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Policy and Dairy Development[1]

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Introduction

Does government policy improve the lives of rural people? Does it instead hurt them? Or is it irrelevant for most purposes? Earlier chapters have examined these questions for different types of government policy. Most notably, we conclude that land policy, on which Kenya and Tanzania have differed dramatically since independence, has not been important in those highland areas which were never occupied by settlers. Has livestock policy been equally unimportant?

If government policy is to have an impact on rural development in East Africa, one channel will have to be through livestock operations. Livestock play a vital role in a highly integrated smallholder economy, providing milk, meat, and manure to rural households. Livestock also provide a way to accumulate wealth, and act as a form of insurance against bad crop years.

There also appears to be clear scope for profitable investment in livestock operations in highland, smallholder areas. Purebred, exotic dairy cattle, such as Friesian Holsteins, have the genetic potential to produce several orders of magnitude more milk than cattle indigenous to Africa. Densely-settled, small-farm areas are well-suited for the provision of livestock services such as veterinarian care and milk marketing. In addition, since milk and milk products generally have one of the highest income elasticities among food items, demand rises with both population growth and per capita income growth.

[1] Helpful comments on this chapter from David Leonard are gratefully acknowledged.

For these reasons Kenya and Tanzania, along with most other countries in Africa, have produced statements about livestock policy that sound remarkably similar. Most such statements stress objectives of increasing smallholder incomes, moving towards or maintaining self-sufficiency in milk and meat production, and improving nutrition through increased consumption of animal products. Most countries also state the need to improve the quality of the livestock herd, and have made some investments in artificial insemination services and the provision of veterinary services.

Unlike land policy, then, there is no dramatic difference in stated policies toward livestock development in Kenya and Tanzania. So then, in similar agro-ecological zones with similar population densities, are the livestock economies similar? The answer is not at all. The two communities surveyed in this study are dramatically different in terms of dairy production and consumption patterns.

So the livestock story is the flip side of the land story. In land policy, Kenya and Tanzania have dramatically different policies, but, in the smallholder coffee areas surveyed by this study, remarkably similar outcomes. In livestock policy, the two countries make similar statements, but produce dramatically different outcomes. This paper examines whether or not these outcomes result from differences in the ways the policies were implemented, and thus are the result of government action, or if these outcomes were the result of other factors not attributable to the governments. While the evidence gathered does not allow for a definitive answer, evidence suggests that actual policies have differed more substantially than statements made about those policies. Furthermore, Kenya supported its livestock policy with significantly more fiscal resources, clearly stimulating investments in improved cattle. Government investments in other sectors, particularly infrastructure, were also key. Dairy production probably would have increased more rapidly in our Kenyan community than in Tanzania even without any difference in policy or its implementation, but government actions spurred even more rapid growth in Kenya.

The remainder of this chapter expands on these issues by, first, detailing the differences in the livestock economies of our two study communities at present. We then look back in time to see when the differences began to occur, in order to see what policies during what time period

made a dramatic difference. Thirdly, we examine present and past government policies and investments in more detail. Finally, we draw conclusions from the evidence.

Dairy Production[2]

Despite similar-sounding policies, livestock and dairy production systems in these communities are dramatically different. Even a casual observer visiting the two communities would notice these differences. In the Kenyan community, every morning such an observer would see groups of fifteen to twenty waiting by the road, waiting to sell fresh milk to the cooperative society's truck. Nothing similar happens in the Tanzanian community. The same observer would notice a large number of cattle with the distinctive markings of Friesian Holsteins in the Kenyan community, but very few in the Tanzanian community. When visiting households in the Kenyan community, in most cases the observer would be served tea prepared with large quantities of milk; in the Tanzanian community, he would receive black tea or coffee much more frequently.

