8 Dynamic Externalities and Structural Change in Kenya

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Economic development and structural transformation are *dynamic* processes in which sectoral interactions are numerous and multidirectional. Recent growth literature has noted that many of these effects occur in the form of externalities not captured in a neoclassical accounting of intersectoral resource flows and price adjustments. This work has emphasized, for example, that increasing returns phenomena such as demand externalities (Murphy, Shleifer, and Vishny 1989a) and human capital spillovers (Romer 1986) can play an important role in leading the growth process. The assessment just presented by Bigsten and Collier in chapter 7 takes a primarily static view of agricultural linkages in Kenya. This chapter points out ways in which such a perspective may overlook important aspects of linkage effects and structural transformation in Kenya. The discussion draws heavily on the successful agricultural and rural development experience in Taiwan to illustrate the potential importance of intersectoral linkages and certain dynamic externalities.

While not claiming to disprove the existence of strong growth linkages between agriculture and other sectors, Bigsten and Collier argue that the only significant connection between agriculture and other sectors is through construction. By way of evidence in support of their view they document the effects of two important agricultural shocks, a coffee boom in 1976–79 and a drought in 1983–84. However, their examination of the short-term macroeconomic transmission of temporary shocks to other sectors of the economy provides little insight into the importance of agricultural development to long-run structural transformation, a question of central and pressing concern. It is not surprising that the results of reduced-form empirical specifications and Granger tests that attempt to encompass complicated and simultaneous underlying structural relationships are not robust. For one thing, the time series is too short and considerable noise is created by a sequence of well-documented macroeconomic shocks during the time period analyzed (1965–87). The perception that gains are transitory, which is especially likely to be true of price shocks, will result in far

different behavior than a steady improvement in underlying productivity and employment opportunities.

Increasing Returns and the Importance of Agricultural Growth

Bigsten and Collier fail to address issues of structural and demographic transition because of the analytic framework they have used. In a static context, it may make sense to think that transfers and the composition of aggregate income do not matter and that pecuniary multipliers therefore have no real effects. In a dynamic setting with externalities, however, the transfer of labor and other resources from agriculture to industry may be important, since the potential gains from economies of scale, learning-by-doing, and technological spillovers are significantly higher in the industrial sector than in agriculture. More generally, employment, investment, and output decisions that have small effects on aggregate output in an Arrow-Debreu model can have large effects when prices already diverge from marginal costs (Shleifer 1990).

What are the causes of such divergence? In an economy in which efforts to expand trade (especially of nontraditional export products) is initially problematic and there are increasing returns to scale in manufacturing, the stimulus of agricultural growth for the rest of the economy may be significant. When a country's manufacturing sector is still extremely small, many kinds of products are not being produced because markets are too small to permit technology with increasing returns to break even. And poor-quality product can exclude producers from export markets. Thus, rising agricultural incomes can produce demand externalities for nonagricultural goods and services that allow real gains in growth from increasing returns technologies to be realized (Murphy, Shleifer, and Vishny 1989b; Matsuyama 1992).

Increasing returns to production can stem from economies of scale (Fleming 1955), perhaps as a consequence of large, fixed, start-up costs, or from the effects of learning by doing (Arrow 1962) or learning by using (Rosenberg 1982). These latter effects refer to the improvements in production quality and efficiency over time that result from accumulated experience in producing and using manufactured and other products. In the early stages of development in Taiwan, for example, textiles and other export-leading sectors first went through a period in which product quality was low and most sales were to the domestic market.

These theoretical insights mesh quite nicely with the evidence presented by Bigsten and Collier documenting the strong link between agricultural development and the growth of rural-based small and medium-scale industry. Significantly, the discussion of "locational aspects of growth and linkages" is the only part of their chapter that takes a careful look at microeconomic phenomena and so provides a glimpse of the rich dynamic interactions at work.

Research has shown that the highest expenditure elasticity for rural households is for local nonfood goods and services, which are typically provided by the small-scale industrial sector (Hazell and Röell 1983; Liedholm and Mead 1987). Small- and medium-scale enterprises (SMEs) also tend to be highly adaptable to new technologies and changing market conditions. Moreover, they have steep, upward-sloping learning curves and introduce new products at a rapid rate, itself an important source of sustained growth (Stokey 1988). In Taiwan, for example, rising agricultural productivity and broadly distributed rural income growth provided an important stimulus to rural SMEs, which still dominate Taiwan's industrial sector (Park and Johnston, in press). Such complementarities between sectors that work through market size effects are ignored in a static neoclassical framework. Fleming (1955) emphasizes that a sector producing good A will have large effects of this type if the income elasticity of demand for good A is low, the elasticity of substitution between A and non-A goods is low, and the elasticity of supply in non-A goods is high—all of which are arguably true for agriculture (A) and small-scale industry (non-A).

