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## AGRICULTURE AND LIVELIHOOD DIVERSIFICATION AMONG RURAL KENYAN HOUSEHOLDS: EVIDENCE OF AGRICULTURAL TRANSFORMATION?

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**INTRODUCTION:** Governments throughout the developing world have a keen interest in diversifying their rural economies. One basis for this desire - concern that reliance on a few crops for cash income can lead to instability in income that threatens rural livelihoods – has undoubtedly been accentuated by the worldwide price crises of 2007/08 and 2010/11. It is also true that, for many households that produce primarily for their own consumption, diversifying by adding cash crops (e.g., cotton, tea, coffee, fresh produce) while continuing to produce for their own consumption can lead to greater incomes; diversification into off-farm activities can also greatly increase (and stabilize) total household incomes. Thus, from the perspective of managing risk and associated vulnerability of rural households, and in some cases from a desire to increase incomes, farm diversification makes sense as a policy goal.

Yet to achieve rapid growth in rural areas and the economy as a whole, it is widely recognized that countries must go through an agricultural transformation, which involves more *specialization* by rural households, not more diversification. Resolving this tension between the clear benefits to rural households in the short- and medium-term from diversification with the long-term need for greater specialization and trade is a major policy challenge for African governments.

This Policy Synthesis addresses this challenge in four ways<sup>1</sup>. First, it refines the understanding of diversification by identifying and quantifying different types of diversification at the level of the rural household, and by showing that diversification proceeds very differently at this level compared to

the broader agricultural sector and the macro-economy. Second, it links these levels of diversification (farm, agricultural sector, macro economy) to the process of agricultural transformation. Third, it empirically examines diversification trends in rural areas of Kenya from 1997 to 2007 and uses this analysis to make inferences regarding the progress of agricultural transformation in the country. Finally, it draws conclusions regarding the policy and programmatic initiatives most appropriate for Kenya at this specific point in the country's development.

### **THE AGRICULTURAL TRANSFORMATION:**

As stated by Staatz, the agricultural transformation "... is the process by which individual farms shift from highly diversified, subsistence-oriented production towards more specialized production oriented towards the market ... Agricultural transformation is a necessary part of the broader process of structural transformation, in which an increasing proportion of economic output and employment are generated by sectors other than agriculture." (Staatz 1999). Literature suggests that the economic benefits from agricultural transformation eventually create their own momentum to move the process forward. Yet government policy can derail or greatly slow this process in a number of ways: by restricting staple food trade, by not allowing land markets to facilitate the consolidation of farms in response to the movement of populations to urban areas, by failing to invest in the agricultural research and hard- and soft infrastructure that will bring down unit costs throughout the food system, and by economic mismanagement that discourages the kind of large-scale private investment that will help pull labor off the farm and into the industrial and service sectors.

<sup>1</sup> See Kimenju and Tschirley 2008 for the larger paper from which this PS is drawn.

Since the mid-1990s, several factors in Kenya have likely promoted its agricultural transformation while others have likely held it back. The absence of extended periods of violence has preserved and perhaps strengthened its long established role as a center of farm- and non-farm investment in East Africa. High population densities in all but the semi-arid areas tend to reduce the cost of exchange in markets and promote a market orientation; relatively high level of rural education compared to neighboring countries will reinforce this tendency. Long investment in agricultural research should increase productivity and facilitate the transformation. Finally, economic liberalization starting around 1994 should have accentuated all these positive factors. At the same time, per capita incomes declined through the 1990s, making it difficult for urban and rural non-farm sectors to absorb agricultural labor. Road infrastructure had deteriorated badly in some areas, making it more costly to rely on markets. All these factors hold back the agricultural transformation, as does the periodic civil strife in some areas. How these opposing factors have played out in the evolution of Kenya's rural economy is the central empirical question addressed in this paper.