The results from our survey document these casual observations. Although the average number of cows per household is not dramatically different in the two communities -- the Tanzanian households average 1.9 while the Kenyan households 1.7 - milk production per household in the Kenyan community is six times as large as in the Tanzanian community. This is made possible in part by the differences in breed noticed by the casual observer; fully 60% of the

[2] Recall that these two communities are in highland, coffee-growing areas in central Murang'a and Kilimanjaro region. See chapter 3 for descriptions of the communities, the surveys administered, and sampling methodology. This chapter focuses on the most important livestock production activity, dairy production. Other livestock, especially pigs and chickens, are important to these communities, but much less so than dairy. These production systems also have been less influenced by government policy than dairy production. The report to USAID on this project (Pinckney 1994) contains copies of the survey forms, a background paper on Kenyan livestock policy by Kangethe Gitu, and another paper providing many more results from the livestock sections of our survey..

cows in Kenya are pure-bred exotics ("grade" cows),[3] while the similar figure for Tanzania is only 13%.[4]

Differences in milk sales are even more dramatic. The Kenyan households sell eleven times as much milk as the Tanzanian households. With the cooperative society buying milk daily, the Kenyans have a ready outlet for as much milk as they can produce. This milk is then sold elsewhere, allowing the community to be surplus in milk production. The Tanzanians, on the other hand, must sell surplus milk to neighbors or in the local market. A few have tried on occasion to establish regular sales to Moshi, but transport costs are high and the condition of the road makes transportation unreliable in the rainy season.

Are the Kenyans then selling milk at the expense of nutrition, sacrificing consumption for money? Once again, the casual observations made above are substantiated by the survey; milk consumption per capita is three times higher in Kenya than in Tanzania. Although most of the households in Kenya sell all of their morning milk to the cooperative society, the evening milk is primarily consumed, with some sold locally. The cooperative society does not collect milk in the evenings.

The Kenyan community, then, produces and sells more milk. It is logical to presume that this is a response to price, with the cooperative society "exporting" milk from the community to higher-priced markets elsewhere, driving up the price in the local community. Under this presumption, the Tanzanian community would not have invested in upgrading their cattle herd because the milk price was too low; Kenyans had made such investments, because the price they were paid was higher.

This presumption is incorrect. In fact, the price of milk in Tanzania is approximately double the price in Kenya.[5] While this helps to explain higher milk consumption in Kenya,

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[3] At least, these cows are reported to be pure-bred exotics. In the Kenyan community, artificial insemination has been important for so many years that some genetically mixed cows may be so close to pure-bred (say, 15/16) that farmers and enumerators are unable to distinguish them from pure-breds.

[4] In the remainder of this chapter and in the accompanying tables we frequently use "Kenya" to mean our Kenyan study community, and "Tanzania" to mean our Tanzanian study community. Statistics from the survey all are for these communities alone, and not for the countries as a whole. References to the entire country are made obvious.

explanations for the much larger Kenyan investments in dairy cattle will have to be found in other areas. At this point, however, we continue to examine the characteristics of milk production during the period of the survey.

So far we have seen on the production side that farmers in Kenya have invested in upgrading their cattle herd substantially, leading to higher milk production. On the other hand, the milk price is much lower, possibly due to the shift out in supply caused by the improvement of the herd. Is this a case similar to the "treadmill" hypothesized for American agriculture, in which technological advances primarily benefit consumers because the shifting supply curve drives down the price of output? Are dairy farmers in Kenya really any better off than those in Tanzania?

In order to answer these questions it is necessary to have some rudimentary understanding of the milk production process. Cows begin to lactate after giving birth. The length of the lactation period depends both on the genetic resources of the breed and management practices. The interval between calving - and consequently the amount of time the cow will not be producing any milk - is also dependent to a large extent on management practices. And while residents of these communities have been keeping cattle for many years, the management of high-grade dairy cattle is new and complicated. Thus, experts in the field conclude that improved nutrition and management alone - without any increase in genetic potential - could increase both milk production and calf production in Africa by more than half (Walshe and others 1991).

Table 11.1 explores these issues by examining the potential cash income per cow by grade in each community. The table answers the question: How much cash income would a farmer make in each community from a cow producing at the mean level of output and using a mean amount of inputs, if all milk produced by the cow were sold? The first column gives the average

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[5] "Approximately" because there is no one "price of milk" in the communities, and also because of the usual exchange rate issues. Exchange rate issues are discussed in the income chapter. Recall that the Moshi *bureau de change* was paying Tsh 10 per Kenya shilling during the fourth round of the survey, and that our food price index yields a ratio of 11.1 Tanzanian shillings for one Kenya shilling. As for the price of milk, in Tanzania farmers sold milk to neighbors or to the local market at prices that varied even on the same day. All of this milk reportedly was consumed within the local community. The median and modal price was Tsh 120 per liter (Ksh 10 or 11 per liter). In Kenya, milk sold within the community from the evening supplies sold for a median price of Ksh 6 per liter, while milk sold to the cooperative society fetched Ksh 3.50 in the early rounds and Ksh 5 in the last round.