There are analogous externalities from technological innovations and investment that are not mediated through market externalities but that reflect more direct interactions between agriculture and industry. New machines or techniques related to agriculture, for example, are often imitated with modifications in other industrial sectors. For instance, the small-scale production of agricultural tools in Taiwan led later to the production of spare parts, more complicated equipment such as power tillers and fans, and even electronic products (Johnston and Kilby 1975). Such technological spillovers represent an externality because the returns are never fully captured by earlier innovators.

As is well known, investment in transport and other infrastructure can generate important public goods externalities. By making it possible for goods to be transported at a low cost over a greater area, investments in such infrastructure represent another way in which production based on increasing returns technologies is brought close to feasibility. Transport infrastructure also facilitates intersectoral labor mobility and benefits firms and producers in many different sectors at once.

These ideas are, of course, akin to the Big Push theory of industrialization associated with Rosenstein-Rodan; but that view of industrialization has often been interpreted as justifying the adoption of plans for very big and coordinated investment projects. But such an interpretation can be misleading. Although this logic definitely argues for government provision of essential public goods, reaching a more advanced stage of industrial development is also constrained by learning requirements and limited markets. This dynamic view of industrialization once again suggests an important role for increasing demand for domestic manufactures by fostering increases in farm productivity and incomes and an expanding export sector.

Because of certain factors in the Kenya case, the dynamic externalities

there are much smaller than in Taiwan. In parts of Kenya, the distribution of land is highly inequitable and so agricultural income gains are not well-dispersed among the population. Consequently, effective demand externalities are greatly reduced (Murphy, Shleifer, and Vishny 1989b). Also, in many areas, rural infrastructure is too inadequate to permit industrialization and commercialization, with the result that industry has become highly concentrated in Nairobi.

Probably most important, Kenya and other developing countries in tropical Africa face an especially difficult challenge in that they are being pressed to come up with a sequence of technological innovations that small-scale farmers could adopt on a wide scale. Agriculture has performed fairly well in Kenya, especially in comparison with other countries in Sub-Saharan Africa.[1] Its rapid expansion of smallholder production of coffee and tea has been particularly significant, and Kenya was one of a few African countries in which maize production attained rapid growth through smallholder production of hybrid maize and increased application of chemical fertilizers. Those achievements were made possible by the establishment of a fairly strong agricultural research system during the colonial period, trial-and-error learning by the European farmers who pioneered coffee and tea production under Kenya's conditions, and more recent research involving international cooperation, which was especially important for hybrid maize. Institutional innovations such as the Farmers' Training Centers (FTCs) and the Kenya Tea Development Authority (KTDA) played crucial roles in supporting the rapid expansion among African smallholders of coffee and tea and dairy production with "grade cattle" (i.e., crosses between high-yielding European breeds and indigenous Zebu cattle) (Anthony et al. 1979).

Kenya's agricultural progress has, however, been largely confined to areas of high and medium potential. These areas have adequate and reliable rainfall, a relatively good road network, and other types of infrastructure, in addition to ready access to profitable technologies. But they account for only about 20 percent of the total land area. In the past, some 80 percent of the country's rural population lived in these areas.

In recent decades Kenya's semiarid farming areas have faced extraordinarily difficult challenges. Population growth resulting from very high rates of natural increase has been augmented by a rapid in-migration from areas of high potential in which the population density increased to such an extent in the past half century that they can no longer absorb a rapidly growing population. Moreover, ecological conditions in the semiarid areas are extremely diverse, with the result that the constraints and opportunities for various crops and types

1. This discussion of Kenya's agricultural performance and of the special difficulties of accelerating technological change in the countries of Sub-Saharan Africa draws heavily on chapter 11 in Tomich, Kilby, and Johnston (1995).

of livestock and for improving the conservation or provision of water vary enormously from one locality to another.

