak (i.e, π is high).

Suppose that, in the second period, a child with human capital h_j remains in the village. His net earnings will then be $\rho(h_j)$ - $(1+r)P_E E_{jc}$ where r is the net interest rate and P_E is the cost of a unit of education.[8] Should the child decide to migrate, his expected gross earnings will be $\pi\lambda\rho(h_j)$ and he incurs a migration cost,

[7] By driving a defaulter's income to zero, no lender would ever fund a migrating child so informal finance flows only to non-migrating children. Our main aim, to show that migration options reduce the loan pool for education, is robust to this simplifying assumption.

[8] A child does not have to explicitly repay education financed by his parents. This allows for an adult's decisions on their children's education to involve additional considerations beyond merely material investment returns.

c.[9] The migration cost c incorporates both the financial costs of relocation as well as the social costs that result from a loss of social relationships that may be intrinsically as well as instrumentally important. The child's second period choice is thus quite simple:

$$\text{Max }(\rho(h_j)-(1+r)P_E E_{jc},\ \pi(E_{jc})\lambda\rho(h_j)\text{ - c}) \tag{1}$$

Where $$\pi(E_{jc})=\begin{cases}\pi & \text{if } E_{jc}>0\\ 1 & \text{if } E_{jc}=0\end{cases}$$ [10]

Adults invest in their community's children with full knowledge that their investment decisions will eventually affect the child's migration decision.

2.2.2 Adult's Investment Decision

All the adults in the village can observe each child's innate ability by the time they need to make educational investments.[11] In deciding how to allocate education investments between their own child and other children in the community, an adult considers the returns to each investment option, taking the children's migration decisions into consideration. The adult household head's first period decision problem can then be characterized by

$$\underset{E_{jj},E_{cj}}{Max}\ w_j - P_E(E_{jj}+E_{cj})+\delta(1+r)P_E E_{cj}+\delta\beta Y_j \qquad \delta\in(0,1),\quad \beta\in(0,1] \tag{2}$$

[9] Note that in equating productivity with wages, we implicitly assume a competitive labor market where firms hire labor up to the point where the marginal product of labor equals the wage rate.

[10] Defining $\pi(E_{jc})$ in this manner captures the fact that the probability of being caught and punished is only relevant when the child received a positive amount of education loans from the community pot on which he can renege.

[11] As primary education is often free or subsidized, the need for educational investments arises mainly at the secondary level and beyond, making this a tenable assumption.

subject to: $Y_j = \text{Max}\ (\rho(h_j) - (1+r)P_E E_{jc},\ \lambda\rho(h_j) - \text{c})$ (3)

$$P_E(E_{jj} + E_{cj}) \leq w_j \qquad (4)$$

$$[\rho(h_i) - (1+r)P_E(E_{ic}) - \pi\lambda\rho(h_i) + c]E_{cj} \ \geq\ 0 \quad \forall i \neq j \qquad (5)$$

where δ is a discount factor reflecting current valuation of future earnings. Note that a household's expenditure on the education of its own child indirectly affects its well being via the function $\delta\beta Y$. The household's utility increases in its child's future productivity given by equation (3). β captures the household's valuation of their child's future income[12]. The function $\delta\beta Y$ flexibly accounts for parental investments in their children's education due to any combination of material and nonmaterial (e.g., altruistic, status) purposes. Equation (4) is a budget constraint.

The optimal investments are intuitive. Households will invest in their own child as long as the increase in their well being resulting from a marginal gain in their child's productivity exceeds the opportunity cost of investing in another child from the community. An adult will only invest in a child from another household within the community if that child will repay his loan. This creates an incentive compatibility constraint (ICC), reflected in equation (5), such that all children receiving educational loans will not be educated beyond the point at which they would rationally migrate to the city and subsequently default on the loan.

As we will show, the incentive compatible level of education depends fundamentally on the spatial variation in returns to education, λ, the cost of migration, *c*, the child's intrinsic ability, α, and the enforcement of loan contracts as reflected in the probability that one can successfully renege on contracts by moving, represented

[12] The Rotten Kid Theorem (Becker, 1974), which states that in the presence of parental transfers even a selfish child will choose actions that maximize the income of the family, suggests setting $\beta = 1$. However, as transfers are made in the first stage and the parent does not have control of the child's second period earnings (as they do under the assumptions of the Rotten Kid Theorem), we opt to set $\beta \in (0,1]$, allowing for the utility parents derive from their child's earnings to vary.

by π. The ICC for the optimization problem reflects the fact that if household *j* does not provide any funding for the education of child $i \neq j$, then it is indifferent to child *i*'s decision to migrate. Households may want their own children to migrate after they are educated, but if they have invested in others' children's education, they do not want those children to leave.

2.3 Analysis

We now analyze the factors that affect the educational outcomes of children and the educational investment decisions taken by adults. Specifically, we investigate how various educational financing schemes affect the optimal education levels in a dual economy setting and how educational investments vary in response to changes in the model's parameters.

To establish a basis for comparison, we first analyze the case in which children only receive educational funding from their own parents and characterize the conditions for migration and the optimal levels of education in each sector. We then allow children to receive informal loans from other households. We show that the presence of an informal credit market weakly increases the educational attainment of all children but its efficiency is decreasing in the rate of out-migration. Finally, we briefly consider the case of a first-best world, where children can borrow on their future productivity from a formal credit market to finance their education. These comparisons show how informal credit markets can break down in the presence of migratory pressures, leading to underinvestment in education, especially among high ability children from poor households.

2.3.1 Household-Funded Education

In this first scenario, a child's education can only be funded by his or her own household, so there is no education loan market.

2.3.1.1 The Child's Decision

We begin by studying the child's problem. The human capital of a child *j* whose education is only funded by his own household *j* is given by $h_j = \alpha_j E_{jj}$. From (1) we know that he will migrate if his total level of human capital h_j implies

$$\lambda\rho(h_j) - \rho(h_j) \geq c \tag{6}$$

Let $\overline{h}(\lambda, c)$ denote the level of h_j that solves equation (6) with equality. This is the threshold level of human capital necessary to migrate. Given that $\rho(.)$ is strictly concave and monotonically increasing, we can apply the inverse-function theorem to establish:

$$\partial(\overline{h})/\partial(\lambda) < 0 \tag{7}$$

and

$$\partial(\overline{h})/\partial(c) > 0 \tag{8}$$

Condition (7) says that as the urban/rural infrastructure ratio increases, the human capital threshold level decreases and thus more people are likely to migrate. Indeed, both within and across nations, actual migration patterns are overwhelmingly toward higher productivity regions. Condition (8) simply indicates that as the cost of migration increases, the level of human capital required to migrate also increases. This wedge creates some modest, but bounded, spatial differences in incentives to invest in education.

Furthermore, since $h = \alpha E$, the threshold level of education needed to induce migration $\alpha\overline{E}(\alpha) = \overline{h}$, is decreasing in natural ability:

$$\partial(\overline{E}(\alpha))/\partial(\alpha) < 0 \tag{9}$$

Thus, everything else equal, high potential individuals are more likely to attain the threshold level and migrate, as reflected in "the brain drain" literature (Stark, 1984, 1999, Masson, 2001, Commander et al. 2003).

2.3.1.2 Household Head's Decision

We now analyze the adult or household head's first period problem. We first characterize the conditions under which an adult will spend all of her wealth on the education of her own child.

Suppose, child *j* migrates in period 2, i.e., the household invests at least $\overline{E}_j$ in period 1. Then, it must have been the case in period one that:

$$P_E \overline{E}_j \leq w_j \tag{10}$$

$$\text{and} \quad \delta\beta\lambda\rho'(\alpha_j E_{jj})\alpha_j \geq \delta(1+r)P_E \ \text{ for } \ E_{jj} \geq \overline{E}_j \tag{11}$$

Put differently, a child will migrate if and only if his parents were both able and willing to provide the child with a level of education that meets or exceeds the threshold level required for migration. Equations (10) and (11) reflect these conditions. Equation (10) sets down the minimum household wealth necessary to make such an investment feasible. Furthermore, as specified in (11), an adult will continue to invest in her migrating child's education as long as the marginal benefit to the household is larger or equal to the opportunity cost. We define $\overset{u}{E}_j$ as the value that solves (11) with equality. $\overset{u}{E}_j$ is thus household *j*'s optimal level of educational investment in their child, *conditional* on anticipating (correctly) that the child will migrate. $\overset{u}{E}_j \geq \overline{E}_j$ is a necessary condition for migration to occur.

For ease of reference, Table 2.1 contains the definitions for key model variables.

Table 2.1: Glossary of Key Model Variables

Variable	Definition
E_{jj}	Amount of a child *j*'s education purely funded by his parents (household *j*)
E_{cj}	Amount of educational units that household *j* invests in non-kin community children
E_{jc}	Amount of child *j*'s education financed by community funds
E^{j}	$\equiv E_{jj} + E_{jc}$, the total education attained by child *j*
E_{j}	$\equiv E_{jj} + E_{cj}$, the total amount of education financed by household *j*
$\overline{E}_{j}$	Threshold level of education needed to make migration rational for child *j*
$\overset{u}{E}_{j}$	Level of education demanded for a child *j* who will migrate to the urban area.
$\overset{r}{E}_{j}$	Level of education demanded for a child *j* who will remain in the rural area
$\overset{s}{E}_{jc}$	Maximum amount of education that the community will finance for a child *j*
$\overset{d}{E}_{cj}$	Amount of education for which a child *j* requires community funding.

If instead the child does not migrate in period 2, then it must have been the case in period one that either $w_j \le \overline{w}_j$ or $\overset{u}{E}_j < \overline{E}_j$ or both. If either condition holds, the adult head continues to spend on her child so long as E_{jj} satisfies

$$\delta\beta\rho'(\alpha_j E_{jj})\alpha_j \ge \delta(1+r)P_E \quad \text{where} \quad E_{jj} < \overline{E}_j \tag{12}$$

This condition assures that at the level of education that exhausts the household's wealth, the marginal benefit to the household from an increase in the non-migrating child's education is greater than the opportunity cost of investing in alternative options. Let $\overset{r}{E}_j$ solve (12) with equality, representing household *j*'s optimal level of education given that child *j* is unable to migrate in the subsequent period.[13]

It is now a simple task to classify the set of children who will migrate if they have no recourse to extra-household education loans to finance their education. Given the set of community-specific parameters, λ, *r* and *c*, a child's migration decision

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[13] A child *j* will not migrate if his parents are wealth constrained ($w_j < \overline{w}_j$), he is ability constrained ($\overset{u}{E}_j < \overline{E}_j$), or both.

depends entirely on his innate ability and the level of his household's wealth. Intra-community variation in migration and education patterns thus arises due to cross-sectional variation in initial endowments. The strict concavity of $\rho(.)$ makes the LHS of equation (12) decreasing in E. Because the threshold level of education, $\overline{E}$, is decreasing in α , per equation (9), at low levels of innate ability α , $\overline{E}$ exceeds the optimal level of education for children who will migrate, $\overset{u}{E}$. Let α^M establish the ability threshold that determines which children migrate irrespective of household wealth, i.e., $\overline{E}(\alpha^M) = \overset{u}{E}$. Figure 2.1 graphs the combination of parental educational investments and innate abilities that jointly determine a child's educational attainment and subsequent locational choice in the second period conditional on λ and c.

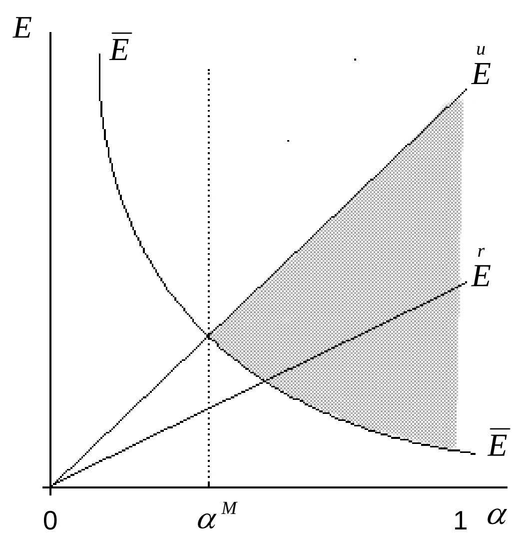

Figure 2.1: Educational Outcomes and Migration Level Conditioned on Child Intelligence and Household Wealth

Consider first the $\overset{r}{E}$ schedule obtained from equation (12). It represents the maximum educational level an adult will "invest" in her child if he stays in the rural area. The $\overset{u}{E}$ schedule, implied by equation (11), has a similar interpretation, but for children who migrate. As returns to education are higher in the city, this schedule strictly dominates the former. Both schedules represent the upper limits of potential education. Which schedule is relevant depends on household wealth and the child's ability. Children whose parents can afford to provide them with a level of education above the threshold (given by the curve $\overline{E}$ corresponding to equation (6)) migrate; the others stay home. For a child with $\alpha < \alpha^M$, the threshold level of education needed to make migration rational exceeds the maximum investment his parent would be willing to make in his education, irrespective of her wealth. These children are ability-constrained and will never migrate. Children with $\alpha \geq \alpha^M$ will migrate only if their parents can afford the threshold level of education, i.e., $w \geq P_E \overline{E}(\alpha)$. The shaded area in Figure 2.1 thus represents the space of children who meet the conditions for migration. Assuming the distribution of innate ability is independent of household wealth, there will be some children with high ability who fall far short of their optimal level of education due to low household wealth. Conversely, wealthy households will educate their low ability children up to the optimal level. Without access to extra-household educational financing, poverty thereby gives rise to lower levels of educational attainment and inefficiencies in the allocation of education across children of heterogeneous ability.

2.3.1.3 The effect of spatial variation in productivity on education levels

Suppose the urban sector underwent a period of heavy investment in its infrastructure, resulting in a relative increase in urban labor productivity. Per equation (11), an increase in λ raises the marginal benefit of human capital thus resulting in higher $\overset{u}{E}$ for all levels of α. Consequently, the threshold level of $\overline{h}$ drops and, for any given α, so does $\overline{E}$ and therefore $\overline{w}$. Since $\alpha^M \overline{E} = \overset{u}{E}$, a decrease in $\overline{h}$ and an increase in $\overset{u}{E}$ imply a decrease in α^M. Thus $\forall \alpha > 0$

$$\partial(\overset{u}{E})\big/\partial(\lambda) > 0 \qquad (13)$$

and

$$\partial(\overline{E})\big/\partial(\lambda) < 0 \qquad (14)$$

Figure 2.2 graphically depicts the effect of increasing urban productivity on educational outcomes and migration rates.

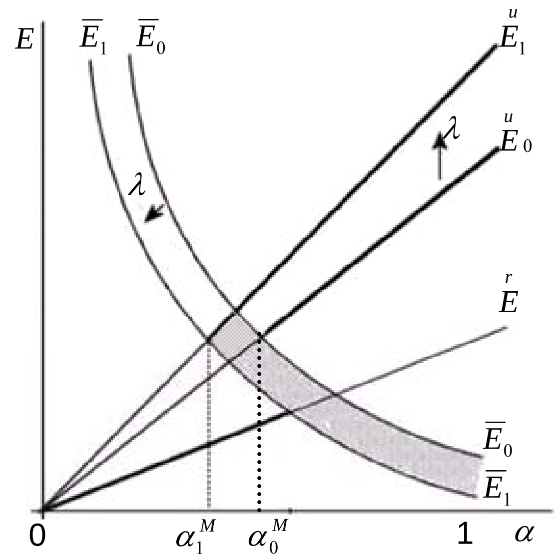

Figure 2.2: Effect of Increasing Urban Productivity on Educational Outcome and Migration Rate

As equations (13) and (11) indicate, an increase in λ pivots $O\overset{u}{E}$ counter clockwise and shifts $\overline{E}$ down causing α^M to fall from α_0^M to α_1^M. The result is an increase in migration if there exists at least one household *j* such that:

$$w_j < \alpha_j \overline{E}_0 \text{ and } w_j > \alpha_j \overline{E}_1 \qquad (15)$$

Condition (15) corresponds to the shaded area in Figure 2. It represents all those children for whom an increase in λ lifted wealth and/or ability constraints enough to make migration attractive. Note that even though their level of education remains the same, they now migrate and thus earn higher wages for any given level of human capital. There will, however, still be those children whose ability and/or household wealth endowment is too low to migrate. Household poverty can result in a large differences between a child’s optimal level of education and the actual amount of education they receive. The extent of this disparity, which increases with increasing spatial differences in labor productivity, is bound by the range $[0, \overset{u}{E}_j]$. This range collapses toward $\overset{u}{E}_j$ (toward $\overset{r}{E}_j$ for $\alpha_j < \alpha^M$) as household wealth increases, and, as is clear in Figure 2, is increasing in α. Moreover, as λ increases, the difference in optimal educational level between a child who chooses to stay in the rural area and one who migrates (for any given level of α) increases. That is, $\partial(\overset{u}{E} - \overset{r}{E}) \big/ \partial(\lambda) > 0$. Conversely, a decrease in λ, due to improvements in rural infrastructure that increases its relative productivity, would reduce the educational investment gap. This reflects the well known phenomenon that as urban centers develop more quickly than outlying rural areas, the socio-economic disparity between urban elites and rural elites grows, reflected here in terms of higher incentives to educational attainment for rural children who expect to migrate. This does not mean that all, or even most of the urban immigrants achieve this level of education. Indeed, increased relative productivity in the urban area increases the rate of migration by loosening the lower boundaries on the ability and wealth constraints. This means that the urban area begins to attract both relatively more skill-poor individuals and those coming from low wealth households. It is therefore safe to conjecture that such a dynamic not only increases the urban-rural polarization but also results in increasing inequality within the urban sector. In a growth model characterized by ability-biased technological transition, Galor and Moav (2000) show that increases in the rate of technological progress result in increasing wage inequality both between and within groups of skilled and unskilled workers. Assuming an urban bias in growth processes, it should be feasible to replicate similar results in a dynamic version of our model. We leave this topic for future extensions of the model.

2.3.2 Informal Credit Market

Thus far we have restricted our attention to the case in which a child's education is financed solely by its own household. This establishes a benchmark against which we now explore the relationship between spatial variation in the returns to human capital and the financing of educational investments. We start by analyzing the household's decision to invest in other children.

2.3.2.1 The Supply of Community Funded Education

We first characterize the conditions under which educational loans can be be provided to children outside of the lender's household. In order for the community to invest in child *j*, i.e., $E_{jc} > 0$, it must be the case that

$$\pi\lambda\rho(\alpha_j(E_{jj} + E_{jc})) - \rho(\alpha_j(E_{jj} + E_{jc})) \leq c - (1+r)P_E E_{jc} \qquad (16)$$

This condition assures the lending household(s) that the recipient child will not migrate and thus renege on his loan. Let $\overset{s}{E}_{jc}$ solve (16) with equality. $\overset{s}{E}_{jc}$ then represents the maximum amount of educational loans the community will supply child *j*.[14] Allowing educational loans shifts the migration threshold since migration effectively generates windfall earnings in the form of loan non-repayments. With lower risks of being caught and larger loans, the community lending constraint will be tighter as lenders adjust for the increased attractiveness of migration.

To provide a clear picture of the determinants of $\overset{s}{E}_{jc}$, we graph condition (16) in Figure 2.3 and analyze the comparative statics with respect to a shift in the model's parameters.

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[14] Note that the supply of loans $\overset{s}{E}_{jc}$ for a child *j* is calculated after household *j* decides how much to invest in its own child's education, E_{jj}, independently from lending or borrowing options. Then, starting from the optimal educational expenses provided by the household, informal (or formal) lending may take place.

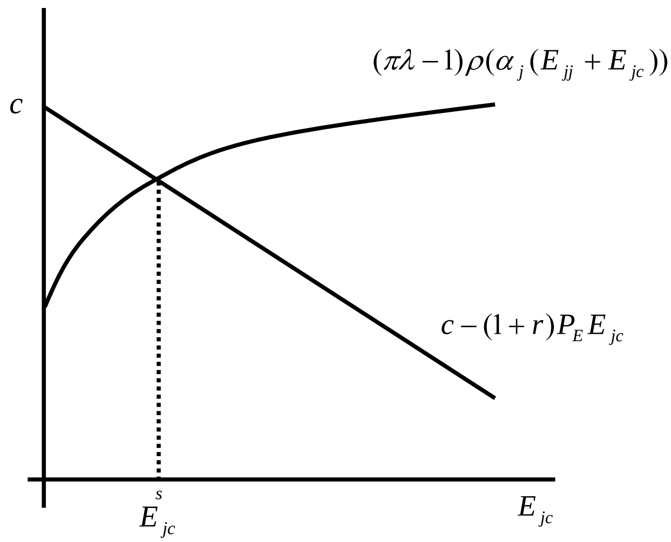

Figure 2.3: Determinants of Maximum Level of Community Financed Education

Recall that the right-hand side of condition (16) captures the net cost of migration. When $E_{jc}=0$, the net cost is constant, as in the model without any educational loans. As a child takes out educational loans, i.e., E_{jc} increases, the net cost of migration decreases at the rate $(1+r)P_E$ as migrating now induces windfall gains from default on the loans. The left-hand side of condition (16) crosses the vertical axis below *c*.[15] Since both functions are strictly concave, and thus their difference is also strictly concave, then for any given E_{jj}, $(\pi\lambda-1)\rho(\alpha_j E^j)$ is increasing in E_{jc}. E^s_{jc} reflects the loan value where the child is indifferent between staying and repaying his loans or migrating and defaulting, and thus represents the maximal supply of community-financed education.

Recall that π denotes the probability that a child escapes attempts by the community to punish him for defaulting on his loans. For large π, migrants find it relatively easy to avoid punishment. A rural household with surplus investible

[15] We know that $E_{jc}>0$ implies that $E_{jj}<\overline{E}_j$. Thus, since $\overline{E}_j$ is such that $((\lambda-1)\rho(\alpha_j\overline{E}_j)=c$, then for $E_{jc}=0$ and $\pi\in(0,1)$, it follows that $(\lambda\pi-1)\rho(\alpha_j(E_{jj}+E_{jc})<c$.

resources will rationally seek to protect itself from potentially bad investments. As Figure 2.4 shows, because an increase in π shifts up the expected gain of migrating, it lowers E^s_{jc}, reducing the supply of informal educational loans available to child *j*.