Table 11.1 Potential Cash Income Per Cow by Grade and Country

Type of Cow	Liters per Day	Percent Lac-tating	Liters per Cow per Year	Milk Price per Liter, local currency	Gross Value of Milk Output	Cash Ex-penses	Net per Cow, Tsh	Net per Cow, Ksh
Tanzania								
Grade	3.0	0.33	365	120	43800	1811	41989	3817
Mixed	1.8	0.38	252	120	30262	1061	29201	2655
Local	0.8	0.24	70	120	8436	109	8327	757
Kenya								
Grade	5.1	0.72	1337	5	6686	794		5892
Mixed	5.8	0.78	1641	5	8208	789		7420

Notes: "Liters per Day" reports the average milk production per cow by grade and country for lactating cows during the 4th round of the survey. "Liters per cow per year" is the product of the first two columns multiplied by 365. Tanzania shillings are converted to Kenya shillings at an exchange rate of 11 to 1 (see chapter 3). The local price used is the median price of milk in the communities in the final round of the survey.

number of liters per day produced by cows of different breeds. Here we divide the total milk production per breed by the number of cows *presently lactating.* In Tanzania, clearly higher grade cattle are producing more milk. Controlling for breed, cows in Kenya are producing more than those in Tanzania. However, if the only differences between milk production in Kenya and Tanzania were the different composition of breeds and the difference in milk production per cow within a breed, production in Kenya would be 2.7 times as large as in Tanzania rather than 6 times as large.

An even more important difference between the production systems is the percent of cows lactating, as indicated in the second column of the table. In Kenya, about 3/4 of the cows are lactating at any one time, while in Tanzania only about 1/3 are lactating. This difference is directly related to nutrition, health, and management of insemination. Consequently, controlling for breed,

milk production per cow per year is more than six times as high in Kenya for cows described as "mixed," and about three and a half times as high for grade cows.[6] The price differential, however, makes up a substantial proportion of the difference in productivity. Mean cash expenses, too, are much less in Tanzania, less than 1/7 of the amount spent in Kenya (after adjusting for exchange rates). Only seven out of the 115 Tanzanian households purchased commercial feed for their cows, while 31 of the Kenyan farmers did. Undoubtedly this accounts to a large extent for the differences in productivity between the communities within a breed.

Potential cash income per cow, then, is only about 55% higher for purebred exotics in Kenya. The difference is considerably larger for mixed cows. Keep in mind, however, that median income per adult equivalent in these communities is only 6872 Ksh in Kenya and 5340 Ksh in Tanzania, including the value of own-produced food.[7] These figures for return per cow are thus quite large by the income standards of the communities, even in Tanzania. This is reflected in the percent of income generated by livestock: 31% in the Kenyan community, 10% in the Tanzanian community.[8]

One final note on the table: The lack of a difference in cash expenses per cow for mixed and grade cows in Kenya also helps to explain the apparently higher productivity of mixed cows. In fact the differences in liters per day and percent lactating are not statistically significant; nevertheless, it is interesting that the cows with higher genetic potential do not produce more milk. Surprisingly, this is in accord with recommendations of experts in the field; in environments in which the cows are producing less than 4000 liters of milk per year, there is no additional benefit to owning a purebred exotic instead of a 3/4 cross. Since both types of cows are producing well below their genetic potential at these low levels of productivity, the additional genetic potential of

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[6] Part of the difference in the "mixed" category could be genetic. It is probable that the mixed cows in Kenya are a higher proportion exotic than those in Tanzania. In most cases, farmers do not know the genetic mixture of their cows.

[7] Recall from the income chapter that we adjust household size for average calorie consumption of persons of different age and gender. These figures are actually median expenditures per adult equivalent which, for reasons discussed in the income chapter, we believe constitute better proxies for income than our direct income measure.

[8] All of these calculations exclude the value of manure, which is substantial, but exceptionally difficult to measure.

the purebred is unimportant. Assuming a lactation rate of 78%, 4000 liters per year translates to about 14 liters per day of lactation. In our Kenyan sample, we have only three cows that are producing this much -- and two of them are mixed.