Kenya's experience makes it clear why past exhortations to bring the green revolution to Africa have not been an adequate response to the widespread failure of food production to keep pace with rapid population growth in the countries of Sub-Saharan Africa. Many failed to appreciate that the green revolution that got under way in the mid-1960s (and much earlier in Japan and Taiwan) had its principal impact in countries that had already acquired considerable indigenous research capability. These countries were therefore able to make good use of imported "prototypes" of genetic material, a growing body of scientific knowledge, and effective methodologies for experimental work to develop crop varieties and agronomic practices suited to the conditions in their specific localities. Moreover, much of Asia already had the basic irrigation facilities and other infrastructure required to take full advantage of the yield potential of the improved seed-fertilizer combinations. These facilities only needed to be improved and enlarged.

Sub-Saharan Africa has even more intractable problems arising from the diverse ecological and socioeconomic conditions of the region. Policymakers and researchers have been slow to recognize that the yield-increasing technologies that were immediately profitable to most farmers in Asian countries were often not profitable under African conditions. Farming areas in Africa differ greatly, for example, in the extent to which rural population growth (and other factors) have enhanced the profitability of shifting from extensive to intensive farming. Matlon (1990, 18) puts the point concisely: "Net benefits to yield-increasing technologies are directly related to the cost of land saved, and inversely related to the opportunity cost of the additional capital or labor employed." Although costs can be expected to change in predictable directions with population growth and enlarged commercial demand, it is likely that irrigation, which can greatly reduce the heterogeneity of rainfed agriculture, will continue to be of extremely limited importance in most of tropical Africa. Even if population growth and other socioeconomic factors increase the attractiveness of investing in irrigation, the physical environment in much of Sub-Saharan Africa severely limits the scope for cost-effective investments in irrigation (Moris and Thom 1987).

Experience in Australia, the United States, and a few other developed countries demonstrates that there is considerable potential for increasing the productivity of rainfed agriculture in semiarid regions by soil- and water-conserving technologies. But there is little scope for a direct transfer of those technologies because they are implemented with large-scale equipment that is too capital intensive to be appropriate for African countries, given their need for capital-saving, labor-using technologies.

Animal-powered and other simple, inexpensive items of farm equipment have been neglected in Sub-Saharan Africa, partly because of the erroneous

expectation that African farmers could shift directly from the hand hoe and machete to tractors. In fact, wider use of simple but well-designed farm equipment can make two notable contributions. By easing seasonal labor bottlenecks and making it feasible to implement practices such as terracing or tie-ridging, which are usually uneconomic when carried out with hand hoes, an appropriate sequence of mechanical innovations can accelerate the increase in agricultural productivity and output. Moreover, and particularly relevant to this chapter, the local manufacture of such equipment can have a highly beneficial impact on the growth of rural-based manufacturing firms through its effects on dynamic externalities, as well as changes in the composition of income and demand resulting from widespread increases in farm productivity.

In chapter 7 Bigsten and Collier report that the value added of small-scale enterprises in rural Kenya grew at an impressive average rate of 17 percent from 1973 to 1982. The number of such firms grew even faster. It is less meaningful to try to establish whether agricultural growth "caused" that expansion than to note that there were undoubtedly reciprocal and positive interactions between the two processes. Given the extent to which industrial investment has been concentrated in Nairobi and a few other urban enclaves, it is somewhat surprising that the relative importance of secondary centers has increased.

Also, just as in Taiwan, the nonagricultural sources of rural household income in Kenya have become increasingly important over time as a result of sectoral and labor market integration and gradual structural transformation. Here, it is crucial to understand the country's demographic transition.

The Demographic Transition, Labor Slack, and Structural Adjustment

Taiwan's experience demonstrates the importance of taking a *dynamic* view of the development process and of paying due attention to vital factors that tend to be ignored in the comparative statistics of neoclassical economics. A low-income, late-developing country with the structural and demographic characteristics of the Taiwan of 50 or even 30 years ago will be suffering fundamental disequilibria that can only be overcome by the time-consuming process of structural transformation and by completing the half-completed demographic transition. In 1960, Taiwan was still an economy with an abundant agricultural labor force—56 percent of the total labor force depended mainly on agriculture for income and employment, the country's total labor force was increasing rapidly, and the farm labor force was still increasing.

