Performance and Survival of Non-Farm Entrepreneurship in Rural Africa: Evidence from the LSMS-ISA Surveys

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Abstract

Using the World Bank's LSMS-ISA database, we explore the performance and survival of non-farm enterprises in Ethiopia, Malawi, Nigeria, and Uganda. We estimate productivity dispersals and multinomial logit models, and find that most rural non-farm enterprises operate in low-risk, low-productivity types of sectors, such as trade, sales and services. Fewer households enter into more risky, but also more lucrative sectors. We further estimate determinants of enterprise productivity using a Heckman selection model and panel data analysis. We find that rural non-farm enterprises are on average less productive than those in urban areas, and that female-owned enterprises are less productive than male-owned enterprises. We also find that enterprises operating continuously over the year are more productive than enterprises operating intermittently, and that shocks negatively affect enterprise productivity. We finally present evidence that rural non-farm enterprises show a higher probability of exiting the market due to idiosyncratic household shocks than urban enterprises. Overall, the performance and survival patterns of non-farm enterprises in rural Africa reflect a difficult business environment, a lack of adequate financing and social protection, as well as continuing regional and gender disparities.

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1 Introduction

Non-farm enterprises largely fulfill a risk-management and survival function in rural Africa, where a lack of sufficient formal employment is prevalent despite decades of rural development policies (see Nagler and Naudé, 2014; Rijkers and Costa, 2012; Start, 2001). The relative contribution of the rural non-farm economy to household income in Africa is significant and has increased over time (Rijkers and Costa, 2012; Haggblade et al., 2010). *Push* factors such as household shocks, seasonality in agriculture, and household surplus labor are important determinants of a rural household's decision to operate a non-farm enterprise (Nagler and Naudé, 2014). Given that a large share of rural households are thus pushed into informal enterprise activity, it is widely assumed that these will not be very productive. Surprisingly, the literature so far lacks empirical evidence on the performance and survival of these enterprises. This lack of knowledge is a serious lacuna: policies to support rural development and job creation are expected to raise the productivity of rural enterprises. In contrast, a relatively large literature has dealt with the performance and survival of urban enterprises in Africa, and on the performance of farms (agricultural productivity) (e.g. Alene, 2010; Block, 2010). Even the impact of non-farm enterprises on farm productivity has been relatively frequently studied (e.g. Oseni and Winters, 2009).

We consider this scholarly neglect as detrimental given the acute need for more and better jobs in Sub-Saharan Africa, especially for the young population. It is expected that 170 million young people will enter the labor force between 2010 and 2020 (Fox et al., 2013). More productive enterprises are more likely to survive and hence create the employment opportunities urgently needed (Owoo and Naudé, 2014; Wennberg and Lindqvist, 2010).

In this paper we take a pioneering step towards addressing this shortcoming by exploring the non-farm enterprise performance in four African countries using the World Bank's Living Standards Measurement Study - Integrated Surveys in Agriculture (LSMS-ISA) data set. The database covers six countries in Sub-Saharan Africa over the period 2005 to 2013. We focus on Ethiopia, Malawi, Nigeria, and Uganda due to data availability. For Ethiopia and Malawi the data allows us to differentiate between different types of business activity and account for their performance (as reflected in labor productivity), while for Nigeria and Uganda panel data allows a richer analysis over time. While not perfect to study enterprise performance and dynamics, the surveys capture useful information about the output and labor of rural non-farm enterprises, about the reasons why some enterprises are more productive than others, and about the reasons why some enterprises cease operating.