So the Kenyan community has cows with a higher rate of lactation, more milk produced per day while lactating, but a lower price for the milk produced. In neither community are cows producing anywhere near their genetic potential, but they are somewhat closer in Kenya.

Changes in Dairy Production Over Time

The marked difference in the genetic makeup of the cows in the two communities underlines the importance of understanding when these changes took place. If the changes in policy to be discussed in the next section are correlated with changes in breeds at the local level, a plausible case can be made that policy has made a difference.

All farmers were asked for their history of livestock ownership, both the number of cows and the breed of those cows. Results are presented in Table 11.2. Kenya's lead in the quality of the livestock herd has been in existence for over 25 years. Even in the late sixties, almost half of the cows in the Kenyan community were improved, while only 11% were improved in Tanzania. Differences between the communities increased during the seventies; by the end of the decade, almost 90% of the cows in the Kenyan sample were improved, while the figure was only 25% in Tanzania. There were virtually no more grade cows at this time in Tanzania than there had been a decade earlier. The pace of change slowly picked up in Tanzania in the early eighties, however, and in the latter part of that decade a dramatic change occurred: the percent of cows unimproved decreased from about 2/3 to less than 1/3. Meanwhile, by the early eighties virtually all cows in the Kenyan sample were improved; after that there was a small increase in the percent of purebred exotics.

Table 11.2 Changes in Livestock Ownership Over Time

	1965/69	1970/74	1975/79	1980/84	1992
Tanzania					
Cows/HH	2.7	2.5	2.6	2.2	1.9
% Local	89	83	75	65	31
% Mixed	4	10	17	27	57
% Grade	7	8	8	8	13
Kenya					
Cows/HH	1.8	1.6	1.5	1.5	1.7
% Local	54	25	12	2	0
% Mixed	34	47	52	47	40
% Grade	13	28	36	52	60

Source: 1991/92 Survey

The top line for each country gives the number of cows per household over time. Note that in Tanzania there has been a marked drop in the number of cows as the percentage improved increases. Given the relative cost of the different types of cow, however, the total value of the livestock herd has increased substantially in real terms during the period, despite the reduction in numbers.

How important were these changes in numbers and genetic potential to dairy production? Unfortunately, it is not practical to ask farmers how much milk a cow was producing twenty years in the past. Table 11.3, however, presents calculations of the changes in milk production per household over time, holding lactation rates and milk production per lactating day at their 1992 level for each breed. Since it is quite likely that both lactation rates and milk production per day have increased over the last two decades as farmers gain experience and knowledge about the proper way to maintain high-quality cows, the table's calculations are a lower bound for the changes in milk production over time.

The first line for each country presents an index of milk production per household over time, using 1992 productivities for each country, with Tanzania in 1965/69 as a base. The second line for Kenya gives the same numbers, using Kenya's values in 1965/69 as the base, in order to

Table 11.3 Minimum Change in Milk Production Per Household Over Time

(Index, Tanzania 1965/69 = 100)

	1965/69	1970/74	1975/79	1980/84	1992
Tanzania					
Tanzanian Productivity	100	106	122	119	153
Kenyan Productivity					854
Kenya					
Kenyan Productivity	592	732	775	835	938
Kenya 65/69 = 100	100	124	131	141	158

Notes: The calculations are based on changes in breed composition and number of livestock owned per household, holding lactation rates and production per cow within breeds constant.

facilitate comparison of the percentage increases in the two countries over time. Note that even in the late sixties, Kenya was producing almost six times as much milk as Tanzania. After this point, milk production per household increased in both countries, but considerably more rapidly in Kenya through the early eighties, by which time production in Kenya had grown twice as rapidly as production in Tanzania. At this point, milk production in Kenya was about seven times that in Tanzania. Indeed, between the late seventies and early eighties, milk production per household in Tanzania may have fallen slightly, as decreased numbers of cows more than offset the increased number of mixed cows. The large strides in varietal improvement in the late eighties, however, compensated for much of the earlier stagnation; by the time of the survey, milk production per household in both communities had increased between 50 and 60 percent compared to the late sixties.

The second line of the Tanzanian section presents, for the time of the survey, the index of Tanzanian production using Tanzania's number and composition of cows but Kenya's level of productivity per cow. This adjustment makes up almost the entire difference between the countries. The remaining difference is about ten percent.