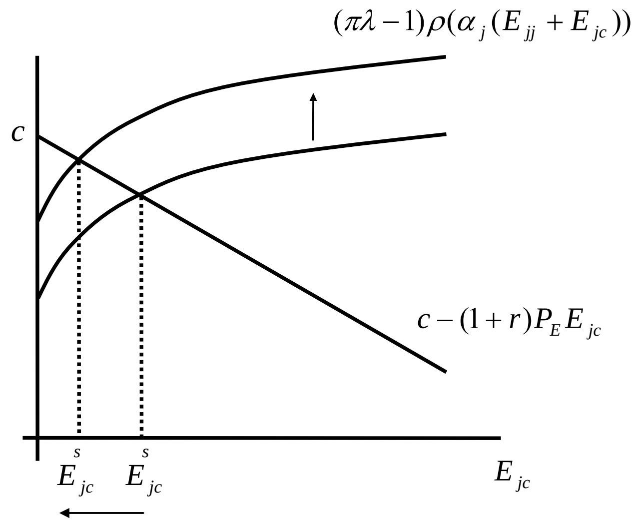

Figure 2.4: Response of Community Financed Education to Increases in Urban Productivity and Ease of Default

Figure 2.4 similarly shows the decrease in E^s_{jc} resulting from an increase in λ. Again, this is merely the rational response of adults protecting their investments in the face of an increased incentive for educated children to migrate. On the other hand, in a community with strong social networks and in which personal welfare is inextricably linked to social status, the resulting increase in the cost of moving is likely to relax this constraint of loan provision. These outcomes highlight our central result. As the expected benefit of migration increases for an educated child, the supply of community-financed educational loans decreases. That is, $\partial(E^s_{jc})/\partial(\lambda) < 0$, $\partial(E^s_{jc})/\partial(\pi) < 0$, $\partial(E^s_{jc})/\partial(c) > 0$. Thus, the more attractive the migration option, the more the initial wealth of the child's household conditions its educational attainment.

The return on educational investment is given by $(1+r)$. One would expect increases in investment returns to increase $\bar{E}^{s}_{jc}$. However, a higher return to investment implies a larger debt burden per unit of education financed for the child, which increases his incentive to migrate and default. As such, increases in the net return on educational investment, *r*, actually decrease $\bar{E}^{s}_{jc}$, the maximum level of education the community is willing to invest in any child j. That is, $\partial(\bar{E}^{s}_{jc})/\partial(r) < 0$. Figure 2.5 shows this result. An increase in r represents a steeper slope on the net cost to migration curve which then intersects the expected net gain to migration curve at a lower $\bar{E}^{s}_{jc}$.

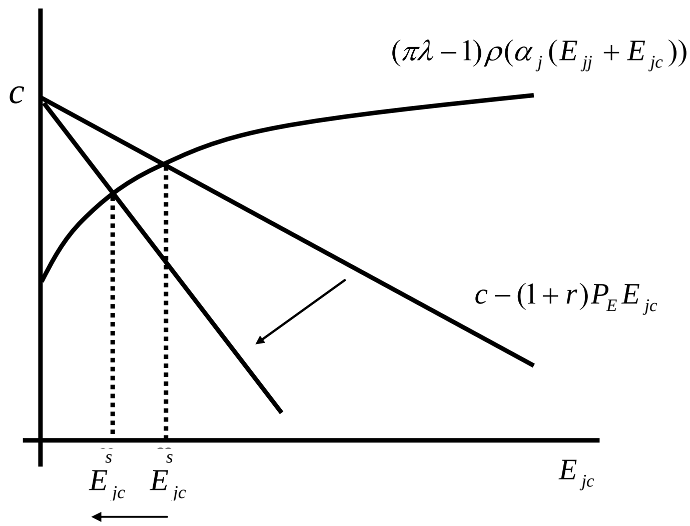

Figure 2.5: Response of Community Funded Education to Decreases in Costs of Migration

2.3.2.2 The Demand for Community Funded Education

As a result of the fixed rate of repayment $(1+r)$ that an investor receives per unit of education financed, the investor may be willing to invest in a child beyond the level that optimizes the child's productivity. However, the child (or his parent, acting on his behalf) will reject all loans whose repayment cost exceeds the resulting productivity increase. Recall that $\bar{E}^{r}_{j}$ was child *j*'s optimal level of education if he stayed in the rural area and only his parent financed his education. We now establish the child's demand for community-provided educational loans to supplement parental financing. Given the level of education provided by his own household, E_{jj}, child *j* will accept any level of community funded educational units E_{jc} that satisfies

$$\rho'(\alpha_j(E_{jj} + E_{jc}))\alpha_j \geq (1+r)P_E \tag{17}$$

Let $\overset{d}{E}_{jc}$ solve (17) with equality, denoting child *j*'s optimal demand for education loans. If community willingness to lend to child *j* is at least as large as the child's demand for education, i.e. $\overset{s}{E}_{jc} \geq \overset{d}{E}_{jc}$, then child *j's* total educational attainment will be $E_{jj} + \overset{d}{E}_{jc}$ and will not be constrained by the contractual demands of the informal credit market structure. If on the other hand $\overset{s}{E}_{jc} < \overset{d}{E}_{jc}$, then the child will receive a total education of $E_{jj} + \overset{s}{E}_{jc}$, the amount funded by his household and community loans. Note that from equations (12) and (17) we have that

$$\beta\rho'(\alpha_j \overset{r}{E}_j)\alpha_j = (1+r)P_E \tag{18}$$

and

$$\rho'(\alpha_j(E_{jj} + \overset{d}{E}_{jc}))\alpha_j = (1+r)P_E \tag{19}$$

it follows that

$$\overset{r}{E}_j \leq E_{jj} + \overset{d}{E}_{jc} \tag{20}$$

Thus, for any child *j* who does not migrate, $\overset{d}{E}_{jc} \geq 0$ and they demand a weakly positive level of community funded education (strictly positive $\forall\beta < 1$).[16] This is true because while a child absorbs the full return from increased productivity resulting from additional education, the ensuing indirect increase in the household's utility is discounted by β. Whether a child's educational attainment is constrained by the community supply of education loans or by the child's demand for education loans depends on the child's ability and his household's wealth. Any child who seeks an

[16] One can prove this as follows. $\forall\beta < 1$, equations (18) and (19) imply that $\overset{r}{E}_j < E_{jj} + \overset{d}{E}_{jc}$ Suppose $\overset{d}{E}_{jc} = 0$. Equation (20) then implies that $\overset{r}{E}_j < E_{jj}$. This is a contradiction since, given that the optimal level of household funded rural education is $\overset{r}{E}_j$, it must be that $E_{jj} \leq \overset{r}{E}_j$. It follows that $\overset{d}{E}_{jc} > 0$. For $\beta = 1$, $\overset{d}{E}_{jc} = 0$ iff $w_j \geq P_E \overset{r}{E}_j$.

education level that would make migration a rational second-period decision will be constrained by the limited community education loans available to him. Unlike the household-only funding scenario in which any child with $\alpha \le \alpha^{M}$ would never migrate, that threshold falls to zero in the presence of lending because for large enough loan values the benefit of migrating and defaulting becomes irresistible. Migration becomes more inviting as the probability of getting caught $(1-\pi)$ decreases, the marginal cost of education $(1+r)P_E$ increases, and the personal return to education, α, increases. $\overset{s}{E}_{jc}$ is thus decreasing in α_j, though even with $\alpha_j = 1$, a child *j* will always have access to a positive supply of community loans.[17] Meanwhile, a child's demand for education, and thus for educational loans, is monotonically increasing in α. Figure 2.6 depicts the demand and supply of community education as a function of α.

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[17] This result follows from the definition of $\overline{E}_j$ and $\overset{s}{E}_{jc}$. $\overline{E}_j$ is such that $(\lambda-1)\rho(\alpha_j\overline{E}_j) = c$ and $\overset{s}{E}_{jc}$ solves $(\lambda\pi-1)\rho(\alpha_j(\overline{E}_j+\overset{s}{E}_{jc})) = c-(1+r)P_E\overset{s}{E}_{jc}$. Let $\alpha_j = 1$ and $\pi \in (0,1)$. Suppose $\overset{s}{E}_{jc} = 0$, this implies that $(\lambda-1)\rho(\alpha_j\overline{E}_j) = c$, and $(\lambda\pi-1)\rho(\alpha_j\overline{E}_j) = c$. This is a contradiction and thus. $\overset{s}{E}_{jc} > 0$.

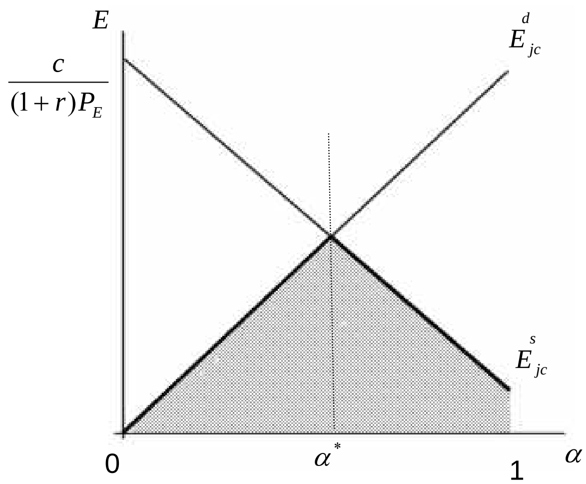

Figure 2.6: Demand and Supply of Community Funded Education

The bold sections of the demand and supply schedules represent the education loans child *j* receives in equilibrium. All those children with $\alpha \leq \alpha^*$ will receive their optimal level of education while children with $\alpha > \alpha^*$ will be constrained by the amount of loan the community is willing to finance.[18] The striking implication is that with imperfectly enforceable credit contracts and migration options, children are implicitly punished for being born intelligent. High innate ability increases the benefits to migration, inducing rational investors to limit loans as a defense against default. This also results in an inefficient allocation of educational opportunities. *Ceteris paribus,* low ability children who generate less productivity from a given level of education receive more funding and thus more education.

Moreover, since education loans are decreasing in child innate ability beyond some point α^*, high ability children will depend disproportionately on their parent's wealth to finance their education. For wealthy households, the imperfect enforceability of informal lending contracts will not constrain the child's educational

[18] The low-density exception are children of households whose wealth and resulting investment choices bring the child nearly to the migration threshold, but a single unit of community-financed education would provide education sufficient to make it worth the child's while to migrate.

attainment and adult earning prospects (see Figure 1). But for poor households, the constrained supply of educational loans limits opportunities.

We modeled an unconstrained community education lending fund, one that is always capable of meeting the demand for loans, i.e. $\sum_{j=i}^{N} E_{cj} \geq \sum_{j=1}^{N} E_{jc}^{d}$, subject only to the incentive compatibility constraint. Whether this condition is met depends on the distribution and aggregate level of wealth across households and the distribution of abilities across children in the community. A community poorly endowed with wealth but richly endowed with intelligence is likely to be unable to provide the optimal levels of education for many children. This simple model nonetheless captures the key elements of our story: that informal financing weakly dominates the household-only provision of education under any distribution of α and w, that spatial disparities in returns to human capital reduce the available supply of educational loans, and that this financial market imperfection will most adversely affect high ability children from poor households.

2.3.3 The First-Best World

While we have shown that informal credit is better than no credit, the incentive compatibility constraint results in inefficiencies and inequities in lending patterns. For completeness, we investigate the extent of these inefficiencies by comparison with a complete, competitive credit market with perfect contract enforcement.[19]

In the first-best world of perfect credit markets, all children receive their ability-specific optimal level of education financing, regardless of whether they migrate or not. Moreover, for those children whose parents discount the utility they receive from their children's wellbeing (i.e. - where $\beta < 1$), the first-best optimal level

[19] As the results of the first-best counterfactual are similar to most analyses of competitive markets, we limit ourselves here to a brief presentation of the key results. A complete analysis with detailed derivations is available in the working paper version, available from the authors upon request.

of education strictly dominates the purely household-funded optimal level of education for all but the lowest ability children who would remain in the rural village regardless. Perfectly enforceable credit contracts make the migration decision independent of the education financing problem. This lowers the threshold level of innate ability needed to migrate and in equilibrium increases educational lending and attainment, especially by high ability children. Absent first-best credit markets, informal credit increases the funding available for children's education and thus increases educational attainment. But informal credit fails to fulfill the demand by higher ability children from poorer households, creating important inefficiencies and inequities.

2.4 Discussion and Policy Implications

The central results of our model highlight three key points. First, spatially varied returns to education tighten the incentive compatibility constraints inherent in imperfectly enforceable credit markets and thereby limit the usefulness of informal educational loans.

Second, our model underscores the importance of effective credit contract enforcement mechanisms for optimal investment in children's education, especially for children of relatively high innate ability. Perfectly enforceable education loans afford children the opportunity to realize their full potential and to break free of poverty traps caused by low initial household wealth endowments. But when migration options constrain informal community financing, poor children's prospects may be severely limited by their parents' poverty, as in Loury (1981).

Third, increasing spatial inequality in productive infrastructure without any significant improvements in loan contract enforcement mechanisms increases incentives for rural-to-urban migration. But children from relatively wealthy homes are disproportionately able to capitalize on these opportunities as informal education loans become increasingly supply-constrained when urban-rural productivity differences grow. Thus, as the urban-rural poverty gap increases, poor children of high innate ability become increasingly consigned to a low-education poverty trap of the sort first posited by Loury (1981).

If increasing educational attainment in less-favored rural communities, especially among high ability children, is an objective for policymakers, then our analysis suggests a means by which public investment might "crowd in" private educational investment. Governments and donors might improve rural infrastructure in ways that encourage private business investment that stimulates skilled employment and thereby raises the expected returns to human capital. This might include programs of rural electrification, improvements in rural communication infrastructure, road improvement and maintenance, and provision of police protection. Improving rural infrastructure reduces incentives to migrate out of rural villages, making informal loan contract enforcement easier and thereby increasing the provision of private, informal finance.

Though such a policy would indeed relax the incentive constraints on the informal financial market and weakly improve access to education loans, its aggregate impact depends on the availability of local funds for educational investment. It would also depend on whether the returns to investment in the education of non-kin children provided higher returns than other investments. Recall that our model abstracted away from aggregate wealth constraints. Where this assumption does not hold, the informal credit market will be further limited by a binding loan availability constraint. Moreover, as relative returns to productive infrastructure increase in the rural area, alternative, non-educational investment opportunities may become increasingly attractive. Together, these factors may decrease the share of community funds available for long-term investments in education.

If development processes such as growing urban-rural labor productivity gaps unleash forces that undermine the effectiveness of informal credit markets, it becomes crucial to develop universally accessible formal financial markets. Toward this end, governments and donors should invest in credit contract enforcement, perhaps through credit reporting bureaus or improved judicial processes, in order to stimulate the supply of education loans.

It would be instructive to expand this model to allow for dynamics to explore the potential divergence of rural and urban livelihoods and the prospective intergenerational reproduction of poverty. Indeed, as poorer and less skilled individuals tend to remain in the rural area, we would expect that spatial mobility combined with imperfect credit markets would yield over time a rural population with a distribution of innate abilities and wealth that results in a decreased rate of migration and a low steady-state level of rural educational attainment and productivity. The simple two-period model we have developed nonetheless provides a credible answer to the puzzle of underinvestment of education in rural areas based on the twin empirical regularities of spatially varied returns to human capital and imperfect loan contract enforcement in rural credit markets.

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CHAPTER 3

3 MAKING LOANS TO MAKE FRIENDS: Explaining the Dismal Financial Performance of Financial Service Associations

3.1 Introduction

It is now widely acknowledged that lack of access to credit is a major impediment to the alleviation of poverty. The poor, who may benefit from securing credit to invest in profitable self-employment or small enterprise projects, oftentimes do not have the collateral needed to secure a loan from formal credit markets (Mosley 1986, Udry 1990). Without the requisite collateral, conventional individual-liability lending arrangements become unprofitable for formal banking institutions who face prohibitively high monitoring and information gathering costs that encourage the twin problems of moral hazard and adverse selection. This leads to binding credit constraints.

There has been a surge of interest over the past decade in a variety of microfinance institutions (MFIs) that have arisen as second best solutions that can offer credit to customers with no collateral and still induce rates of repayment that are relatively high and allow for self-sufficiency. These MFIs largely share the common feature of requiring borrowers to form groups in which all borrowers are held jointly liable for each other's loans. As a joint-liability contract is likely to invite groups of acquaintances and close associates, such collective credit agreements alleviate the problems of informational asymmetry and costly monitoring and can thereby support credit agreements that conventional banking practices cannot.

Economic theorists have focused a lot of attention on understanding the mechanisms by which these MFIs thrive in environments where formal financial markets are thin or non-existent. The literature has identified several theories explaining microfinance success (See Ghatak and Guinnane 1999, and Morduch 1999, for recent surveys). Most of these explanations rely fundamentally on the existence of strong personal ties to community norms that sustain nonopportunistic behavior and transmit personal information across the community network. Besley and Coate (1995) argue that the credible threat of social sanctions in such environments acts as a deterrent to reneging on group loan agreements. Here, the high personal value placed on social capital acts as a viable substitute for asset collateral. In a similar vein, Stiglitz (1990) shows how jointly-liable contracts can induce peer monitoring efforts that both lower interest rates and increase repayment rates. As their interests are also at stake, group members have an incentive to punish partners that renege on their responsibilities and in so doing limit the incidence of moral hazard. Group-lending contracts can also solve problems of adverse selection by offering contracts that encourage peer selection strategies that identify risky groups from safe groups (Ghatak, 1999).

Along with the theoretical advances that highlight the various ways in which joint-liability lending institutions outperform formal banking institutions, the programmatic success of the pioneer group-lender, Bangladesh's Grameen Bank, has catapulted microfinance delivery to the forefront of development practices. Over the three decades since its inception in 1976, the Grameen Bank built up an impressive program offering collateral-free loans to groups of jointly liable poor villagers in rural Bangladesh, with a primary focus on women. By 1994, the Bank was the largest micro-lender in Bangladesh with a cumulative investment over US$1 billion disbursed over more than 2 million members, 94% of whom were women (Grameen Bank, 1994). Riding this wave of success, the microfinance concept spread rapidly worldwide and was touted as a new paradigm of economic development. Microfinance programs enjoyed wide support among development practitioners and donors have been more than willing to provide funds to extend the reach of such programs among marginal and vulnerable populations worldwide.

In 1997, a meeting of high profile donors, development practitioners and organizations produced a document hailing MFIs as the key element in fostering economic and social development in the 21st century and began an initiative, the Microcredit Summit Campaign, to raise $20 billion to support microfinance startup schemes for the following 10 years (Microcredit Summit Report, 1997). By 2005, the sum of MFIs affiliated with the Microcredit Summit Campaign reported a clientele numbering close to 100 million persons, more than 70% of whom were classified among the poorest of the poor when their first loan was issued. The Campaign has been extended to 2015, and has set the goal of ensuring that 175 million of the world's poorest families (about 875 million individuals) have access to credit for entrepreneurial and other productive projects (Daley-Harris, 2005).

While we applaud this achievement and recognize the crucial role that access to credit can and does play in providing the poor with a pathway out of poverty, a history of unmet expectations and checkered success begs for caution. The success of MFIs are often defined by the following criteria: the number of borrowers served, the repayment rates, and the volume lent. Outside of Bangladesh and Indonesia, however, MFIs have had limited success. Several studies have highlighted instances in which MFIs failed to meet their key objectives, or even had a negative impact on members (Osterloh 2003, Zeller and Meyer 2002, Kaboski and Townsend 2000, Morduch 1999, Rahman 1999, Deschamps 1989, Braverman and Guasch 1984). In Kenya, for example, after fifteen years of microfinance programmes and over $100 million of donor money spent, only about 70,000 individuals had been reached (Jazeyeri, 2000). Furthermore, there are often no monitoring mechanisms to verify NGO claims about outreach and impact. The problem is further aggravated by eager donors who do not impose stringent conditions on the funds they give out and do not worry much about future sustainability or consequences (Gaspart and Platteau 2005, Morduch 1999). In many areas, opening an NGO, MFI or otherwise, has become a business whereby savvy entrepreneurs take advantage of the overzealous donor interest in such programs to enrich themselves (Mosse 2001, Harrison 2002, Jazeyeri 2000). The relative ease of attracting donor funds has generated an artificial demand for MFIs which are too often hapharzardly implemented and marketed. The result has been an alarming increase in micro-indebtedness by unsuspecting members with the consequence of a rise of social tensions that threatens to erode the selfsame social capital on which these programs base their success (Rahman, 1999).

This paper investigates the ways in which microfinance provision, an idea with great potential, can unravel and yield perverse outcomes that are counterproductive to its stated objectives. Specifically, we focus on Financial Service Associations (FSA), a particular and novel form of MFI whose structure was actually designed to mitigate some of the problems that befall the customary MFI. Despite the logic and grand claims of FSA promise, Osterloh (2003) documents a dismal reality of poorly performing FSAs in Kenya. Building on Osterloh, we construct a model explaining the failure of these FSAs. We argue that the set of assumed community and individual characteristics upon which the success of FSAs crucially depend, do not adequately represent the environment and behavioral motivations of the clientele.

The rest of the chapter is organized as follows. The following section contains a brief description of the concept and structure of FSAs and describes more specifically the role that FSAs have played in Kenya. In section 3, we develop a simple model to explain why FSAs have had little success in Kenya. Section 4 concludes.

3.2 Financial Service Associations

3.2.1 Concept and Operation

FSAs differ from traditional MFIs in that they do not rely on outside sources of funding to finance credit provision. Rather, in the FSA model, equity capital for loans are generated by selling shares to community members. The total value of the shares sold generates the loan fund, redistributable amongst members via credit. The purchase of a share confers membership.[20] Shares are priced low enough to allow for community wide participation but benefits are increasing in shares held to reward investment in the bank. For example, in the Kenyan FSAs Osterloh (2003) studies, credit limits are set at four times the value of a member's shares.

Being locally owned, financed and managed, FSAs were designed to assure sustainability and exploit the informational advantages common to traditional communities. Moreover, FSAs were to encourage the development of local management and entrepreneurial capacity by inducing incentives for efficient monitoring of FSA accounts and for capitalizing on the opportunity of accessible investment loans (Jazeyeri, 2000). Since the FSA model emerged through a pilot project in South Africa in 1994, FSAs have proliferated across the African continent. By the year 2000, over 160 FSAs were functioning in 8 different countries (Benin, Congo, Gabon, Guinea, Kenya, Mauritania, South Africa and Uganda). In total, they

[20] FSAs resemble early models of credit unions in that they were also informal organizations in which members pooled money amongst themselves to create a loaning fund accessible only to members (Clark, 1943). Over time, lessons learned through failure or sub-par performance culminated in formal organizational structures governing credit union (Black and Dugger, 1981).

had made over $2.5 million in loan disbursements and had a combined membership of over 50,000 (Jazeyeri, 2000).

