



Transition in Sub-Saharan Africa: Agriculture, Urbanization and Income Growth

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Summary. — Econometric analysis of some 40 years of data has provided mixed results, because of the defects of the data, and because there are some relatively sudden structural economic shifts. An important shift is when agricultural labor ceases to grow, now happening in sub-Saharan Africa (SSA). A model of the interrelationship over time of the rural, mainly agricultural sector, and the urban, mainly manufacturing and service sector, is proposed. Each provides a market to the other. Growth in both requires investment, but of distinctly different types. Their interaction results in an S-shaped curve. Many SSA countries are in the acceleration phase, and its agriculture, particularly in semi-arid areas, is increasingly oriented to the growing home market. Case studies show farmers have invested and adopted new technologies but the transition to an urbanized economy has been hindered by poor policies. The current need is for appropriate investments and policies to develop the productivity of the urban sectors, so that they can continue to stimulate agriculture, and provide jobs for those who are leaving farming.

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1. TRANSITIONS AND GROWTH MODELS

Development theory has been preoccupied with providing improved living standards and quality of life either to the great majority, or more recently, to the poorest of the poor. This normally requires economic growth greater than population growth, both to improve incomes directly, and to increase the taxable capacity underpinning good government services.¹

It is clear that the high-income countries are urbanized and have large industrial and service sectors. Agriculture provides only 2% of their GDP, compared with 10% in middle-income and 41% in low-income countries (World Bank, 2000b). Most low-income countries have a higher proportion of their labor force in agriculture than its proportion of output value. Many development economists in the 1950s and 1960s therefore urged the need to shift labor into higher productivity sectors, by a structural transformation leading to industrialization of their economies. Rostow (1960) propounded a rapid take-off stage, for which a necessary condition was a rise in the productive

investment rate to over 10% of national income. It was generally believed in the 1960s that such investment must be made by government, due to lack of private capacity. In consequence, high taxes on agriculture through marketing boards and export duties had general approval. Helleiner (1966) wrote in relation to Nigeria:

The disposition of Marketing Board surpluses may not have been perfect, but the rates of return from their investments in research, roads, agricultural schemes, universities, modern manufacturing plants and so forth are unlikely to have been any lower than

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those on housing, sewing machines, land clearing, and the other small-scale outlets for peasant funds discussed above, let alone so much lower as to offset the difference between savings rates (p. 184).

The failure of policies aimed at inducing rapid industrialization discredited belief in a take-off and stages of growth.² The importance of the agricultural sector as a supplier of raw materials, food and labor, and as the home market for local industrial output, noted by Johnston and Mellor (1961), was increasingly recognized. The low productivity of many government investments and the outright failure of some became better known. Structural adjustment implied "a shift away from inward-oriented import-substituting development strategies to more outward-oriented ones" (Alexandratos, 1995), and debt-ridden countries have been urged to increase and diversify agricultural exports.³

If GDP rises smoothly as a result of long-term effects of capital formation, labor force expansion and technological change, it can be modeled by econometric analysis, using the 30–40 years of statistical data which are now available for a large number of countries. Kenny and Williams (2001) have shown the limited explicatory power of econometric models, and their often contradictory results. They note several causes, including, importantly, the assumption that the process of economic growth is the same, not only in all countries, but in all periods of time. They suggest therefore, "that mathematical modeling techniques have invaded territory to which they are ill-suited" (p. 14).

This paper uses a few generally agreed principles of economic growth to construct a nonmathematical model that reflects historical experience. The model conforms to the broad thrust of available statistical data, but shows that economies are fundamentally different at different points in time, particularly in the relationship of their agricultural and nonagricultural sectors. Policies therefore need to be varied according to the stage at which the country finds itself, rather than applied universally. The development of the agricultural sector is initially extremely important. At a later stage, however, increases in the productivity of towns are required, to improve urban incomes, to provide alternative occupations to the rural poor, and to stimulate agricultural investment through growing demand.

Tomich, Kilby, and Johnston (1995) also returned to a stages approach in their book, *Transforming Agrarian Economies*. The model differs from them in emphasizing the change in markets rather than in labor disposition, and the acceleration of change. They identified countries with abundant rural labor with 50% or more of the labor force in agriculture, but thought that

...it will be decades before they reach the *structural transformation turning point*, when the absolute size of the agricultural work force begins to decline. Until then, poverty can be alleviated only if productivity and employment in the rural economy are increased (pp. 9–10).

In fact, a number of countries even in sub-Saharan Africa (SSA) are at or near this point. Calculating from (World Bank, 2002), urban population in SSA increased at an average of 5% p.a. and rural at 2% p.a. 1968–2000, and averaged 34% of the total in 2000. It is now heading for 50% in some (Figure 1). Rural population growth had dropped to 0.4% p.a. or less in eight out of the 20 largest countries in 1998–2000 (Figure 2), and not all rural is agricultural. While policy debates have focused on the pros and cons of exports, the swiftly growing internal market has become much more important to farmers, and is a main generator of change in farming systems, particularly, but not only, in the semi-arid areas. The urban market is attracting not only their products, but also their labor.

The model is delineated and explained in Section 2. Section 3 illustrates the dubiety of much of the population and national income data relating to SSA, which lies behind allegations of low or negative growth rates in income per capita, and falling agricultural output per capita (World Bank, 2000a). Wiggins (1995, 2000) has already discussed the conflict between these statistics and the evidence of change and growth gathered from a limited number of village case studies. As these can be unrepresentative, Section 4 illustrates the rapidity of change in four semi-arid African districts, 1960–2000. Some 30% of the SSA population live in semi-arid areas (Jahnke, 1982), which provides a difficult environment for agriculture. If there are achievements in these areas it is likely that this is also the case in the better-endowed areas. Section 5 considers the policies and government services likely to be most important in the near future.

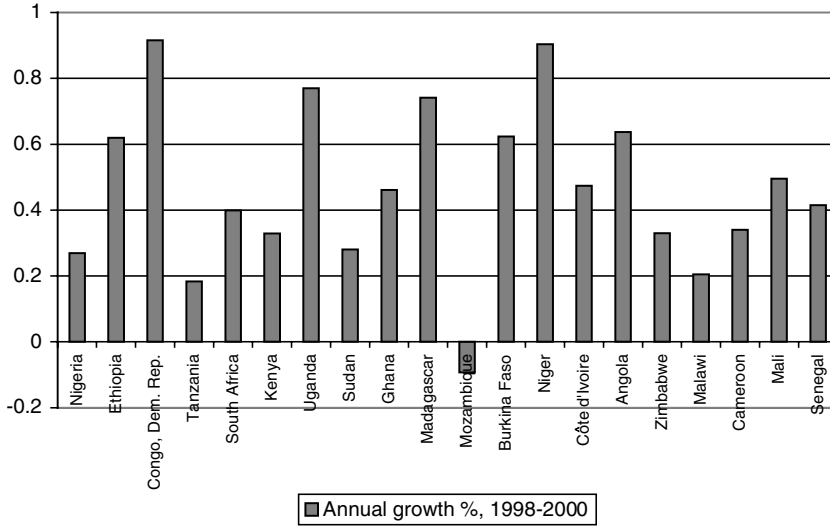


Figure 1. Annual percentage growth in rural population, 1998–2000, in sub-Saharan African countries currently having a population over 10 million, in 1968 and 1998. Source: Calculated from World Bank (2002). Countries in this and subsequent figures are arranged in order of population size.

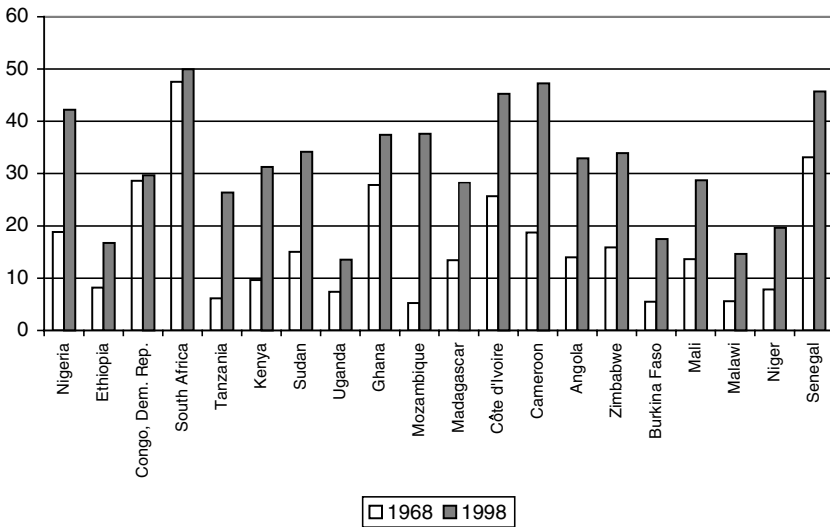


Figure 2. Urban population, largest SSA countries, as a percentage of total population. Source: Calculated from the World Bank (2002).

2. THE MODEL

(a) Basis

The model utilizes some of the most basic and durable concepts in economics:

—The division of labor by specialization improves productivity and leads to technological improvements developed out of the skills and experience of the specialists. Adam Smith gave his famous illustration of pin manufacture. Specialization requires

concentrations of population—in villages and to an increasing extent as specialization proceeds, in towns and cities, to facilitate the exchange of services, products and information.

