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Patterns of labor productivity and income diversification – Empirical evidence from Uganda and Nigeria

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ABSTRACT

The labor productivity gap and differentials within and between farm and non-farm sectors is the key to understanding household income diversification patterns. This study shows that the labor productivity gap between farm and non-farm sectors attenuates after controlling for labor intensity. Within agriculture, there are no productivity gaps between staple and high value crops. This provides some evidence of underemployment in agriculture and employment gaps between the farm and non-farm sectors. In addition, diversification into and within farm and non-farm sectors is positively correlated with labor productivity in the specific sector. Diversification into non-farm activities may, however, reduce farm labor productivity and requires policies that reduce such tradeoffs in the transformation process. In addition, the pathways linking income diversification and labor productivity are complex and non-linear. In Uganda, income diversification is higher among resource-poor households (with limited family labor, land, and livestock) in rural areas away from main roads or urban centers. In Nigeria, diversification is higher for male-headed households with productive assets (family labor and land) and in areas closer to markets and urban centers.

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1. Introduction

One of the main features of sub-Saharan African economies is the lower share of agriculture's value added compared to its share of employment. The agricultural sector accounts for about 15% of the value added compared to 55% for services and 30% for industry (ECA, 2016). On the other hand, the agriculture sector accounts for about 60% of the labor force and total employment (ILO, 2015). This implies a higher value added per worker in the non-agriculture sector than in agriculture.

The current literature on the role of productivity gaps in structural transformation focuses in particular on differentials between labor devoted to agricultural and non-agricultural sectors (Gollin, Lagakos, & Waugh, 2014; McCullough, 2017; McMillan & Headey, 2014; Nagler & Naude, 2014). The approach used in these studies to represent farm and non-farm decisions neglects two factors that are key to understanding the full process of transformation: the role that diversification of income strategies plays in facilitating structural transformation and the importance of productivity differentials within farm activities relative to cross-sectoral differ-

entials. Evidence from the literature on the nature of the relationship between labor productivity and income diversification is mixed and varies depending on the agricultural potential and the economic conditions and the available sources of income that rural households face (Barrett, Reardon, & Webb, 2001; Bryceson, 2002; Ellis, 1998; Haggblade, Hazell, & Reardon, 2007). In zones of rapidly growing agricultural productivity and dynamic economic conditions, rising farm labor productivity releases family workers to undertake non-farm activities and increases non-farm income and household expenditures on nonfood items (Ellis, 1998; Haggblade et al., 2007). On the other hand, limited agricultural potential and lack of wider opportunities in agriculture could also be a catalyst for households to expand their activities outside of the farm (Ellis, 1998). Low or falling agricultural labor productivity could in this case induce out-migration of labor or diversification into the available low-return non-farm activities in the rural sector (Barrett et al., 2001; Haggblade et al., 2007; Reardon, 1997; Winters et al., 2009). Under these conditions, without technological change, land and labor productivity in the agriculture sector will fall resulting in distress diversification into low return and labor intensive farm and non-farm activities.

In this study, we explore the extent of the cross-sector productivity gap using the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) data from two

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countries in sub-Saharan Africa when alternative measures of labor inputs for employment in farm and non-farm sectors are taken into account. The study also investigates the existence of possible productivity differentials within the agriculture sector by comparing cropping strategies between staple crops and high value crops.

The contributions of the study to the development literature are twofold. First, the paper quantifies cross-sector differences in labor productivity and determines whether the largest productivity gaps are between the agriculture and other sectors, or within agriculture. Second, the paper enhances the current understanding of the structural transformation processes by providing additional information on the potential relationship between labor productivity and income diversification strategies and factors that explain differing patterns. We believe that this is the first study to perform a detailed examination of the correlates of and relationships between labor productivity and income diversification within agriculture and allied non-agriculture sectors across countries in sub-Saharan Africa, especially in the context of Nigeria and Uganda.

The paper follows the McCullough (2017) procedure for sector classification which is consistent with the categorization proposed by Barrett et al. (2001) for farm and non-farm activities.¹ The analysis is based on nationally representative balanced panel data from LSMS-ISA data in Nigeria and Uganda constructed for households over two and three rounds, respectively. The empirical analysis uses three complementary econometric approaches to generate the evidence: (i) random effects tobit estimation to account for the censored structure of the panel data to identify the determinants of labor productivity; (ii) linear seemingly unrelated regression approach to identify the determinants of income shares and their relationship with labor productivity; and (iii) normalized Herfindahl-Simpson's (NHS) diversity indices and correlated random effects double hurdle choice model to determine the correlates of income diversification patterns and their relationship with labor productivity.