3.2.2 The Kenyan Experience

Evidence from the FSA experience in Kenya, however, paints a somber picture. In a detailed analysis of ten FSAs serving various regions across Kenya, Osterloh (2003) shows that repayment rates are well below those required for financial sustainability. Loan repayment data from 894 of the 976 total loans issued by the sample FSAs show that 315 (35%) of the loans were found to be in arrears. Defined as loans with principal past due, the amount in arrears represented 24% of the total value of loans issued and 64% of total share capital. Furthermore, while FSA bylaws require that late principal is penalized by a 15% premium on the interest rate, Osterloh found that none of the sample FSAs reliably and consistently imposed the penalties. Moreover, a majority of unpaid loans are those taken out by wealthy members. Indeed, the 20 largest loans in default represented 14% of the total share value of all ten FSAs (Osterloh, 2003). As loan amounts are capped at a multiple of the shares one owns in the FSA, each of the 20 loans were too large to have been provided to any but the wealthiest members of the FSAs. In essence, this means that poorer members are subsidizing non-performing loans to the rich and the FSA in effect acts as an implicit regressive tax vehicle redistributing the meager wealth of the poor to the relatively wealthy!

This perverse consequence of an otherwise promising initiative may be due to an inadequate and incomplete characterization of individual motivations in traditional communities. The low asymmetries of information that traditional communities enjoy is frequently cited as endowing such communities with the social infrastructure upon which they can pursue economic transactions despite the absence of formal enabling institutions. Unfortunately, less attention is given to those features of social embeddedness, such as the politics of patronage and power, that are equally common to traditional communities and serve to undermine the productive potential of social cohesion (Barrett 2003, 2005a, Gaspart and Platteau 2005, Platteau and Abraham, 2002).

The experience of FSAs in Kenya serves as a good case study that reveals some of the ‘imperfections’ of tight-knit communities that limit their ability to sustain and induce economically beneficial and social welfare enhancing behavior. In environments often targeted by MFIs, the high degree of socialization also gives rise to a culture of patronage and favor-peddling. Empowered by a leadership role in a local FSA, for example, an individual may be compelled to use loan provision and monitoring decisions to buy influence and secure or maintain goodwill among friends and neighbors. In fact, once perceived to be in a position of privilege, turning one’s back on requests for assistance could invite retribution from one’s network of associates (Platteau 2000, Platteau and Abraham 2002). The result is a tendency to offer credit to individuals who are not likely to meet repayment conditions and a weakened resolve to impose ex-post sanctions to punish defaulters. As Osterloh (2003) points out, in Kenya, the Credit Committee formed specifically to use local information on loan applicants to screen out ex-ante credit risks in one FSA (North Horr) turned down only 8 of 340 loan applications. This may also explain why none of the FSAs studied by Osterloh charged penalties on late repayments of principal.

The structure and design of FSAs make them particularly vulnerable to the influences of patronage and favor-peddling. The FSA is typically managed by a Board of Directors (BoD) democratically elected by the shareholders. The BoD is then in charge of managing all FSA resources, making loan decisions, keeping the accounts, and so on. Because they preside over the equity capital generated by all member's savings, any losses the FSA incurs do not directly affect the BoD but rather are spread out in a general devaluation of all members' share values. Thus, if the disutility from rejecting a loan application *ex ante* and enforcing penalties *ex post* (which the BoD bears personally) is greater than the consequent loss in share value (which is borne by the entire membership), the BoD may rationally (self-interestedly) choose to knowingly offer loans that underperform. It is important to note that FSA funds are drawn exclusively from the community and thus any losses incurred by offering loans to unproductive members and failing to punish defaulters is absorbed by the entire membership in the form of eroding share values. This has serious implications for poverty alleviation efforts especially if, as Osterloh shows, a vast majority of principal in arrears is held by relatively wealthier members who default on loans.

In what follows, we develop a simple model of FSA style micro lending to explain the dismal performance of the FSAs in Kenya and to highlight the organizational features that limit its effectiveness. Where credit providers can invite social retribution for denying loans to friends and neighbors, the resulting nonmaterial incentive to offer loans to individuals who are uncreditworthy in expectation results in the provision of nonperforming loans. This effect becomes more pronounced under the organizational structure of the FSA, whereby credit committees bear the full social cost of screening applicants, but only share in a fraction of the financial benefits of good financial stewardship. Arguing that the costs of rejecting wealthy applicants are higher, we show that credit committees relax their screening and enforcement functions in proportion to the applicant's wealth. By extension, we highlight the resulting redistributive effects, wherein the deteriorating share value of poorer members subsidize nonperforming loans to the wealthy.

3.3 The Model

The framework is a two-period, principal-agent model with a single risk-neutral principal and multiple risk neutral agents.[21] The principal, who makes lending decisions, denotes the FSA management. While in practice the management is comprised of a board of several persons, abstracting to a single individual does not alter the main results. The agents are FSA members. Each member is endowed with a productivity parameter α with support (0,1]. Defining α as the probability of a successful outcome in pursuing an investment project, we assume that all members have the option of investing in a project θ that yields $\overline{\theta} > 0$ with probability α and $\underline{\theta} = 0$ with probability $(1-\alpha)$. The lender, by virtue of the rich information structure present in traditional communities, is able to costlessly establish each borrower's productivity parameter α.

The projects require a fixed cost of *K* which members can only finance by obtaining a loan from the FSA. Because members are not required to offer collateral to obtain credit, the loans are of limited liability in nature. That is, if they realize a project outcome of $\underline{\theta}$, they cannot repay their loans and must default. Following the convention in the literature, we allow for such 'liquidity-constraint' defaults and seek only to investigate the incidence and determinants of 'strategic' defaults whereby borrowers have a high project realization, $\overline{\theta}$, and are therefore able to repay their loans, but chose instead to default.

[21] We borrow the general structure of our model from de Aghion (1999). However, where de Aghion analyzes a joint-liability contract agreement between a conventional bank and two jointly-liable associates, we extend the model to highlight the specific structure of the FSA wherein an elected board makes the screening and monitoring decisions on behalf of the entire membership.

3.3.1 Base Case: No Moral Hazard

To fix ideas, we first model the unrealistic scenario in which borrowers voluntarily repay their loans without coercion. We will later build up the model, subsequently introducing the specific organizational features of FSAs, as well as more realistic assumptions on the behavioral motivations of both borrowers and lenders. Assume that all members (henceforth borrowers) are completely honest and will not default for strategic reasons. Assume also that the principal,(henceforth the lender) is the sole provider of micro credit loans and he seeks to maximize his expected net profit. This implies that the lender will only offer loans if,

$$\alpha Kr - (1-\alpha)K \geq 0 \qquad (1)$$

where *r* is the gross interest rate which we take to be given.[22] Solving equation (1) for α we get,

$$\alpha \geq 1/(1+r) \qquad (2)$$

Let $\alpha^*(\mathrm{r})$ equate equation (2). Then, for all borrowers with $\alpha \geq \alpha^*$, the lender will offer the loan. For all $\alpha \geq \alpha^*$, we assume that $\overline{\theta}$ is such that $\alpha\overline{\theta} > Kr$. This assures that the expected net present value of undertaking the project is positive for all members who are offered loans (otherwise a risk-neutral member would not request a loan) and that they can in fact repay their loans conditional on realizing $\overline{\theta}$ (else the lender would not offer the loan).

3.3.2 Self-Interested FSA Members

Now, suppose instead that borrowers are self-interested and, even upon realizing $\overline{\theta}$, will only repay their loan if the personal benefits of repaying outweigh those of reneging. In addition, to introduce a key feature of the FSA structure, recall

[22] We hold the interest rate *r* to be exogenous in order to highlight the central decision making features over which local FSA management have control: the screening of applicants and the sanctioning of defaulters. Interest rates are often set independently by implementing NGOs.

that FSA rules only allow members who have shareholdings in the association to take out loans, with the maximum loan being a multiple of a member's share value. As such, if a borrower reneges, we assume that they forfeit the shares that they hold in the FSA. Denote $1/\varphi$ as the multiple of share holdings that sets the upper bound of the loan amount a member can obtain; $K\varphi$ is thus the share value needed to support the loan amount *K*.[23]

In addition we assume that failure to repay ones loan's conditional on realizing $\overline{\theta}$ is punishable by the imposition of social sanctions, *S*. The lender, who will impose the sanctions on any strategic defaulter, must first be able to ascertain a borrower's project realization. We model this by introducing a monitoring technology whereby the lender undertakes to monitor the borrower's activities with the aim of uncovering the borrower's project realization. We assume a perfect monitoring technology. A lender who decides to monitor borrowers will always accurately determine project realizations. Denote γ as the probability that the lender will monitor the borrower. Should a borrower decide to default strategically, the lender will discover the deceit and punish the borrower to the tune of S.[24] The borrower has information on γ.[25] Monitoring, however, takes effort and is not costless to the lender. We assume a linear cost of monitoring and denote *c* as the marginal cost of γ.[26]

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[23] For simplicity, we assume that all members have the same value of shares in the FSA and that *K* is the maximum amount they can borrow. That is, all members have $K\varphi$ worth of shares in the FSA. While in reality wealthier members are likely to own more shares and take bigger loans, this simplification only strengthens our result that screening and monitoring functions are increasingly ineffective in member's wealth. If wealthier members were to take larger loans and default, poorer members would only experience a faster deterioration in the share value.

[24] In communities with a high degree of socialization, where members place a high value on their social standing and relationships, social sanctions can involve the exclusion of deviant members from valuable community networks or the costly tarnishing of their reputations.

[25] This assumption turns on the existence of low asymmetries of information present in tightly-knit traditional communities.

[26] Cost of monitoring can also be interpreted as a reluctance to impose sanctions on a member of one's own community since, for example, it may result in tensions that could damage valuable relationships.

The timing of the model is as follows. First, lenders observe α and decide whether to extend the loan. If they decide to extend the loan, they then make their monitoring decision, which the borrower observes. In the next period, project returns are realized and borrowers receiving positive realizations decide whether to repay the loan or whether to default. Strategic defaulters who were monitored are then sanctioned. We model this problem as a two stage game and solve for the sub-game perfect Nash equilibrium through backward induction.

In the second stage, a borrower, having realized $\overline{\theta}$, will then only repay if:

$$\overline{\theta} - Kr + K\varphi \geq \overline{\theta} - \gamma S \tag{3}$$

In order to assure repayment, a lender must thus set γ such that.

$$\gamma \geq \frac{K(r-\varphi)}{S} \tag{4}$$

Let $\gamma^{*}(K, r, M, S)$ solve equation (4) with equality[27]. Knowing this, in the first stage, the lender chooses γ such that

$$\alpha Kr - c\gamma - (1-\alpha)K \geq 0 \tag{5}$$

Since the marginal cost of sanction is increasing to the lender, he will set γ equal to γ^{*} or zero. Given the present structure, $\gamma = 0$ implies that the lender has offered a loan but chooses not to impose sanctions against defaulters. With no threat of sanctions, the only loss to a borrower who reneges are his shares in the FSA, valued at $K\varphi$, that he would necessarily forfeit. Since $Kr > K\varphi$, if $\gamma = 0$, a borrower will strategically default and the lender will incur a loss of K per loan.[28] Clearly, a lender will set

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[27] Since $\gamma \in (0,1]$, we assume $S \geq K(r-\varphi)$. Indeed, all informal credit enforcement methods that rely on the credible threat of sanctions require them to be powerful enough to act as a deterrent to contract default. Consequently, the vast majority of the literature analyzing informal contract enforcement is set in rural traditional communities where the relatively high degree of social embeddedness justifies the use of sanctions as a powerful enforcement device.

[28] Recall that as the gross interest rate, $r > 1$, and as the borrowing fraction $\varphi < 1$.

$\gamma = \gamma^*$ on all loans offered, and not offer any loans to borrowers who are expected to renege.[29] Solving equation (5) for α, we get

$$\alpha \geq \frac{1}{1+r} + \frac{c\gamma^*}{K(r+1)} \tag{6}$$

Let α^γ solve equation (6) with equality, α^γ then represents the threshold probability of success below which a lender will not lend to a prospective borrower. It is easy to see that $\alpha^\gamma > \alpha^*$. Therefore, the space of borrowers whose productivity parameter falls between $[\alpha^*, \alpha^\gamma)$, who were eligible for loans when default was not an option, are no longer considered creditworthy. This represents a decline in aggregate social welfare as all borrowers with $\alpha \geq \alpha^*$ have a positive net present value of project investment (See Figure 1 in section 3.3). Where borrowers are opportunistic, α^γ is nonetheless the second best optimal productivity threshold.

3.3.3 Community Norms and Personal Incentives Supporting Assistance

We now extend the model by incorporating a particularly important decision making determinant that has so far been left out of models of informal microfinance lending. The same tight-knit traditional ties that allow lenders to rely on the credible threat of social sanctions should a borrower default may also limit their ability to make decisions solely on the basis of the expected profitability of loans. A well-known feature of traditional societies is their strong egalitarian tendency (Platteau, 2000). Redistributive norms may consequently develop and persist to maintain equality and limit the emergence of class, or to keep members from accumulating wealth that would enable them to evade their obligation to community insurance or consumption smoothing pools (Fafchamps 1992, Platteau 2000). A lender who has the capacity to assist a borrower in the form of offering credit might invite scorn from the community

[29] In what follows, we assume that $c\gamma^* < K$. If not, monitoring loans would cost more than the loan value itself and the FSA, or any other credit scheme, would not rationally exist.

if he refuses to extend a loan. Furthermore, a lender might have a personal incentive to oblige certain, often more powerful, members of the community or friends, family and neighbors. Special favors to powerful individuals may return positive dividends in the future or may serve to solidify patron-client relationships that are common in more traditional communities.

We model this mechanism by further endowing each borrower with wealth w that is known to the lender, where a borrower's wealth can be interpreted as a metaphor for the 'power' they wield in the society and therefore their expected value as a friend. We then impose a cost δw on the lender for refusing to extend loans. The parameter δ captures the generalized norm of assistance that compels the lender to assist any member of the community. Consequently, a lender will now offer loans if the following condition holds:

$$\alpha K r - c\gamma^{*} - (1-\alpha)K \geq -\delta w \tag{7}$$

Solving this for α we get,

$$\alpha \geq \frac{1}{r+1} + \frac{c\gamma^{*} - \delta w}{K(r+1)} \tag{8}$$

Let $\alpha^{\delta w}$ solve equation 8 with equality. Note that $\frac{\partial(\alpha^{\delta w})}{\partial(\delta)} < 0$ and $\frac{\partial(\alpha^{\delta w})}{\partial(w)} < 0$. This implies $\alpha^{\delta w} \leq \alpha^{\gamma}$, signifying that the lender now offers credit to borrowers whose expected financial return on the loan is negative. Moreover, it now becomes possible for a lender to offer a loan to some clients but fail to monitor them with positive probability. This will occur if the disutility of refusing to grant a member a loan, δw, is greater than the value of a lost loan, K. In other words, if the expected return on a loan that requires positive monitoring effort (and thus a sufficient and credible threat of sanctions conditional on default) is less than the cost of the loan, but a lender is still compelled by the logic of social norms and his own personal incentives to offer the loan, he is better off not incurring the cost of monitoring and instead writing off the loan. As we know, all non-monitored borrowers will subsequently default sanction-free.

More formally, we know that a loan will be granted to all applicants with wealth *w* satisfying $\delta w \geq K$. Let $\overline{w} = \frac{K}{\delta}$ denote the minimum wealth threshold for which securing a loan is guaranteed. Recall the decision making process a lender faces. First, he decides whether to offer the loan. Conditional on offering a loan, he then decides whether to monitor the loan, i.e., whether to set $\gamma = 0$ or $\gamma = \gamma^*$. Thus far, all members offered loans were monitored with probability γ^*. With the introduction of δw, however, a subset of members with $w \geq \overline{w}$ will not be monitored; they will essentially be given free loans, or grants.

To determine who receives free loans, note that once a loan is offered, the lender will lose *K* if he fails to monitor the loan and can expect $\alpha Kr - c\gamma^* - (1-\alpha)K$ if he monitors. Thus, for all α satisfying,

$$\alpha Kr - c\gamma^* - (1-\alpha)K < -K \tag{9}$$

the expected return on a monitored loan is less than the value of a lost loan and giving a free loan is the dominant strategy for the lender. Let α^{-k} solve equation (9) with equality. It is easy to see that $\alpha^{-k} = \frac{c\gamma^*}{K(r+1)}$. Consequently all members with a wealth productivity parameter such that $w \geq \overline{w}$ and $\alpha < \alpha^{-k}$ will be given free loans[30].

Graphical representations may provide greater clarity of the problem. In Figure 3.1, we first graph the second-best productivity threshold, α^{γ}, against the first-

[30] Note that this implies that at wealth level greater than $\overline{w}$, applicants are implicitly punished for having productivity greater than α^{-K}. This is essentially a construct of the model that arises from that fact that lenders invite retribution for screening out applicants but not for monitoring them. As such, since members with $\alpha > \alpha^{-K}$ have expected profits (or losses) greater than the cost of a free loan, they are monitored. From the point of view of the FSA, however, any loan given to a member with $\alpha < \alpha^{\gamma}$ is loss making, with losses moving inversely with α until the lower threshold for losses on a single loan, *K*, is reached at α^{-K}.

best, α^*. Note that productivity thresholds are independent of borrower wealth in both instances. The shaded area represents the space of members whose loan applications will be accepted and will subsequently be monitored with probability γ^*. In expectation, all these loans yield weakly positive profits to the lender. Insofar as it represents lost opportunities for accessing credit, the space between α^* and α^γ represents the aggregate loss of welfare due to costly monitoring in the face of self-interested borrowers. This space increases (α^γ increases) as the disutility of monitoring, *c*, increases, or the personal cost of social sanctions, *S*, decreases.

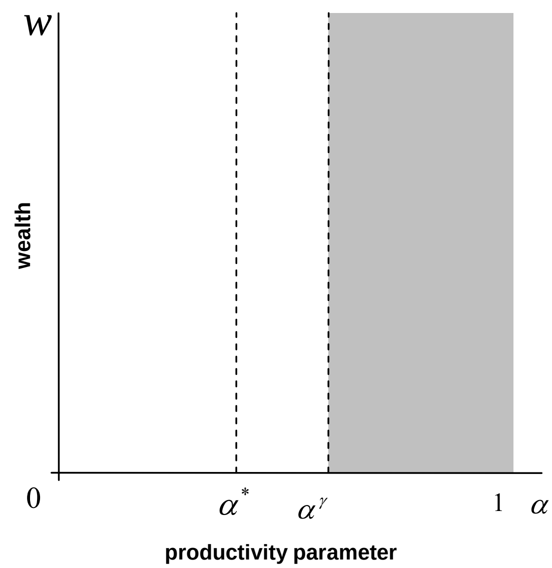

Figure 3.1: Loans Offered Under Costly Monitoring

In Figure 3.2, we depict the effect of incorporating non-material considerations on the part of the lender that arise from community norms and personal incentives that support the provision of loss-making loans. We draw in the productivity threshold $\alpha^{\delta w}$ that results when the lender factors in these considerations into his loaning decisions. $\alpha^{\delta w}$ is downward sloping in *w* indicating greater leniency in loan provision to the wealthy. We also draw in $\overline{w}$, the wealth above which loan provision is guaranteed. That $\alpha^{\delta w}$ crosses $\overline{w}$ at α^{-K} can be easily verified by substituting $\overline{w}$ for *w* in $\alpha^{\delta w}$ and performing a simple algebraic manipulation. Up to $w = \overline{w}$, all loan applicants falling to the right of $\alpha^{\delta w}$ will be granted loans and monitored. Above $\overline{w}$, applicants falling to the right of α^{-K} are monitored. The subset of these that lie in the lightly shaded area will yield financial losses to the lender in expectation. Those falling in the dark shaded area are given free, unmonitored loans.

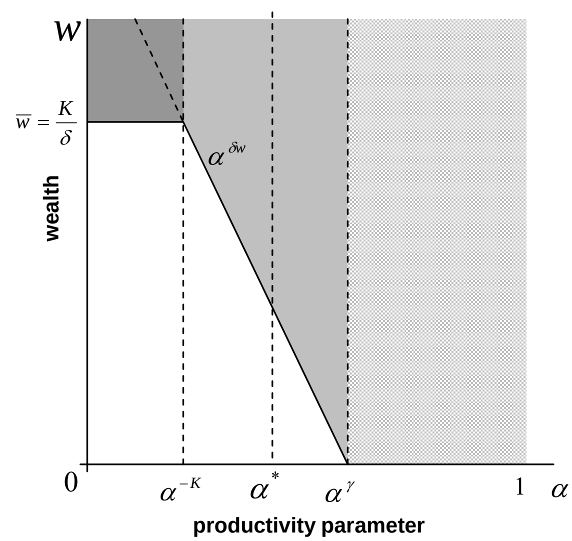

Figure 3.2: Effect of Assistance Norms and Patronage Incentives on Loans Offered

To briefly summarize, we have thus far shown that where social externalities give lenders a personal incentive to grant powerful members special privileges ($\delta w > 0$), they are likely to provide loans to uncreditworthy but relatively wealthy borrowers; individuals who in expectation represent negative profits to the lender. These individuals will nonetheless be monitored with probability γ^{*} and punished by sanctions should they attempt to default conditional on a positive realization. However, where these non-material incentives are particularly strong (when $Kr < \delta w$), lenders may extend free credit. That is, they will provide loans to borrowers with no intention of monitoring and full expectation of default. These borrowers, who we assume know the value of γ, will thus all renege on their debt repayment commitment. While such a policy affects all members by way of the generalized norm, δ, the wealthier members of society (those to whom personal favors are likely to generate positive externalities) fare better. The wealthier one is, the more likely they are to be extended a free loan. While this is a crucial result, its consequence is most potent in the FSA setting, to which we now turn.

3.3.4 Modeling the FSA

We now extend the model to better capture the structure of the FSA. Previously, we modeled a leader who was compelled by certain social norms to provide non-performing loans. One may rightfully dismiss such a situation as unrealistic. Indeed, why should any person present themselves as a lender in an environment in which they are set up to suffer losses? In an FSA, however, the "lender" is not an individual using his own resources as equity. Rather, the "lender" is simply an elected shareholder who makes decisions on behalf of all members. Essentially then, modeling the decision making process of an FSA requires one main alteration to the previous model. The lender's (FSA manager) decision function must be modified to account for the fact that he now oversees total FSA profit but only receives indirect benefits in the form of increasing share values which are spread over all shareholders. However, the FSA manager still bears the full brunt of the costs associated with rejecting loan applicants, δw, and monitoring, $c\gamma^*$. This mismatch of personalized losses from disciplined lending but generalized gains leads to socially suboptimal credit decisions.