—The division of labor is limited by the extent of the market. The extent of the market is determined in great part by the costs of transport in relation to the value of the product, and also by the numbers and incomes of the potential purchasers.⁴

—Improvements in output per labor day or per hectare require the investment of either or both capital and labor for a delayed reward, but there are diminishing returns to additional units of the same input unless there is also a change in technology or in the nature of the output. Hence sustained growth depends on the combination of investment with new or modified and adapted technologies (Romer, 1989). This applies both in agriculture and industry (Anderson, 1990; Tiffen & Mortimore, 1994). The development of technology is facilitated endogenously by specialization, but is also helped by the openness of society to information from external sources, whether brought in by the written word and other media, through the mechanisms of external trade,

or through the concentrations of people typical of a market place.

—Investment, while a necessary condition for improved output and incomes, is not a guarantee of either. A given amount of investment does not and cannot produce a given amount of growth. Investment incurs risk, and is more likely to be successful with good information about the nature of the risks and of the market, and if the investor has been able to develop his/her skills and judgement. The more complex and larger the investment, the larger is the range of specialisms needed to provide information, and the greater the need for qualitative and quantitative skills in managing and assessing it.

(b) *Sectoral change over time*

There is a symbiotic relationship between the agricultural and nonagricultural sectors of an economy, which changes over time, as illustrated in Figure 3. In phase A, almost all labor is absorbed by producing food for its own household, at low levels of output per labor unit. In scattered communities in a period when transport was slow, expensive and difficult, labor has to be spread inefficiently to cope with

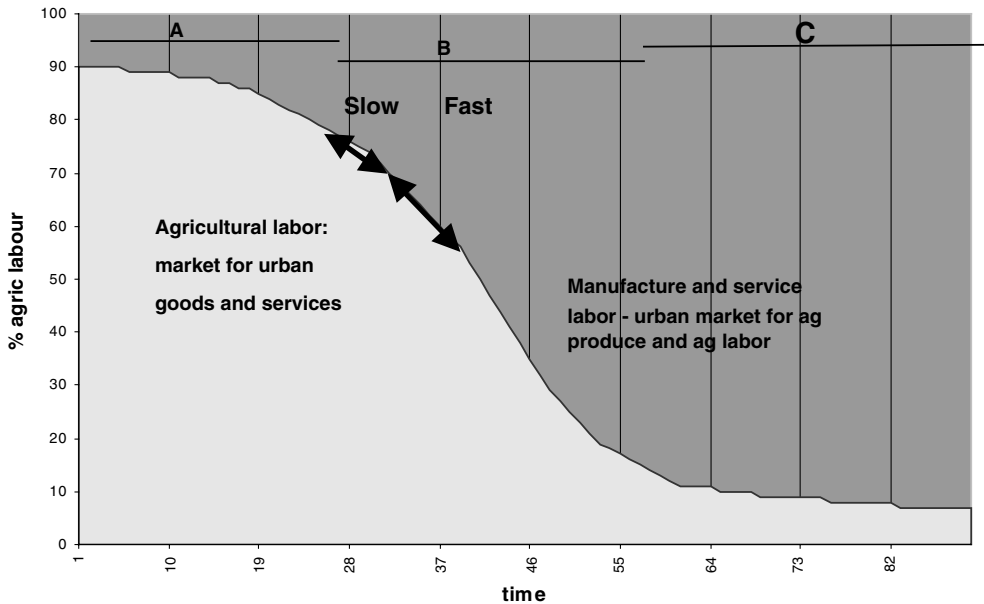


Figure 3. *Agricultural, manufacture and service sector labor over time. Note: Arrows show positions of low income and lower middle income countries in 1960 and 1980, as given in World Bank (1983).*

a variety of needs. As Smith (1776, p. 338) remarked:

Without the assistance of some artificers... the cultivation of land cannot be carried on but with great inconvenience and continual interruption. Smiths, carpenters, wheelwrights and ploughwrights, masons and bricklayers, tanners, shoemakers and tailors are people whose service the farmer has frequent occasion for.

Farmers are unable to sell any surplus they produce, if all near them are similarly engaged, and they have no access to other centers of demand.⁵ Typically, occasional surpluses are spent in feasting and drinking rather than investing to produce more. With low population density, extensive agriculture, using long fallows to restore fertility, is appropriate (Boserup, 1965).

Moving out of this situation is slow and difficult. Figure 3 shows that agricultural and nonagricultural labor form each other's market. The respective size of the market, shown by the vertical columns, limits the development of the other sector. Typically the first nonagricultural sectors to develop are those of administration and defense, which often cull any small agricultural surplus that exists without contributing much to the reduction of "inconvenience" and the interruption of agricultural tasks by other necessities.

The units of time in Figure 3 are not standardized. Phase A typically lasted many centuries while the transition phase B may be accomplished in 50–500 years. Its length, often difficult to document in the absence of historical data, depends in part on the technologies available in an external contact economy (Gershenkron, 1962). In the early slow part of phase B it is usually assisted by access to external capital and markets to expand the non-agricultural sector and transport facilities. In Britain, generally recognized as the home of the industrial revolution, it began with raw wool exports to only slightly more advanced economies in Europe in the medieval period, and started gathering speed circa 1760–1800. Later developing countries have generally made the transition more quickly than the United Kingdom. The most recent examples are in eastern Asia.⁶ Change accelerates as productive technologies and technologies for the exchange of goods and information improve. Concentrations of people facilitate the exchange and development of ideas (Simon, 1977). Countries

that cut themselves off from the exchange of goods, ideas and capital, as did China for many centuries, (Landes, 1998), and Albania more recently, move more slowly down the curve.

The contact economy also provides a market for farmers hitherto dependent on an extremely small nonagricultural sector. The enlarged market provides a "vent" for farmers, and stimulates efforts to provide a surplus above family needs in return for desirable consumer goods and inputs, many of which are initially imported. In countries which initially have some underused labor and land the export crop is additional to existing production (Myint, 1967). Hopkins (1973) illustrated this with special reference to West Africa. In countries with large numbers of peasant farmers, their additional purchasing power stimulates the consumer goods and service sectors. This effect is not so powerful in countries where a few people control most of the land and hold down agricultural wages, as in parts of Latin America, as Tomich *et al.* (1995) point out. Fortunately, this does not apply in most of SSA, where small-scale farming predominates.

The external economy may also provide investment capital that begins to expand the local urban sector, with port and transport facilities, etc. Smith thought the rapid progress toward wealth of "our American colonies" in the 17th and early 18th century was due to the fact that their citizens were able to concentrate their scarce capital resources on the development of agriculture (which he saw as its most productive and secure use) because British merchants were supplying the capital for the much more risky export trade—ships and even warehouses (Smith, 1776, p. 329). The steam ship and railway expanded the reach of export markets in Asia in the 19th century, but, aside from ports, major transport and urban infrastructure investments for SSA only occurred in the first half of the 20th century.

Under the stimulus of export markets for a product which many can supply, agriculture begins to become more productive. Initially, there is vacant land farmers can develop for cropping. They are helped by better implements usually brought in by trade—axes, metal hoes, animal-drawn ploughs, etc. These are often locally manufactured once the market is established, though they will only be selectively adopted, according to their suitability for the land-labor ratios and other local conditions (Pingali, Bigot, & Binswanger, 1987).⁷ Farming can therefore begin not only to supply food,

but also to release labor to a growing urban sector, which is beginning to produce and supply consumer goods, services and some of the inputs for agriculture, reducing the inconvenience of self-manufacture, and freeing up labor for more intensive farming. The urban sector can begin to grow because farmers are now becoming a local, effective, cash-earning market. The economy is embarking on phase B, in Figure 3.

In turn, a larger, more productive urban sector enlarges the market for farmers and stimulates them to invest in improvements. Without investments to improve productivity a falling proportion in farming would be unable to supply the needs of a greater proportion in the nonagricultural sectors. The internal market becomes very large by phase C. At this stage the manufacturing and service sectors are no longer limited to the agricultural sector for their internal market, since they are also selling to other specialists in the nonfarm sectors. The size of the internal market for farm output depends on the incomes (and therefore productivity) of urban people, as well as actual numbers in towns, since Bennet's Law predicts that as incomes rise, the share of starchy staples in food declines, and diet shifts toward livestock products, fruit and vegetables (Tomich *et al.*, 1995, p. 163). It is also governed however, by the costs and speed of transport facilities for bulky and/or perishable commodities.⁸

Rural should not be equated with agricultural. While agricultural activities take place almost entirely in the rural areas, rural areas will also develop services and small-scale manufacturing activities to meet local needs. Large-scale manufacturing industries will be located in urban areas at nodal points on the transport network, to facilitate distribution to a wide market.⁹

As the manufacturing and service sector increases its productivity and income, it attracts labor out of agriculture, leading to the faster stages of phase B. At some point, even in populations that are still growing, the actual numbers of people performing agricultural tasks begins to drop, as well as their share in the work force. There is a growing need for additional capital to substitute for labor. As an example, farmers on a new irrigation scheme in Muda, Malaysia, found themselves obliged, during 1974–79, to begin hiring combine harvesters and other machinery to replace the labor of sons and daughters who had moved into a growing industrial sector.¹⁰ Some

farmers are forced out of farming by their inability to finance new capital requirements, or their heirs choose to sell up to transfer into activities perceived as more profitable. A tendency toward larger, capital-intensive farms develops as phase C approaches. This paper is not examining phase C, but concentrates on phase B, as it is likely to develop in SSA.