The story that the LSMS-ISA data tell us in this regard is that households in rural Africa are first and foremost engaged in agriculture. As agriculture is risky, households may cope or manage this risk through operating non-farm enterprises (see Nagler and Naudé, 2014). In the presence of market failures for credit and insurance, most households operate enterprises in low-risk, low-productivity types of sectors, such as trade, sales and services. Fewer households can enter into more risky, but also more lucrative sectors. The performance of non-farm enterprise productivity is furthermore affected by the location of the enterprise. The local business environment therefore matters, both in terms of whether it provides an environment conducive for business and whether and

how agriculture and its seasonal effects impact the business. In this regard non-farm enterprises in rural areas are less likely than those in urban areas to operate continuously throughout the year. The fewer months they operate during one year, the less productive they are. The low(er) productivity of non-farm enterprises is a concern given that less productive enterprises are also less likely to survive. Although the LSMS-ISA does not allow us to study the survival dynamics of non-farm enterprises rigorously, the available evidence suggests higher rates of failure and exit: while both urban and rural enterprises fail in most cases due to poor profitability and a lack of finance, rural non-farm enterprises are almost twice as likely to cease operations due to household shocks compared to urban enterprises. Overall, the findings in our paper suggest that the performance and survival patterns of rural non-farm enterprises in Africa reflect a difficult business environment, a negative impact due to a lack of adequate credit and social protection schemes, including (micro)-insurance and social assistance, as well as continuing gender disparities.

The paper continues as follows. In section 2 we discuss the relevant literature on non-farm enterprises in Africa, focusing first on patterns and determinants, then on their performance and productivity, and finally on enterprise survival and exit. In section 3 we describe the LSMS-ISA database. In section 4 we present and discuss our empirical results, analyzing the dispersal of enterprise productivity, types of business activity, determinants of productivity, and survival and exit. We use different econometric techniques, such as multinomial logit models, a Heckman selection model and panel data analysis. The final section summarizes and concludes.

2 Literature Review

We use the term "rural non-farm enterprises" to refer to small, informal household enterprises in the rural non-farm economy. The latter includes all non-agricultural activities in rural areas including on-farm (but non-agricultural) activities such as agribusiness, as well as services, trade and retail, tourism, rural industrialization, construction, and mining (Nagler and Naudé, 2014).

Our review of the relevant literature is organized into three sections. In section 2.1 we summarize the patterns and determinants of rural non-farm entrepreneurship in Africa based on our companion paper (Nagler and Naudé, 2014). In section 2.2 we screen the literature about what is known of enterprise productivity and performance in Sub-Saharan Africa, and in section 2.3 we finally discuss the relatively small literature on enterprise survival and exit.

2.1 Patterns and Determinants

After a period of neglect in the 1980s and 1990s the importance of the non-farm sector for rural development in Sub-Saharan Africa is now widely acknowledged. The rural non-farm economy contributes with shares between 30 to 50 percent to the overall household income (Rijkers and Costa, 2012; Haggblade et al., 2010). There is also recognition that

rural households diversify their income streams through non-farm activities, given the risky environment in the agricultural sector. These enterprises practically substitute for the lack of insurance and social protection schemes (Nagler and Naudé, 2014).

Despite the contribution that the non-farm economy makes to welfare in rural Africa, it appears to be stagnant. The patterns of non-farm entrepreneurship show evidence of failure of rural development and structural adjustment in Sub-Saharan Africa. Nagler and Naudé (2014) conclude, for example, that rural development policies in Africa have had limited impact in fostering the structural change in rural areas that are consistent with notions of modern economic development. Being still a largely informal and survivalist sector, rural non-farm enterprises provide a risk-diversifying mechanism for households, similar to the 1960s. More specifically Nagler and Naudé (2014) find that non-farm enterprises in rural Africa still "tend to be small, informal household enterprises that provide predominantly goods and services to the local economy". Between 91 and almost 100 percent of these non-farm enterprises operate in the informal sector, where they have none or limited social protection. In their majority these enterprises operate in the immediate surroundings of the household residence, providing predominantly basic consumer goods and services to the local economy. Based on these findings we expect *a priori*, that most non-farm enterprises in rural Africa are characterized by low productivity, and may have short life-spans of operation.

Actual empirical evidence on the performance of non-farm enterprises in Africa is however scarce. There is a lack of knowledge about the productivity, survival and failure of these enterprises, as compared to the growing evidence on urban-based, manufacturing and farming enterprises. The lack of knowledge on these issues constitutes a serious lacuna, since effective policies to support rural development are pressing to raise the productivity of rural enterprises. Most rural enterprises are not productive enough to grow further and provide employment, and many operate only intermittently or fail after a short time. In the next section we survey the relevant literature and accentuate the literature gap on the productivity of non-farm enterprises.