### LINKING DIVERSIFICATION TO THE AGRICULTURAL TRANSFORMATION:

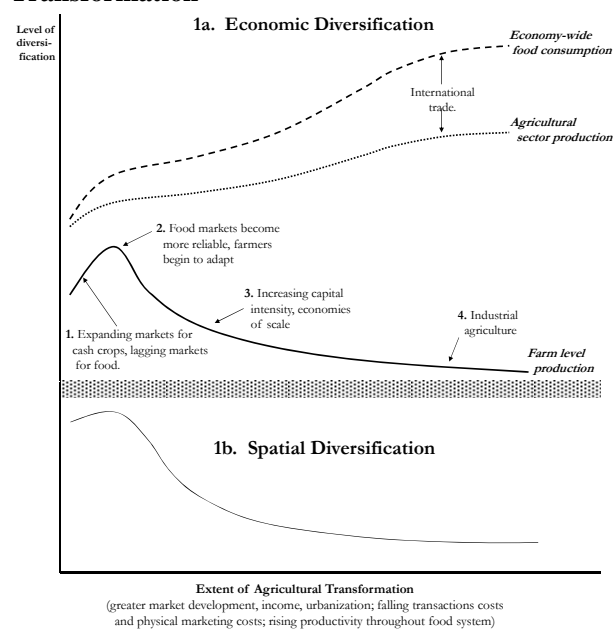
Diversification refers both to the number of economic activities an economic unit (a household, a village, or any other aggregation up to the national level) is involved in and to the dispersion of those activities' shares in the total economic activity of the unit. Diversified units have many activities with similar shares, while in specialized units just a few activities account for high shares of total economic activity.

Figure 1 depicts the expected relationship between agricultural transformation and two dimensions of diversification: *economic diversification* by level of the agricultural economy (panel 1a), and *spatial diversification* across a country (panel 1b). Because staple food market development lags that of cash crops<sup>2</sup>, smallholder farmers in the early stages of the agricultural transformation are likely to become *more* diversified as they add cash crops and traded livestock products to their portfolio while attempting still to produce all their staple food needs. Over time, improving food markets allow farmers increasingly to specialize in those activities in which they have a comparative advantage, moving rapidly away from small, diversified farming operations to larger, and

more capital intensive and specialized operations. The rate of change can be dramatic in some cases; see Pingali (1997) for examples from Asia.

Because agro-ecology and consumer preferences are not homogeneous over space, overall agricultural production will always be more diversified than will production on individual farms (see Agricultural Sector Production curve in Figure 1). Moreover, diversification at this level will increase as the transformation proceeds, driven by income growth and urbanization that lead to broader consumer preferences. Thus, the typical pattern over the course of the agricultural transformation is that aggregate agricultural production will become more diverse as production on individual farms becomes more specialized (less diverse). Overall consumption of agricultural products (the top line in Figure 1) will diversify at an even more rapid rate, as traders and food companies draw on regional and international trade to complement national production and meet the demand for more diverse consumption by wealthier consumers.

**Figure 1. Diversification and the Agricultural Transformation**



Source: Adapted from Timmer (1997)

Production systems show very little spatial specialization in the early phases of the transformation, as limited trade means that each region needs to produce nearly everything it consumes. As markets open and the costs of trade fall, however, production of specific crops and livestock will begin to migrate towards areas presenting the best agro-ecology. Timmer (1997)

<sup>2</sup> See Kimenju and Tschirley 2008 for an explanation of this phenomenon.

notes that economies of scale in marketing reinforce this tendency: areas that begin to specialize in specific crops see their unit marketing costs fall rapidly, reinforcing the tendency towards regional specialization.

Looking beyond agriculture, rural households can be expected to follow a broadly similar pattern with regard to *livelihood diversification*, i.e., economic diversification beyond agriculture. In the early phases, those households with the capacity to do so will diversify into salaried wage employment and profitable off-farm businesses while maintaining their farm operation. Eventually, however, their rising opportunity cost of time and the increasing knowledge- and capital intensity of agriculture will drive them either to leave agriculture or to re-specialize as full-time farmers; a very small share of farm production will remain long-term in the hands of part-time farmers with off-farm income.

**ECONOMIC REFORMS IN KENYA AND EXPECTED SPECIALIZATION:** The course of economic reform in Kenya since 1994, together with our conceptual model, leads to four testable hypotheses:

**Hypothesis 1:** Because of general economic reforms, greater population densities, and rising incomes (at least since 2000), household livelihood specialization will have increased from 1997 to 2007, with some households moving towards reliance on off-farm incomes while others have prioritized more intensive crop or livestock agriculture.

**Hypothesis 2:** Due to agricultural marketing reforms, especially in the maize and dairy sectors, crop- and agricultural diversification will have decreased (specialization will have increased) from 1997 to 2007. For example, some households will have specialized more in maize or wheat or vegetable production, others in dairy or other livestock activities.

**Hypothesis 3:** Because lifting of movement restrictions 15 years ago on maize has led to more domestic and regional trade in this grain, maize production will have become more concentrated regionally, across villages within regions, and across households within villages.