(c) *The importance of investment and the differing nature of investments required to improve agricultural and nonagricultural productivity*

While in historical experience the growth of the manufacturing and service sector is generally associated with higher incomes per capita, this desirable outcome has depended on effective investments in all sectors, and, therefore, on policies that have provided incentives and security for investment in and maintenance of new assets, and the availability of information and education to increase ability to select effective investments.

Characteristically, but not exclusively, raising the productivity of the small-scale farming sector requires many repeated small private investments (developing new land, acquiring a new tool or other input, increasing the value of livestock held, planting and nurturing tree seedlings, etc.). These are barely perceptible to outsiders, though they can have a significant impact on production (Tomich *et al.*, 1995, p. 21). In some cases the investment can be of work for a delayed reward, rather than actual cash. The cumulative size of these incremental and intermittent investments depends on whether there is an enabling policy environment, which preserves private incentives to invest, spreads information about opportunities and risks, and improves access to markets. Effective private investment in agriculture is most assisted by appropriate public investments outside agriculture, for example, in communications infrastructure¹¹ to assist marketing and the gathering of new information. State investments in primary education can assist in the uptake and assessment of information.

Although agricultural investments are typically small and incremental, there are exceptions. Government investment in large irrigation facilities has been crucial in Asia, though often beset by difficulties in management and maintenance. The water resources of SSA make it necessarily more reliant on small-scale irrigation to which farmers can themselves contribute re-

sources and management inputs. State investment in research has also been important and can speed up the development of improved crop varieties, etc.

By contrast, large increases in the productivity of the industrial and service sector depend characteristically, but not exclusively, on large-scale, lumpy, investments in electricity, water, communications, etc., which are typically supplied by state, municipal authorities or by shareholders in large private firms (often foreign in the initial stages). These are being termed collective investments, in contrast to the family-scale investments in farming. Large collective investments, like family investments, need good information and risk assessment to succeed but, as the demands are more complex, this requires public and private investments in higher education for management as well as in primary education for the workforce.

(d) *Goodness of fit with statistical time series*

It has already been said that the curve in Figure 3 is not based on consistent time units. It is presented to illustrate a pattern, and the steepness of the slope in phase B will vary according to the circumstances and policies of particular countries. The point at which it levels out will depend in part on the size and natural assets of different countries, and in part on their policies. But, it will always take the form of a backward sloping *S*, owing to mutually reinforcing and accelerating impacts of one sector upon the other. These impacts are related to the efficiency and income effect of the investments made in each sector. They will be less where the major element in the service sector is an unproductive civil service, or where the state has invested in manufacturing projects that fail to give an economic return. The World Bank estimates that the productivity of investment in SSA needs to double (World Bank, 2000a).

Nevertheless, the model as depicted fits reasonably well with data on percentage of the labor force engaged in agriculture for 1960 and 1980. The change in their position is shown by the arrows on the curve. Low-income countries, less than 18% urbanized in 1960, moved relatively slowly in 20 years from 77% engaged in agriculture to 70% in 1980. Lower middle-income countries, less than 38% urbanized in 1960, moved more rapidly in the same 20 years from 71% in agriculture to 55%. The figures are not exactly comparable, as some countries have moved from one category to the other in the

same 20 years. They tend however, to confirm the thesis that urbanization and, by implication, the development of the manufacturing and service sector, accelerate, giving rise to the S-shaped curve depicted in Figure 3. They also confirm that this process is associated with increasing wealth per capita. The agricultural labor force figures are somewhat suspect, since they tend to be worked out as a residual after the known workforce in formal sectors have been deducted (Tomich *et al.*, 1995). They include many in the nonformal nonagricultural sector. Hence, the data on urbanization provide a better guide to the scale of change, though there are problems with varying definitions of urban. Figure 2 shows that since 1960 most SSA countries have become over 30% urban and five are over 40%. This implies agricultural labor occupies no more than 60–70% of the labor force, placing them clearly in the transition phase B of Figure 3.

3. THE WEAKNESSES OF THE STATISTICAL BASE

National statistical data have many weaknesses in SSA (and probably elsewhere).

(a) *Population and labor data*

While the World Bank population and urbanization figures can be accepted as giving orders of magnitude, they are not safe as accurate inputs into mathematical comparisons between countries.¹² Censuses have been infrequent in many SSA countries. The results are late in entering national and international statistics. The on-going population transition in some countries, and the AIDS epidemic in others, have probably lowered annual growth rates below estimated rates. The most glaring errors are in Nigeria, where the census of 1991 counted 88.99 million. However, the World Bank (2002) was still giving 98.98 million as the 1991 figure, and adding 2.8% annually till 1997, reducing this by stages to 2.4% in 2000. This produced an estimated population of 127 million in 2000, whereas a continuous growth rate of 2.4% from the census figure results in 110 million.¹³ The discrepancy in the divisor affects all Nigerian per capita data, and even affects group data for SSA, as Nigeria holds 20% of the SSA population.

Definitions of urban vary by country and by census date. Urban in Nigeria in 1963 was

defined as agglomerations over 5,000, and over 20,000 in 1991. In Niger, in 1988, “urban” was places of more than 2,500 with a government office (Republic of Niger, 1992). In Senegal, urban in 1988 meant having a municipal commune. The second largest city, Touba, a religious rather than administrative headquarters, was administratively rural, though it counted 183,000 inhabitants in 1988, (Barry, Ndiaye, Ndiaye, & Tiffen, 2000). By 1999 it was reported as 500,000 (Coulon, 1999)—not insignificant in a country with a total population of 10,000,000.

Employment by sector is generally acknowledged to be the weakest part of most census data.¹⁴ The percentage living in rural areas can be taken as the upper limit for agricultural labor, since the number of rural people whose main activity is outside farming is almost certainly greater than the number of urban people whose main activity is farming. Many studies have found considerable rural nonfarm income. In a review of 25 case studies in SSA, at times varying from 1974 to 1990–91, Reardon (1997) found its average share of household income to be 45%. Bryceson (2002) found higher levels by the later 1990s in six SSA countries, with 60–80% of income from nonagricultural sources. If carried out only in the off-season these activities are not competitive with farm labor, but some household members give preference to nonfarm labor even in the farming season. Demand for

local retailing, transport, and manufactures rises when farming areas generate higher output and higher incomes. In five villages in Java visited in 1974 and revisited in 1987, it was observed that farm incomes had improved by possibly 30–50% in real terms, and there was better clothing, wider possession of consumer goods, and better access to education and transport (Prabowo & McConnell, 1993). This obviously meant more employment of rural teachers, drivers, shopkeepers, etc. and there were specialized industries in some villages. On the Muda irrigation scheme in Malaysia every additional \$1 earned from improved rice output generated another \$0.74 of activities and earnings off-scheme (Bell, Hazell, & Slade, 1982). These intersectoral linkages are also noted in SSA (Barrett, Reardon, & Webb, 2001) but these often “informal” activities may not be caught in official statistics.

(b) *Agricultural output, food imports and contribution to the GDP*

Agricultural output is notoriously difficult to estimate. The amounts consumed on farm or traded domestically are likely to be underestimated. Figure 4 shows the value of agricultural exports as a percentage of agricultural GDP for 1995. It is immediately apparent that Zimbabwe and Malawi were not valuing their locally consumed crops and livestock.¹⁵ A survey in a

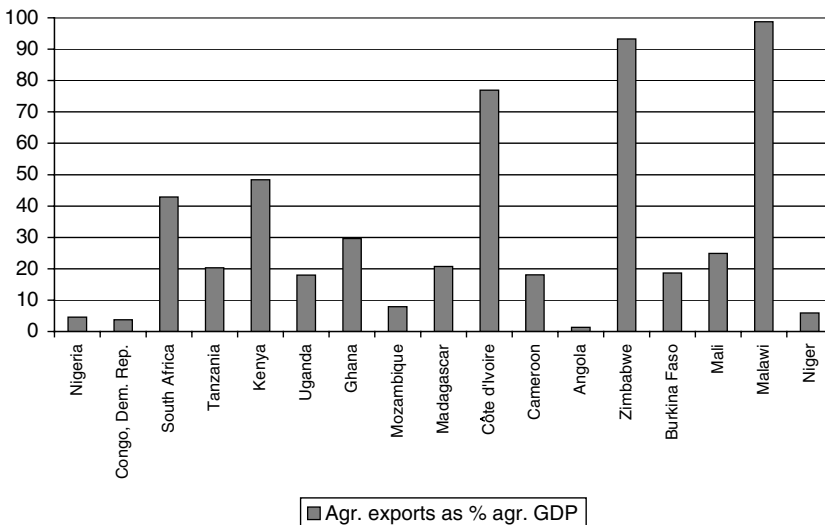


Figure 4. *Agricultural exports as a percentage of agricultural GDP in largest SSA countries, in 1995. Source: Constructed from World Bank (2000) (data not available in 2002 version).*

tobacco growing area of Malawi found that just over 40% of farmers' income came from crop sales, of which only 15% in 1990 and 9% in 2000 came from the export crop, tobacco. The field pea contribution was 10% in 1990 and 23% in 2000 but until 1998 this crop was not officially recorded (Orr & Mwale, 2001).

