Effects of Increasing Population Density on Smallholder Agricultural Intensification in Rural Kenya

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1. Introduction

Reducing poverty and hunger have been a critical policy concern in most of the African countries for the past half-century. Yet, despite series of governments interventions, poverty still remains pervasive. In 2005, more than 40 percent of Africa's population was estimated to be poor. Based on the region's land resource endowment, an agricultural-led growth strategy has been touted as the best way for reductions in poverty. However, survey data show that household landholding sizes in this region have shrunk in the last two decades. Many households now live in highly densely populated areas where all arable land is either fully allocated or already under cultivation. More than half of smallholder farms are less than 1.5 hectares. Even in countries with low population densities, there are inequalities in land access. What do such small land sizes in the context of increased inaccessibility to land and limited off-farm employment opportunities mean for an inclusive poverty reduction strategy in Africa?

2. Objective

The study examines how rising population pressure affects smallholders' production and welfare in Africa. It is motivated by the need to understand the nature and magnitude of emerging land constraints in African agriculture using Kenya as a case study. Kenya is a useful case given that it is among the most densely populated countries in the region and may therefore provide an advance picture of the dynamics that other countries in the region are likely to face in the not too distant future.
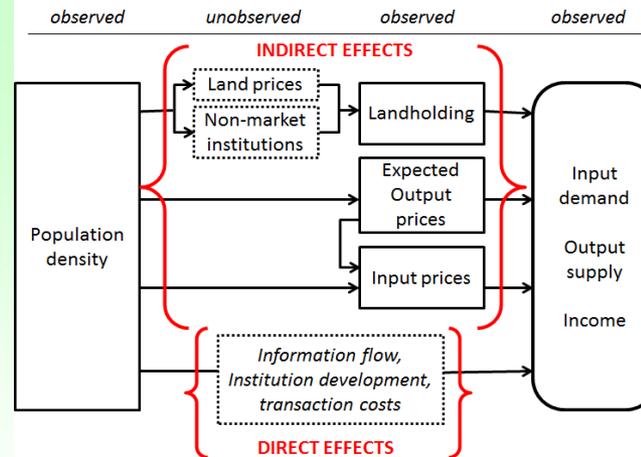
Figure 1: Conceptual framework

Table 1: Regression results summary

OBJECTIVE:	VARIABLE:	Direct partial effects	Indirect partial effects	Total partial effects	Turning point: persons/km^2
INPUT DEMAND	Fertilizer use (kgs) per ha cultivated	0.011	-0.065	**-0.054**	417
	Cash input use per ha cultivated	0.021	-0.018	**0.003**	439
OUTPUT SUPPLY	Net crop production per hectare cultivated	0.149	-0.062	**0.087**	982
	Net farm production per hectare cultivated	0.083	0.005	**0.088**	994
SMALLHOLDER COMMERCIALIZATION	Household crop commercialization index	0.043	0.004	**0.047**	619
HOUSEHOLD INCOME	Income per adult equivalent	-0.037	-0.03	**-0.067**	--
	Off-farm income per adult equivalent	0.00	0.00	**0.00**	--

3. Methods and Data

Panel econometric techniques are applied on five-year panel data collected in 1997, 2000, 2004, 2007 and 2010 covering 1,169 smallholders. The estimation strategy deals with the potential endogeneity of population density in input demand and output supply equations using a control function approach.

4. Study Results

The results show that smallholder agriculture farming practices in the areas of high population density are distinctly more land-intensive. However, land is becoming an increasingly constraining factor of production in this areas. About 20 percent of the Kenyan rural population are now beyond the Boserupian agricultural intensification thresholds. Inputs use and output intensification rise with population density up to certain level; beyond this threshold, rising population density is associated with sharp declines in agricultural intensification. This is giving rise to substantially lower farm incomes and asset wealth in these areas.

5. Policy Implications

- Public investment in agricultural research focusing on new land-saving farm technologies and practices appropriate for small farms.
- Physical infrastructure investment in less populated areas- e.g. roads and irrigation.
- Market and non-market land reforms to increase smallholder access to land.
- Outmigration and non-farm employment creation.