2.2 Productivity

Enterprise productivity refers to how efficiently enterprises transform inputs into outputs. The most frequently used measures are total factor productivity (TFP) and partial measures such as output per labor unit. Syverson (2011) contains a review of the substantial literature on enterprise productivity, of which the vast majority deals with enterprise performance in developed economies. In this literature the most important determinants of enterprise productivity are education, experience and skills levels of managers and workers and market structure (Biesebroeck, 2005; Bloom and Reenen, 2010; Moretti, 2004). This literature also elaborates that female-headed enterprises are less productive than male-headed enterprises (Amin, 2011; Kinda et al., 2011; Rijkers and Costa, 2012; Saliola and Seker, 2011). Furthermore enterprises clustered together are more productive, due to localization and urbanization economies such as knowledge and technology spill-overs (Bloom et al., 2013; Martin et al., 2011), horizontal linkages (Nichter and Goldmark, 2009) and more competition (Foster et al.,

2008; Ali and Peerlings, 2011). As a result the geographical location of an enterprise, and in particular its proximity to other productive enterprises, are likely to influence its productivity.

While a solid body of literature has dealt with the above dimensions of enterprise productivity, only a few studies have analyzed enterprise productivity in the African continent. Moreover, most of those that do, focus either on formal enterprises or manufacturing enterprises. These enterprises tend to be overwhelmingly urban-based. There is therefore a huge gap in the current literature on the productivity of rural non-farm enterprises.

For African countries most work has been conducted on the impact of the business environment on enterprise productivity. Various studies, using mainly World Bank data on formal enterprises, have found that a poor business environment reduces enterprise productivity and growth. Major studies include Arnold et al. (2006), Dollar et al. (2005), Eifert et al. (2008) and Dethier et al. (2010). Less work has been done on clustering and spatial spill-overs. The only study for rural Africa that has conducted this kind of analysis so far is Owoo and Naudé (2014). They use geo-referenced rural household data from Ethiopia and Nigeria and find evidence of significant spatial auto-correlation from the productivity levels of enterprises in one location (the enumerator area) on that of closely located enterprises.

Further research that has attempted to deal with the lacuna of productivity measure of rural non-farm enterprises, is one study by Rijkers et al. (2010). They analyze the productivity of non-farm manufacturing enterprises in rural Ethiopia. Comparing the productivity of rural and urban manufacturing enterprises, they find that rural enterprises are less productive than urban enterprises. To be more precise: the output per labor ratio for remote rural enterprises is 0.43, while it is 0.95 for enterprises in rural towns, and 2.30 for enterprises in urban Ethiopia (Rijkers et al., 2010, p. 1282). Furthermore they point out that productivity levels are more dispersed in the case of rural enterprises, and that female-headed enterprises are less productive than male-headed enterprises. In our estimates we confirm these findings also for a larger sample and more countries.

The remaining studies have dealt with manufacturing firms in Africa. Söderbom et al. (2006) and Söderbom and Teal (2004) use data for these manufacturing firms and find that more productive firms tend to survive longer in Africa. This happens however only in the cases when they have attained a certain firm size. Frazer (2005) finds, using Ghanaian enterprise-level data, that more productive enterprises are also more likely to survive compared to less productive enterprises.

If productivity matters for enterprise survival and growth, we expect that non-farm enterprises in rural Africa have on average a lower likelihood to survive than enterprises in urban areas. This is also a possible explanation for Nagler and Naudé (2014) who find in their study that a smaller share of non-farm enterprises in rural areas are active throughout the year. In the next section we survey what is known about the survival of African enterprise, noting again the lack of knowledge about the survival and failure patterns and determinants of rural non-farm enterprises.