Let N be the number of FSA members. Assume all members hold a similar number of shares, thus profits are equally distributed among them. The FSA manager will now offer loans and subsequently monitor loans and enforce sanctions to all members endowed with productivity parameter α such that

$$\frac{\alpha K r}{N} - c\gamma^* - \frac{(1-\alpha)K}{N} \geq -\delta w \quad (10)$$

Solving equation (10) for α we have

$$\alpha \geq \frac{1}{1+r} + \frac{(c\gamma^* - \delta w)N}{K(1+r)} \quad (11)$$

Let $\alpha^{\delta w N}$ solve equation (11) with equality. The lender will thus offer loans in the general case to only those members with $\alpha \geq \alpha^{\delta w N}$. Note that for N=1, $\alpha^{\delta w N} = \alpha^{\delta w}$.

We ask first how increasing the size of the FSA impacts on the lenders' decision making. Differentiating $\alpha^{\delta w N}$ by *N* we get have,

$$\frac{\partial(\alpha^{\delta w N})}{\partial(N)} = \frac{c\gamma^* - \delta w}{K(1+r)} \quad (12)$$

When $c\gamma^* > \delta w$, it is evident that $\alpha^{\delta w N}$ is increasing in *N*.[31] This means that as the size of the FSA increases, the lender will increase the probability of success required by borrowers and thus reduce the number of loans he will offer. The intuition of this is fairly simple. While financial benefits are now diffuse, the nonmaterial costs are personalized and fully absorbed the lender. He must therefore increase the probability of success among his customers in order to minimize FSA losses. Holding δ constant, note that increases in *w* mean that the quantity expressed in equation (12) gets smaller. As such, even though the space of members unable to attract loans grows due to increasing N, the space varies inversely with wealth.

When wealth increases such that $c\gamma^* < \delta w$, $\alpha^{\delta w N}$ becomes decreasing in *N* and the lender okays more loan applications, despite knowing that this increases the number of borrowing members generating expected losses. So long as the cost of rejecting a loan applicant, δw, is greater than the expected financial loss from the

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[31] The expected cost of monitoring, $c\gamma^*$, will be larger than the nonmaterial incentive for offering loans, δw, when threat of social sanctions, S, is a relatively weak deterrent of deviant behavior, when the generalized norm of assistance, δ is sufficiently low, and/or when the wealth of the borrower is significant.

loan, the imperative to assure that the FSA is profitable is dominated by the disutility of denying credit to wealthy members.

A lender will also be tempted to give out more free loans as the FSA grows in membership. In this case, lenders will lose K/N , their personal claim to the loan, if a borrower defaults. As such, all loan applicants with wealth satisfying $\delta w > K/N$ will receive loans. To find the subset of these that will get free loans, let $\overline{w}^N = K/\delta N$. Applying the same method as in section 3.3, substitute $\overline{w}^N$ for w in $\alpha^{\delta wN}$ and simplify. The result is

$$\alpha^{-KN} = \frac{c\gamma^* N}{K(r+1)} \tag{13}$$

the productivity level below which the expected return on a monitored loan is less than the value of a free loan. Any member with wealth, $w \geq \overline{w}^N$ and productivity parameter $\alpha < \alpha^{-KN}$ will receive free loans. It is clear that $\overline{w}^N \leq \overline{w}$ and $\alpha^{-KN} \geq \alpha^{-K}$, with the difference, in both cases, growing in *N*.

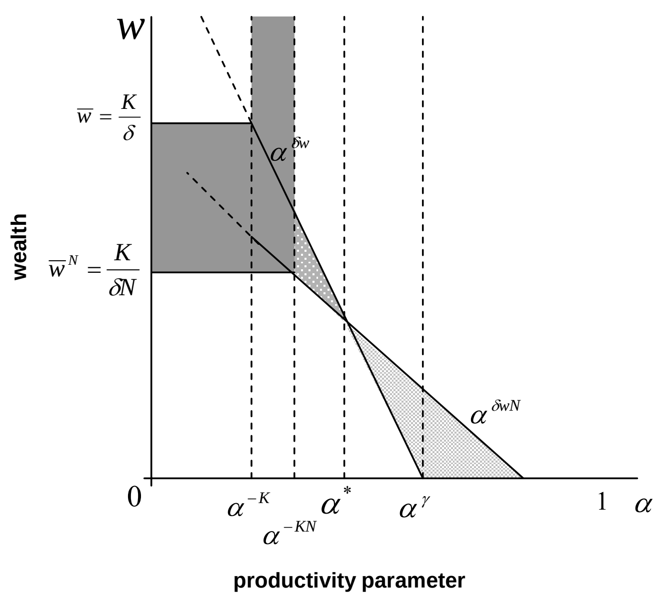

Figure 3.3: Effect of Increasing FSA Membership on Loans Offered

Figure 3.3 highlights the consequences of increasing FSA membership. We highlight the space of members affected by increasing *N*. The light shaded area represents those who are locked out of loan opportunities as membership grows. Not only are the poorer members more adversely affected, but many who would be financially profitable to the FSA at large (those with $\alpha > \alpha^{\gamma}$) are not offered loans. On the other hand, more members among the wealthy, whose loans constitute expected financial losses to the FSA, become eligible for loans. The space of these members who receive monitored loans is given by the medium-shaded area, while the increase in members receiving free loans is given by the dark-shaded area.

To summarize, as the FSA gets larger in size, it gets increasingly inefficient as an informal credit device, becomes more unsustainable, and, most importantly, disadvantages the poor in favor of the rich. This is particularly noteworthy given that the logic of FSAs requires a large membership. In order to be able to provide loans, FSAs need to raise a significant amount of equity capital, and, if most of their membership are poor, this can only be done by signing on a large number of members. Because FSA members all own shares in the institution, if the wealthier members are screened in a less stringent manner, allowing them to default in greater numbers, poorer members disproportionately bear the brunt of decreases in share value, effectively subsidizing the wealthy with the eroding value of their share capital. In effect, FSAs become an implicit regressive tax vehicle, redistributing wealth from the poor to the rich due to the social costs inherent to denying loans to ones friends and neighbors and the fact that such costs typically increase with the power and wealth of the prospective borrower. This effect is magnified by the externality inherent to FSA lending decisions, wherein credit committee members personally incur the social costs of rejecting loan applicants but bear only a fraction of the costs of extending loans likely to prove unprofitable.

3.4 Conclusion

Unlike canonical models that paint an overly optimistic picture of the potential of MFIs to thrive in traditional communities by exclusively highlighting their informational advantages, we introduce the common features of patronage and favor-peddling into our model to explain the dismal financial performance of FSAs. Where individuals known to be in positions of privilege will invite costly retribution from friends and neighbors if they neglect to share the benefits, or could provide favors that may yield future dividends, the advantages of low information asymmetries are likely to be dampened. The irony is that the same high degree of socialization that confers informational advantages on traditional societies also breeds incentives for patronage and favor-peddling.

We show that where a culture of patronage exists, the consequent nonmaterial incentive additionally faced by credit providers causes them to relax their screening and enforcement intensity to the financial detriment of the organizations they serve. As the social costs of rejecting wealthy applicants are likely to be higher, the wealthy are particularly favored and may even be allowed to default without fear of sanction. We invoke this dynamic to explain the dismal financial performance of FSAs in Kenya as documented by Osterloh (2003).

By requiring credit committee members to bear the full burden of the social costs of screening applicants and sanctioning defaulters while financial benefits are spread out evenly across the membership, the structure of FSAs renders them particularly vulnerable to the provision of underperforming loans in the name of patronage. In an analytical analog of Osterloh's empirical evidence, we show that credit committees are induced to offer nonperforming loans to the wealthy that are indirectly paid by the eroding share value of the poor. As FSAs are targeted mainly toward poor communities, the fact that the poor might be induced to place their meager savings into a scheme that ends up swallowing their wealth would be unfortunate.

This evidence calls for a critical reevaluation of FSA design, as well as mechanisms of microfinance provision more generally. Furthermore, it cautions that a failed microfinance delivery mechanism is not simply a sub-optimal outcome but could quite easily result in perverse consequences that leave the intended beneficiaries worse off than they initially were. Because the effectiveness of these institutions is highly contingent on the social context in which they operate, and because their failure has repercussions for poor and vulnerable members, the design of microfinance delivery mechanisms requires a detailed and nuanced understanding of the specific context in which they are to be implemented. It must be remembered that while the bonds of friendship can facilitate the provision of informal loans, the converse is oftentimes true: offering cheap or free loans can secure friendship.

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CHAPTER 4

4 IMPERFECTIONS IN MEMBERSHIP BASED ORGANIZATIONS OF THE POOR: An Explanation for the Dismal Performance of Kenya's Coffee Cooperatives

4.1 Introduction

Promoting the capacity of the poor to mobilize for collective action is increasingly championed as an effective mechanism to empower the poor and amplify their ability to leverage resources for their benefit. The increasing attention paid to the catalytic role that membership based organizations of the poor can play in improving the welfare of the poor is a natural and complementary extension to the recent emphasis on decentralization of development services and on the positive role social capital can play to stimulate rural, traditional economies.

While a general consensus exists that empowering the poor to take a proactive role in their development should be a central pillar of development efforts, it is not as clear that membership based organizations are always the most effective means to achieve such ends or that they necessarily improve the welfare of their members. Numerous studies have documented cases in which collective organizations with a development mandate have failed to meet their stated objective, at times even leaving members worse off (Gugerty and Kremer 2004, Morduch 1999, Rahman 1999). Drawing from such experiences, a nascent literature now studies how the very act of creating a membership based organization can give rise to incentives that work against the original intended goals of the organization (Gugerty and Kremer 2004, Stiles 2002, Howes 1997).

This paper highlights this issue from the perspective of the smallholder coffee sub-sector in Kenya. We hypothesize that the marked deterioration of coffee cooperatives in Kenya can be partly explained by institutional changes in cooperative organization that gave full ownership and administrative control to members. The rules by which cooperatives' memberships elect their leaders, and the lack of accountability among the leadership, lends itself to capture by corrupt individuals whose rent-seeking predictably reduces members' efficiency and welfare.

Before the advent of structural reforms in the nineties, coffee was Kenya's top foreign exchange earner. At that time the government played a key role in regulating the activities of the nation's cooperatives. Liberalization brought with it a withdrawal of government involvement in cooperatives and a series of reforms which culminated in the new Cooperatives Act of 1998. By this act, the government gave up its policy making jurisdiction over the economic activities of cooperatives. Grower-members have fully owned and managed their cooperatives ever since. Concurrently, payments made to coffee growers plummeted and the coffee smallholder industry found itself mired in increasing levels of corruption, political opportunism and gross mismanagement.

In a similar vein to Gugerty and Kremer (2004), we argue that the regulation change that made members fully responsible for running cooperatives changed the incentive structure facing members and officials in a way that counteracted the expected benefits to collective organization. More specifically, we contend that unregulated access to cooperatives' coffers now enjoyed by elected cooperative officials significantly increased the rents that self-interested officials could expect to extract from the treasury. Consequently, and as widespread anecdotal evidence confirms, the process of electing a governing board from among the membership became subject to manipulation by rent-seeking candidates.

Based on this premise, we model the susceptibility of cooperatives to capture by corrupt and opportunistic members who would extract rents from collective earnings for their own benefit. We show that in the absence of formal rules to credibly punish bribery, members of a cooperative can rationally elect an official in open democratic elections who they know will reduce the returns they would otherwise receive from the cooperative. The model, briefly summarized, works as follows. Due to the large rents a corrupt candidate can expect upon winning office, he is willing to buy the minimum required votes to guarantee an election victory. As an honest candidate will not siphon cooperative profits for personal gain, she cannot afford to exchange favors for votes and is thus at a competitive disadvantage. Voters, on the other hand, will accept any bribe that is at least equal to the expected loss in welfare they will sustain should their vote swing the election outcome. As the number of voters increase, the likelihood of being a swing voter decreases making it increasingly cheaper to buy votes and therefore more likely that a rent-seeking candidate will buy his way into office.

The very nature of corruption, however, makes it a tricky task to collect the requisite data accurately so as to undertake a robust empirical test that captures the presence of rent-seeking activity and its effect on the welfare of members. As such, we take a somewhat indirect approach and test instead the validity of our model's implications. Drawing on evidence from the smallholder coffee sub-sector in Murang'a District, Kenya, we show that contrary to widespread belief, smaller cooperatives are more efficient than their larger counterparts, a result that finds direct support in the model. We also find that attributes of the cooperative indicative of rent-seeking activity, such as performance measures and members' perceptions, are directly related to farm level technical-efficiency. The implication is that changes to cooperative voting procedures could reduce corruption and increase productivity and rural incomes.

The rest of the chapter is structured as follows: Section 4.2 gives a brief description of the institutional environment within which the coffee cooperatives function and provides the contextual justification for the assumptions used in the model. Section 4.3 briefly summarizes the pertinent literature and discusses this paper's contribution. In Section 4.4 we build a model that captures the essence of the problem. Section 4.5 introduces the data and offers empirical evidence to support our claims. A discussion of our findings concludes the paper in Section 4.6.

4.2 Coffee Cooperatives in Kenya

4.2.1 Organizational Structure

Since its introduction as a cash crop in the early 1900s, coffee has traditionally been the backbone of Kenya's rural highlands economy. Coffee was the nation's top foreign exchange earner from independence in 1963 until it was surpassed by tourism in 1989. Since then, national coffee earnings have steadily declined and currently rank fourth after tourism, tea, and horticulture (Karanja, 2002). From its heyday in the 1970s and 1980s, when international coffee prices were high and the government regulated production and marketing systems, Kenya's coffee sector now finds itself in crisis.

Small-scale production systems dominate the Kenya agricultural sector, accounting for approximately 60 percent of marketed output. The coffee sector is particularly affected by the fragmented nature of small-scale production with over 75 percent of the land under production controlled by smallholder farmers.[32] For this reason, the smallholder coffee sector has traditionally been organized into cooperatives in order to facilitate regulation and to improve the effectiveness and

[32] Any farmer with less than five acres of land under coffee production is classified as a smallholder grower.

efficiency of coffee production, marketing and the provision of key inputs such as fertilizers, pesticides, credit and extension services.

The socio-economic landscape at the time, combined with the physiology of coffee, initially justified such an organizational structure. As soon as coffee cherries are harvested they begin to ferment, a process that affects the quality of the bean. This requires the cherries to be pulped as soon as possible after they are picked. Pulping stations are thus needed to be sufficiently close to the farmer in order to assure prompt delivery. As pulping stations involve large setup costs that are prohibitive to individual small growers, and as one pulping station can cater to hundreds of growers, it made sense to pool their resources together within a cooperative framework to share the setup costs and enjoy the resulting local economies of scale. These pulping stations are called "factories". A single cooperative can encompass multiple factories.

All smallholders were and continue to be legally bound to market their coffee through cooperatives. Each cooperative controls a loosely defined catchment area.[33] All coffee growers whose land falls within a particular catchment must register as a member with their respective cooperative. Conditional on cooperative membership, the choice of which factory to deliver one's coffee to is more flexible, being a function of proximity and political considerations[34]. Essentially, the farmers' only task is to grow the coffee, and deliver their product (coffee cherry) to their choosen pulping station. In return, growers are paid twice annually. The first payment comes at the beginning of the season (pre-harvest) as part of what is called Coffee Advance Payments (CAPS). CAPS are often calculated as the lowest expected payment per

[33] By loosely defined, we mean that no legally defined boundaries enclose the catchments. A combination of natural borders (rivers, main roads, etc.), political boundaries (location, sub-location, etc.), and initial distribution of households across cooperatives at the time of their conception forms the basis of generally accepted informal boundaries that define catchments.

[34] While in theory, one is free to market through their factory of choice, switching pulping stations is generally frowned upon and is likely to invite sociopolitical retribution that limits one's practical choices.

kilo for the coming season. At the end of the season, after coffee sales have been realized and all requisite deductions taken, the remaining amount is then distributed to farmers as the second payment.

At the factory, the cherries from each grower are weighed, recorded and then put through the initial phase of processing. Primary processing involves the sorting and pulping (removing the coffee bean from its outer fruit) of the cherry. The beans are then laid out to dry and thereafter stored in the form of ”parchment coffee”, awaiting transportation to millers for secondary processing. Millers hull and clean the parchment coffee to produce what is known as green (raw) coffee. They then sort and grade the coffee by size and quality, bag it according to expected value, and send it forward to the coffee auctions through which, by law, all Kenyan coffee must be sold. The coffee in each bag belongs to one particular factory within the cooperative. This allows for inter-factory price variation that takes into account variation in quality and thereby reduces the potential for moral hazard at the larger cooperative level.[35]. The transaction between buyer and seller at the auction is often carried out on behalf of the cooperative by an agent hired by the miller.

Once the coffee is sold, the miller deducts his share of the commission and sends the rest to the cooperative. The larger cooperative management then deducts all of its operating costs including loan repayments, services and maintenance expenses, and other fees. The deductions are made from factory kitties as a proportion of each factory’s membership to the total (i.e., uniform deduction per cooperative member). The remaining funds are then distributed to factory managers who further deduct the

[35] Each factory pools their coffee cherry together such that each farmer’s contribution is indistinguishable. Individual growers may therefore have the incentive to shirk on efforts to produce high quality coffee and free ride on the efforts of others within their factory group. Factory specific pricing limits free-riding to the factory level.

costs of factory level operations then distribute the remaining money to farmers as their second annual payment.

4.2.2 Institutional Evolution - the Reform Period

Reacting to pressure from international donors in the late eighties and early nineties, the government enacted a series of reforms aimed at the eventual liberalization of the Kenyan economy. As Kenya's main foreign exchange earner, the coffee sector was a major target for reforms. In October 1992, the Coffee Board of Kenya (CBK) was authorized to conduct the Nairobi coffee auction in dollars and was later granted the permission to also pay farmers in dollars. This lifted the implicit tax burden, estimated at 29%, that farmers previously faced due to an overvalued Kenyan Shilling (Ephanto, 1993). Changes were also made to improve the system by which growers received revenues generated from sales of their coffee. The new system eschewed the previous practice of pooling payments across time and farmers in order to reduce price variation across time and price spread between growers. Under the new "direct-payments" scheme, growers could now receive payments for sales of their own coffee on a weekly basis, thus improving their liquidity and stimulating incentives for the production of quality coffee.[36]

Further reforms included the licensing of four new commercial millers in 1993 thereby dismantling the monopoly in the milling sector previously held by the Kenya Planters Cooperative Union (KPCU). In 1996, efforts to stimulate production changed the rules governing the licensing of coffee growers. The threshold acreage under coffee required for a grower to be registered as an individual planter (rather than a smallholder) was reduced from 20 to 5 acres. The idea was to improve incentives for

[36] The benefits to this policy did not accrue directly to smallholder farmers as the pooling of their payments continued at the cooperative level.

higher quality by increasing the number of growers benefiting from the "direct-payments" scheme.

The policy change of particular interest to the hypothesis advanced in this paper involves the new Cooperatives Act of 1998 which gave farmers complete autonomy over the activities of the cooperative. Prior to 1998, the government played a major role in the running of cooperatives through the office of the commissioner of cooperatives, and their field-agents, led by district cooperative officers (DCOs). Although members owned the cooperatives and elected their board members, the commissioner's office had powers to dissolve the governing board, call for fresh elections or directly appoint a care-taker committee. DCOs were also involved in the vetting of candidates for management positions. More importantly, DCOs were counted as extra-official members of the governing board and were mandatory signatories to all cheques and withdrawals made by the management. The commissioner's office was also the sole agent authorized to audit society accounts.

Under the new policy, government no longer had any policy making jurisdiction over the economic activities of cooperatives and took on a minimal advisory role. Under the Cooperatives Act of 1998, cooperative board members were free to conduct elections as they pleased, make hiring decisions of their choice, and contract, if they so wished, their auditors of choice. DCOs were no longer required to co-sign on any financial transactions. Extension services, previously provided through the Ministry of Agriculture, were also withdrawn. In effect, cooperative board members now had complete authority over the running of cooperatives without the oversight of a regulatory agency with any teeth to prosecute malfeasance. These changes increased the incentives to rent-seeking by providing board members with unfettered access to cooperative coffers without the fear of prosecution.

Thereafter, payments to growers plummeted amid growing political opportunism at the grassroots level that damaged farmer morale and raised the level of corruption and mismanagement in cooperative administration. Through the years, a general decline in the attendance of annual general meetings (AGMs), called to elect board members, ensued as growers began to be disillusioned by the electoral process. Widespread belief has it that a majority of those who continued to attend AGMs are bribed for a pittance. Indeed several of the growers we talked to unabashedly acknowledged that they indeed had accepted bribes of Sh 100 (roughly, $1.40), or offerings of the local brew on election day to vote a particular candidate. In this way, corrupt board members entrench themselves and embezzle the proceeds of coffee sales, further eroding the ailing cooperatives.

4.2.3 Weak International Markets Are Not the Key Factor

In this paper, we argue that much of deterioration of the coffee cooperatives can be attributed to institutional changes that culminated in complete unregulated farmer autonomy over all aspects of cooperative management. Anticipating critics who may instead argue that declining international coffee prices explain the bulk of Kenya's smallholder coffee crisis, we provide some evidence that other key coffee exporting countries, similarly affected by low coffee prices, were not as adversely affected as Kenya. This difference, we claim, is the result of the poor sequencing, design, and implementation of institutional reform in Kenya's coffee sector.

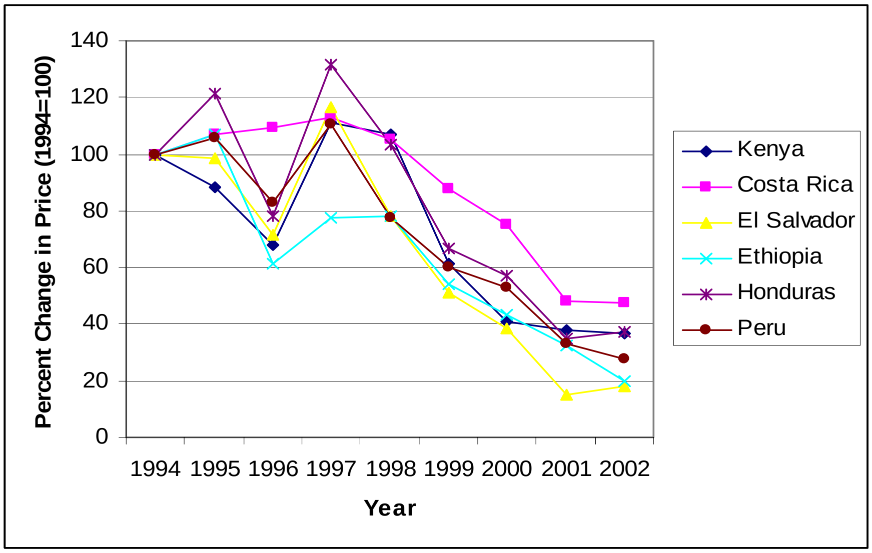
The three figures below compare various indicators of the performance of Kenya's coffee industry against five other coffee exporting nations that principally grow the high quality Arabica bean. For ease of comparison, we standardize all 1994 figures to parity at one hundred, and examine the relative trend of changes in the indicators vis-à-vis their 1994 position. The price data was deflated to the 1994 level to take control for inflation. To better inform the comparisons, Table 4.1 below presents the 1994 levels data for the selected indicators (yield, production and price) across the six countries.