Despite the growing urban population, who, being slightly better off, consume more high-value foods and beverages than rural people, food imports have generally remained in a range of \$3–\$10 per head (Figure 4) since 1980.¹⁶ Food import data in countries with limited import routes are likely to be more reliable than food production data, but not all countries measure imports. Calculations from (World Bank, 2002) show that among the nine large countries supplying this data, in eight, food imports per capita have been static or falling since the mid 1980s, Kenya being a possible exception. In most they have remained below \$10 per capita, in constant 1995 US\$. Senegal, where policy favored rice imports to increase specialization on groundnuts, is exceptional with a level generally above \$25 per capita, though it seems to have fallen since the devaluation of the FCFA in 1994. Nigeria, up at nearly \$35 in 1981–82, fell back to \$4–8 after successive devaluations. Some temporary rises due to droughts can be seen, particularly marked for Zimbabwe, 1989–91. The implication is that in most countries, farmers have kept up with the level of demand, and changes in its nature, with variations in part due to policies, and occasionally to drought. This is incompatible with the calculated volume of food output by major crop given in Tables 8–6 (World Bank, 2002), (which quotes FAO data). This shows annual percentage growth in almost all cases of less than 1%, which is certainly less than population increase. Static per capita production implies an annual growth in food crops equal to population growth, unless imports are rising.¹⁷

Farmers might meet internal demand without increasing productivity if they transfer resources from export crops to food crops. But, volumes for three main exports, cocoa, cotton and coffee, 1968–97 were maintained (World Bank, 2002). Groundnut exports fell substantially during 1968–78, stabilized 1978–88 and fell again somewhat during 1988–98. Our studies show more of the crop going to meet local demand, but falls in export prices and rosette disease in Nigeria in the 1970s are other factors.

If we ignore the countries with obvious errors in Figure 4, most countries are not exporting more than 20% of agricultural production value, so 80% is locally consumed. Crops internally consumed are now much more important than crops exported, as we should expect to happen with countries in the transition phase B depicted in Figure 3.

4. FARMERS' INVESTMENTS IN RESPONSES TO CHANGING MARKETS IN FOUR SEMI-ARID DISTRICTS OF SSA

Given the deficiencies in national data, the processes of change are best understood and tested against the model in Figure 3 at a district level. At this level sample data from villages can be related to district statistics and, therefore, to the national statistics built up from them. This has been done for four semi-arid areas, 1960–2000. These are Makueni District, Kenya, Diourbel Region, Senegal, Maradi Department, Niger and the Kano hinterland, Nigeria.

Farmers in these areas are restricted in the crops they can grow, unless they have access to pockets of irrigable or water-retentive land. The main crops are cereals and pulses, low in value in relation to bulk, but capable also of providing fodder to livestock. In the past the main export crop was groundnuts, and in Makueni, cotton. Three districts have one short farming season lasting three to five months, but Makueni has two wet seasons of about three months each. Rainfall is very variable from year to year, giving a risk of crop failure. Nevertheless semi-arid areas contain large populations, with particularly high densities in the hinterlands of Kano in northern Nigeria and Dakar in Senegal.

In terms of the model, we are particularly interested to see whether there has been escalating growth in urban populations. If so, we need to see if farmers have been making the appropriate private investments to respond to a growing urban market for both their products and their labor, or if they have been held back by deficiencies in policy, or in the government supply of some of the services identified as particularly necessary. Changes in land markets should also occur as land becomes more scarce, and in labor disposition if urban occupations become more attractive. Second, we need to see if the collective investments and policies required to make the growing nonfarm sector more productive are in place, so that it can

both provide jobs for people leaving the farms, and a growing market for higher value farm produce such as livestock, fruit and vegetables.

The studies were carried out by teams of scientists from the countries concerned, profiling particular aspects of change, 1960–2000, using methods and data appropriate to the subject matter. This included literature reviews; collection, discussion and analysis of district data with the appropriate government office; air photo and remote sensing interpretation; and collective interviews and sample surveys of 10–12 randomly selected farmers in four representative villages.¹⁸ The country team leaders were Francis Gichuki (Kenya), Abdou Fall and Adama Faye (Senegal) and Yamba Boubacar (Niger), who collaborated with Drylands Research in developing from the profiles three national syntheses, using the findings to trace and understand socioeconomic and environmental change in its various interactions over time. The Nigerian study was limited, for financial reasons, to five profiles, which included an in-depth study of the marketing of food crops and livestock in the Kano area and a review of policy. Findings were checked by one or more workshops in which District officials and farmer representatives took part. DFID also provided funds for endorsement exercises in the local constituencies in 2001–02.

(a) *Changes in rural and urban population and in urban demand*

Rapid growth of the local towns occurred in three of the four study areas, with urban population being now 30% or over in two cases (Table 1).

The increase in the urban market over time is particularly visible in northern Nigeria and Senegal, but the outcome in terms of effective demand for local farm produce differed. Table 1 shows the increase in local urban grain requirements estimated at 200 kg/head. During 1952–91 the urban population of the two states constituted from the colonial Kano Province increased at about 8% per year, while the rural increase was nearer 1.6%. In 1952 Kano municipality was the only town with more than 20,000 inhabitants; by 1991 it had been joined by 11 others (Tiffen, 2001). To cater solely for the local towns, each rural family needed to supply 10 times as much grain to urban markets on average in 1991 compared with 1952. In addition, they were supplying grains and pulses (especially maize and cowpeas) to the even

more urbanized southern Nigeria (Ariyo, Voh, & Ahmed, 2001). If Nigerian farmers as a whole had failed to invest, food imports would have increased dramatically, but this has not been the case. In the late 1960s Nigeria's food imports were \$2–\$3 per capita (World Bank, 2000a, 2000b, 2000c). Figure 5 has shown that although these billowed during the petroleum boom and while the currency was overvalued, in the 1990s they were running at only \$5–\$8 per capita (all in constant 1995\$). Given that the import figure includes all foods and beverages, this does not suggest a large import of staple grains. The scale of the increased production demanded from farmers is understated in Table 1, as not all families living in towns of less than 20,000 are primarily engaged in agriculture. It also takes no account of industrial needs. Maize, sorghum and millet are important inputs into large commercial brewing, flour milling and animal foodstuff enterprises (Swindell, Iliya, & Mamman, 1999).

Crop production data for the Kano area was only available to us 1982–90 (World Bank, 1995), when yields were strongly linked with rainfall (Tiffen & Mortimore, 2002). But, for Maradi, Niger, there is a series of District figures running from 1964 to 1998. These show the expected variation in production per capita (taking the total population) from year to year, under the influence of rainfall variation. They also show that, after recovery from the droughts in the early 1970s, farmers upped their production to average around 300 kg/capita, (Mortimore, Tiffen, Boubacar, & Nelson, 2001) despite a growing rural population, and despite the virtual cessation of supportive projects after 1985, under structural adjustment (Hamadou, 2000a; Figures 4 and 5). This must mean that they saw an incentive to increase their sales.

The net sellers of grain to the towns are not evenly distributed among the rural population. In a large CARE sample in Maradi in 1996 the families defined as the most vulnerable (56%) produced 125 kg cereals/capita, against a moderately poor group (27%) who produced 311 kg, and a relatively well-off group of 17% who produced 580 kg/capita (CARE International au Niger & Université d'Arizona, 1997). The average was 252 kg/capita, in a somewhat below average rainfall year. Food selling was near universal but if one estimates per capita needs at 200 kg/capita/annum, it is apparent that quite large numbers of rural families are net buyers of cereals, and that a minority are net sellers.¹⁹ Maradi town has grown, but

Table 1. *Population and urban grain demand per rural person in four semi-arid areas*

		Total	Urban ^a	% Urban	Urban growth p.a.	Rural density	Urban grain need, kg per rural person ^b
Kano Province	1952	3,396,350	130,173	3.8		77	8.0
Kano and Jigawa States	1991	8,685,995	2,516,686	29.0	7.9	(Jigawa) 118 (Kano) 169	81.6
Maradi	1960 (estimate)	561,000	–	–		13	
	1977	949,747	44,459	4.7	–	22	9.8
	1988	1,389,443	110,739	8.0	8.7	33	17.3
Diourbel	1960 (estimate)	261,000	n.a.	n.a.		n.a.	
	1976	423,038	120,249	28.4		70	79.4
	1988	620,197	251,799	40.6	6.9	94	136.7
Makueni (dryland only)	1962	170,717	–	–	–	38	
	1989	524,025	–	–	–	102	

Source: Calculated from census data: summaries in Gichuki (2000a), Barry *et al.* (2000) and Tiffen (2001).

^a The 1991 Nigerian urban definition as settlements of over 20,000 is here applied to all data, regardless of country and time differences. Makueni has no towns of this size.