At the present time, Kenya and most of the other countries of Sub-Saharan Africa are still "late-late" developing countries. Table 8.1 summarizes the demographic characteristics of Kenya and Tanzania, along with average figures for 38 Sub-Saharan countries. Note particularly the rates of growth of their agricultural labor force. The rates of growth of their total labor force are, of course, even higher. The rate of growth of their population of working age is

TABLE 8.1 Structural and demographic characteristics of Kenya, Tanzania, and Sub-Saharan Africa

Characteristic	Period	Kenya	Tanzania	Sub-Saharan Africa
Agriculture's share in GDP (%)	1965	35.0	45.0	43.0
	1987	31.0	61.0	34.0
Agricultural labor force (percentage of labor force)	1970	85.0	90.0	76.0
	1985	79.0	83.0	74.0
	2000	72.0	75.0	66.0
Agricultural labor force growth rates (% per year)	1970–80	3.2	2.3	1.9
	1980–85	3.0	2.2	1.7
	1985–2000	3.1	2.3	1.8
Population growth rate (% per year)	1970–80	4.0	3.4	3.0
	1980–85	4.2	3.6	3.1
	1985–2000	4.3	3.8	3.3
Agricultural exports' growth rates (% per year)	1961–70	4.4	4.3	2.3
	1970–80	3.6	−4.4	−2.2
	1980–85	4.0	−4.9	0.4
Agriculture's share in total exports (%)	1983–85	68.0	79.0	26.0
Fertilizers (kg/ha)	1982–84	27.0	5.0	9.0

SOURCE: Alexandratos (1988), tables A.1, A.3, and A.7.
NOTE: Figures for Sub-Saharan Africa are averages for 38 countries.

determined essentially by the population growth rate (although there will obviously be a lag of some 15 years before a reduction in birth rates will begin to be reflected in a slowing of the rates of growth of their populations of working age).

In an earlier version of their chapter, Bigsten and Collier asserted that "in a small fully open economy with perfect factor markets, there are no multiplier effects" because "expansion of agriculture is at the expense of the rest of the economy as the sector bids away labor and capital from other uses." The summary data in table 8.2 point to the importance of "slack" in the agricultural sector of a late-developing country and the large potential that exists for expanding farm output through the interacting effects of technological change, investments in infrastructure, and fuller utilization of the existing stock of farm labor.

The threefold increase in Taiwan's farm output between 1911–15 and 1956–60 cannot be explained simply by increases in conventional inputs of land, labor, and capital. According to various estimates (Lee 1971), more than half of the growth of farm output is to be attributed to increases in *total factor productivity* (TFP). Table 8.2 directs attention to one significant component of that increase in TFP. Substantial "labor slack" existed in Taiwan's farm econ-

TABLE 8.2 Changes in farm output and various inputs in Taiwan, 1911–1915 to 1956–1960 (index numbers except as otherwise indicated)

Period	Total Farm Output	Cultivated Land Areas	Cropped Area	Farm Labor Force	Labor Inputs in Working Days
1911–15	100	100	100	100	100
1956–60	337	127	196	149	198

Period	Working Days			Fertilizer Consumption (1,000 metric tons)	Total Current Inputs[a]
	Per Cultivated Hectare	Per Cropped Hectare	Per Worker		
1911–15	195	167	117	50.8	100
1956–60	305	170	155	663.5	512

SOURCE: Lee (1971).

[a]In contrast with Japan, feed for livestock has long been an important component of current inputs in Taiwan. It accounted for 57 percent of current inputs in 1911–15 and 41 percent in 1956–60, when fertilizer represented 45 percent of the total.

omy because agriculture as the "self-employment" sector par excellence still provided income and employment for the bulk of the country's labor force. As a result of the structural and demographic characteristics that prevailed during that period, the *stock* of farm labor increased by 50 percent over that 45-year period. But the *flow* of labor inputs into agricultural production, measured in working days, virtually doubled. Thus, an important source of the increased farm output was *fuller*, as well as more efficient, utilization of the available stock of farm labor. It is evident from table 8.2 that this fuller utilization of the farm work force was associated with a large increase in working days per cultivated hectare but only a trivial increase in working days per cropped hectare. The explanation, of course, is that expanded irrigation had permitted a large increase in multiple cropping, which in turn explains the increase from 117 to 155 days per year of farm work per worker. The large increase in farm output associated with fuller utilization of the available stock of farm labor was also facilitated by a sequence of technological and economic innovations, such as the introduction of labor-intensive enterprises (e.g., raising mushrooms) that required very little land.