Table 4.1: 1994 Levels for Coffee Indicators of Select Exporting Countries

	Kenya	Costa Rica	El Salvador	Ethiopia	Honduras	Peru
***Yield (Hg/Ha)**	5,035	13,582	8,344	8,280	7,050	5,562
***Production (Mt)**	79,900	147,998	140,534	207,000	126,182	91,340
****Price (US cents/lb)**	251.4	137.2	194.6	184.3	163.1	97.9

Source: * Food and Agriculture Organization. ** International Coffee Organization

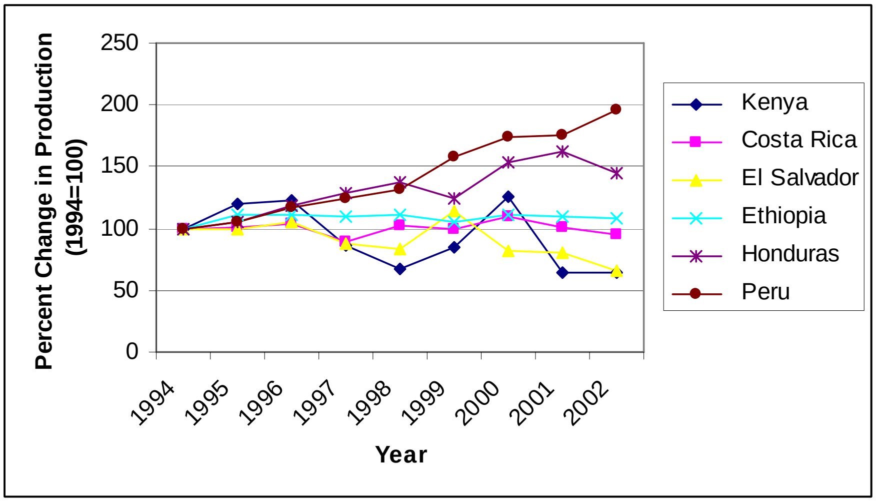
While Kenya posts the lowest total production and average yield of the six countries, it received the highest price for its coffee exports, a testament to the renown premium quality of its coffee. Peru on the other hand, second only to Kenya in its low yield and production, also posted the lowest price. Of the six nations, Ethiopia had the highest total production in 1994, almost three times more than that of Kenya. Costa Rica, for its part, posted significantly higher yields than the rest.



Source: International Coffee Organization (ICO) Statistics

Figure 4.1: Green Coffee Prices for Select Exporting Nations

Figure 4.1 compares relative changes in the average price paid for green coffee across the chosen countries. There has been a general downward trend in prices and all nations received a lower return for their coffee in 2002 than in 1994. Kenya's coffee in 2002 fetched approximately 35 percent of the price that it did in 1994. Costa Rica and Honduras, whose 2002 coffee prices were approximately 47 and 37 percent of their 1994 level respectively, were the only countries whose coffee prices fell less that Kenya's. Both Ethiopia and El Salvador witnessed close to an 80 percent deterioration in the real price paid for the coffees between 1994 and 2002, while Peru faced a 70 percent drop.

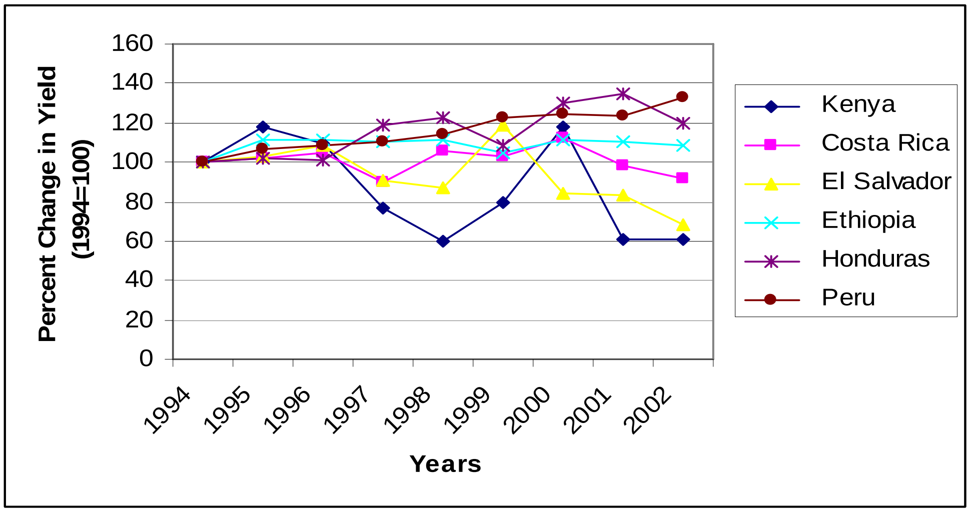


Source: Food and Agriculture Organization (FAO_ Statistics)

Figure 4.2: Coffee Production for Select Exporting Nations

Despite the steep price decrease, Peru posted an impressive growth in total production of close to a 100 percent between 1994 and 2003 (Figure 4.2). Kenya, on the other hand, which had relatively modest price decreases, witnessed a decrease in output to 65 percent of its 1994 level in 2002. This significant contraction in output was mirrored only by El Salvador, which also posted the largest decrease in its prices.

Changes in average yields, another indicator of sector performance, further highlights the stagnation of Kenya's coffee industry. Despite posting the lowest relative yields in 1994 (See Table 4.1), it also posted the largest decrease in yields (Figure 4.3). In 2002, Kenya's coffee yield was estimated to be only 60 percent of its 1994 level. Meanwhile, Peru and Ethiopia, both experiencing a relatively larger decline in price than Kenya, posted gradual and consistent increases in yield.



Source: FAO Statistics

Figure 4.3: Coffee Yields from Select Exporting Nations

These data indeed suggest that declining world prices for coffee cannot fully explain the collapse of the Kenyan coffee industry. Other nations, similarly or worse affected by low prices, were not only able to maintain their aggregate output and average yields, but were in most cases able to increase yields and boost production. This indicates that additional circumstances specific to the Kenyan coffee industry must have amplified the negative consequences of the unfavorable international market.

Moreover, the preceding figures are national aggregates and therefore do not present an adequate picture of the plight of the smallholder sub-sector. In the 1990s, the smallholder share of national coffee output was just below 60 percent on average. However, while production in the plantation sector decreased by around 39 percent in the last decade, the decline in smallholder farms was around 47 percent during the same period (Karanja et al., 2002). Furthermore, smallholder yields are far less than estate yields. Table 2 below presents a comparison of smallholder and estate production and yields through the 1990s.

Table 4.2: Clean Coffee Production and Yields in Kenya: 1991/92 - 2000/01

	Production (MT)			Yield (kg/ha)		
Year	**Estates**	**Smallholder**	**National**	**Estates**	**Smallholder**	**National**
1991/92	37,520	51,977 (58%)	89,497	987	439	565
1992/93	32,781	42,426 (56%)	75,207	859	352	474
1993/94	33,037	39,747 (54%)	73,516	860	324	457
1994/95	32,795	62,567 (65%)	95,806	855	510	595
1995/96	40,109	56,881 (58%)	97,576	1,045	464	606
1996/97	29,737	38,261 (56%)	67,997	748	312	419
1997/98	22,061	32,981 (60%)	55,042	555	269	339
1998/99	28,700	39,400 (58%)	68,100	684	307	400
1999/00	38,500	62,200 (62%)	100,700	916	485	592
2000/01	26,900	24,800 (48%)	51,700	640	193	304
Average	**32,240**	**45,124 (58%)**	**77,514**	**815**	**365**	**475**

Source: Karanja et al. 2002

For the smallholder coffee farmer in Kenya, the combination of these three trends - declining prices, output and yields - contributed to a significant deterioration in the welfare of growers who for decades had depended on coffee incomes as a secure and relatively lucrative livelihood.

4.2.4 Institutional Apparatus Undermining Cooperative Efficiency

In this sub-section, we discuss two features of the institutional environment in which cooperatives operate that undermine cooperative efficiency and facilitate rent-seeking. These features also provide the justifications for assumptions central to the model that we build in section 4.4.

4.2.4.1 Perfect Vote Signaling

All of the nine coffee cooperatives we visited conducted their elections in the traditional fashion of *mlolongo*. *Mlolongo*, literally translated as "line-up", describes the method of having voters line up behind their preferred candidate with the candidate having the longest line winning the election. Clearly, the consequence of such a method is that everybody knows who everybody else voted for. This facilitates vote-buying by offering a free and perfect enforcement mechanism for candidates. A voter who might otherwise simply accept the bribe and thereafter vote independently under a secret-ballot regime must now consider the cost of near-certain punishment should he deviate. A secret ballot system for democratic majority-rules elections weakly dominates a perfect signaling *mlolongo* approach. *Mlolongo* provides the enforcement mechanism a rent-seeking candidate could use to advance his objective, undermining grower productivity in the process.

4.2.4.2 Local Monopsony Power

Kenyan law requires all coffee growers with less than five acres of land under coffee to market their output solely through cooperatives. Furthermore, due to poor transportation infrastructure and the need to pulp coffee cherry very soon after it is picked in order to avoid quality-reducing fermentation, each cooperative has a legally defined catchment area. Making it illegal for cooperatives to buy coffee from growers outside their particular catchment area effectively grants cooperatives local monopsony protection and shields them from potential competition. The logic of organizing to attain an input-output mix at the bottom of the long run average cost curve assumes a competitive market that requires collective cooperation among small producers who intend to be competitive. Yet, protecting such organizations against competition discourages them from being efficient as there are no longer constraints that force them to maximize the benefits to cooperation. The very motivation for organization, to attain optimal scale in the face of competition, loses its salience under monopsony. Instead, local monopsony protection empowers rent-seeking managers to exploit their growers by forcing members to accept payments lower than the counterfactual competitive equilibrium price.

4.3 Literature Review

Several authors have investigated the cause and consequence of 'election capture' by rent-seeking individuals in various settings. Besley and Pratt (2004) develop a model in which government officials can bribe media outlets, who are privy to signals of the officials' type and can convey this information to the voting public, in order to suppress any negative information. Given the degree of commercialization of the media, the level of transactions costs between government and the media, and the rents to holding political office, an equilibrium of media capture and thus control of political outcomes can result. Besley and Burgess (2002) also use the media as a source of information that can force governments to be more accountable by creating a better informed constituency. The basic idea in these models is that voters who have more accurate knowledge of candidates' positions and policies are more likely to elect officials who are more responsive to their collective needs. This paper differs by showing that where candidates can bribe voters directly, a corrupt elected leadership equilibrium can occur even when voters have full knowledge of the candidates' types. Put differently, our model relaxes the informational assumptions of Besley and his co-authors while achieving similar results.

Member heterogeneity is often highlighted as a reason why collective agreements break down. Bardhan and Singh (2004), for example, investigate the relationship between the likelihood of cooperation and the level of inequality in the distribution of private assets. They show that while infinitely repeated games supported by trigger strategies can sometimes overcome moral hazard problems, increasing levels of within-group inequality reduces the degree to which cooperation can be sustained. In a paper that is similar in focus to ours, and whose framework we borrow, Banerjee et al. (2001) present a theory of rent-seeking in sugar cooperatives whereby differences in the control rights of cooperative management favoring larger land owners and the homogenous pricing of cane to all farmers leads to inefficiency.

In this paper we argue that even within a homogenous population facing perfect information, corruption can still thrive. Herein lies the significant departure of this paper from the extant literature. The literature has thus far overlooked how the very act of creating a membership based organization (MBO) can give rise to incentives that result in the differentiation of otherwise homogenous populations. Leadership opportunities that favor those with managerial skill, entrepreneurial proclivity, political finesse, etc. provide members endowed with the requisite aptitudes the opportunity to advance their personal agendas. As the returns to leadership or management positions grow, the incentive for rent-seekers to manipulate MBO elections in their favor also increases. Once elected, they can then exploit the situation, doing just what is necessary to placate members while maximizing personal benefit.

In our model, unlike preceding ones, the “elite” are ex-ante indistinguishable among the group but benefit as a result of the process that triggered their latent, context-specific (and in this new context, valuable) endowments that allows them to manipulate the process to their benefit making them ex-post “elites”. This occurs in spite of complete information for all group members.

Following Okada (1993), we use an n-person prisoners’ dilemma structure to investigate the possibility of cooperation among homogenous, fully informed and self-interested individuals. The institution that we model is based on the coffee cooperatives in Kenya but is easily generalizable to most producer organizations owned by members and managed by a board of directors democratically elected from the membership.

4.4 Model

4.4.1 Members

The cooperative is defined as a provider of intermediary services for *N* member growers in its proximity. All *N* growers in the area must channel their output through the cooperative, which has the technology to extract coffee beans from coffee cherry. Participation is exogenous and there is no competition. We assume homogeneous members who have similar endowments and are subject to the same constant returns to scale production technology. Coffee cherry is produced from land and labor, a variable input that is available at a fixed wage. We denote l as the labor input per unit land, and $f(l)$ as the cherry production function per unit area planted in coffee. $f(l)$ is a twice differentiable and strictly concave function that satisfies $f'(l) > 0$ and $f''(l) < 0$ for all $l > 0$. If p represents the price growers receive for coffee, then each member's problem is given by $\underset{l}{MAX}\ pf(l) - wl$. Let l^* satisfy $pf'(l^*) = w$, reflecting the optimal labor input at the price p.

4.4.2 Cooperative

The cooperative takes the output provided by all members, converts coffee cherry into coffee beans and sells it on the market at the competitive price p^*. For simplicity, we assume a one to one conversion of cherry to bean[37]. As such, total sales for the cooperative are given by $Q \equiv Nf(l)$. Letting F denote the fixed operating costs faced by the cooperative, and $v(Q) = vQ$ represent its variable costs, the total profit is given by

$$\Pi = [p^* - v - p]Q - F . \qquad (1)$$

[37] The actual mean conversion rate of coffee cherry to coffee beans is given at 7:1

The price, p, paid to members is set at the discretion of an official elected by the members in a democratic process.[38]

4.4.3 Voting

We present two candidates who compete in an election to manage the cooperative. We assume one candidate to be benevolent and his opponent to be a corrupt opportunist. The benevolent candidate upholds the spirit of cooperation and chooses p to maximize farmer payments. The corrupt candidate, on the other hand, is a rent seeker who chooses p to maximize his own benefit and may offer bribes to members in an effort to buy their vote. We assume members to be rational and to perfectly observe the type of each candidate prior to casting their vote. A candidate wins an election if he secures a majority of the vote. We now show that there exist circumstances in which rational voters will elect the corrupt candidate who they know will skim money from the cooperative and thus depress the price p that they receive for their cherry.

4.4.4 The Benevolent Candidate

As the benevolent candidate maximizes farmer payments subject to the profit constraint, he will set p to maximize aggregate social profit which is given by $N[pf(l) - wl]$. It follows that the efficient price is such that $p = p^* - v$ i.e., all

[38] As formulated, we do not allow cooperatives to channel any of their revenues into productive investment. Accommodating investments would require a dynamic model. This would raise the possibility of corrupt officials offering higher payments than benevolent officials by splitting funds targeted for investments between personal rents and increasing payments to pacify members and win their support. Nevertheless, unless corrupt officials could manipulate member information on the expected returns on investments, the optimal distribution of revenues between payments and investments under a benevolent candidate should continue to hold even under a corrupt leadership. As such, limiting ourselves to a static model free of investment options does not weaken our results. Furthermore, for the specific context of Kenyan Coffee Cooperatives, abstracting from investment options is not far removed from reality. None of the cooperatives visited show any evidence of a tendency to invest.

profits will be distributed equally across members. Should the members elect the benevolent candidate, they are assured of receiving this price.

4.4.5 The Corrupt Candidate

Given that the corrupt candidate is an opportunist and would like to use the power of elected office to capture more than his fair share of the collective profits, the only way he can extract rents is to reduce the price *p* offered to growers below the socially optimal price set by his opponent and to retain the remaining profits.[39] However, in order to win a majority of the votes, the corrupt candidate must offer voters an incentive to induce them into accepting the lower product price they know he will set. We model this incentive by allowing the corrupt candidate to offer bribes to voters in return for their vote. The bribing mechanism that we employ is a one-shot homogenous offer given simultaneously and independently to voters who must decide to reject or accept the offer without consultation with other voters or any knowledge of their decisions. The setup is akin to an n-player noncooperative prisoner's dilemma and will be shown to result in a similar coordination failure in which equilibrium outcomes leave all players worse off than they would otherwise be if they jointly chose the socially efficient course of action.

Let $\alpha > 0$ denote the minimum bribe the candidate must pay to any one voter to secure his or her vote. Let n = {1,2,…,N} be the set of members. Every member i $\in$ N, once offered a bribe, can choose either to accept the bribe $\{A_i\}$ or to reject it $\{R_i\}$. The payoff to member i is not only a function of his decision, but also of the decisions of all other members in the cooperative. Let the payoff to member *i* be represented by the function

[39] Only by reducing *p*, can the cooperative itself make positive profits. As we assume that the cooperative's elected official is fully in charge of the treasury, any positive profits will be siphoned off by a opportunistic, rent-seeking candidate.

$$g_i(b_i, h), \quad b_i = A_i \text{ or } R_i, \quad h = 0, 1, \ldots, N-1 \tag{2}$$

where b_i is player i's action and h is the number of other members who *reject* the bribe offer. The co-op elects the candidate receiving a majority (i.e, at least N/2) votes.[40] We sometimes omit the subscripts indicating players if no confusion arises.

Let p_A denote the price paid to growers when a majority accept the bribe and the corrupt candidate is voted in and p_R be the price paid when they reject the bribe and elect the benevolent candidate. Note that $p_R = p_A - v$ is the socially efficient price and thus $p_R > p_A$ and $f(l_R) > f(l_A)$. The following characterizes all possible outcomes given various combinations of the players voting decisions.

$$\forall h \geq N/2 \quad \begin{Bmatrix} g(R,h) = p_R f(l_R) - wl_R & \equiv G(R,R) \\ g(A,h+1) = p_R f(l_R) - wl_R + \alpha & \equiv G(A,R) \end{Bmatrix} \tag{3}$$

$$\forall h \leq N/2 - 1 \quad \begin{Bmatrix} g(R,h) = p_A f(l_A) - wl_A & \equiv G(R,A) \\ g(A,h+1) = p_A f(l_A) - wl_A + \alpha & \equiv G(A,A) \end{Bmatrix} \tag{4}$$

$G(b_i, M)$ is a simplified version of the payoff function where M=R if $N/2$ members or more reject the offer of α, and $M = A$ if less than $N/2$ reject it. Figure 4.4 below presents a graphical representation of the payoff functions and their relative ranking.

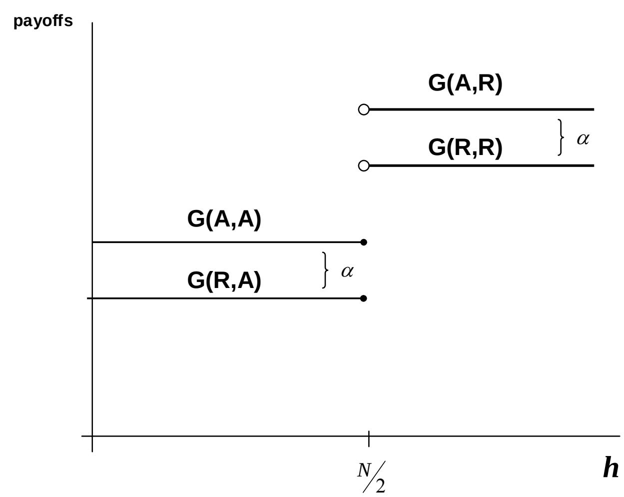


Figure 4.4: Individual Payoffs as a Function of Aggregate Voting Patterns

[40] For simplicity, assume that if the vote is tied, the corrupt candidate wins.

Due to the fact that this is an election game with majority rules, outcome/payoffs being different depending on who wins, the n-person prisoner's dilemma is not defined across all strategy sets. Around the threshold the otherwise dominated strategy dominates. It is clear from Figure 4 that A is clearly a dominant strategy in almost all cases. This regularity breaks down however, when $h = N/2$. More formally, $g(A, N/2) < g(R, N/2)$, but $g(A,h) > g(R,h)$ for all $h \neq N/2$.

4.4.6 Equilibrium Outcomes

We first look for the *pure strategy Nash equilibria* (PSNE) that will result in the corrupt candidate being elected. It is straightforward to see that only two PSNE exist, one in which all individuals accept the bribe, i.e., $b_i = A$ for all $i \in N$, and the other which has exactly one more than half of the membership rejecting the bribe, and the rest accepting it, i.e., $b_i = R$ and $h^* = N/2 + 1$.

Nevertheless, these results are not very interesting as the likelihood that an individual accepts a bribe is independent of how much the bribe is, or of other parameters such as the size of the cooperative that are likely to be taken into consideration in the decision making process. As the probability that one is a pivotal voter increases, and as the opportunity cost of electing the corrupt candidate increases relative to the bribe price, one would intuitively imagine that the second equilibrium, in which the minimum number of voters needed to elect the benevolent candidate reject the bribe, is more likely to result. Furthermore, as the corrupt candidate is footing the bill for the bribe price, it would be reasonable to assume that he would want to make the smallest total payoff sufficient to win the election. As such, he would only want to pay off exactly half the voters.

To find the bribe price per voter that is needed to get exactly half the membership to accept the bribe, we look for a *mixed strategy nash equilbria* (MSNE) that has the probability of rejecting a bribe $t \in (0,1)$ as a function of α ,p_A, p_R, and N. This will allow us to conduct comparative statistics so as to identify the set of conditions under which a corrupt candidate is likely to be elected. To find the MSNE, it has to be that the rejection possibility is determined such that every player is indifferent as to rejecting or accepting the bribe if all other players follow the solution strategy.

Let $b = (b_1,...,b_N)$ be any MSNE point where $b_i = [t,(1-t)]$ for all $i \in N$. Then, by definition of MSNE, for all $i \in N$ it must be that,

$$g_i\left(b^*/R\right) = g_i\left(b^*/A\right) \tag{5}$$

where b^*/R and b^*/A are the strategy combinations obtained from b^* if b_i^* is replaced with $b_i=R$ and $b_i=A$ respectively.