2.3 Survival

The literature concurs that while starting a non-farm enterprises in rural Africa is relatively straightforward (Shiferaw, 2009), it is more challenging for enterprises to grow and survive (Bekele and Worku, 2008). To date there have been few empirical studies that examine the survival and exit of non-farm enterprises in rural Africa. The literature on enterprise survival largely deals with urban-based enterprises in developed countries. In this literature a number of salient facts have been established such as that larger, older and more productive enterprises have a higher probability of survival (see for instance Caves, 1998; Geroski, 1995; Sutton, 1997). Managerial capabilities are often important, and as per Mincer (1974) often seen as an indicator of enterprise productivity (Key and Roberts, 2007; Variyam and Kraybill, 1994). Firm age and size may reflect an enterprise's ability to overcome financial constraints.

In Africa only a handful of studies have dealt with enterprise survival and exit. One of the first studies use firm-level data and proportional hazards regression models (McPherson, 1995). The data covers approximately 21,000 firms across Botswana, Malawi, Swaziland, and Zimbabwe. The author finds that enterprise size does not significantly affect the survival of enterprises in Botswana and Swaziland, but that larger firms are less likely to survive in Zimbabwe. These results are in contrast to those found in developed countries. McPherson (1995) also finds that rural enterprises are more likely to fail than urban enterprises and that enterprises based in and around the household also face a higher likelihood of exiting operations. Heterogeneity is another notable feature of his results: while female-headed enterprises do not have a different likelihood of failure in Botswana and Swaziland, female-headed enterprises do have a higher likelihood of failure compared to male-headed enterprises in Malawi and Zimbabwe.

Since McPherson's (1995) study, the determinants of enterprise survival, growth and exit in Africa have also been investigated by Bekele and Worku (2008), Frazer (2005), Klapper and Richmond (2011), Loening et al. (2008) and Shiferaw (2009). These studies established that managerial and technical skills, finance and social networks, the macro-economic and business environment, as well as firm age and size determine the likelihood of enterprise survival. Furthermore, according to Frazer (2005) a significant proportion of enterprises do not exit the rural market because of economic or business reasons, but due to personal reasons "such as bad health or retirement, while others closed because better options became available" (Frazer, 2005, p. 590). Loening et al. (2008) also suggest that non-business factors can influence the time in operation or the exit of rural enterprises. Agricultural seasonality, for example, may result in non-farm enterprises not operating the whole year, and temporarily stopping due to agriculturally-determined reasons. These handful of studies have focused only on urban-based and/or formal enterprises in Africa, hence a large gap remains in our understanding of the survival dynamics of informal household enterprises in rural Africa.

Before setting out our own contribution to the literature surveyed here, we summarize the literature review: enterprise performance is important for survival and job creation in Africa's rural areas. To date we know however very little about the performance and survival of these non-farm household enterprises. The existing literature has either dealt

with enterprises in developed economies, or with the productivity and survival of formal and/or manufacturing enterprises in urban areas in Africa. Rural, non-farm enterprises have been seriously neglected. A major reason for this lacuna might be due to a lack in adequate (panel) data on rural non-farm enterprises. The recent LSMS-ISA data set of the World Bank, although still subject to shortcomings, provides for the first time (panel) data on rural entrepreneurship to explore these issues to a greater extent than what has been previously possible. In the next section we describe this data set and the country data we use, as well as our methodologies for exploring enterprise productivity and survival.

3 The Database

The LSMS-ISA database is the result of nationally representative, cross-sectional and longitudinal surveys conducted by the World Bank in collaboration with national statistical offices in various countries in Sub-Saharan Africa.[1] The surveys cover six countries at the time of writing: Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda. Cross-sectional data is currently available for all countries, and panel data for Nigeria, Tanzania and Uganda.

The surveys consist of three parts: a community questionnaire, an agricultural questionnaire and a household questionnaire. The community questionnaire collects community-level information and covers access to public services and infrastructure, social networks, governance, and retail prices. The agricultural questionnaire collects information on crop production, storage and sales, land holdings, farming practices, input use and technology adaption, access to and use of services, infrastructure and natural resources, livestock, and fishery. Finally, the household questionnaire captures household demographics, migration, education, health and nutrition, food consumption and expenditure, non-food expenditure, employment, non-farm enterprises and further income sources, dwelling conditions, durable assets, and participation in projects and programs. All data is furthermore geo-referenced.