Thus, although Tanzania lagged behind Kenya for many years in varietal improvement, and still does to some extent, at this point the reason Kenya is producing six times as much milk per household as Tanzania is primarily because of milk production per cow, holding variety

constant. Cows in Tanzania -- and to a much lesser extent in Kenya -- are producing far below their genetic potential. Increasing that genetic potential more may have some marginal impact on production, but the main challenge will be to increase output of mixed and grade cows. This suggests that, in the future, livestock policy in both countries, but especially in Tanzania, needs to focus on improving nutrition and management rather than on genetic improvement.

Livestock Policies in Kenya and Tanzania

This section provides a brief sketch of livestock and dairy policies in the two countries., beginning with Kenya.[9]

In our particular community, the road from the closest large town, Thika, was tarmacked in 1968/69. This greatly facilitated trade, eventually leading to milk marketing services. Beginning in the mid-seventies, marketing agents would buy milk from local producers and transport it to the Thika cooling plant, where it was sold to the KCC. In 1980 KCC opened a cooling plant at Githumu, 10 km away from our study site. KCC began buying directly from farmers in the community after that time (Kimani, 1992).

In the country as a whole, government provision of livestock services began during the colonial area with the focus on providing artificial insemination and veterinary services for settlers. Artificial insemination began in 1935, with the objective of reducing the need to import breeding stock. The milk parastatal, the Kenya Cooperative Creameries (KCC), began operation in 1925 but had no African members until shortly before independence in 1962. Africans were barred from owning grade dairy cattle, as they were barred from growing coffee, ostensibly to control the spread of disease. As with coffee, some Africans violated the law and began to keep high-quality cattle anyway. The government relented on some of these restrictions in the 1950's, and artificial insemination services began in Central Province at that time.

After independence KCC agreed to expand dramatically its purchasing network in Central Province as the price it paid in order to maintain its monopoly of the Nairobi market (Heyer 1981). This period directly after independence saw the development of the basic structure of government

intervention that would continue for the next 25 years. There were five prongs to this: Artificial insemination, provision of veterinary services, the provision of milk marketing services, livestock extension, and credit for purchases of grade cattle. We will discuss here only the first three of these. In addition to these services directly related to dairy production, basic improvements in infrastructure, particularly improvements in roads, had a major impact on the potential for dairy development.

Artificial insemination had been provided at cost during the colonial era and in the first years of independence. With the help of aid from Sweden, subsidies were introduced in 1967, decreasing the cost of insemination by 75 to 87 percent initially, and by 97% in 1971. With a reliable and virtually free insemination service provided by the government, artificial inseminations grew rapidly, doubling between 1968 and 1971. Leonard (1991) contends, however, that the large subsidies involved were unsustainable and ensured the eventual demise of the services. By the 1980's, with the government as a whole experiencing a significant budget crunch, Al services became less reliable and therefore of much less use to farmers. Fees have been increased dramatically with a view towards cost recovery, but, in late 1992, the charge was the same in nominal terms as in the early sixties. This is well below the cost to the government of providing the service, and even at this higher price, demand for the service continues to outstrip what government can provide.

The provision of veterinary services follows a similar story. Livestock in this part of Africa have been subject to epidemics of communicable diseases such as rinderpest for centuries. During the early colonial era the focus of the veterinary department was on inoculations and other disease control measures to prevent widespread disaster. Such services are clearly public goods; private, profit-maximizing agents would underinvest in these services because the benefits are shared by so many.

In the mid-seventies, however, the government expanded the operations of the veterinary department by opening eighteen clinical centers for smallholders, expanding greatly the curative services available to smallholders. Both drugs and the services of the veterinarians were highly

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[9] The following section draws extensively from Leonard (1991),

subsidized. Unlike the prevention of disease epidemics, curative services benefit primarily the owner of the animal. Economic theory suggests that subsidies in this case will lead to overuse of the product and a burgeoning total subsidy bill; this is exactly what happened. The same budget crunch that hampered AI services in the eighties hit the veterinary services even harder, with the result that both preventive and curative services were affected. As Leonard (1991) states, "Producers would have been much better served by an officially and openly private veterinary care system .... The great majority of the Kenyan government veterinarians wanted privatization but could not find the formula for making it politically palatable .... They were trapped by the embrace of earlier government favor."