When $b_i=R$,

$$g_i(R,h) = \begin{cases} G(R,R) & \forall\ h \geq N/2 \\ G(R,A) & \forall\ h \leq N/2 - 1 \end{cases} \tag{6}$$

When $b_i=A$,

$$g_i(A,h) = \begin{cases} G(A,R) & \forall\ h \geq N/2 + 1 \\ G(A,A) & \forall\ h \leq N/2 \end{cases} \tag{7}$$

Let $J = \binom{N-1}{h} \cdot t^h (1-t)^{N-h-1}$ be the binomial distribution for the probability t of h other members rejecting the bribe out a total $N\text{-}1$ possible rejections. Then equation (5) can be rewritten as

$$\sum_{0 \leq h \leq \frac{N}{2}-1} J \cdot G(R,A) + \sum_{\frac{N}{2} \leq h \leq N-1} J \cdot G(R,R) = \sum_{0 \leq h \leq \frac{N}{2}} J \cdot G(A,A) + \sum_{\frac{N}{2}+1 \leq h \leq N-1} J \cdot G(A,R) \tag{8}$$

Setting $B = \binom{N-1}{N/2} t^{N/2} (1-t)^{N/2-1}$ and rearranging, we find

$$\sum_{0 \leq h \leq \frac{N}{2}-1} J[G(R,A) - G(A,A)] - BG(A,A) = \sum_{\frac{N}{2}+1 \leq h \leq N-1} J[G(A,R) - G(R,R)] - BG(R,R) \tag{9}$$

Simplifying further yields

$$B[G(R,R)-G(A,A)] = \sum_{0\le h\le N-1} J\alpha - B\alpha \,. \tag{10}$$

Recall that J represents the probability that h/N members reject a bribe where the a priori probability of an individual rejecting the bribe is given by t. As such, it is clear that $\sum_{0\le h\le N-1} J = 1$, as we are summing all possible values of h across the entire distribution. This leaves us with the following condition

$$B[G(R,R)-G(R,A)] = \alpha^* \tag{11}$$

Equation (11) is key to our model. α^* can be interpreted as the bribe that a candidate must offer in order that no more than $N/2$ members reject it when all members are playing the mixed strategy $b_i = [t,(1-t)]$ for all $i \in N$. It is the amount at which the expected benefit of rejecting the bribe and forming the minimum coalition to block the corrupt candidate from election is at least as large as the gain from deviating.

Expanding equation (11) into its component parts, we have:

$$\alpha^*(p_R, p_A, t, N) = \left(\binom{N-1}{N/2} t^{N/2} (1-t)^{N/2-1} \right) \left[p_R f(l_R) - p_A f(l_A) - w(l_R - l_A) \right] \tag{12}$$

We use this formulation of the of the bribe price to derive the set of conditions under which a corrupt manager equilibrium will arise. We set up the corrupt candidate's problem as

$$\underset{Y,p_A}{Max} \quad Y + p_A f(l_A) - wl_A \tag{13}$$

$$\text{subject to} \qquad [p_R - p_A]Nf(l_A) - F - Y - N/2\,\alpha^* \ge 0 \tag{14}$$

where Y denotes the amount of cooperative profits that the corrupt manager would extort. His total welfare, represented by equation (13) is thus a function of the amount of Y he is able to steal and, as he is also a member of the cooperative, the returns to his cherry production p_A, both variables that he chooses in order to maximize his welfare given the incentive compatibility constraint he faces in equation (14). The constraint is made up of net cooperative profits from coffee sales less fixed costs, the rents captured by the manager, and the aggregate bribe price paid. It reveals the tension that arises from the dual sources of money the corrupt candidate receives. On the one hand, he has an incentive to set the payment p_A for cherry as high as possible as the total output, and thus revenue, is an increasing function of the payment received. On the other hand, a desire to extract the maximum rents means setting *Y* as high as possible. However, it is clear from equation (14) that any marginal increase in *Y* must result in a decrease in p_A. Any equilibrium will necessarily involve positive amounts of both variables. p_A must be positive or no profit will be realized and thus, not only will the corrupt manager have no resources to steal, he also will not recoup his spent bribe funds. However, *Y* must also be positive as the manager would be the sole beneficiary of this income, while the same amount distributed to the membership in the form of a payment increase will generate only a fraction of the welfare to him. Note also that this implies that p_A is strictly less than p_R.

To solve the model we first substitute $\alpha^*(p_R)$ from equation (12) into the constraint. Suppose then that the constraint does not bind. In this case, it must be that all first derivatives are zero. But taking the derivative with respect to *Y* gives 1=0 which is a contradiction. As such the constraint must bind and we can thus solve it for *Y** which yields

$$Y^* = (p_R - p_A)N \cdot f(l_A(p_A)) - F - {}^{N}\!/_{2} \cdot \alpha^*(p_A). \qquad (15)$$

The first term of equation (15) represents the total amount that a corrupt manager would skim off collective profits with the last term accounting for the total bribe price paid. As the corrupt candidate requires 50% of the vote to be elected, he will rationally only buy the minimum necessary for voting. Plugging equation (15) into the objective function, our candidate only has to choose p_A to solve

$$\underset{p_A}{Max} \quad [p_R - p_A]N \cdot f(l_A(p_A)) - F - N/2 \cdot \alpha^*(p_A) + p_A \cdot f(l_A(p_A)) - w \cdot l_A(p_A). \tag{16}$$

Due to the strict concavity of $f(.)$ and $l(.)$, it is clear that the objective function is also strictly concave in p_A and that a solution therefore exists. This, however, simply means that if a candidate chooses to win office by buying votes there will exist a payment level that will allow him to recover the funds he spent to win the election with a positive remainder that he can pocket. However, for a self-interested corrupt co-operative member to make the decision to stand for election, it must be the case that doing so would weakly improve his welfare. This requires that the following condition be satisfied

$$Y^* + p_A f(l(p_A)) - wl(p_A) \geq p_R f(l(p_R)) - wl(p_R) \tag{17}$$

To investigate the likelihood that the above inequality holds, we expand and rearrange it to yield

$$\frac{(p_R - p_A)N \cdot f(l_A(p_A))}{p_R f(l(p_R) - p_A f(l(p_A) - w(l_R - l_A)} \geq 1 + \frac{N}{2}\left(\binom{N-1}{N/2} t^{N/2}(1-t)^{N/2-1}\right) \tag{18}$$

Equation (18) indicates that for a corrupt manager equilibrium to exist, the ratio of the total stolen from collective profits to the welfare loss due to reduced coffee payments has to be larger than one plus the probability of being the swing voter multiplied by the minimum number of voters needed to win the election - in this case *N*/2 . Given that $p_R > p_A$ and thus $l(p_R) > l(p_A)$ and $f(l(p_R)) > f(l(p_A))$, and since $f(.)$ is strictly concave, it must be that

$2(p_R - p_A) f(l(p_A)) > p_R f(l(p_R) - p_A f(l(p_A) - w(l_R - l_A)$ and thus for any $N \geq 2$, the left hand side of equation (18) is greater than one and increasing in *N*. To investigate the behavior of the right hand side, we turn to the Figure 4.5 below.

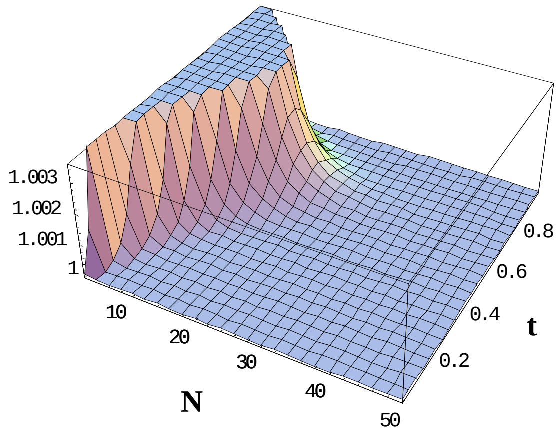


Figure 4.5: Probability of Being a Swing Voter + 1

As Figure 4.5 shows, the right hand side of equation (18) decreases asymptotically towards one in *N* for all possible values of *t*. Given that the left hand side is strictly increasing in *N*, it must be the case that there exists a threshold number of members above which it is always welfare improving for a corrupt candidate to bribe his way into office. Moreover, the benefits to capture increase as the cooperative gets bigger. The threshold, however, is a function of *t* and it is clear from the plot that a value of *t* around its mid-range has a much higher threshold than the extremities of *t*. Figure 4.6 below shows the effect of changes in *t* on the likelihood of being a swing voter holding *N*=10.

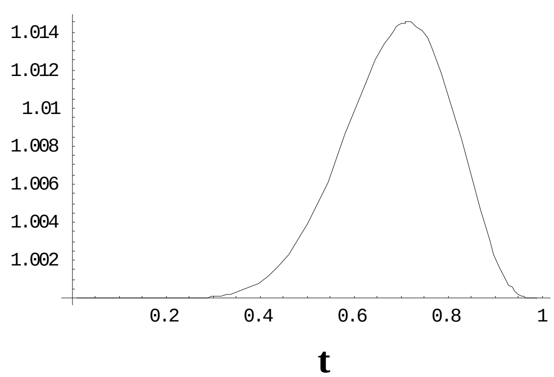


Figure 4.6: Probability of Being a Swing Voter + 1 (N=10)

Interpreting t as a proxy to a norm of integrity or commitment to the collective spirit of the cooperative, Figure 6 is quite telling. Assuming that a value of t close to zero indicates strong norms of integrity where individuals are *a priori* unlikely to accept a bribe and a value close to one indicates a lack of collective commitment. This result then says that the cooperative is more likely to fall into the hands of a corrupt manager where norms are stronger, regardless of which norm prevails. This goes against the dominant view that strong norms are unambiguously more conducive to efficient outcomes in collective settings. Here, a social commitment against corruption actually serves to facilitate personal deviation from the norm. Individuals offered bribes in such a setting perceive that the likelihood of being the pivotal voter is relatively low because others are not generally disposed to accepting bribes. Ironically, because they are then willing to accept a lower price to sell their vote, it becomes easier for a corrupt candidate to buy his way into office.

4.4.7 Comparative Statistics

Having shown that a corrupt manager equilibrium exists and is likely to occur under very general conditions, we now move on to equilibrium price response to changes in key variables. Differentiating equation (16) with respect to p_A gives

$$\begin{aligned} &[p_R - p_A]N \cdot f'(l_A(p_A)) \cdot l_A'(p_A) - N \cdot f(l_A(p_A)) \\ &- N/2 \cdot \alpha^*'(p_A) + p_A \cdot f'(l_A(p_A)) \cdot l_A'(p_A) + f(l_A(p_A)) - w \cdot l_A'(p_A) = 0 \end{aligned} \quad (19)$$

Substituting in $f'(l_A) = w / p_A$ and simplifying yields

$$[\frac{p_R}{p_A} - 1] \cdot w \cdot l_A'(p_A) - \frac{(N-1)}{N} \cdot f(l_A(p_A)) - 1/2 \cdot \alpha^*'(p_A) = 0 \quad (20)$$

where from equation (12),

$$\alpha^*'(p_A) = -\left(\binom{N-1}{N/2} t^{N/2}(1-t)^{N/2-1}\right)\left[f(l_A(p_A))\right] \quad (21)$$

Substituting this back into the first order conditions gives

$$[\frac{p_R}{p_A}-1]\cdot w\cdot l_A'(p_A)-\left\{\frac{(N-1)}{N}+\frac{1}{2}\left(\binom{N-1}{N/2}t^{N/2}(1-t)^{N/2-1}\right)\right\}\cdot f(l_A(p_A)=0\,. \tag{22}$$

While we cannot solve equation (22) explicitly for p_A, we invoke the implicit function theorem that allows us to investigate the behavior of p_A as various parameters change. For simplicity, let $Z(N,t)\equiv\left(\binom{N-1}{N/2}t^{N/2}(1-t)^{N/2-1}\right)$. Totally differentiating equation (22) thus yields

$$w\left(\frac{\partial p_R}{p_A}-\frac{p_R\partial p_A}{p_A^2}\right)l'(p_A)+\left(\frac{p_R}{p_A}-1\right)\partial w l'(p_A)-\partial p_A\left(\frac{N-1}{N}+0.5Z(N,t)\right)f'(l(p_A))l'(p_A)+$$
$$\left(\frac{p_R}{p_A}-1\right)w\partial p_A l''(p_A)-f(l(p_A))\left(\frac{(N-1)\partial N}{N^2}+\frac{\partial N}{N}+0.5\left(\partial t Z^{(0,1)}(N,t)+\partial N Z^{(1,0)}(N,t)\right)\right)=0 \tag{23}$$

As $Z(N,t)$ represents a probability, it is clear that $Z(N,t)\in(0,1)\ \forall\ t\in(0,1)$ and all N>0. However, given the discrete nature of the combinatoric term, the derivative $Z^{(1,0)}(N,t)$ is not defined. We deal with this by using the gamma function which is a generalization of the factorial to real number arguments where $\Gamma(N)=(N-1)!$. This allows us to solve for $Z^{(1,0)}(N,t)$. Appendix 1 provides a more formal definition of the gamma function as well as the derivation of the following results:

$$Z^{(1,0)}(N,t)<0\ \forall\ t\in(0,1) > 0 \text{ and all } N>0, \tag{24}$$

$$Z^{(0,1)}(N,t)>0\ \forall\ t\in(0,{}^{2N}\!/_{3N-2}) \text{ and all } N>0 \text{ and } Z^{(0,1)}(N,t)<0 \text{ otherwise.}$$

With this result we can solve equation (23) to explore a relationship of interest by setting the derivatives of variables we want static at zero and rearranging to attain the solution. As such we are able to get the following results:

$$\frac{\partial p_A}{\partial N}=\frac{-p_A^2 f(l(p_A))\left(1+N^2\right)Z^{(1,0)}(N,t)}{N\left(\left(Np_R w+p_A^2\left(N-1+NZ(N,t)\right)f'(l(p_A))\right)l'(p_A)+Np_A(p_A-p_R)wl''(p_A)\right)} \tag{25}$$

$$\frac{\partial p_A}{\partial t} = \frac{-Np_A^2 f(l(p_A))Z^{(0,1)}(N,t)}{\left(\left(Np_R w + p_A^2\left(N-1+NZ(N,t)\right)f'(l(p_A))\right)\right)l'(p_A) + Np_A(p_A - p_R)wl''(p_A)} \tag{26}$$

$$\frac{\partial p_A}{\partial w} = \frac{Np_A(p_R - p_A)l'(p_A)}{\left(\left(Np_R w + p_A^2\left(N-1+NZ(N,t)\right)f'(l(p_A))\right)\right)l'(p_A) + Np_A(p_A - p_R)wl''(p_A)} \tag{27}$$

Equation (25) describes the effect that an increase in the size of the cooperative has on the payments growers receive for their cherry conditional on a corrupt management. Given the result in equation (24) it is clear that the numerator is positive. Moreover, since we know that $p_R > p_A$, and $l''(p_A) < 0$ by assumption, the denominator is also positive thus yielding a positive relationship between cooperative size and level of payment. This is an interesting result given that we earlier showed that the benefits of capture are also increasing in *N*. Essentially, this results from the fact that each additional member reduces the probability of being the swing voter by larger than $(N-1)/N$ such that the total bribe cost falls despite having to pay more individuals. The corrupt candidate thus distributes the extra slack between slightly increasing the payment to members cherry as well as the amount he siphons such that he maximizes his total gain.

Equation (26) captures the payment response to increases in the *a priori* likelihood that the voting strategy favors accepting the bribe. By equation (24) we know that the relationship will be negative for all $t \in (0, {}^{2N}\!/_{3N-2})$ and positive for all $t \in ({}^{2N}\!/_{3N-2}, 1)$. This result also turns on the direct effect that changes in *t* have on the total bribe price. Where *t* is close to zero, signifying a mixed strategy that heavily favors rejecting the bribe, it is actually much cheaper for the corrupt candidate to buy votes as the likelihood that any individual voter will swing the election outcome is extremely low. As *t* gets larger and the *apriori* likelihood that any one candidate is picked becomes more balanced, the total bribe cost increases due to the heightened possibility that any single voter could affect the election outcome. As such, needing to recoup an increasing cost of victory, the corrupt manager thus reduces the payment he offers members. However, as t approaches one, the falling probability that any individual swings the vote again drops the total bribe price and the payments thus increase.

Equation (27) investigates the relationship between changes in the opportunity cost of labor and payments, a relationship that we find to be negative. If wages were to increase resulting in a shifting of labor away from coffee production and into wage labor, total cooperative output and thus net profits would decrease. Facing a shrinking pie, the manager must thus increase his relative share of the pie to minimize the resulting decrease in the returns to corruption. This result suggests the possibility of a dynamic cycle that can sink a captured cooperative. Suppose relative wages increase as the returns to coffee production decreases. Labor time devoted to coffee would decline and aggregate production would thus fall as would total revenues. To buffer their rents from these cuts, rent-seeking managers lower payments to farmers even further. Farmers can be expected to respond by cutting back further on the labor time dedicated to coffee. The vicious cycle thus continues.

Thus far, the model corresponds well with the general trends in the smallholder cooperative industry. We have shown that under institutional circumstances similar to those that underlie coffee cooperatives in Kenya, corruption can very easily take root among the leadership. Plenty of anecdotal evidence indicates that rent-seeking in cooperatives is indeed widespread. The model implies that rent-seeking results in a drop in payments to farmers and production. With these analytical results in hand, we move on to the empirical analysis and ask how well our model holds up against actual data at the cooperative level.

4.5 Data Analysis

4.5.1. Data

The data were collected over a three month period between November 2003 and February 2004. The effort was part of a larger study of the institutional arrangements in the smallholder coffee, tea and dairy sub-sectors in Murang'a District of Central Kenya, a high potential agricultural area on the eastern slopes of the Aberdare ranges endowed with good soils and favorable rainfall.

In order to capture variation at the institutional level, our sampling method was stratified. We first identified coffee cooperatives, dairy cooperatives and tea factories in Murang'a, collected institutional data at this level, then randomly sampled their members for further in-depth, farm level surveys. About 60 percent of the sample grow coffee, 30 percent tea, and about 70 percent have one or more dairy cattle - with obvious overlaps.

For the purposes of this study, we utilize the sub-sample of households that were affiliated with a coffee cooperative. We picked nine out of a total 19 coffee cooperatives in the District, purposively selecting the cooperatives so as to achieve the greatest variation in spatial coverage of Murang'a, cooperative size, and subjective performance based on information from the District Cooperative Officer, the District Agricultural Officer, and recent payments offered to members for their output. Once the cooperatives were selected, we randomly picked a factory (or more for the larger cooperatives) and from that randomly selected our household sample from the register of members[41].

[41] Depending on their size, cooperatives in our sample had between 1-12 factories. Given the difficulty in accessing selected members in the rainy season of Kenya's hilliest and most mudslide prone District over seasonal roads, it became too restrictive to randomly survey at the cooperative level as opposed to the factory level. Furthermore, the per cooperative sample sizes would have been too small to capture any inter factory differences. To cater to the possible bias of selecting respondents from one or two factories, we collected basic statistics from each factory.

At the institutional level, our collection efforts were hampered by a lack of available information, secrecy on the part of the managers, and a general unwillingness to provide the information sought. While we had initially planned to collect information on prices paid to farmers, costs of operation, mark-ups, prices received from auctions, services offered to farmers, fees charged for services, structure and duration of contracts, feasible number of prospective contractors, etc. for the past couple of years, we were unable to get a full set of responses from most cooperative managers. Thankfully, the farm level surveys were relatively successful and we recovered a lot of useful data. We recorded information on inputs and costs of production, credit access and use, farm size, area under coffee, other farm enterprises, social organizations involved in, extension services received, and fertilizer use among others. Table 4.3 below presents some general statistics of the cooperatives.

Table 4.3: Descriptive Statistics for Sampled Cooperatives

Cooperative Name	Number of Members Sampled[42]	Number of Factories Owned	Total Number of Members	Average Yield (Kgs/Tree)	Payment (Ksh) per Kilo of Cherry[43]	Coeff of Variation Of Pay Across Factories
Kamacharia	18	4	3760	1.94	4.82	0.43
Gaturi	48	5	3752	1.97	3.97	0.80
Weithaga	20	4	2101	2.51	3.27	0.22
Kanyenyaini	15	2	1249	2.96	7.68	0.18
Kahuhia	50	6	3704	1.35	1.41	0
Iyego	36	12	7000	2.33	5.27	6.35
Kiru	19	4	2837	1.12	4.51	0.16
Kangunu	21	1	1320	3.54	15.85	-
Kiriti	20	3	2085	1.66	7.99	0.10

[42] For various reasons beyond our control, e.g. Gaturi was close to a dairy cooperative whose sampled members were largely also New Gaturi members, difficulties in access etc., the per cooperative sampling proportions are quite different. To correct for this, we use cooperative level weights where necessary.

[43] All prices quoted herein and through this section are deflated to 1998 prices using the mean national CPI index published by the Central Bank of Kenya.

As Table 4.3 shows, there is considerable variation among the cooperatives along every dimension. Cooperative size as defined by the total number of active members varies from Kanyenyaini with 1249 members to Iyego which has roughly 7000. Kangunu, which is only marginally bigger than Kanyenyaini and is the only society with a single factory, also has the highest sample average yield of 2.99 kilograms of cherry per tree, more than five times that of Kamacharia which trails in coffee yield at a mere 0.56. The largest variation, however, occurs in the payments farmers receive from their respective factories. Kangunu, which paid its members Ksh 15.85 in the 2002/2003 season, paid more the ten times the amount that Kahuhia growers received. The payments, collected from cooperative records, are given as averages across all factories belonging to the cooperative. All members are paid at the factory level with payments varying among factories within any one cooperative due to quality and quantity of coffee produced. The standard deviation of payments across factories, normalized by their respective means, is given in the final column. Note that Iyego posts a higher normalized standard deviation than its mean, suggesting that some members must have been receiving negative payments. This is indeed true for several factories where a negative payment simply means that not only did the farmers attached to those factories receive no payments for the 2002/2003 season, but they were additionally burdened with debt that carried forward into the next season.