Despite its strengths and usefulness, the data shows also weaknesses for present purposes. For example, a comprehensive analysis of enterprise survival and failure is constrained due to a lack of data on failed enterprises. Furthermore, enterprises are not explicitly tracked over the survey rounds in Tanzania and Uganda. Therefore we cannot follow the enterprises over each survey round to study their individual performance over time. Empirical estimates using duration analysis are therefore not possible to conduct at present. More general, but less precise estimations are still possible to conduct, specifically at different aggregation levels. Following our empirical analysis in the next section, we suggest that in future waves and countries, where the LSMS-ISA surveys is still planned to be conducted, a number of modifications and additions should be made to the questionnaire. A full elaboration of these fall outside the scope of the present paper, however we want to briefly mention them as an illustration of the type of current shortcomings we face: apart from clearly tracking individual enterprises over various

[1] Additional information on the LSMS-ISA: www.worldbank.org/lsms-isa

survey rounds, discontinued enterprises should equally be registered and information collected. We suggest to add specific questions to know more about these discontinued enterprises, e.g. when exactly was the enterprise discontinued (year and month), and the reason for stopping enterprise operations. Adding modules to the questionnaires to collect information that allow to estimate production functions and technical efficiency, including price information, information about the final product(s) and their prices, wages paid per worker, input costs (intermediate inputs), overhead (transport, security), fixed and working assets employed in the enterprise (to know more about the capital intensity), would all greatly facilitate future analyses of the rural non-farm enterprise sector.

In the next section we share, from our analysis of this data, new empirical evidence on the productivity and survival of non-farm household enterprises in rural Africa.

4 New Empirical Evidence

Having reviewed the literature and identified the knowledge gaps in the rural non-farm enterprise sector, we set out our analysis and discuss the new empirical evidence in this section. We organize our exposition as follows: first we dissect the patterns and determinants of the productivity of non-farm enterprises, using a partial productivity measure (output per worker), and apply a number of different regression techniques: the Heckman selection model, multinomial logit regressions and panel data analysis. Second we investigate and discuss what the data can tell us about the survival and exit of these enterprises.

4.1 Patterns and Determinants of Productivity

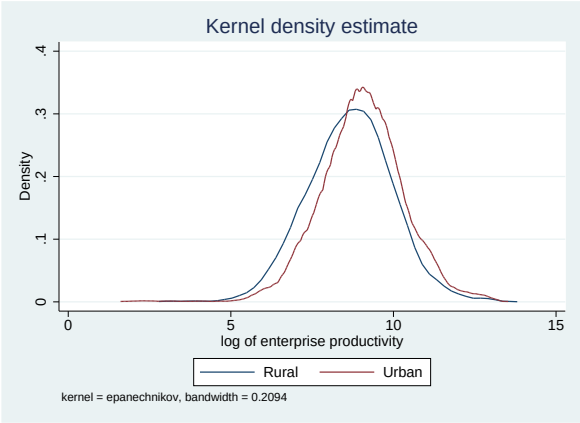
In this sub-section we screen the patterns and determinants of non-farm enterprise productivity in rural Africa. We are specifically interested in gender and location characteristics, as well as types of business activities.

4.1.1 How Productive are Non-Farm Enterprises?

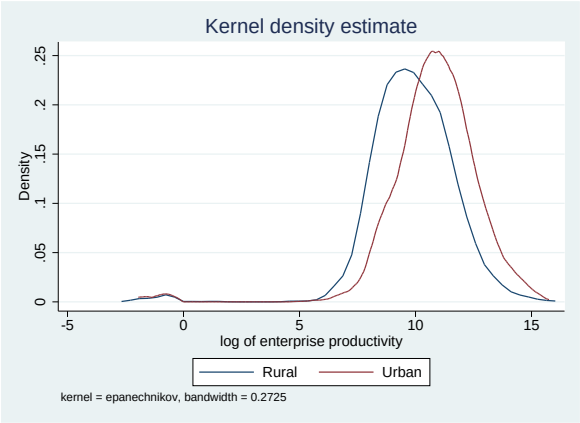
For Nigeria and Uganda we can calculate the dispersal of enterprise productivity by region, gender and wave. Productivity is calculated as total sales (of last month) divided by the number of workers in the enterprise for Nigeria, and as monthly average gross revenues during the months of operation divided by the number of workers in the enterprise for Uganda. Figure 1 shows that differences by region and gender confirm our expectations: urban enterprises are more productive than rural enterprises, and enterprises with a male owner are more productive than enterprises with a female owner. There are no strong trends over the short time period we examine: although productivity improved slightly in Nigeria in the second wave, no similar improvement took place in Uganda.