**Hypothesis 4:** In all cases, increased specialization will have been more pronounced in areas of higher population density, greater agro-ecological potential, and proximity to large urban markets. Central Highlands and High Potential Maize Zone (HPMZ) thus stand out as primary candidates for greater household level specialization in livelihoods,

agriculture, and cropping and greater spatial specialization in maize production.

**EXAMINING TRENDS IN DIVERSIFICATION FOR EVIDENCE OF AGRICULTURAL TRANSFORMATION:** We use the Herfindahl index, as applied by Kurosaki (2003) to quantify diversification:

$$D_k = 1 - \sum_{i=1}^N (s_{i,k})^2$$

where  $s_i$  refers to share and  $\sum_{i=1}^N s_{i,k} = 1.0$ .  $D_k$  varies from a value of zero to (a limit of) 1.0, with zero indicating complete economic specialization in one activity or complete spatial specialization into one spatial unit, and 1.0 indicating that economic output comes from many different activities or spatial units, none with a predominant share.

We first examine *household economic diversification* (crop, agricultural, and livelihood), then focus on spatial diversification in maize production in response to the maize market reforms of the mid-1990s. Crop diversification is based on five crop groups: cereals, tubers and pulses, fruit and vegetables, industrial crops, and all other crops. Agricultural diversification adds three livestock categories to these five crop categories: cattle; goats, sheep, and pigs; and poultry. We then calculate livelihood diversification by adding four off-farm activities to the eight agricultural activities: salaried employment, informal businesses, remittances, and farm kibarua (wages earned by working on other people's farms). Data come from the TAPRA household panel database collected in four years: 1997, 2000, 2004, and 2007.

Table 1 presents results for crop, agricultural, and livelihood diversification. Several results stand out. First, crop diversification increased over the period but at a rapidly decreasing rate, and actually fell slightly (meaning that specialization began to occur) from 2004 to 2007. Second, agricultural diversification may have stabilized, though the trend in this case is not as clear. Finally, livelihood diversification steadily increased throughout the period. Together, these results suggest that households are slowing or even reversing their crop and broader agricultural diversification – by beginning slowly to specialize in these areas – but are continuing to diversify their livelihoods by adding off-farm activities to their existing agricultural activities. This suggests that the country as a whole remains at quite an early stage of the agricultural transformation (see Figure 1).

**Table 1. Crop, Agricultural, and Livelihood Diversification Indices in Kenya, 1997-2007**

Year	Type of Diversification		
	Crop	Agricultural	Livelihood
1997	0.49	0.60	0.59
2000	0.57	0.60	0.62
2004	0.60	0.65	0.63
2007	0.59	0.65	0.66

Analysis by production zone shows that crop specialization has begun to take place in HPMZ, Eastern Lowlands, Central Highlands, and Western Transitional zones, while Coastal Lowlands and Western Lowlands remain in a diversification phase. Agricultural diversification follows a broadly similar path, though generally with more continued diversification than at the crop level. Overall, these results provide support for our fourth hypothesis, suggesting that areas of greater population density and agro-ecological potential and closer to urban centers have seen more specialization than other areas.

We analyzed household diversification patterns by their position in the distribution of per capita income, with two key results. First, higher income households are consistently less diversified – more specialized – than lower income households. Second, the highest income households turned sharply towards specialization both in crops and more broadly in agriculture between 2004 and 2007; lower income households show a mixed pattern for crop diversification and are clearly continuing to diversify across agricultural activities. These patterns are consistent with the conceptual model we laid out, in which greater specialization eventually is associated with higher and growing incomes.

Hypothesis 3 suggested that maize production will have become more concentrated in response to the lifting of maize movement restrictions in the mid-1990s. In fact, results (not presented here) show the opposite: diversification indices across households within villages, across villages within regions, and across regions all show steady or rising diversification, regardless of zone. These results show clearly that the maize market reforms of 1994 have had substantial positive effects in reducing real maize and maize meal prices (and especially in reducing the margin between maize grain and maize meal Jayne and Chapoto 2006). However, they have

had no discernable effect on households' propensity to produce maize; nearly all households across the country attempt to produce maize for their own consumption, though many are unable to do so and become net buyers of maize. The reasons for this surprising finding merit further research.