4.5.2 Empirical Strategy

Our goal is to test for the presence of rent-seeking behavior in cooperatives and to show that, to the extent it exits, it has an inverse relationship to farm level technical efficiency. Diminishing efficiency is a stricter measure of the negative consequence of rent-seeking as it goes beyond merely asking if total output or yields have decreased - a trend that has already be shown to exist in the aggregate. A decline in output itself is not necessarily a signal of weak performance and could simply suggest that other livelihood options/alternatives began to yield higher returns and members were shifting their resources accordingly. Falling output may thus reflect a rational shift in aggregate production patterns in response to changes in the expected returns of available livelihood options. As such, in our empirical investigation, we impose a more stringent condition, seeking to identify a statistically significant association between farm-level technical inefficiency and corruption or mismanagement at the cooperative level.

The idea is that beyond declines in output, rent-seeking at the cooperative level that results in higher deductions from members' payments and a reduction in the provision of services generates disincentives for members that are manifest in lower technical efficiency. Growers associated with more corrupt cooperatives are likely to become disenchanted and reduce the effort they apply to the production of coffee. By controlling for observable inputs to production, the resulting measures of technical efficiency proxies, to some extent, for the unobservable level of effort. If measures of cooperative corruption and mismanagement are associated with low levels of technical efficiency, then it is possible to attribute part of the poor performance of cooperatives to infiltration by rent-seeking board members.

To tease this out from our data, we conduct three separate but interrelated tests. First, we estimate a stochastic production frontier for coffee yield and use the results to generate a farmer-specific measure of technical (in)efficiency. We then conduct two separate factor analyses to extract proxies that together provide an indication of the likelihood and extent that the various cooperatives are involved with rent-seeking behavior. The third test uses the efficiency measures generated from the frontier estimation as the dependent variable in an OLS regression aimed at determining the sources of technical (in)efficiency. The rent-seeking proxies generated from the factor analyses are here used as independent variables in an effort to gauge the relationship between cooperative level rent-seeking and individual member technical efficiency.

4.5.3 Estimating Technical Efficiency

To investigate patterns of farm-level technical efficiency, we estimate a stochastic coffee production frontier then calculate each unit of observation's deviation from this benchmark of optimal efficiency. Stochastic production frontier models were introduced independently by Aigner, Lovell, Schmidt (1977) and Meeusen and van den Broeck(1977). They provide estimators for the parameters of a linear model with a disturbance that is assumed to be generated from two separate processes: one that has a strictly non-negative distribution that parameterizes the inefficiency error term, and the other with a symmetric distribution to capture random error. The following briefly summarizes the stochastic production frontier problem[44].

Suppose firm *i*'s expected output q_i is given by

$$q_i = f(\mathbf{z}_i, \beta)\xi_i \exp(v_i) \quad (28)$$

where $f(\mathbf{z}_i, \beta)$ denotes the production function, $\xi_i \in (0,1]$ captures the degree of firm *i*'s technical efficiency where $\xi_i = 1$ signifies optimal production, and $\exp(v_i)$ denotes random shocks to which firm *i* could be exposed. Taking the natural log of equation (28) on both sides yields

$$\ln(q_i) = \ln\left[f(\mathbf{z}_i, \beta)\right] + \ln(\xi_i) + v_i \quad (29)$$

Defining $u_i = -\ln(\xi_i)$, assuming *k* inputs we estimate the following production frontier:

$$\ln(q_i) = \beta_0 + \sum_{j=1}^{k} \beta_j \ln(z_{ji}) + \sum_{j=1}^{k} \gamma_j [\ln(z_{ji})]^2 + v_i - u_i \quad (30)$$

[44] Much of this section is drawn from Kumbhaker and Lovell (2000).

Since u_i is subtracted from $\ln(\xi_i)$, restricting $u_i \geq 0$ implies that $\xi_i \in (0,1]$ as specified above.

In estimating the frontier, we assume a normal distribution for the symmetric disturbance term and a half-normal for the distribution of the inefficiency term. Table 4.4 below provides summary statistics for the variables used in the estimation.

Table 4.4: Descriptive Statistics for Frontier Estimation Variables

Variable	Mean	Std. Dev.	Min	Max
Coffee Yield*	2.04	1.96	0.16	7.5
Plot Area* (acres)	0.56	0.49	0.00	3.00
Land Area* (acres)	1.84	1.77	0.20	13.00
Household Labor* (Days)	44.84	38.06	0	120
Hired Labor* (Days)	29.37	38.35	0	112
Age of Coffee Tree*	30.88	11.13	2	50
Pre Harvest Damage*	26.73	32.29	0	95
Inorganic Fertilizer (0=N, 1=Y)	0.234	0.424	0	1
Organic Fertilizer (0=N, 1=Y)	0.447	0.498	0	1

* Denotes variables used in natural log form in estimation. For these variables, we followed the common practice of substituting 0.001 for zero-valued observations to log-transformations to be defined across the variables range. Statistics presented for non-transformed variable.

Our measure of technical efficiency in coffee production is yield in kilos of coffee cherry per tree. In order to minimize the influence of outliers, we truncated the yield variable by assigning all observations below the fifth percentile with the fifth percentile value and similarly constrain those above the 95^{th} percentile to the 95^{th} percentile[45]. This results in a sample mean yield of 2.04 kilos of cherry per coffee tree. Average acreage under coffee is calculated at 0.56 while average household total landholdings are several times larger at 1.84acres. Household and hired labor use, specifically for coffee production, averages 44.8 man days and 29.4 man days per season, respectively. We include the age of the household's coffee trees as a regressor

[45] We performed similar transformations for both labor variables and the variable for tree age which all contained extreme outliers. Without limiting the distribution in this manner, results were less precise and rendered insignificant parameter estimates for several variables that are otherwise significant.

to capture the physiological relationship between tree productivity and its age. A relatively high average age of 31 years indicates a longstanding tradition of coffee production in the area.

Pre-harvest damage refers to the estimated percent of total output that was lost pre harvest due to natural causes. We recognize the potential endogeneity of this variable as it is likely to be correlated with plot-level managerial ability that also plays a role in determining technical efficiency. However, pre-harvest damage also contains both exogenous components such as rainfall and pest infestation as well as quasi-fixed components such as plot slope (a key factor as Murang'a is Kenya's hilliest District). Moreover, not accounting for this variable may significantly overestimate the technical inefficiency of farms struck by exogenous shocks directly impacting on yield. By potentially understating technical inefficiency, we strengthen our final results.

Due to large variance in fertilizer application rates, a significant number of zeros, and a range of possible fertilizers to choose from, we constructed a single dummy variable for the use of both inorganic and organic fertilizers. For inorganic fertilizers, we summed up the per kilo use of DAP, CAN, NPK, and MAP and created a dummy variable equal to 1 if use was above the fifth percentile of all non-zero observations and equal to zero otherwise. In a similar manner, we constructed the dummy for organic fertilizer from use of farm yard manure and compost. With this formulation, twenty-three percent and forty-five percent of our sample utilized inorganic and organic fertilizers respectively.

Agricultural productivity depends heavily on agro-ecological and bio-physical conditions that are largely exogenous (Sherlund et. al, 2002). In an attempt to capture the effects of agro-ecological variation on technical efficiency, we included farm-level altitude in the estimation. However, after several different specifications all yielded highly imprecise estimates that often increased the standard errors on the estimates of other model parameters, we opted to leave it out. One possible explanation is that while altitude gradually but steadily increases form the Eastern border of Murang'a to its Western border at the foothills if the Aberdare Mountain Ranges, its very hilly terrain throughout results in rapid fluctuations of altitude across short distances, that could confound the mean effects.

Assuming that households in close proximity to each other are relatively likely to experience similar agro-ecological environments, we attempt to overcome this problem by specifying the inefficiency disturbance to be heteroskadastic across cooperatives. This allows the model to capture cooperative specific differences in mean technical efficiency. Apart from capturing productivity differences related to environmental conditions, heteroskadasticity across cooperatives will also control for inefficiency effects that arise from poor management at the cooperative level. Among other things, this can include poor timing for the provision of time-sensitive inputs such as fertilizers, or credit needed to purchase various inputs (Hanchate, 1996), and political wrangling among the leadership or insecurity that results in effort-reducing distraction among workers (Barrett et. al, 2003).

We present the results of our frontier estimation in Table 4.5 below.

Table 4.5: Stochastic Production Frontier Estimates

Parameter	Coefficient	Std. Err.	Parameter	Coefficient	Std. Err
Constant	0.656	0.830	$\ln(\sigma_v^2)$	*** -1.853	0.236
Plot Size	** -0.256	0.103	$\ln(\sigma_u^2)$		
Plot Size^2	*** -0.043	0.010	**Kamacharia**	*** 1.996	0.758
Land Size	* -0.138	0.079	**Gaturi**	*** 2.597	0.779
Land Size^2	-0.050	0.039	**Weithaga**	0.025	0.805
Household Labor	-0.003	0.024	**Kanyenyaini**	** 2.023	0.990
Household Labor^2	0.008	0.007	**Kahuhia**	*** 2.882	0.801
Hired Labor	*** 0.112	0.020	**Iyego**	*** 2.067	0.803
Hired Labor^2	*** 0.028	0.005	**Kiru**	*** 3.199	0.799
Tree Age	** 0.638	0.263	**Kiriti**	*** 2.870	0.802
Tree Age^2	** -0.109	0.045	**Constant**	** -1.998	0.795
Harvest Loss	* -0.135	0.071			
Harvest Loss^2	** -0.047	0.024			
Inorganic Fertilizers	*** 0.658	0.112			
Organic Fertilizers	0.058	0.107			
Log Pseudo-Likelihood	-28011.05		**No. of Observations**	207	
Wald chi2(14)	210.57		**Prob > chi2**	0.00	

*** - Significant at 99% level ** - Significant at 95 % level * - Significant at 90 % level

Results indicate that the total acreage of land available to the grower, the acreage under coffee, the amount of hired labor used in coffee production, the age of the coffee trees, the use of inorganic fertilizers and the estimated pre-harvest loss were all significantly related to the observed cherry coffee yield. Given the log-quadratic specification, interpreting the results are not to straightforward. To give a better sense of the estimated relationships, we compute farm-specific elasticities based on actual input levels and frontier parameter estimates. Below, we show the kernel regression of the elasticity on variables of interest.

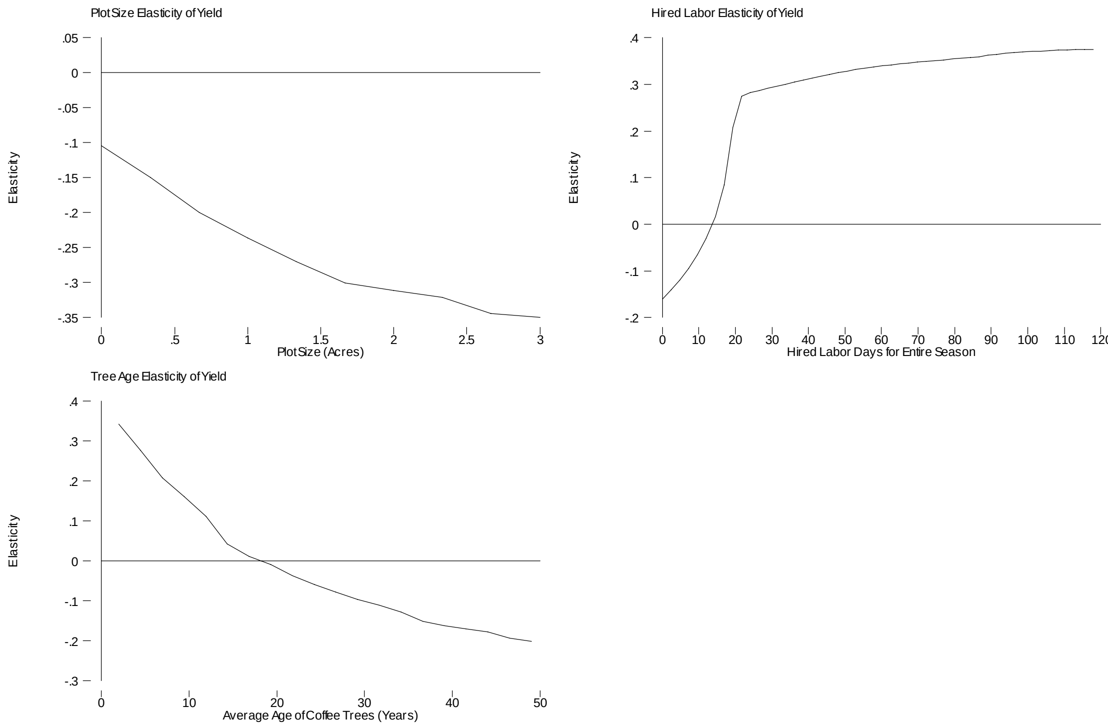


Figure 4.7: Kernel Regression of Estimated Yield Elasticities With Respect to Variables of Interest

The plot size elasticity of yield is negative and decreasing across the whole range of plot size. Essentially, this means that the optimal strategy is not to devote any land to coffee production. Having controlled for total land holdings, increasing plot size under coffee implies a larger ratio of total land devoted to coffee. This provides some evidence (albeit inconclusive) of allocative inefficiencies, suggesting that available alternatives for land-use are likely to be more productive. A majority of farmers, disenchanted by the dismal returns to coffee, indicate that they have recently often neglected their coffee, tending to it minimally or intensively intercropping with beans, napier grass, maize etc. Since both the required effort and the opportunity costs of land increase with plot size, the larger the plot, the greater the incentives to intercrop and the tendency to reduce husbandry toward a low return crop. Such a dynamic could also explain the negative plot size elasticity of yield.

While yield response to inputs of hired labor does not follow the typical inverse-U trajectory, it seems to fit the particular context quite well. Coffee production requires a minimum threshold of labor input for any positive level of output. Pruning, weeding, collecting and transporting raw cherry to pulping stations are just some of the necessary tasks. Furthermore, informal labor contracts of less than are day are very rare in Murang'a. Consequently, low inputs of hired labor can imply a high degree of underemployment as a laborer may be needed for several days throughout the season but be largely underemployed. Nonetheless, as marginal labor inputs above the requisite minimum would only occur if current labor time is fully employed, labor elasticity of yield is positive at higher inputs of labor.

The estimated elasticity of yield with respect to tree age is quite intuitive. As coffee trees age to maturity, here estimated at around 18 years, they increase in productivity. However, once they reach maturity their productive capacity peaks and steadily declines thereafter. While this inverse-U age productivity relationship is expected of the physiological process, it is interesting to note that despite this fact, the uprooting of coffee trees was outlawed until 2002. Furthermore, there is no mechanism within cooperatives that attempts to correct for this by initiating a scheme to facilitate smallholder farmers' replacement of old trees with new ones. As such, the average age of the coffee trees in our sample is over 30, more than ten years past their prime. The use of inorganic fertilizers, which has dramatically decreased in the recent past as most cooperatives are too heavily indebted to provide such inputs to its members, is strongly and significantly related to yields.

Our principal objective in estimating the production frontier was to obtain the estimates of grower technical efficiency within our sample. We included cooperative level dummies to control for heteroskedasticity in the inefficiency error term. Estimates for eight of the nine cooperative dummies are statistically significant indicating that systematic differences in farm-level technical efficiency exits across cooperatives. As presented in Table 4.5, the estimates are parameterized as the log variances of the error components. From these results, we can extract the farm-specific estimates of technical efficiency. These estimates will later be used as the dependent variable for the test we run to look at the effect of corruption at the cooperative level on farm specific efficiency. Table 4.6 below presents some descriptive statistics on the estimates of technical efficiency.

Table 4.6: Descriptive Statistics of Technical Efficiency Estimates

	Mean	Std. Dev	Min	Max
Kamacharia	0.50	0.19	0.18	0.78
Gaturi	0.46	0.25	0.04	0.86
Weithega	0.75	0.06	0.66	0.87
Kanyenyaini	0.59	0.21	0.07	0.84
Kahuhia	0.39	0.24	0.04	0.80
Iyego	0.54	0.21	0.10	0.85
Kiru	0.26	0.17	0.06	0.57
Kangunu	0.76	0.08	0.64	0.88
Kiriti	0.42	0.28	0.05	0.88
Total	0.50	0.25	0.04	0.88

What immediately stands out from these statistics is the large variation in technical efficiencies both within and between cooperatives. Gaturi, whose mean efficiency is slightly less than the full sample average, has farmers posting technical efficiencies as low as four percent and as high as 86 percent of the optimal. Kangunu and Kanyenyaini are the two most efficient cooperatives with an average efficiency of about seventy five percent of the optimal and very low standard deviations. Kiru, the least efficient, produces at an average rate of just twenty-six percent of the optimal. Across the whole sample, farmers post an average efficiency rate of fifty percent.

Though, for reasons previously explained, we use variations in technical efficiency to confirm the existence and consequence of rent-seeking behavior on cooperative performance, our analytical model made no explicit predictions of the relationship between corruption and technical efficiency. Instead, the model showed that where corruption was present, payments made to farmers would be relatively lower. We further justify the use of technical efficiency as an indicator of rent-seeking activities by showing in, Figure 4.8, the relationship between payments and mean efficiency at the cooperative level. As expected, lower payments are associated with lower levels of efficiency. The results suggest that technical efficiency can be used as a proxy for lower payments, whereby low levels of technical efficiency imply a greater likelihood of corruption amongst the cooperative leadership.

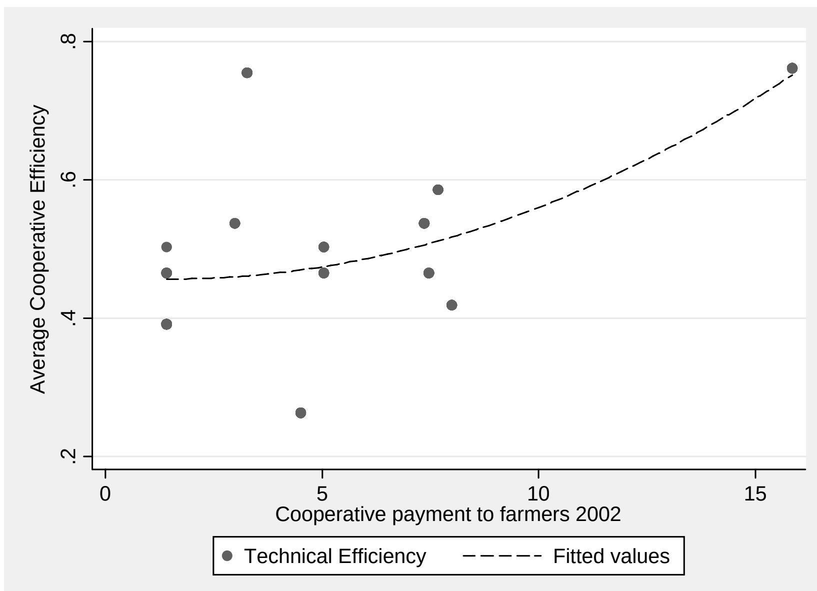


Figure 4.8: The relationship between cooperative payments to farmers and their technical efficiency

4.5.4 Creating Proxies Associated with Rent Seeking Behavior

The next step is to create proxies as indicators for the relative level of corruption and management incompetence between the cooperatives. The idea is to identify and differentiate cooperatives by the likelihood that they are run by rent-seeking or inept board members. This is not a straightforward task as there is no direct measure of corruption, nor would the cooperative management offer any information that may implicate them. Moreover, our sample includes only nine cooperatives with a total of thirteen factories limiting any regression analysis we can use to generate the requisite proxies.

As such, we take a different approach, seeking to identify corruption within cooperatives indirectly by studying the outcomes and perceptions that are commonly associated with corruption or mismanagement. It is important to note that with the data we have available, we are not able to differentiate between corruption or management incompetence. Nevertheless, as the negative effect that either corruption or mismanagement has on member welfare is identical, we feel that making such a distinction is not crucial to our analysis or its implications. Henceforth, we use corruption and mismanagement interchangeably.

Factor analysis, which is concerned with uncovering the latent structure of a set of variables, is well suited for our purposes. Essentially, factor analysis uses the covariance matrix generated from a set of variables to find a smaller number of common factors that linearly reconstruct the original variables. These common factors, depending on the weights they assign to the different variables (known as "loadings"), can then be interpreted as proxies for the common structure that they represent.

We use factor analysis to reduce a set of variables into common factors that correspond to various aspects of cooperative organization and practice that are likely to affect its productivity and are plausibly related to the degree of corruption plaguing the cooperatives. We conduct two separate tests, extracting two underlying factors from each. The first includes only factory level variables and aims at generating common factors that speak to the structure and performance of the cooperatives. The second test includes farmer level variables that capture subjective perceptions of cooperative effectiveness, and farmers' confidence with cooperative policy makers and government officials.

Table 4.7 below defines the variables used in the first test and provides some basic statistics.

Table 4.7: Variables Used to Generate Size and Performance Factors for Cooperatives

Variable	Definition	Mean	Std. Dev
payment	total factory level payment (Ksh per kg of output) made to members for 2002/2003 season	5.52	3.98
members	number of active members per cooperative	3413	1738
factories	number of factories operated by cooperative	5.31	3.12
payvariance	coefficient of variation of intra-cooperative pay	0.31	0.4
quality00	net value of coffee sales 2000 (ksh per kilo)	81.69	28.85
quality99	net value of coffee sales 1999 (ksh per kilo)	76.68	8.03
coopyield	average cooperative yield for 2002/2003 season (kg per tree)	1.84	0.67

Payments to farmers, which are unique at the factory level, averaged a mere 5.52 Kenya Shillings for the 2002/03 season.[46] Cooperatives averaged 3412 active members and owned just over five factories on average. To capture the effect of externalities associated with variations in intra-cooperative factory payments, we include their coefficient of variation which as a mean value across cooperatives of 0.31. The net value of coffee sales, which is the factory specific price received at the Nairobi Coffee Auctions (where the vast majority of coffee is marketed) less marketing and milling costs, proxies for the quality of coffee produced. We also include the average cooperative yield, which for the 2002/2003 was a paltry 1.84 kilos of cherry per tree.[47]

[46] Recall that all prices and values are deflated to 1998 prices.
[47] As we will subsequently be using the factors generated from this analysis as explanatory variables in a regression with the extracted technical efficiency estimates as the independent variables, we exclude own yield from the average cooperative yield generated for each household. This avoids the problem of spurious correlation that could arise since the technical efficiency estimates are also based on yields.

Table 4.8: Results of Cooperative Size and Performance Factor Analysis

Factor	Eigenvalue	Proportion of Variance Explained
Size	2.98	0.54
Performance	1.70	0.31

ROTATED FACTOR LOADINGS

Variable	Size	Performance	Uniqueness
members	0.97	-0.21	0.02
factories	0.96	-0.19	0.04
payvariance	0.90	0.16	0.15
payment	-0.22	0.87	0.19
quality00	-0.04	0.58	0.66
quality99	0.32	0.29	0.81
coopyield	-0.06	0.75	0.44

Table 4.8 presents the factor analysis results. Of seven possible factors, we retain only two for extraction. There is no strictly defined procedure for determining the optimal number of factors to retain. The decision often depends on a combination of a predetermined hypothesis and a sensible cut-off criterion; either a threshold eigenvalue above which factors are retained (commonly between zero and one), or a degree of variation that the first *n* factors must explain (commonly 90%).