Figure 1: Productivity Dispersal by Region, Gender and Wave

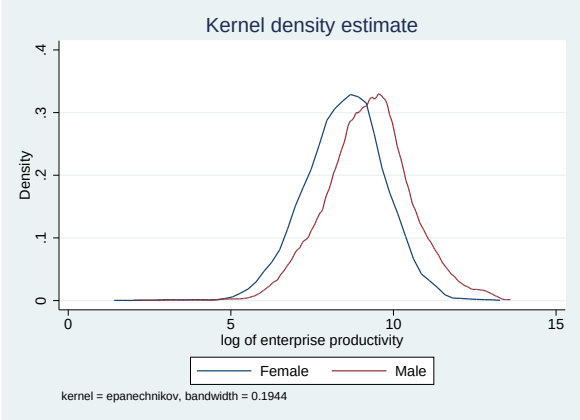
(a) Nigeria - by Region



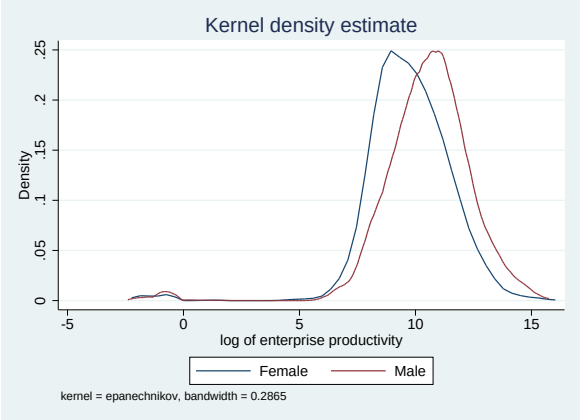
(b) Uganda - by Region



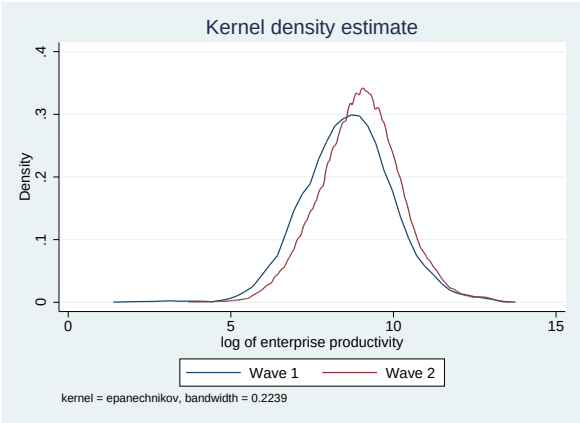
(c) Nigeria - by Gender



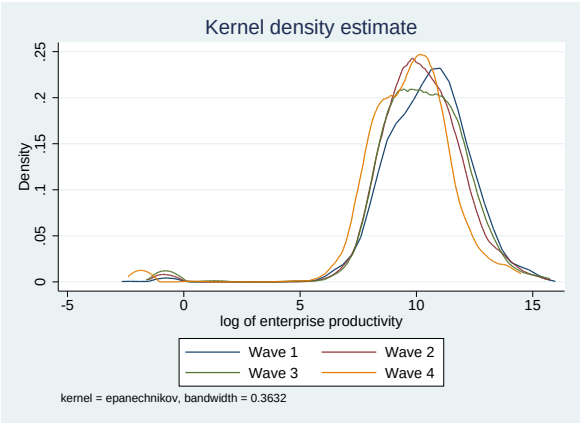
(d) Uganda - by Gender



(e) Nigeria - by Wave



(f) Uganda - by Wave



Source: Authors' own calculations based on the LSMS-ISA database.

