World Development xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

Cities and agricultural transformation in Africa: Evidence from Ethiopia

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ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Agricultural transformation
Crop intensification
Urbanization
Cities
Ethiopia
Sub Saharan Africa

ABSTRACT

Due to the rapid growth of cities in Africa, more rural farmers are providing staple foods to urban residents. However, empirical evidence on how urbanization affects these farmers is scarce. To fill this gap, this paper explores the relationship between proximity to a city and the production behavior of rural staple crop producers. More in particular, we analyze data from teff producing farmers in major producing areas around Addis Ababa, the Ethiopian capital. We find that farmers more closely located to Addis Ababa face higher wages, land rental rates, and teff prices, leading to better incentives to intensify production as seen in the uptake of modern inputs. Moreover, we observe that land and labor productivity as well as profitability in teff production improve with urban proximity. Our results suggest that better connectivity of rural farmers to cities and growing urban demand for food are important associates of the process of agricultural intensification and transformation in Ethiopia.

1. Introduction

Agricultural transformation is crucial for poverty reduction and improved food security in Sub-Saharan Africa (SSA) as its agriculture sector is characterized by mainly small-scale, low productivity, low external input usage, and family labor oriented enterprises (FAO, 2015; World Bank, 2008). Inducing a transformation towards higher agricultural productivity is therefore often a policy priority in many SSA countries (Wiggins, 2014). This is especially important given that 70% of the SSA population, and the majority of the poor, are living in rural areas where farming remains the most important economic activity (Christiaensen, Demery, & Kuhl, 2011).

Several drivers of agricultural transformation have been identified in the literature. Boserup (1965) saw growing population densities, and the associated increased land pressure, as the prime cause of technological change in agriculture. Population density and intensification of agricultural land are especially relevant in settings of semi-subsistence farming, prevalent in large areas of SSA (Jayne, Chamberlin, & Headey, 2014). Transformation and technological change are also driven by changes in input and output prices – as explained by Hayami and Ruttan's (1985) induced innovation theory, by market access (Pingali, Bigot, & Binswanger, 1987), and by growing demand in international and domestic food markets (Djurfeldt, 2015; Reardon & Timmer, 2014).

In this context, urbanization can play an important role. The number of people living in cities in SSA grew by 160% between 1990 and 2014 and this number is expected to triple to 1.3 billion people by 2050 (UN, 2014). Urbanization is considered an important driver of economic development, long-term structural transformation, and poverty alleviation in SSA (Dorosh & Thurlow, 2014; Ravallion, Chen, & Sangraula, 2007). Urbanization not only affects people living in cities (as they shift from agricultural activities to more economically rewarding non-farm activities); but also agriculture and households in rural areas (Bloom, Canning, & Fink, 2008; Christiaensen & Todo 2014). Urbanization indirectly affects rural households through urban-rural spillovers and economic linkages, such as remittances and rural non-farm income opportunities (Cali & Menon, 2013).

More directly, urbanization may cause a transformation in agriculture through changes in demand for food and agricultural products (Reardon, 2016). Increasing consumption and preferences for higher quality agricultural products raises urban demand and willingness-to-pay for agricultural products (Djurfeldt, 2015; Reardon & Timmer, 2014; Tschirley, Reardon, Dolislager, & Snyder, 2015; Tschirley et al., 2015). Few studies have investigated how this affects labor allocation and agricultural production systems in the rural hinterland. Studies in Asia found that distance to urban centers affects specialization and organization of rural labor: rural residents close to urban markets are more likely self-employed (outside agriculture) or have (remunerative) non-farm

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https://doi.org/10.1016/j.worlddev.2017.10.032
0305-750X/

wage employment. On the contrary, rural households further from urban centers specialize in agricultural production (Deichmann, Shilpi, & Vakis, 2009; Fafchamps & Shilpi, 2003, 2005). The seminal work of von Thünen (1826) also linked urban demand to specialization in agriculture and further showed that distance to urban markets influenced the type of agricultural production systems.[1] Recent work by Binswanger-Mkhize, Johnson, Samboko and You (2016), Damania et al. (2016) shows that urban proximity enhances the adoption of agricultural technologies and agricultural incomes. However, the pathways through which these impacts work are not always clear.

We contribute to this literature by analyzing how proximity to a large city affects farmers' agricultural production practices. We develop a model of how distance to an urban market affects agricultural intensification and productivity, and test the predictions of this model using micro level data on staple food crop production in Ethiopia. Ethiopia is an excellent case study since urbanization is increasing rapidly and more rural farmers are becoming part of agricultural supply chains to cities. At the same time Ethiopia remains one of the poorest and most food insecure countries in SSA, with the majority of its people still highly dependent on the agricultural sector for their livelihoods (von Grebmer et al., 2015). Agricultural transformation is therefore high on the agenda of local policy makers as well as researchers engaged in understanding different aspects of structural transformation in Ethiopia.