^b Grain need assumed as 200 kg per head per year. Urban demand at this level has been divided by rural population. To get demand per rural family it is necessary to multiply this up by family size, which varies by country.

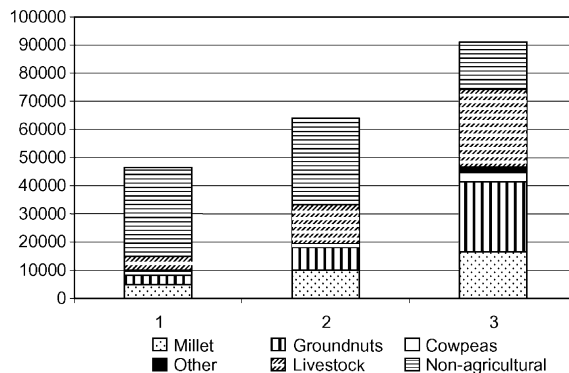


Figure 5. Structure of incomes by type of household, Diourbel, 1999-2000. Source: Faye and Fall (2000), Figure 1. Household types as in Table 2.

important influences on farmers are the large towns across the border in Katsina State, Nigeria. Grains and pulses flow in both directions, depending on harvest conditions, prices, and exchange rate differences (Meagher, 1997).

Most Maradi farmers have relatively small farms. Cereal yields are in the order of 300-500 kg/ha, which gives an idea of the modest cropped hectares in families producing 125-600 kg/head. The distinguishing characteristic of large sellers is their good management quality, which has enabled them to accumulate resources (from livestock sales, crop production or nonfarm incomes) for investment in intensification. Farmers of one southern Maradi village said, in discussing the findings of the research, that farming was only profitable for those who had the means to invest, and those who could await a favorable moment for selling. Commerce, crop farming and livestock raising could not be disassociated (Boubacar & Ibrahim, 2002).

In northern Nigeria the most efficient farms were found to be most numerous in high-density areas with good market facilities. These had smaller than average farms with 4.4 ha as against the average in the sample of 5.8 ha (Okike *et al.*, 2001). There are larger farms in the vicinity of some big cities, encouraged by the state, where entrepreneurs, variously from trade, the old aristocracy, modern business or the civil service and army, bought land in the 1980s and invested heavily in mechanized farms using hired labor, in response to a perceived growing and profitable demand for millet and other staples. In the 1990s their average size in the vicinity of Sokoto had been reduced to 20-50 ha because of rising costs of fuel, shortage of

spare parts, and high wage bills (Swindell *et al.*, 1999), a trend also noted by Balcet (1997). A sudden burgeoning of large-scale farms was also seen round Kano but they were estimated to account for only 5% of total agricultural production. Mustapha and Meagher (2000) noted that many of these "modern" enterprises foundered when state support was reduced in the aftermath of falling oil prices. A particular feature in northern Nigeria has been the burgeoning of *fadama* farming (on low-lying or riverine land), utilizing small pumps to raise groundwater, to irrigate wheat and vegetables. This demands large inputs into small areas (generally less than one ha) but leads to very profitable sales to the towns (Swindell *et al.*, 1999; World Bank, 1995).

Local urban growth was also very substantial in Diourbel, Senegal, due largely to the new city of Touba as well as growth in the two of the three older departmental towns (Barry *et al.*, 2000). In addition, farmers had easy access to the expanding capital, Dakar. But, there was almost no urban market for the grain they could produce, millet, due to the long-established preference for rice. While they maintained output of millet per agricultural worker 1960-92 at around 500 kg for family use (weather permitting), output per total population fell to around 100 kg (Faye, Fall, Mortimore, Tiffen, & Nelson, 2001, Figure 14). The market for groundnuts as a local cooking oil and ingredient was distorted by government efforts to channel all groundnuts to state oil mills, whose high processing costs mean that urban consumers preferred cheaper imported oils (Gaye, 2000). Hence, the main local impact of urbanization was on demand for meat, par-

ticularly after the devaluation of the FCFA made imported meat more expensive. From erratic figures available from the veterinary department, small livestock increased from 100–140,000 1966–72 to 200–250,000 in the 1990s. (Cattle numbers were relatively static; holdings of equines grew somewhat, Faye, Fall, & Coulibaly, 2000). Sales were not equally distributed, for it was only the farmers who had the resources to invest in livestock, concentrated among those who did not usually have to buy in grain, who were able to go in for substantial livestock fattening (Figure 5). As in Nigeria, there are some much larger, more mechanized farms, operated mainly by religious leaders and businessmen, whom we excluded from the sample. In the early 1970s these only produced a small proportion of the groundnut crop (O'Brien, 1975), but the current position is not known.

The exception to local urban growth was Makueni, in Kenya. This part of the former Machakos District had experienced an influx of rural settlers 1950–90 (Tiffen, Mortimore, & Gichuki, 1994). Neither Wote, which was made the capital of the newly formed Makueni district in 1992, nor any of the settlements along the Nairobi–Mombasa highway on its southern edge, had attained a population of 20,000 by the 1989 census. It may be significant that, unlike the district towns in the other three countries, there had been no collective urban investment to 1998 in electricity, telephones, etc.,²⁰ so, even on the highway, enterprises were limited to services to travelers, marketing, and such crafts and small industries as can operate competitively without power.

In Kenya as a whole, Figure 2 shows that urbanization was estimated at 30% by 2000. Makueni farmers had some access, over poor roads, to Mombasa and Nairobi, for their higher value crops such as fruit and vegetables but had no comparative advantage in producing maize for these towns (Gichuki, Mbogoh, Tiffen, & Mortimore, 2000). Mbogoh (2000) found cereal production per person since the district was formed in 1992 varied enormously from year to year, according to district statistics (which are no more than guesstimates).²¹ The average grain and pulse production 1992–98 just about met district needs taking all years together. In some years however, farmers were net buyers of cereals and beans (and forced sellers of livestock) while in other years they could sell grains and restock on animals. Unfortunately, livestock disease could wipe out

their insurance against crop failure (Fall, 2000). In the worst years, many were dependent on food aid from relatives or the government.

(b) *Farmers as investors*

As business managers, farmers have to decide how to react to changing product and factor markets, and whether, and in what, to invest.

In northern Nigeria growing food demand has been met by complementary farm investments, despite having to cope with frequent changes and reverses in government policies which have affected the level and competitiveness of food imports, the cost and availability of farm labor, the subsidization or not of fertilizer and other inputs, etc. (Mustapha & Meagher, 2000). In response to the labor shortage induced by the urban-centered infrastructural petroleum boom in the 1970s, Kano farmers invested to a very considerable extent in buying or hiring ox-drawn equipment, previously rare in the Kano-close settled zone. Maize, a minor crop in 1979, became a major crop in suitable areas by 1989, as farmers adopted a new variety (TZB) that was very responsive to fertilizer, subsidized at the time (Smith, Barau, Goldman, & Mareck, 1994). When the fertilizer price was raised, farmers reduced its usage,²² and reverted to older techniques of maintaining fertility, long practiced in the densely settled area around Kano (Mortimore, 1993). They selected and crossed new and old varieties of seed that best matched their ecological niche and changed economic circumstances (Mortimore & Adams, 1999), while also adopting new crops such as soya beans (Balcet, 1997).

Farmers have also responded to the growing demand for meat. The most efficient farms, with the highest gross revenue per ha and the highest net revenue per farm, were those purchasing in the most crop residues and other inputs, to maintain more than double the average number of livestock in addition to crops, using three times as much manure as the average and more days of animal traction (usually hired) (Okike *et al.*, 2001). Areas of common grazing in the densely settled Kano and Jigawa states are very limited, but 1984 data show the high numbers of livestock kept on farms with some water-retentive land (20–40% of such households had cattle, and 75–90% had around 15 sheep and goats) (World Bank, 1995, Table 3.8). The livestock are penned to maximize manure collection and to fatten up quickly. The

high inputs of labor this requires for feeding and watering, as compared with herding (Mortimore & Adams, 1999) is only worthwhile if there is an active market for livestock as well as cereals. There is now an active market for crop residues, with prices higher for groundnut and cowpea hay than for grain (Baba & Magaji, 1998). Farmers have recently shown interest in a new cowpea variety that gives more fodder, though it requires spraying (Singh, Larbi, Tabo, & Dixon, 2001).

Farmers in Diourbel, Senegal, also calculate the returns to different farm enterprises and technologies and invest accordingly. In the 1960s through to the 1990s, Senegal farmers weighed up the value of investing in fertilizer in relation to its price and groundnut prices, and the merits of heavy *versus* light ploughs, or in buying a plough *versus* a cart for transport (Faye *et al.*, 2001). In response to the growing urban market for meat, and the rising price of mutton, many in this so-called groundnut basin had by the 1990s decided to go in for animal

fattening. Schoonmaker Freudenberger and Schoonmaker Freudenberger (1993) reported how families in a village to the north of Diourbel said it was better to invest in five lambs than to seed an area with 500 kg of groundnuts. Livestock have become a major element in farm incomes of the better off, as shown in Figure 5. By 1999 much of their groundnut production was not sold for export, but consumed locally as nuts or oil, with the cake and hay providing valuable fodder supporting their livestock enterprises (Faye, 2002; Faye & Fall, 2000). Their investments have followed suit, as shown in Table 2. It is not surprising that the poorest spend little on farm inputs, but it is worthy of note that the investments of the middle and better-off segments get directed toward livestock rather than crop enterprises.