The KCC story of milk marketing is not dissimilar. The opportunity to sell daily as much milk as desired is clearly key to the development of a dairy industry. KCC clearly expanded these opportunities to many smallholders in the 1970's, with its purchases growing by 15% per year during this time. But by the time of our survey, there was widespread dissatisfaction with the KCC. Farmers in our sample and elsewhere were discussing boycotts of the cooperative because of low prices and late payments; there was a shortage of milk in Nairobi, prompting private entrepreneurs to drive pickup trucks to rural areas, including our sample community, and offer almost sixty percent more than the KCC price for milk, cash paid on the spot. KCC's raising the price offered to farmers by 40% alleviated some of these concerns, but at the close of our survey there was still considerable disgruntlement with the cooperative.

Thus, Kenya's livestock policies began to shift toward smallholders at independence and have moved increasingly in that direction through the seventies. Milk marketing, veterinary services, and artificial insemination all have played important roles in the rapid development of dairy in Kenya, but also have suffered in the last decade. Government has been faced with proposals to increase cost-sharing and improve efficiency in these areas since at least 1982, but moving from subsidized provision to providing services at cost has proven to be difficult for politicians.

The story in Tanzania is quite different. Through the early eighties, Tanzanian policy maintained a belief that large, state farms could be productive, and that cooperative village

farming could work. Thus, a large, donor-funded project between 1976/77 and 1982/83 began eighteen large-scale dairy farms run by parastatal organizations and cooperatives. Other farms were begun in ujamaa villages. The ujamaa schemes -- all in the Mara region - failed within five years. Altogether 45 milk collection centers were built, but only five were still working in 1993; two milk processing factories built under the same project are operating at only a small percentage of their designed capacity. The performance of the large-scale operations was also poor, with milk production from these operations showing significant declines over time.

In 1983 the government shifted the emphasis of dairy policy to the smallholder sector. The main prongs of this strategy are increasing supplies of improved cattle through bull centers, heifer breeding units, and artificial insemination, and educating smallholders on animal feeds and use of other production inputs through extension services. Funds for these government interventions have come primarily from donors.

The major thrust for dairy cattle breeding was on the successive upgrading of indigenous cattle through cross breeding programs. The policy called for an integrated breeding program involving the use of heifer breeding units, artificial insemination, bull centers, breeding stations and a program for the distribution of upgraded bulls to smallholders and villages. The government had built fifteen heifer breeding and multiplication units by 1992, containing a total of over two thousand animals. These units are located in the high rainfall areas of Tanga, Coast, Iringa, Kilimanjaro and Rukwa regions. Tanzania has seven artificial insemination centers located in Tanga, Kilimanjaro, Arusha, Mara, Mwanza, Kagera and Dar es Salaam regions. Together these regions account for an estimated three-quarters of all dairy cattle in the country (United Republic of Tanzania 1993).[10] Between 1983 and 1990 approximately 115,000 artificial inseminations were performed nationwide, with almost half of those in Kilimanjaro Region. Prices for artificial inseminations and improved cattle were originally subsidized, but have now been set at full cost.

Thus, Tanzania in the last decade has shifted the focus of its policy so that it is more similar to Kenya's. Tanzania has not, however, made the provision of veterinary services a high

[10] Kilimanjaro is the main region for dairy cattle, containing approximately 40% of the national total.

priority, instead focusing on upgrading the quality of the cattle population. While Tanzania has been expanding its Al and breeding programs, Kenya has been cutting back. Nevertheless, Kenya's is still substantially larger; between 1982 and 1990 over 600,000 artificial inseminations were performed in Murang'a District alone. This was approximately eleven times the number performed in the larger Kilimanjaro region during the same time period. Similarly, Kenyan government expenditure on livestock development continues to dwarf Tanzania's; in the late eighties, Kenya was spending approximately ten times as much as Tanzania on livestock development.

Conclusions

Did policy make a difference in the development of dairy in these communities? Or, as in the case of land policy, was the government irrelevant?

Government policy clearly did make a difference in Tanzania. The growth in the reported numbers of improved dairy cattle correspond nicely with the change in government policy in 1983, shifting toward smallholders and emphasizing improved breeds. It is hard to imagine the stock of cows improving so dramatically between the early eighties and 1992 without some provision of high-quality semen or mature grade cows from the government. Although these improved cattle are not producing anywhere near their genetic potential, they are nevertheless providing their owners a substantial income, based on the standards of the community. The absence of any assured market outlet, however, is limiting further dairy development in the Tanzanian community.