Although urban enterprises are more productive than rural enterprises, the simple dichotomy between rural and urban areas may be of limited usefulness in Africa. There is much variation in Africa's economic geography between deep rural, small towns, and major urban areas. The potential importance of secondary towns and rural agglomerations has generally been underestimated. As Christiaensen et al. (2013) argue, productivity might be higher in metropolitan areas, but not all inhabitants from rural

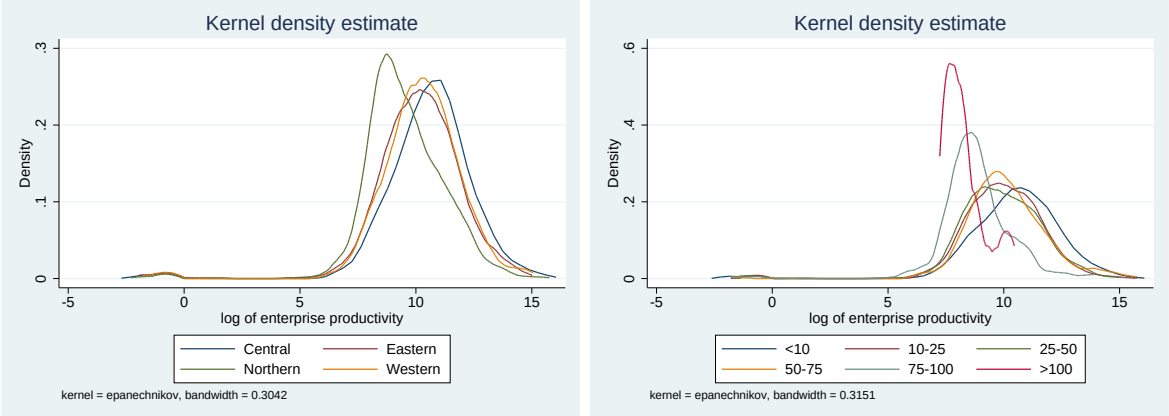
areas are or will be able to access opportunities in these areas. Using data from Tanzania they find that only one in seven people who escaped from poverty did so through migrating to a large city, but that one in two did so by moving to secondary towns.

Hence we are interested in providing a finer analysis of how spatial location affects productivity of non-farm enterprises. To do so we turn to Uganda due to the country's division in four main regions (Central, Eastern, Northern, Western). These four regions are distinct in terms of population density, business environment and history. Over the past ten years economic growth has been largely concentrated in the Central region, while in the Northern region an insurgency raged from 1987 to 2006. The Western region has equally been affected by negative spillover effects of the conflict in Sudan (Blattmann et al., 2012). This allows us to obtain some indication of how the local business environment may affect enterprise productivity, as regions that experienced conflict are more likely to show a relatively poorer business environment (Brueck et al., 2013).

We expect that non-farm enterprise productivity is higher in the more densely populated and more peaceful regions (Eastern and Central regions) compared to the Northern and Western regions. Indeed Figure 2a confirms our expectations: the Central region (with the capital Kampala) returns the highest enterprise productivity, with similar outcomes for the Eastern and Western region. The Northern region, with the lowest population density and a history of conflict, is home to the enterprises with the lowest productivity of the four regions.

Figure 2: Productivity Dispersal by Geographical Region and Distance from Secondary Towns

(a) Uganda - by geographical region **(b)** Uganda - by distance (in km)



Source: Authors' calculations based on LSMS-ISA data.

Within these regions the question can be raised what is the impact of distance to the closest secondary town on enterprise productivity. To answer this question we refer again to Uganda and take different distances of the household enterprise to the closest population center or secondary town. We compare the productivity density of the enterprises by various distance categories from these population centers. We expect, following Christiaensen et al. (2013), that proximity to a secondary town increases enterprise productivity and that it should gradually diminish over distance, reflecting that spatial spillovers are limited in terms of distance. Figure 2b confirms our expectations: enterprises of households living up to 10 km from a population center or secondary town

are the most productive, followed by enterprises in households living up to 25 km, 50 km and 75 km away, respectively. If households live more than 75 km or 100 km away, the results show a significant drop in enterprise productivity, suggesting that formation of rural secondary towns and cities, providing links between rural areas and major cities, may be an important phase in the structural transformation and poverty reduction of agrarian societies like Uganda.