The way farmers plan, assess, invest over time and juggle resources, was particularly illustrated in the Makueni study. Farmers were asked to identify the three most important past

Table 2. *Use of money income by 38 Diourbel farmers (1999–2000)*

Type of household ^a	Type 1	Type 2	Type 3
<i>Household characteristics</i>			
Percentage of sample in this type	29.4	41.2	29.4
Estimated income per head in past year (FCFA)	46,456	64,054	91,019
Months own millet and groundnuts met family needs	<6	6–11	12+
Percentage of income not farm generated	68	48	18
Percentage of family workers absent in farming season	25.0	16.7	18.8
<i>Use of money income (per cent)</i>			
<i>Consumption</i>			
Buying millet	16.9	7.5	5.4
Buying rice	15.2	13.1	10.3
Buying other food	22.0	11.7	26.6
Clothing	14.3	19.2	9.0
Buying other products	5.6	2.7	3.2
<i>Farm-related expenditure</i>			
Equipment	0.5	0.6	2.1
Buying animals	0.8	12.0	18.9
Buying animal food or medication	1.1	4.4	2.9
Buying crop inputs	1.9	1.9	2.4
Payment for services	1.6	1.8	2.0
<i>Other expenditure</i>			
Health and education	3.6	4.1	2.7
Ceremonial expenses	16.6	21.0	14.5
Total	100.0	100.0	100.0

Source: Faye *et al.* (2001).

^aPercentage not farm-generated calculated from original data not there quoted. The sample was small, being based on 10 randomly selected farmers in four villages but the results are all in the direction expected.

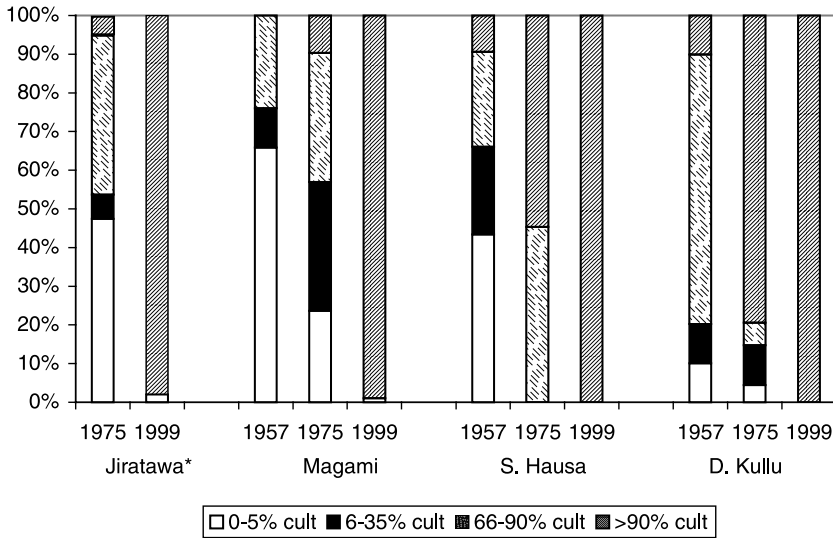


Figure 6. Expansion of cultivation in four terroirs, Maradi Department, Niger, 1957–99, in four cultivation frequency classes (percent of area). Source: Mahamane (2001): Tables 5, 7, 9, 11. Villages arranged from south to north. No data are available for Jiratawa in 1957.

investments contributing to their welfare. Terracing, planting trees, clearing bush, building a house, and educating children topped the charts (Nelson, 2000). Clearing bush and building a house were preliminary investments. Terraces, trees and education came in later stages. On the farms in the sample, the construction of terraces and drains had taken, per ha, 30–60 man days and Kenya shillings 5,000–9,000 (Gichuki, 2000b), and had been gradually extended to all their cropped land. All farmers had planted fruit trees, ranging from three on very small farms to over 200 on some larger ones. This involves considerable investment in labor for planting pits and watering during establishment, as well as manure and seedling purchase. Half the sample had made investments intended to improve output even during the difficult 1990s, bunched in years giving a good harvest. All farmers could readily identify the next one or two investments they wanted to make when resources became available. These were mainly related to equipment (67%), inputs (17%) and granaries (13%), needed to increase their output of cereals and pulses (Mbogoh, 2000). A good half of the finance for their investments came from nonfarm income (Nelson, 2000), which in bad years gets taken up by consumption needs.

In Maradi, the main investment initially was in clearing new land for cultivation, within the

village area while available, later further north. The process is made visible by air photograph and satellite data (Figure 6). In one of the four villages, Jiratawa, there was also project investment in an irrigation scheme, but the others were unassisted. Owing to the availability till recently of land that could be fallowed or cleared, investment in intensification is only just beginning. Investments in equipment (Table 3) have accelerated since the devaluation of the FCFA, which, as in Burkina Faso (Hoffmann, 1998) and Senegal, has resulted in improved prices for local livestock and grains (Kherallah, Delgado, Gabre-Madhin, Minot, & Johnson, 2000).

The volume of farm investment in the districts over the 40 years could not be calculated, but it was certainly substantial in Makueni, Maradi and the Kano area. In Makueni and Maradi, credit was unimportant, and finance came from crop and livestock sales, family transfers, and use of nonfarm income. We have no data on the role of credit in the Kano area, but some was available. Credit was part of the state-imposed system in Diourbel, c1965–80, when all producers had to belong to a co-operative, which provided inputs on credit, and sold output at controlled, low, prices. In bad years, farmers were obliged to default, eventually bringing about the bankruptcy of the responsible state organization (which was also

Table 3. *Years in which 40 interviewed farmers acquired new capital equipment in Maradi, Niger*^a

	Plough oxen	Ox cart	Heavy plough (charrue)	Light plough (houe)	Bicycle	Motor cycle
To 1994	1	8	10	4	2	0
After 1994	18	9	2	34	6	4

Source: Hamadou (2000b).

^aThe FCFA was devalued in January 1994, and 1994 was counted in the pre-devaluation epoch, on the supposition that its effects on prices might not be immediate. (Shaikh & McGahuey, 1996 actually found some pretty immediate increases in water conservation techniques for cereals in western Niger.) The heavy plough had been promoted, and credit provided, under a project, which ceased operation in 1987.

overstaffed, inefficient and corrupt) and impelling Senegal to adopt drastic retrenchment policies (Gaye, 2000).

The important role of livestock, themselves a form of capital and an insurance substitute, but also demanding capital for replacement and maintenance, was evident in all the districts. But, in lowland Makueni, Kenya, livestock appeared particularly vulnerable to disease, and many farmers had experienced substantial stock losses. Some farmers in the limited areas with suitable topography had built small dams to water crossbred cows, to take advantage of the recently improved milk market when the Marketing Board's monopoly of urban sales was abolished, and these also invested in spraying equipment and veterinary supplies. For most farmers, dairying was too hazardous (Fall, 2000; Mbogoh, 2000).

(c) *Exports versus local urban markets*

Exports overseas have become less important in the 1990s compared to 1960–70 (Maradi farmers still export, but to towns just over the border in Nigeria). Nigerian groundnut exports fell drastically due to rosette disease in the early 1970s. The crop is now reviving, with the aid of new resistant varieties, there and in Maradi, but sales are oriented to the towns (Ariyo *et al.*, 2001; Hamadou, 2000a). Even in Diourbel, Senegal, where the Government has continued to view groundnuts as an export crop, many farmers grow it, but do not sell (Faye & Fall, 2000), and they rank its uses as food, fodder and then cash (Faye, 2002). In Makueni, cotton was briefly promoted as a cash crop under an aid program 1978–87 but collapsed due to late payments by the responsible parastatal (Tiffen *et al.*, 1994). Some farmers would be glad if a ginnery could be re-established locally (Gichuki *et al.*, 2000).

(d) *Changes in the land market and in income distribution*

Land scarcity has developed everywhere, due to a slow increase in rural population and improved market access, which has increased the value of output, and encouraged farm expansion when land was available. As a result, land has become a marketable commodity, in all four of the areas examined. This has been least the case in the Diourbel Region, partly because of the 1964 Senegal statute ascribing ownership to the state and user rights to the user, but also because state policies have in various ways decreased the profitability of groundnut and millet sales, leading to substantial emigration out of farming²³ (Faye *et al.*, 2001). There has not been the same competition to obtain land for young families, or to retain land, as in the other three districts.

In the other three areas the land market is active. Intensification increasingly needs cash to buy labor, inputs, equipment and livestock, in addition to, or in substitution for, labor for a delayed reward. Not all farmers have been able to find the resources and to manage the associated risks. Even in Maradi, where intensification is at an early stage, some poor farmers have had to sell fields to the more successful (Boubacar, 2000). In the Kano area, some farmers have been less able to cope than others with the rapid changes in matters such as fertilizer prices, product prices, etc., and Meagher and Mustapha (1997) noted increased income differentiation in one village, between 1989–90 and 1992–93, between small farmers who had to buy in food at rising prices, and larger farmers, who were better able to play the markets. Farmers, or their heirs, who inherit smaller farms, if unable to find the necessary capital to intensify production from a small land holding, are increasingly forced to look to other occupations for a living, and some prefer,

or are forced, to sell up. Near Sokoto and Gusau, in northwest Nigeria, some farms have diminished in size to a garden plot, and the main income is earned by agricultural wage labor or other labor. These areas also have many intermediate viable small farms, and some large capitalized farms. In the rapidly changing job and land market of Nigeria, affected by petroleum booms and busts, inflation, import bans and relaxations, voluntary buyers and sellers of land may come to regret their decisions, but the worst sufferers are often those whose land has been forcibly taken over by the state (Iliya & Swindell, 1997), often without compensation, to accommodate urban expansion.