Just as clearly, government policy made a difference in Kenya. The large investments made after independence in upgrading the livestock herd were already evident in our community in the late 1960's. Improving infrastructure through paving of roads and building milk cooling centers also were important in allowing the KCC to ensure a market for milk producers in the area. Despite the financial problems encountered by both the Veterinary Department and the KCC -- problems that resulted from oversubsidizing services on the one hand and poor management on the other -- livestock operations continue to provide almost 1/3 of income to the households in the sample.

If both governments have assisted the development of dairy, why is the Kenyan community so far ahead of the Tanzanian community? The answer lies in a combination of factors: the greater amount of investment, the longer time of the investments, the synergy of different investments, and geographical luck.

As noted above, Kenya has invested and continues to invest considerably more in livestock production than Tanzania. While it is clear that the politicians' desire to push the price of government-provided services toward zero in the long run damaged the ability of the government to continue to provide such services, there can be no doubt that cheap provision of Al services and preventive veterinary services aided the development of a critical mass of high-grade cattle in Central Province, thereby making daily purchases of milk by the KCC potentially profitable. This critical mass also should make the eventual transition to private curative veterinary services practical, as the costs of providing such services decrease significantly with the density of the cattle population. While prices for milk in the local market in Tanzania are high, farmers have no assurance that all the milk brought to market will be sold. And nominal prices are sticky in this market; an increase in supply does not necessarily mean that the market will clear at a lower price. Thus, investments that will improve the security of a market outlet are one key element that allowed dairy development in the Kenyan community to outpace the same in the Tanzanian community.

Second, Kenya had been investing in smallholder dairy for almost thirty years at the time of our survey; Tanzania only shifted its focus to smallholders in the early to mid-eighties. Even if the quality of the herd is built up quickly, building sufficient milk marketing infrastructure to allow intensive feeding and milking takes time. The Tanzanian study site in 1992 appears to be at about the same stage as the Kenyan study site around 1970: after almost a decade of improvement in cattle quality, more than half of the cows are improved, but there is no assured market for milk and no marketing infrastructure. Because of these factors, we suspect that milk yields per cow in the Kenyan study site in the early seventies were much closer to Tanzanian yields today.

Third, infrastructure investments, particularly rural roads, have been considerably larger in Kenya also. The synergy between investment in roads and livestock development is difficult to

overestimate. Without accessible roads in the rainy season, even the most efficient milk marketing organization cannot assure farmers that it will buy milk 365 days per year. No access in the rainy season effectively means profits per cow are only 3/4 what they would be otherwise. Rather than improving rural roads, Tanzania saw its road network deteriorate during the eighties. Only in the nineties have improvements begun. It is unlikely that assured, daily marketing for milk will be available in our Tanzanian community until the road up the mountain slope is upgraded.

Finally, the Kenyan community is placed more favorably than the Tanzanian community with regard to market outlets. Although the two communities are approximately the same distance from major towns - Thika and Moshi - the Kenyan community is only 75 km from an almost limitless milk market, Nairobi. The relative importance of geographical luck and other factors is impossible to gauge. Given the high price of milk prevailing in Moshi at present, there seems to be scope for considerable expansion of milk consumption through the development of efficient marketing services and improvement in infrastructure. Such investments followed by an increase in supply, a drop in price, and increased consumption could allow milk from this community to be sold in Moshi. We thus do not believe that geographical luck tells the most important part of the dairy story.

Future policies, then, need to focus those areas of investment that only government can provide: improvements in rural infrastructure and preventive veterinary care. The development of an efficient milk marketing system is vital, but as the Kenyan experience shows, a monopoly buyer can become inefficient and nonresponsive to the needs of dairy farmers. It is less clear that Tanzania needs to continue to make serious efforts to upgrade the quality the dairy herd. As shown in Tables 1 and 3, the major determinant of the differences in milk production between the communities is milk production per cow, not the difference in quality of the herd. There is little rationale for moving to pure-bred exotics at these production levels. Clearly the provision of AI services or sales of high-quality cows at cost would be valued by the community, and these investments were vital in the eighties as a critical mass of high grade cows was created. But at present, the major barrier to dairy development in our Tanzanian community is marketing infrastructure; further improvements in the herd alone are unlikely to break down that barrier.

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