The discussion of "labor market distortion" by Bigsten and Collier, based on their figure 7.1, is particularly misleading. Given Kenya's structural and demographic conditions, increases in nonfarm employment will coexist for many years with a continuing increase in the absolute size of the farm labor force. Because of the agroclimatic conditions in Kenya and elsewhere in tropical Africa, it seems unlikely that the increase in the flow of labor inputs into

agricultural production will exceed the growth in the stock of farm labor, as it did in Taiwan between 1910 and 1960. Hence, policies that foster the dynamic externalities between agriculture and industry and that lead to the rapid growth of nonfarm job opportunities are needed to prevent diminishing returns to agricultural labor from making it excessively difficult to increase per capita GNP. According to recent evidence, Kenya has finally entered the declining fertility phase of the demographic transition. This circumstance will, of course, facilitate the transformation of the country's overwhelmingly agrarian structure. But given the extraordinarily high rates of natural increase in recent decades, Kenya will continue to confront a severe labor absorption problem for many years.

Conclusion

In a country such as Kenya with an economy that it still predominantly agrarian, it is essential to consider dynamic externalities associated with linkages between agricultural and nonagricultural growth. As the preceding discussion suggests, those externalities are likely to be very significant because the transfer of labor and other resources from agriculture to industry can lead to important gains from economies of scale, learning by doing, and technological spillovers that are larger in the industrial sector.

Taiwan's well-documented development experience makes it clear that such linkages and dynamic externalities were an important source of that country's rapid growth, especially in the 1950s and 1960s when the country's economic structure was still predominantly agrarian and the growth rates of the population and the labor force were high. Furthermore, Taiwan's experience and the recent growth literature calling attention to the potential importance of externalities not captured in the comparative statics perspective of a neoclassical view of resource flows and price adjustments suggest that a country's success in realizing those potential gains will be influenced strongly by strategic decisions that shape the pattern of its agricultural and rural development.

As noted earlier, emphasis on intersectoral growth linkages has in the past been commonly associated with Rosenstein-Rodan's Big Push theory of industrialization, which supposedly justified very large and coordinated investment projects. In fact, Taiwan's experience points up the advantages of policies and programs that foster a broadly based pattern of agricultural development and geographically dispersed industrialization carried out mainly through the rapid growth of small- and medium-enterprises. Many of those policies and programs are described in detail in chapter 2. But certain elements of Taiwan's strategies for agricultural and rural development merit special attention because they seem to have made notable contributions to growth through their positive impact on dynamic externalities, including increases in total factor productivity.

A short list of key elements in Taiwan's development strategy would certainly include sustained investments in agricultural research, which gener-

ated a sequence of labor-using, capital-saving innovations that could be used efficiently by small farmers with limited cash income; investments in rural infrastructure, including the transport and communications network and electricity, in addition to irrigation and drainage facilities; the creation of effective farmers' organizations; investments in education; and investments in public health programs that reached the rural as well as urban population and had a particularly pronounced effect in reducing infant and child mortality, thereby contributing to the subsequent success of family planning programs. Throughout, careful attention was given to sequencing and a "phased approach" and to institutional and organizational factors. Indeed, it has been said that "the main secret of Taiwan's development" was its "ability to meet the organizational requirements" (Hsieh and Lee 1966, 103, 105).[2] Taiwan avoided the common problem of failing to achieve a balance between public sector responsibilities and the resources available for fulfilling those responsibilities because its interventions were *selective*. The knowledge, capabilities, and learning capacity of small farmers were recognized and appreciated. And government action was concentrated in areas where direct intervention is indispensable, notably public goods such as research, extension, infrastructure, and support for local institutions such as the farmers' associations and irrigation associations.

In addition, Taiwan created a policy environment that permitted price and market mechanisms to play a key role in guiding the development process. Thus individual farmers and the entrepreneurs who created and guided the SMEs that played such a crucial role in rural industrialization exercised their initiative by responding to price signals that reflected the social opportunity cost of resources. In part, this was a result of the government's commitment to control inflation and its adoption in the 1950s of monetary and exchange-rate policies that promoted exports. In addition, the government encouraged the use of technologies that required a minimum of capital and took full advantage of indigenous resources, notably Taiwan's abundant supply of increasingly high-quality labor.

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2. In a 1990 paper, S. C. Hsieh, currently governor of the Central Bank of China, Taipei, and formerly chief economist and secretary general of Taiwan's Joint Commission on Rural Reconstruction, points out the importance for development of sequencing, a phased approach, and an integrated perspective. In his view, it is vital not only to take into account the linkages between the agricultural, industrial, and social sectors but also the importance of institutional factors and a proper balance between the role of government and the private sector.

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