**EXAMINING THE DRIVERS OF DIVERSIFICATION:** We apply three panel econometric models to examine the drivers of crop- and livelihood diversification<sup>3</sup>. Results reinforce conclusions from previous sections of the paper that Kenya is at an early stage of the agricultural transformation, while providing useful insights about the drivers of that process. Several specific results stand-out. First, *male headed households tend to be more specialized* in their livelihood activities. Because the regression controls for household income, this result may suggest greater risk aversion among female household heads (who diversify to spread risk), which could be a rational reaction to the absence of a key income earner. Second, *higher income households are clearly more specialized*, both in cropping and livelihoods. This finding is consistent with a broad array of research (see Delgado and Siamwala 1997) that shows the poorest households to be the most diversified, as a risk management strategy. The income result also suggests that, even in the early stages of the agricultural transformation, households that are able to specialize tend to benefit from it.

Third, *farmers with more land tend to be more specialized in their cropping activities but more diversified in their livelihoods*. Again, this result echoes a wide array of research in Africa showing that farms specialize as they grow larger and that households with the highest off-farm earnings tend to have the highest agricultural incomes (Reardon, Crawford, and Kelly 1994; Reardon et al. 2000; Tschirley and Benfica 2001). A fourth finding is that *better infrastructure leads to greater diversification*. These results strongly suggest, consistent with other results, that Kenya remains in the early stages of the transformation, where factors that are positive for development lead to more diversification for most households, not more specialization. However, a fifth finding is that, controlling for infrastructure and other variables, *proximity to a large urban market drives greater specialization*; this result is expected

<sup>3</sup> The models used are random effects (RE), correlated random effects (CRE), and fixed effects (FE). We use all three due to differing assumptions that each makes regarding “unobserved effects”. Results across all three models, for both crop- and livelihood diversification, are quite robust. See Kimenju and Tschirley (2008) for more detail and full econometric results.

on the basis of our model. Finally, we find that *households in zones with higher agricultural productivity have more diversified livelihoods*, implying diversification into non-farm activities. This finding supports a fundamental tenet that increased farm productivity is critical to fuel growth in the rural non-farm sector and spur the agricultural transformation.

**CONCLUSIONS:** The big picture that emerges from this research is that Kenya in 2007 was in quite an early stage of the agricultural transformation, earlier than hypothesized at the outset of this paper. With regard to our specific hypotheses, our analysis suggests a rejection of hypothesis 1: most households in Kenya are still diversifying their livelihoods, adding non-farm activities as they maintain their farming portfolio. We can also clearly reject hypothesis 3: maize production has become less spatially concentrated, not more, despite demonstrably more fluid domestic trade in the crop.

On balance, our analysis supports hypothesis 4: Central Highlands and High Potential Maize Zone saw cropping agriculture and broader crop plus livestock agriculture become more specialized in 2007. Our regression analysis also shows that areas closer to sizeable urban areas tend to be more specialized than comparable areas further away. Finally, evidence supports hypothesis 2: crop and broader agricultural diversification have decreased, though this trend showed itself only in the final period and is not uniform across the country.

If this conclusion stands up to further analysis, it has important policy implications for the country, because it indicates that Kenya is facing a *change in the direction of change*. While increased diversification has for most households been associated with higher welfare in the past, increased specialization will be needed to improve welfare in the future. This suggests that policies and programs previously well adapted to the country's circumstances will become outmoded and even counter-productive. Policies must therefore shift from promoting diversification to facilitating specialization among the increasing number of households likely to want to do this. Balance is needed; the shift in policy will not be absolute, but it is important that the relative emphasis begin to change in a fundamental way. Key aspects of this change include:

- The technical research portfolio will need increasingly to emphasize high yielding crop and livestock packages, even if they imply more risk;

- Farmers will increasingly need access to the right inputs at the right time. While government input programs can provide access to some inputs for many farmers, private systems are likely to be better at providing the range of differentiated inputs needed by the new technologies. It is thus important that any government input programs be modest in scope and well-targeted, and that they not interfere with the growth of private input channels;
- The country will need more investment in supply chain efficiencies, including improved extension, market information, physical market places, and cold chains for perishable items like fresh produce, dairy, and meat. Some of these investments will need to be facilitated by government, but they must be conceived and implemented in a highly collaborative fashion with private sector;
- Increased attention will need to be paid to negative environmental effects from agriculture; though possibly modest now, such effects could grow very rapidly in the absence of an appropriate policy framework, due to increased input use;
- Specialization will drive less efficient farmers out of agriculture. For the agricultural transformation to proceed, macroeconomic and investment policy must encourage strong investment throughout the economy so that those leaving the farm will be able to find gainful employment elsewhere;
- Finally, the government's decision to offer free primary and now secondary education appears well timed, as greater education will be needed to drive the growth of the non-farm economy

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