We draw three major results from our analysis. First, the extent of cross sector labor productivity gap is highly sensitive to measurement definitions; labor productivity in non-agriculture activities in Uganda and Nigeria is, respectively, twelve and three times higher when expressed on a per worker basis but falls to twofold when expressed on a per person-days basis. These findings confirm those of Gollin et al. (2014) and McCullough (2017) and provide useful insights about the underemployment gap in the agriculture sector relative to the non-agriculture sector. Second, within the agriculture sector, there is lack of evidence of labor productivity gaps when it is further adjusted for person days worked across cropping strategies – i.e., between staple crops and high value crops. Third, there is a positive relationship between labor productivity and income shares from a specific sector, indicating that households allocate resources in favor of the sector that provides the highest labor productivity. However, if there are potential gains from both specialization and risk sharing, then the predicted positive relationship between labor productivity and income diversification could be ambiguous. In Uganda, the NHS income diversification index seems to be higher among resource poor households (with limited family labor, land, and livestock) in rural areas away from main roads or urban centers. Whereas in Nigeria, the diversification index increases with productive assets (family labor and land) and in areas closer to markets and urban areas.

The analysis provides a careful and more complete description of factors that seem to predict income diversification and its relationship with labor productivity without attempting to establish

the causal links between the two. Hence, we cannot conclude whether labor productivity drives income diversification or vice versa, and may not have identified all the factors that cause households to choose less or more diversified strategies.

The rest of the paper proceeds as follows. Section two presents how we measure labor productivity and income diversification. Section three describes the data and presents summary statistics. The core of our analysis is presented in section four where we estimate and discuss the relationship between labor productivity and income diversification. The following section presents the correlates of income diversification. The last section concludes highlighting some policy implications.

2. Measurement of labor productivity and income diversification

2.1. Labor productivity

To examine patterns of labor productivity within and outside agriculture, a measure of labor productivity is first constructed. In staple and high value crops, labor productivity is given by the ratio of the returns to family labor and land (value of farm production minus operating costs of production) to the total labor input (in person days or workers). Similarly, the ratio of the returns to family labor and capital (sum of wage labor and profit from operating an enterprise) to the total labor input (in person days or workers) is used to measure labor productivity in the non-farm sector. Labor productivity is calculated as follows:

$$LP_{k,i,t} = \frac{NR_{k,i,t}}{LI_{k,i,t}} \quad (1)$$

where k denotes activity sectors of staple crops, high value crops, and non-farm activities; i and t respectively index households and panel data year; $LP_{k,i,t}$ is household i 's labor productivity from sector k in year t ; $NR_{k,i,t}$ is net returns; and $LI_{k,i,t}$ is labor input used expressed in terms of person days or workers.

2.2. Income diversification

Two different indices are used to determine factors affecting income diversification and the relationship with labor productivity across staple crops, high value agriculture, and non-farm activities: the shares of income from different activities and the normalized Herfindahl-Simpson diversity index.

The income shares are given by the ratio of income from a sector of activities to the total sum of incomes across all sectors at the household level (excluding livestock, remittances and transfers).²

$$IS_{k,i,t} = \frac{I_{k,i,t}}{I_{i,t}} \quad (2)$$

where $IS_{k,i,t}$ is household i 's income share from sector k (staple crops, high value crops, or non-farm) in year t , $I_{k,i,t}$ is household income for a given activity sector k , and $I_{i,t}$ ($\sum_k I_{k,i,t}$) is the total household income across all activity sectors.

However, income share measurements focus on one metric of the extent of the dependence and reliance on a particular sector as the source of income (Barrett, 2005). Alternatively to the one-metric measure of diversification, the Herfindahl-Simpson and Shannon-Weiner indices have been used in numerous empirical studies of income diversification strategies (Johny, Wichmann, &

² In many countries, livestock is an important income diversification strategy. Because of data limitations to measure labor productivity and income, we focus on two major agriculture income diversification strategies in the farm sector and the non-agriculture sector. Future research that includes livestock income sources and which separates wages from self-employment will be an improvement on this paper.

¹ Assignments to agriculture (or farm) and non-agriculture (or non-farm) consider only the nature of the product and the types of factors used in the production process irrespective of location, scale, technologies, or returns from the activities (Barrett et al., 2001).

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