(e) *The labor market, specialization and diversification of incomes*

In Nigeria, census data showed average family size of five in Jigawa, and 5.4 in Kano, with the (male) household head said to constitute 70–80% of its economically active work force.²⁴ In Makueni, the resident family was 5.8, including two adult workers and children in school. These figures do not suggest an abundance of labor on family farms. In all four countries the farm household was also financially and emotionally linked to adult children and/or spouses who worked elsewhere either as commuters, or for part of the year, or as permanent urban residents. Family labor has to be carefully allocated across occupations, and decisions have to be made as to whether to utilize child labor, or forgo it in favor of sending children to school.

The model in Figure 3 was built on the premise that specialization brings benefits. It is apparent that farmer households in semi-arid areas do not specialize in the sense of only growing crops or only rearing livestock, nor in the sense of relying only on farm income. The separation of farming and herding made sense in semi-arid areas in phase A with low population density and limited access to markets for farm products, but in phase B, in semi-arid areas, the integration of crops and livestock by smallholders becomes advantageous to provide manure and draught power, the more so as their main crops also provide animal feed.²⁵ In Maradi, many settled Hausa farmers were acquiring cattle, and many Fulani herders were cultivating crops around a camp that was becoming permanent (CARE International au Niger & Université d'Arizona, 1997; Morti-

more *et al.*, 2001). Studies of Fulani livestock raisers in reserves in northern Nigeria show both they and the farmers outside the reserve now combine livestock and cropping, in a variety of ways (Baba & Magaji, 1998; Hassan, Hoffmann, & Steinbach, 1998). If it is not a contradiction in terms, semi-arid farmers have become specialists in mixed farming and crop-livestock integration.

In semi-arid areas with variable rainfall, income diversification, in the sense of combining farming and nonfarm activities within one household, has advantages, particularly by spreading risk. A Makueni farmer said "When there is a drought, I lose as a farmer, but as a teacher, I never experience that drought. I still get my salary and can survive better than if I was only a farmer" (Nzioka, 2000, p. 12). Ellis (2000, p. 5) points out that this cuts across the view that specialization and market exchanges are the way to higher incomes and improved welfare, and it might therefore be thought to be in contradiction with the economic logic behind Figure 3. We must distinguish, however, between household and individual specialization. In the Kenyan case quoted above, the husband concentrated on teaching, and his wife on farming, and they both benefited from sharing resources.²⁶ In other cases, a second activity may be carried out in a different season—a man farms in the wet season, and trades in the dry, so he can give full attention to each in turn. Indeed, by turning over his capital several times in the dry season, he gains additional resources to buy inputs for the farming season.²⁷ It is necessary again to distinguish between those who sell small amounts out of necessity, and those who buy in from others and trade on a considerable scale. The latter are generally in the upper echelons of small farmers. CARE International au Niger and Université d'Arizona (1997) found grain sold by even in the most vulnerable households (56% of their Maradi sample)²⁸ who had then to finance by some means or another grain purchases later. A few people in this group and the middle group (27%) were able to buy on a larger scale, as an agent of a bigger trader who advanced them money. Wholesaler traders who bought and resold hundreds of sacks of grain on their own account were almost all in the "riches payans" category (17%).

It has been observed that diversification does not necessarily level rural incomes. There is often a U-shaped relationship in which the proportion of nonfarm in total farm household

income is high for both rich and poor, and lower in the middle groups (Barrett, Bezuneh, Clay, & Reardon, 2000; Bryceson, 2002; Iliya & Swindell, 1997; Reardon, Taylor, Stamoulis, Lanjouw, & Balisacan, 2000; Toulmin *et al.*, 2000). When diversification is driven by desperation, families try to cobble together a living by farming, working for others, collecting, hawking, handicrafts etc., and each activity may impede good achievement in the others. Ellis (2000) refers to the key difference between individual diversification and low levels of skill, associated with poverty, and household diversification, in which individuals specialize, which is associated with the better off. In Nigeria, the most successful farmers were those who had within their household someone in well-paid or middling formal sector jobs, or in trading and contracting, which provided a cash flow to finance farm inputs. These households contained individual specialists, backed by accumulated capital or skills, while in poorer households people scramble for casual labor alongside their own farming (Iliya & Swindell, 1997). This was also the case in western Kenya (Hamilton, 2003). In Côte d'Ivoire a middle group of specialist farmers could also be distinguished (Barrett, Bezuneh, & Aboud, 2001).

In Senegal, Table 3 and Figure 5 show that the poorer households in Group 1 scraped a living from a diversity of local occupations. The wealthier households in Group 3, who were investing most in livestock, tended to have most of their nonfarm income in the form of remittances from urban-based children. Those in residence concentrated on farming, but in all households, around a fifth of the family work force was absent in the farming season (Table 3). Farmers in Diourbel calculate the opportunity cost of using their sons' labor on the farm or encouraging them to migrate to urban areas or, if they can manage the higher cost, overseas. Some of the ceremonial expenses listed in Table 4 support the Mouride leadership in construction and merchant enterprises in Dakar, Touba and overseas, where petty trading, transporting, laboring, etc. provide income to adherents despite lack of formal qualifications (Babou, 2002; Wilson Fall, 2000).

A remarkable difference between Kenya and the two francophone countries was in investment in education. Makueni parents invested heavily in educating all their children, boys and girls, motivated in part by the hope of qualifying one or more to compete successfully for a skilled or professional occupation (Nzioka,

2000). They were well aware that their children would need nonfarm incomes and, despite high costs, sent all boys and girls to primary school, most to nursery school, and 20–30% to secondary school (with an anxious eye on the job market, to see if the latter was cost-effective).²⁹ Education was regarded as a priority expenditure; and farm investments got what was left over (Nzioka, 2000; Gichuki *et al.*, 2000). On average the household included two nonresidents, and while 23% of these worked on family farms elsewhere,³⁰ 26% were in urban employment in the private sector, and 10% in urban-based government employment. Due to the lack of local towns, rural businesses and government services provided comparatively few jobs (Nzioka, 2000). Educated children in jobs were expected to, and did, assist their parents with emergency expenditures, and, importantly, with financial resources for investments to improve the farm (Nelson, 2000; Nzioka, 2000). This is household diversification, with individual specialization. A similar value was placed on education in western Kenya (Francis, 2000; Hamilton, 2003).

In Diourbel and Maradi the nonfarm occupations open to the illiterate young were mainly unskilled labor and petty trading. Rural parents did not see their children as likely to succeed in academically-oriented schooling, which starts from day one in French. Hence, migrating rural children can contribute less to the productivity of the urban work force in Senegal and Niger than in Kenya. With unskilled jobs, their small remittances assist subsistence, not farm investment (David & Niang, 1995; Diarra Doka, 2001; Wilson Fall, 2000). Nigeria is an intermediate position, with some families able to access jobs through education, and others investing in traditional clientage relationships to access less skilled work or to get into trade. In Nigeria, as in Kenya, nonfarm earnings financed farm investments (Iliya & Swindell, 1997).

The market for farm labor has also become important, as efficient farmers need to buy in labor at crucial times or for special tasks. In Makueni we found wages varied according to demand, level of skill and value of marginal output (Nelson, 2000). Similar wage variation was noted in Nigeria, where the agricultural labor market centers on towns, where it is easiest for seekers of employment and seekers of labor to meet. Farmers with very small farms could intercalate work on these with work for others, and because of their experience, were

preferred to cheaper student labor (Swindell *et al.*, 1999).

5. CONCLUSIONS AND POLICY IMPLICATIONS

We need to understand the interrelationship of the agricultural and nonagricultural sectors at different points in time as population grows, and redistributes itself between urban and rural. When the current round of censuses has been analyzed, we shall probably find more evidence of rapid change, and governments need to be ready with appropriate policies. The growth of the local urban market in SSA has been demonstrated. Policies which increase the purchasing power of local urban communities are becoming more relevant than export-oriented ones. The recent drops in livestock turnover in northern Nigeria due to falling urban incomes (Ariyo *et al.*, 2001) affect not merely farmers' incomes, but also their ability to insure, and to maintain soil fertility.

Farmers have responded to increased demand by a multitude of small investments linked to changes in technologies and in products, but they have been hindered by state control of markets (as in Senegal) or rapidly changing policies, exchange rates and inflation (Nigeria, and to a lesser extent, Kenya). Agricultural output can now only be increased by very efficient combinations of land, labor and capital. Those farmers who cannot invest are increasingly being forced out of farming. Some of the children of even the prosperous farmer will need, or be attracted to, other livelihoods. The rural poorest need a vibrant nonfarm sector.