To study the relationship of agriculture with proximity to cities, we use data from Ethiopian teff farmers located in major producing areas surrounding the capital Addis Ababa. Teff is a staple crop and major source of income for farmers in rural areas, and is an important food for urban consumers, and therefore especially relevant for Ethiopian policy makers because of its food security and income consequences. Focusing on one crop in one country allows us to measure the size of the hypothesized effects of urban proximity on agricultural intensification and to better identify the driving mechanisms behind this. Teff production and consumption is mainly restricted to Ethiopia, providing a closed economy setting. As a consequence, teff prices – as well as other intensification outcomes – are not directly determined by international prices.[2] Moreover, teff has a high income elasticity, implying that rising incomes and urbanization rates raise the demand for teff and thereby potentially drive teff intensification and transformation.

We find that farmers located close to Addis Ababa receive higher output prices, and face increased wages and land rental rates. As a consequence, urban proximity is positively related to the use of modern inputs, i.e., chemical fertilizers and improved seeds. The direct effect of urban proximity, combined with the indirect (output) price effect, result in higher land and labor productivity and profits. Our findings therefore suggest that improved access to urban markets associated with growing cities will likely lead to increased modern input use and transformation to higher agricultural productivity levels. In contrast, we do not find a significant and positive relationship between intensification and rural population densities (proxied by farm size) in the cross sectional setting of our paper. This finding could be explained by the results of Headey, Dereje, and Taffesse (2014) and Josephson, Ricker-Gilbert, and Florax (2014) who show immiserizing intensification driven by land pressure increases in rural Ethiopia. In the conclusion we however emphasize that the implications of our findings should be interpreted with care since the popularity and high (urban) price of teff in Ethiopia is somewhat atypical for staple crops, and the effect of urbanization might therefore be different for other staple crops or agricultural products in other African countries.

2. Background on cities and teff in Ethiopia

Urbanization in Ethiopia is one of the lowest in the world, with only 17% of its population estimated to live in cities in 2012 (World Bank, 2015). However, rapid growth of cities has occurred in the past and even faster changes are expected in the future. Schmidt and Kedir (2009) estimate that, based on an agglomeration index approach and using the last three national censuses (1984, 1994, 2007), urbanization rates have increased from 3.7 to 14% over the period studied, almost quadrupling the urban share of the national population (CSA, 2007). Using the latest census information, Addis Ababa is by far the largest city in Ethiopia – in 2007 about a quarter of all the 10.5 million urban residents in Ethiopia lived in Addis (Schmidt & Kedir, 2009). Driven by complementary rapid road infrastructure development, Kedir, Schmidt, and Tilahun (2015) further estimate that only 15% of the population was located within 3 h of a city with a population of at least 50,000 in 1997/1998, but in 2010/11 this number had changed to 47% of the population (Fig. 1). Fig. 1 also shows that the number of towns with at least 50,000 residents has increased, another indication that cities are growing in Ethiopia. The World Bank (2015) expects that urban populations will continue to grow rapidly in Ethiopia. It projects an annual growth rate of 5.4% over the next decades, which would lead to a tripling of the urban population from 15.2 million in 2012 to 42.3 million in 2034. By 2028, 30% of the population would live in urban areas.

We focus in this paper on teff. Teff is an important staple crop in Ethiopia, both in terms of cultivated hectares of land, grain production, and commercial value. In 2011, teff constituted 23% of the total grain crop area and 17% of the total grain production in Ethiopia (CSA, 2012). Moreover, production has doubled in the last decade, from over 1.5 to 3.5 million metric tons. 29% of teff production is sold, relatively high compared to other cereals such as wheat and maize (20 and 11% respectively). Hence, teff has a higher commercial surplus, and is often considered a cash crop for its producing farmers (Minten, Tamru, Engida, & Kuma, 2015; Minten, Tamru, Engida, & Kuma, 2016). Teff yield levels are however relatively low, and the government has been rolling out several interventions to boost teff yields, including the promotion of row planting at a reduced seed rate (see Vandercasteelen, Dereje, Minten, & Taffesse, 2013).

Teff is also an important staple food in Ethiopia, commonly eaten by urban households. In urban areas, teff accounts for 23% of per capita total food consumption (Berhane, Paulos, & Tafere, 2011). In Addis Ababa, teff makes up almost half of total cereal expenditure, while in other regions this is much less. Moreover, teff is consumed relatively more by richer and urban households – the income elasticity of demand for teff is high in urban areas, estimated to be 1.1 by Berhane et al., (2011). Moreover, household real incomes (proxied by per adult equivalent consumption) in Ethiopia are increasing, by an estimated 20% between 2005 and 2011 (MoFED, 2013). The expected growth in the number and in the average incomes of urban households seems set to increase the urban demand for teff well into the future.

3. Conceptual framework

To derive hypotheses on how distance from urban areas affects famers' input use ("intensification"), we use a simple partial

[1] Because of lower transportation costs, farmers living close to markets receive higher effective market prices for their products, which increases their rented land value. Rural areas close to markets will therefore specialize in high value commodities; and market expansion will result in the development of different spheres of land uses and specialization of different agricultural products centered on the urban market.

[2] This setting does not allow to identify how urban proximity affects farmers' production of other crops or crop diversification strategies in Ethiopia. Farmers might for example substitute teff by other crops in more rural areas.

Please cite this article in press as: Vandercasteelen, J., et al. Cities and agricultural transformation in Africa: Evidence from Ethiopia. *World Development* (2017), https://doi.org/10.1016/j.worlddev.2017.10.032