The first factor, which we call *size,* seems to describe the cooperative size. It loads heavily on members, factories, and variance of pay within the cooperative, which are all correlated with increasing size. The low uniqueness posted by each of these variables, indicates that the underlying factor of size is well defined by these variables. Uniqueness is defined as that fraction of variance for the variable that is *not* explained by the factors. The second factor, which we call *performance* loads primarily on variables associated with the performance or productivity of the cooperative as given by the payments its members receive, the volume of output they produce and the quality of their coffee. As one would expect, and as indicated by the large on positive loadings of these variables on the *performance* factor, performance improves as payments, production and quality of coffee increase.

Beyond the structural features of a cooperative that may determine the ease with which corruption takes root, or its relative performance, that may proxy for the extent of mismanagement or rent-seeking activity, members' beliefs regarding the effectiveness of cooperative management could also reveal key information. To investigate this possibility, we run a second factor analysis on the variables defined in Table 4.9. In order to facilitate interpretation of the subsequent factor loadings, we include the variables' response structure.

Table 4.9: Variables Used to Generate Members' Perception and Confidence Factors

Variable	Definition	Response Structure
goodrelations	members of the coop have generally good relationships with each other	1
Caninfluence	membership can influence decision making process	1
profitdistribute	membership understands how management distributes cooperative profits	1
effectivemanage	management is effective in running the cooperative	1
coopcompare	your cooperative is managed better than other coffee cooperatives in the region	1
Insecurity	this village/neighbourhood has a problem with insecurity and violence	1
Localgovt	local government officials can be trusted	1
Centralgovt	central government officials can be trusted	1
Agofficer	district agricultural officers do their best to improve the welfare of farmers	1
Coopofficer	district co-operative officers do their best to improve the welfare of farmers	1
Creditaccess	do you have access to money lending facilities	2
empowerment	are you able to make important decisions that could change the course of your life	3

Response Structure

1	1 = Strongly Agree; 2 = Agree; 3 = Neither; 4 = Disagree; 5 = Strongly Disagree
2	1 = Yes; 2 = No;
3	1 = Totally Unable; 2 = Largely Unable; 3 = Neither; 4 = Largely Able; 5 = Totally Able

Note that all the variables used for the second factor analysis are ordinal. While ordinality presents a theoretical problem for factor analysis, which is developed for continuous variables, methods created to account for ordinality have thus far proved to be largely computationally infeasible or impractical (Joreskog and Moustaki, 2001). The limited set of methods that can incorporate ordinality into factor analysis, known generally as the UBN (Underlying Bivariate Normal) approach, have proven to yield similar or only slightly better results compared to “standard” ordinal coding. Kolenikov and Angeles (2004), argue that the modest gains from using computationally intensive methods to control for ordinality are not sufficient to recommend its use. Where the variables are mostly dummies, however, they show that not controlling for discreteness leads to significantly inferior results. For completeness, we tried to correct for ordinality by using the *polychoricpca* function in STATA. The two factors thus generated were difficult to interpret and furthermore, when they were introduced as variables in the technical efficiency estimate (substituting for the two factors, *perception* and *confidence,* generated without correcting for ordinality) the model’s R-squared dropped and neither factor was significant. As such, we opted against controls for ordinality.

In Table 4.10 below, we present the results of the second factor analysis.

Table 4.10: Factor Analysis of Members' Perception and Confidence

Factor	Eigenvalue	Proportion of Variance Explained
Dissatisfaction	1.48	0.60
Pessimism	.82	0.33

ROTATED FACTOR LOADINGS

Variable	Dissatisfaction	Pessimism	Uniqueness
goodrelations	0.23	0.04	0.95
caninfluence	0.24	0.05	0.94
profitdistribute	0.37	0.03	0.87
effectivemanage	0.64	0.03	0.58
coopcompare	0.61	0.00	0.62
creditaccess	0.19	-0.06	0.96
insecurity	-0.22	-0.06	0.95
coopofficer	0.40	0.32	0.73
agofficer	0.24	0.40	0.78
localgovt	0.05	0.56	0.68
centralgovt	-0.05	0.55	0.69
empowerment	-0.06	0.23	0.94

Again, we retain only the first two factors which together explain over 90% of the variance among the variables. The first factor, *dissatisfaction*, loads heavily on variables that encompass subjective beliefs of how well the cooperative is managed. These include member ability to influence policy, member understanding of how cooperative resources are used, member ability to access credit and even member beliefs of the dedication of government cooperative officials to their job. While the uniqueness levels of most of these variables are high, *effectivemanage* and *coopcompare*, which are closely related to our interpretation of the underlying factor, are associated with acceptable levels of uniqueness. As loaded, *dissatisfaction* increases as farmers are more likely to rate there cooperative as poorly managed, lacking in the provision of services, associated with violence and disengaged from the membership. As such, we would expect *dissatisfaction* to be negatively related to farmer technical efficiency.

The second factor seems to represent a measure of pessimism in the regulatory environment or a lack of faith in the commitment of policy makers to improve cooperative performance. We call this factor *pessimism*. It is instructive to note that in December 2002, about a year before the field work for this research took place, Kenya held a landmark national election that resulted in the first electoral transfer of power in the country's history. The sense of unbounded optimism and hope was palpable and permeated the whole country (Wolf et al., 2004)[48]. In conversations with our respondents, it was clear that some of this confidence remained. Several respondents attributed their expectation of improved performance in the coffee smallholder sub-sector to their confidence in the new government and its commitment to economic growth. Such sentiment is likely to generate incentives for heightened productivity. Thus we expect a negative correlation between *pessimism* and technical efficiency. Note that the variable *empowerment* loads inconsistently on *pessimism.* Unlike the other variables, higher values of *empowerment* are associated with greater self-assurance and should therefore load negatively on *pessimism*. Nevertheless, with a uniqueness level of 0.94, the variable *empowerment* provides little information to the factor *pessimism*.

4.5.5 Determinants of Farm-Specific Technical Inefficiency

The third empirical test regresses the farm-specific estimates of technical inefficiency, on a set of likely covariates, including the factors associated with various aspects of rent-seeking, in an attempt to determine the correlates of inefficiency. Table 4.11 below presents some descriptive statistics of the variables used in the regression.

[48] Gallup International, in their annual end of year survey, ranked Kenya as the most optimistic country in December 2002.

Table 4.11: Descriptive Statistics For Correlates of Inefficiency Regression

Variable	Mean	Std. Dev.	Min	Max
Gender (Male=1)	0.825	0.381	0	1
Age (Years)	57.753	13.758	27	96
Household Size	5.096	2.244	1	15
Primary Education	0.332	0.472	0	1
Secondary Education	0.328	0.470	0	1
Post Secondary	0.057	0.232	0	1
Experience (Years)	26.017	12.762	1	65
Extension (Recv'd Ext in past 2 yrs=1)	0.320	0.467	0	1
Advance Payment Ratio 2002	0.519	0.308	0.133	1.00
Size	0.00	0.99	-1.12	2.32
Performance	0.00	0.92	-1.46	2.09
Dissatisfaction	0.00	0.81	-2.51	1.70
Pessimism	0.00	0.75	-1.93	1.93

We control for the traditional household demographic variables in addition to experience (the number of years the household has been growing coffee), the receipt of extension services, as well as the ratio of advance payment to total payment received by members. 82% of households are male and the mean age for a household head is approximately 58. Growing coffee is very much an established tradition in the area with the average household engaged in coffee production for over 25 years. The percentage of household heads that have completed either primary or secondary school stands roughly similar at 33%, but less then six percent of household heads have any post secondary schooling. Only 32% of the households had been visited by an extension agent at least once in the past 2 years. For the 2002/2003 season, the average ratio of advance to total payments stood just above fifty percent. The advance ratio is defined as the fraction of total payment that is received as an advance at the start of the season[49]. We include this variable as a proxy for liquidity.

Various hypotheses exist to explain the existence and direction of the relationship between the chosen demographic covariates and technical efficiency:

[49] Recall that cooperatives pay their members in two installments. A coffee advance payment (CAPS) at the beginning of the season, and a final payment at the end of the season.

Gender differentiation in farming activities, the inertia of older households to novel and superior farming practices, the benefits to specialization of roles accorded to larger households, etc. However, as these relationships are not the focus of this study, we remain largely agnostic of their role. As extension services are an important service that cooperatives specifically provide their members to improve their productivity, we expect the receipt of such services to be positively associated with technical efficiency. Furthermore, as advance payments would allow farmers to invest in quality inputs in a timely manner, we hypothesize a positive relationship with technical efficiency.

To test for the relationship between cooperative corruption and farmer technical efficiency, we include the four factors associated with different aspects of cooperative organization and performance that can be linked to the likelihood and extent of rent-seeking activity. The actual values of these variables do not mean much and are here simply normalized to mean zero. However, because the variables are cardinally ranked, the position of a given observation relative to the variable's entire range is important. Given that the variables loading heavily on both the *size* and *performance* factors are all positive, and are all positively related to the underlying notion of cooperative size and performance (eg., more members and more factories likely signify a larger cooperative as larger payments to members and greater production indicates a better performing cooperative), higher values of these factors suggest bigger and more efficient cooperatives. *Dissatisfaction* and *pessimism*, on the other hand, are both negative, increasing as members perceive greater management incompetence or have less confidence in policy makers.

Results are presented in Table 4.12 below.

Table 4.12: Sources of Inefficiency Estimates

Variable		Coefficient	Std. Err
Constant		0.239	0.285
Gender		-0.024	0.049
Age		0.003	0.010
Age^2		-1.1E-05	8.3E-05
Household Size		0.001	0.008
Primary Education		0.017	0.050
Secondary Education		-0.021	0.056
Post Secondary		0.001	0.082
Experience		-0.001	0.006
Experience^2		-6.0E-06	1.0E-04
Extension	*	0.059	0.035
Advance Payment Ratio 2002	***	0.356	0.103
Size	*	-0.031	0.017
Performance	***	0.179	0.034
Dissatisfaction	*	0.037	0.022
Pessimism	*	-0.040	0.023
R-Squared		0.2069	
Number of Observations		197	

*** - Significant at 99% level ** - Significant at 95 % level
* - Significant at 90 % level

None of the demographic variables, including experience in coffee growing, prove to be significantly related to degree of efficiency. A possible explanation is that some of these variables are related to the use and availability of inputs whose variation is already captured in the estimates of technical efficiency. Household size, for example, is probably associated with the use of household labor and the demand for hired labor. Experience, on the hand, is likely to be correlated with tree age.

The receipt of extension services, which we expected to be associated with greater levels of efficiency, does appear to have a statistically significant effect. Given that the mean value of the technical efficiency estimates was a mere 0.50, the high value of the extension dummy's estimated parameter emphasizes the importance of such services. Receiving extension services at least once in the past two years increases technical efficiency by slightly more than ten percent. That a mere 32% of households have had extension visits in the past two years is further evidence of the deterioration of coffee cooperatives.

The fraction of the total payment given as an advance at the beginning of the season, a key policy variable, is strongly significantly and positively related to efficiency. This points to the crucial importance of providing smallholder farmers, who are often cash constrained and have limited access to credit, with some form of advance payment on their output in order to facilitate the timely purchase of critical inputs such as inorganic fertilizers and pesticides.

The four cooperative-specific factors are all significantly associated with farm-level technical efficiency. As hypothesized, *size* is negatively associated with technical efficiency. In our analytical model, we showed that the likelihood of election capture increased with increasing membership, a variable clearly related to a cooperatives size. As such, this result could be interpreted as revealing a significant association between the probability that a cooperative has been captured by rent-seeking officials and technical efficiency. This finding can also be interpreted as suggesting decreasing returns to scale in cooperative production, a result that contradicts the unsupported claims of many policy makers who champion mergers in cooperatives on the basis of increasing returns to scale arguments. The negative and significant result on *pessimism* lends further credence to our claims. Lack of confidence in policy makers resolve to improve the rules and regulations that underlie the smallholder coffee sector suggests a current institutional arrangement that does not provide growers with incentives that aptly reward productive behavior.

The only unexpected result regards the positive and significant relationship between *dissatisfaction* and efficiency. Because *dissatisfaction* explained the least variation among the variables it loaded heavily on, it could be that our interpretation of the latent variable captured in the variable *dissatisfaction* is somewhat imprecise. An alternative explanation is that having controlled for cooperative performance, *dissatisfaction* may be picking up farmer-specific expectations of how cooperatives could be managed, which, in turn, is associated with a farmer's understanding of the disparity between the status-quo and what is possible under optimal management. Such farmers, who are likely to be the most enterprising, would express the most discontent with management while still applying effort into their own production.

High values of *performance*, associated as it is with higher payments to farmers and increases in the quality and quantity of output, suggests a cooperative leadership that seeks to maximize member welfare and provide the right incentives for increased productivity. Low values of *performance*, on the other hand, are more likely to be associated with the fleecing of cooperative revenues by the leadership and the neglect of administrative and management duties. Indeed, our analytical model showed that cooperatives captured by a rent-seeking leadership would be characterized by lower payments to farmers and lower farmer output. Cooperatives with low values of *performance* are thus more likely to be headed by corrupt or inept individuals. As such, the sizable and strongly significant relationship between *performance* and farmer efficiency also supports the hypothesis that rent-seeking at the cooperative level impacts negatively on farm level efficiency.

4.6 Discussion and Conclusion

For almost a decade now, the smallholder coffee sub-sector in Kenya has witnessed a significant deterioration in several key indicators. Both yields and total output have declined, payments to farmers have plummeted, and the relative price of Kenya coffee in the world market has declined. In this paper we investigated the relationship between this decline and changes in the laws governing cooperatives that effectively shifted the managerial and administrative responsibility of running a cooperative onto its members. We hypothesized that by giving cooperative board members unregulated access to the organization's treasury, the new laws made leadership positions lucrative to potential rent-seekers and created incentives for corrupt and self-interested individuals to occupy the available leadership positions. The voting method used in the cooperative subsector facilitates the election of individuals known to be corrupt

In an analytical framework resembling the organizational structure of these cooperatives, we have shown that where managers are chosen from the membership, and where no regulatory oversight exists to curb election fraud or the embezzlement of collective profits, leadership positions are prone to capture by corrupt individuals who have a greater incentive to win elections than benevolent candidates. Our results hold largely due to an implicit assumption that candidates can expect the individuals they bribe to honor their pledge to vote for them, a valid assumption given the particular voting system employed by these cooperatives. Once the cooperative is captured, we show that payments to farmers are set lower than they would otherwise be and that farmer productivity falls as a response. We also find that contrary to the extant literature which lauds the value of strong norms in enhancing economic opportunity and returns in informal settings, strong norms also increase the likelihood that a corrupt candidate wins elections by decreasing the cost of buying votes. This indicates the need for caution in designing membership based organizations that rely heavily on the strength of shared norms to act as a sufficient substitute for formal enforcement mechanisms.

The analytical results suggest several policy implications. First, efforts need to be taken to ensure that politically savvy and self-interested individuals do not continue to manipulate elections. A feasible step toward this end would be to require that elections are carried out by secret ballot in the presence of objective cooperative elections supervisors. Second, in order to pressure cooperatives to operate efficiently and to provide growers with alternatives, growers should be allowed to sell their output to the highest bidder. The current circumstance of coffee cooperatives presents a golden opportunity to make this shift into competitiveness, as the main justification for involuntary membership no longer applies. When cooperatives used to provide their growers with credit, fertilizers, pesticides, extension advice, etc., requiring growers to sell their output to their respective cooperatives was a credible means to ensure repayment for services rendered and inputs provided. As cooperatives today rarely provide these inputs or services, this argument is moot. Increased competitiveness, however, would require a legal system that can formally enforce contracts.

The empirical part of our study complements our analytical model. Evoking our analytical results that, *ceteris paribus*, larger cooperatives and those posting relatively low payments and low outputs are more likely to have been captured by rent-seeking individuals, we generate factors associated with these variables to rate cooperatives by the likelihood that their leadership is corrupt or inept. We then estimate the effect that these factors have on farm-level technical efficiency and find that the same measures of cooperative structure, performance and member' perception associated with increased rent-seeking are also significantly related to reduced technical efficiency. In other words, the evidence suggests that corruption and incompetence among the governing board breeds disillusionment among members that manifests in declining technical efficiency.

Other key results confirm the significant and positive impact that fertilizers, pesticides, and extension services have on coffee yields. Given the extremely low fertilizer and pesticide application rates evident in the sub-sector, and a weak extension system, mechanisms designed to boost the use of these inputs could have a large, favorable impact on yields.

The main goal of organizing smallholder coffee growers into fully autonomous cooperatives was to create the economic conditions that would encourage their productive and marketing capacities. Such an institutional infrastructure was designed to maximize the return to farmers' efforts, increase their output and ultimately improve their welfare. Unfortunately the design has proved faulty and has contributed to stagnation in the sub-sector. The lesson is clear: giving full ownership of producer organizations to members without complementary and enabling regulations, or when the potential for information manipulation exists, only creates the illusion of empowerment and, as we have seen among Kenya's coffee cooperatives, can lead to a deterioration of members' welfare.

Chapter 4 Appendix

4.A.1 Defining the Gamma Function

The gamma function was discovered by Swiss mathematician Leonhard Euler (1707-1783) in his goal to generalize the factorial to non-integer values. The following defines the gamma function:

For x>0, $\Gamma(x) = \int_0^\infty t^{x-1} e^{-t} dt$, $\Gamma'(x) = \int_0^\infty t^{x-1} e^{-t} \log(t) dt$, $\Gamma^n(x) = \int_0^\infty t^{x-1} e^{-t} \log^n(t) dt$

The key functional equation is given by $\Gamma(x+1) = x\Gamma(x)$ which allows the generalization $\Gamma(x+1) = x!$ and enables us to differentiate

$Z(N,t) \equiv \left(\binom{N-1}{N/2} t^{N/2} (1-t)^{N/2-1} \right)$ with respect to N.

$Z^{(1,0)}(N,t) =$

$$\frac{(1-t)^{-1+\frac{n}{2}} t^n (-1+n)!\,\mathrm{Log}[1-t]}{4\left(\frac{n}{2}!\right)^2} + \frac{(1-t)^{-1+\frac{n}{2}} t^n (-1+n)!\,\mathrm{Log}[t]}{2\left(\frac{n}{2}!\right)^2} - \frac{(1-t)^{-1+\frac{n}{2}} t^n (-1+n)!\,\mathrm{Gamma}\left[1+\frac{n}{2}\right] \mathrm{PolyGamma}\left[0, 1+\frac{n}{2}\right]}{2\left(\frac{n}{2}!\right)^3} + \frac{(1-t)^{-1+\frac{n}{2}} t^n\,\mathrm{Gamma}[n]\,\mathrm{PolyGamma}[0, n]}{2\left(\frac{n}{2}!\right)^2}$$

A graphical representation gives a better idea of the shape of the result. As is clear from the Figures 4.9 and 4.10, the function is everywhere negative but asymptotically approaching zero in N.

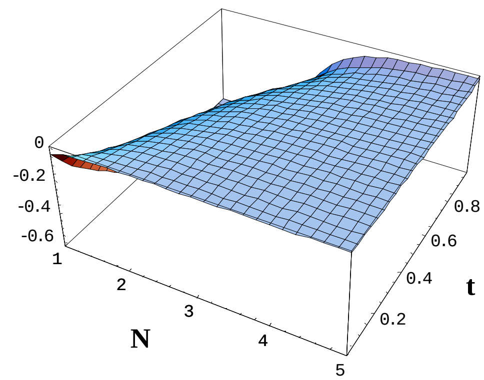


Figure 4.9: Gamma Function Differentiation of $Z^{(1,0)}(N,t)$ _ 1

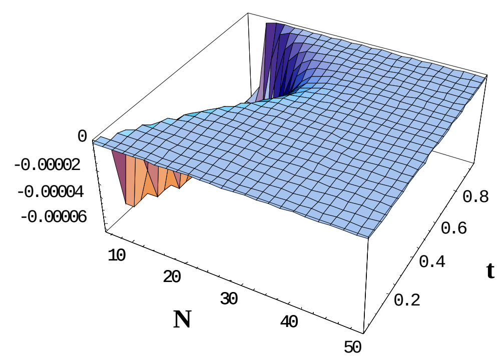


Figure 4.10: Gamma Function Differentiation of $Z^{(1,0)}(N,t)$ _ 2

Similarly taking the derivative with respect to *t* yields,

$Z^{(0,1)}(N,t) =$

$$-\frac{(1-t)^{\frac{1}{2}(-4+n)}\, t^{-1+n}\, (-2\,t + n\,(-2+3\,t))\,(-1+n)!}{4\left(\frac{n}{2}!\right)^{2}}$$

Figure 4.11 below depicts the result. In Figure 4.12 we also plot the two dimensional plane at *N*=10 to give a clearer picture of the function's shape. We see that the function is positive until a certain point at which it becomes negative. Looking that the equation above it is clear that the root is defined by $2N/(3N-2)$ which at *N*=10 gives *t*=0.769

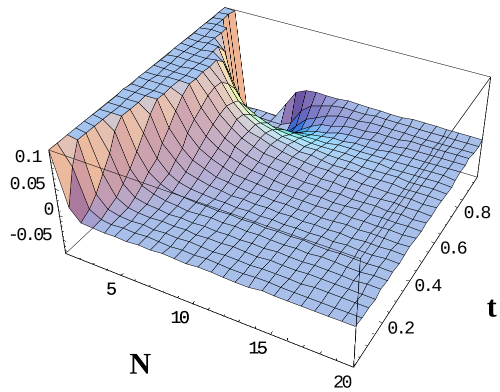


Figure 4.11: Gamma Function Differentiation of $Z^{(1,0)}(N,t)$ _ 3

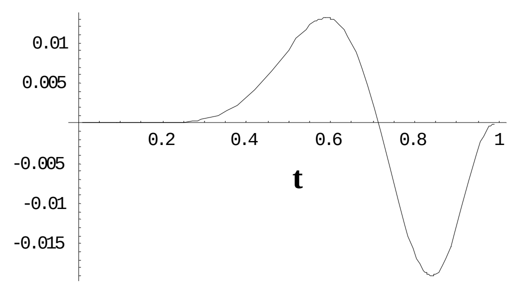


Figure 4.12: Gamma Function Differentiation of $Z^{(1,0)}(N,t)$ _ 4 - (N=10)

Chapter 4 Acknowledgements

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