The appropriate areas for government and aid-assisted investment need to be identified bearing in mind both the different types of investment most required by farm and nonfarm sectors, and the changing urban-rural balance. For some countries, such as Niger, the emphasis must still be the enabling environment to allow small farmers to build up their farms, and become buyers of urban services and manufactures. Other countries now need to give more attention to attracting collective resources to develop the urban sector, while at the same time protecting farmers' capacity to invest to meet urban demand. Priorities for constrained government and aid budgets must be the services and infrastructures which enable citizens to make full use of their own talents, ingenuity

and resources (Drylands Research, 2001). Communications infrastructure, (roads and telephones), primary education, law and order, and good management of the currency are needed by all sectors, and by farmers as well as industrialists. The interaction between the two sectors depends on good communications. Roads usable by lorries remain vitally important both to farmers (Omamo, 1998) and urban consumers. Education benefits both, if its content and language are appropriate. Farmers in Kenya find education, which starts in local languages, worthwhile for their children, and invest their own money in building schools and paying fees (Gichuki *et al.*, 2000; Nzioka, 2000). Swahili, like Hausa, gives access to written information in newspapers, advertisements, etc. Their adult children and spouses had a great variety of occupations. Farmers in the Sahel are not convinced of the benefit of free education starting in French, but illiteracy cuts them off from written information, (whether on a fertilizer label or in the accounts of their *groupement d'intérêt économique*), and from the better-paying nonfarm jobs.

While farmers can usually find family resources for a profitable investment, some services and investments can better be supplied collectively. Examples are preventative veterinary services, some types of water development, and research.

Turning to nonfarm sectors, it is clear that rural families, and especially the poorer ones, rely in part on nonfarm income, preferably in a nearby town or village, if not, in a more distant city.³¹ Premature, state-led industrialization has a poor record. By 1986 most of the state-promoted industries in Maradi town, set up in the late colonial period, or during the uranium boom had closed, and most employment was in the informal sector (Grégoire, 1990; Tiffen, 2001). In Senegal, the modern industrial sector was for various reasons uncompetitive, over-regulated, and suffered from "a domestic market that was highly restricted by low-incomes" (Berthélemy, Seck, & Vourch, 1996, p. 100), so failed to expand. Nigeria has conditions more conducive to successful industrialization, and the modern sector expanded in Kano during the oil boom, with both state and private capital, but import-reliant industries suffered in the 1980s from shortages of raw materials, leading to retrenchment of workers, underutilization of capacity, and closures. While sectors dependent on local raw materials did somewhat better (Olukoshi, 1996), modern industrial

establishments fell from 327 in 1989 to 243 by 1993 (Tiffen, 2001). Industry was hindered by rent-seeking, deteriorating services, and falling demand from consumers hit by inflation (Olukoshi, 1996). Runaway inflation and overvalued exchange rates hindered good management.³² In turn, the downward pressures on wages reduced effective demand for the higher value agricultural products.

Productive investment in West Africa has been more lacking in the industrial sector, which needs collective investment, than in the farm sector which, has responded with family investments. Kenya has a relatively successful modern sector, but concentrated in a few

towns. Government investment in providing infrastructure to more towns—electricity, piped water, telecommunications, etc.—may be more effective than direct state investment in manufacture.

Governments cannot do everything, particularly if they are to avoid taxing away private incentive to invest. They cannot rely on aid, because aid availability per head is going down. Hence, as urbanization proceeds, both aid agencies and national policy makers need to think seriously about appropriate public investments for particular countries at a particular time, and to be conscious that times are changing.

NOTES

1. It could be argued that the poorest of the poor could be helped by income redistribution without growth, but this is politically a more difficult option.
2. They have been more successful in Asia than elsewhere. Kriekhaus (2002) has argued that public savings by states with “high bureaucratic capacity” can successfully allocate resources to strategic industrial sectors. In many cases, however, the need to manipulate resources to reward political supporters has predominated over what capacity there might be.
3. Alexandratos (1995) gives a fuller review of development policy in regard to agriculture than is appropriate here.
4. There are also higher transaction, insurance and information costs in scattered markets (Myint, 1985)—and disruptions from war and disorder.
5. World Bank (2000b, p. 68) quotes a discussion group in Guatemala: “We think the earth is generous; but what is the incentive to produce more than the family needs if there are no access roads to get produce to the market?”
6. Malaysia has made a rapid transition in recent decades (Gemmell, Lloyd, & Mathew, 2000). Japan is a well-known example of an earlier rapid transition. Land-locked countries tend to take longer than the seaboard countries since initially the most efficient transport for traded goods was water-borne.
7. The local black-smithing industry seems to have responded to growing demand for more efficient metal tools earlier in West than in East Africa. In Nigeria it is beginning to be replaced by factory-made equipment and parts supplied by state organizations (Iliya & Swindell, 1997).
8. Transport costs consist of fixed and variable costs. The former are relatively small for human and even animal transport, but high for lorries. Studies in Malawi and Benin found traders used logical combinations of transport, using lorries for distances over 12 and 4 km, respectively. Motorized transport costs were \$0.63 and \$0.28 per ton/km compared with nonmotorized costs averaging \$1.20 and \$1.78. Trading costs were also high in both countries because in the absence of telephones, traders had to travel personally to obtain information, place orders, etc. (Fafchamps & Gabre-Madhin, 2001). High trading costs apply to what farmers need to buy as well as what they want to sell. Omamo (1998) has shown how walking more than 8 km to purchase maize or sell cotton in a market has high opportunity costs, and leads to a preference prefer to earn cash by migratory labor. Poor roads reduce farm incomes, ability to supply food to the towns, and ability to buy goods and services from urban areas.
9. Exceptions will be industries processing bulky or perishable raw materials that need to be located near the source of supply.
10. IBRD (1981) Impact evaluation of the Muda scheme, consulted by the author for a report to the then Overseas Development Administration on Improv-

- ing the Socio-economic and institutional content of irrigation feasibility studies (Research scheme R4006, ESR. 326/307/01, June 30, 1986).
11. Roads and railways, but also telephones and post offices.
 12. Most francophone countries had their first circa 1977 and another circa 1988. Some have held or planned a third, at some point 1996–2003 (United Nations Statistics Division, Population and Housing Census, <http://unstats.un.org/unsd/demographic/census/cendate>, accessed 20/09/02).
 13. FAOSTAT gives a more likely 114 million for 2000. The 1963 census, used as the base for the Bank's calculations, is widely known to have been manipulated upward for political reasons.
 14. The total agricultural labor force is often estimated by reference to the population in a given age range, such as 15–64, from which those known to be in occupations in the formal sector are deducted. The Bank in its Technical Notes to employment tables noted some but not all of the difficulties in estimating unreported economic activity. It ceased to provide agricultural labor statistics after 1990, but FAO continues to estimate them in FAOSTAT.
 15. Local food production must have been substantial, as their food imports in the same year were only \$6 and \$7 per capita, respectively.
 16. Import data are fairly reliable for countries with ports, but not all provide it.
 17. There is no need to produce more food than can locally needed, since crops low in value in relation to bulk can only be exported when transport links are highly efficient—not usually the case in Africa.
 18. The sample surveys were not intended to collect data at a level to enable significance testing, but rather to check and update the information available from the district and the literature.
 19. It is not just surplus food that is sold, as some households sell off grain after harvest or at other times to meet urgent needs, buying back, often at a disadvantage price-wise, later on.
 20. Wote's improved administrative status led to a telephone service and some electricity by 2000.
 21. Statistics were only available from 1992, when the District was formed. Agricultural officers were not able to get out much to estimate production due to budgetary constraints.
 22. Fertilizer was still available at official prices from state organizations in the 1990s, but tended to be monopolized by big farmers or those with the right connections, who might then sell on at higher prices. Subsidies benefited mainly the big farmers (Iliya & Swindell, 1997; Swindell *et al.*, 1999).
 23. Our Senegalese colleagues were particularly keen to test this finding, which had depended mainly on extrapolation from census data, and some reports—Tiffen in Barry *et al.* (2000). Villagers confirmed it.
 24. This takes little account of the income-earning activities of wives, but in Hausa areas these generally prefer to pursue their own crafts rather than to work unpaid on the husband's farm.
 25. As population density rises, and more pasture land is converted to crop production, farmers need manure to replace fallows, and herders find the advantage of combining farming and herding from a settled base, a change analyzed by Binswanger, McIntire, and Udry (1989).
 26. There are also cases in Makueni where the husband works in the farm and the wife is a nurse or teacher.
 27. As reported to the author by a farmer in Gombe, Nigeria, in the 1960s.
 28. CARE interviewed men and women in more than 400 households throughout Maradi District, in 1996.
 29. By 1998, there were slightly more girls in secondary. Parents having difficulty with the fees might think sons had a better chance of earning without formal qualifications (Nzioka, 2000; Gichuki *et al.*, 2000).
 30. Sons are often given a part of the farm to use on their marriage (but the parent retains the title deed).
 31. Long-distance migration seems more disruptive to family structure, judging by Francis (2000).
 32. Olukoshi (1996) regarded the stabilization of the macro-policy environment as a necessary condition for the reversal of de-industrialization.

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