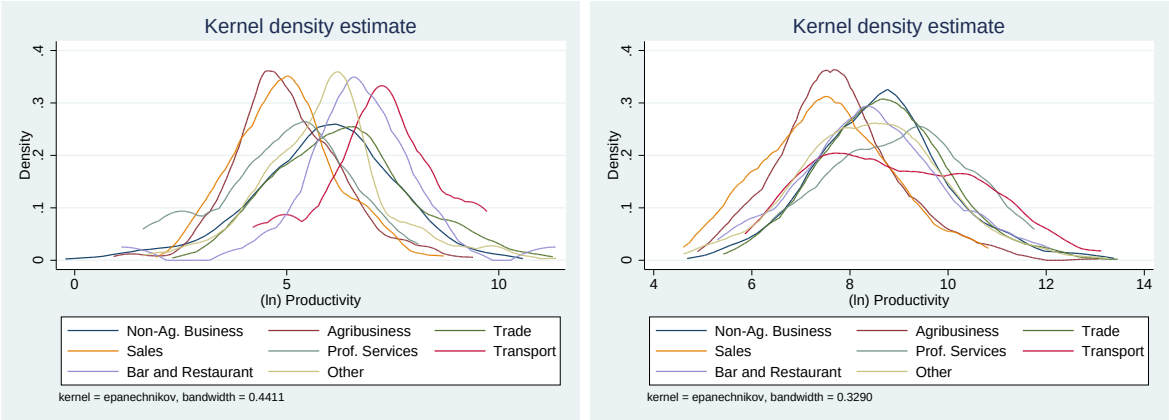
In the next section we continue our empirical analysis of the productivity levels of non-farm household enterprises by asking which types of business activities are the most productive.

4.1.2 Which Types of Non-Farm Enterprises are Most Productive?

We expect a substantial dispersal in the productivity levels of different types of enterprises. Based on the literature we expect that higher productive enterprises are found in niche areas or markets which enjoy higher demand or degree of monopoly power, which in turn may result in higher output. The enterprises' labor ratio in specific sectors might therefore be higher compared to other business areas due to price effects. To explore this assumption we plot in Figure 3 the density of log transformed gross productivity in Ethiopia and Malawi.[2] For both countries productivity is calculated as gross sales divided by the number of employees in the enterprise.[3]

Figure 3: Productivity Dispersal by Business Type

(a) Ethiopia **(b)** Malawi



Source: Authors' calculations based on LSMS-ISA data.

While transport enterprises and bar and restaurants are more productive than agribusinesses and enterprises in the sales sector in Ethiopia, the higher productivity enterprises are found in professional services, non-agricultural business and trade in Malawi. Agribusinesses and the sales sector return again lower productivity levels. Due

[2] We use data from Ethiopia and Malawi due to data availability.

[3] To be more specific, productivity is calculated as average monthly sales over the past 12 months divided by the number of workers in the enterprise for Ethiopia, and as the value of total sales of products, goods, and services during the last month of operation divided by the number of workers in the enterprise for Malawi.

to the expectations that donors and governments often have of agribusiness as a sector wherein African countries may develop a comparative advantage, this finding necessitates further research, which however falls outside the present scope.

4.1.3 Multinomial Logit Model

Given the dispersal of productivity across various business types, we analyze which factors determine the probabilities that rural households, once they have made the decision to operate a non-farm enterprise, to participate in a particular type of enterprise. This is akin to an occupational decision which we approach from the perspective of the random utility model (e.g. McFadden, 1973). Herein rural households attempt to maximize their (joint) utility function by operating the type of non-farm enterprise that will generate the most profits (i.e. are most productive) given their household attributes. Various market failures, such as in the insurance and credit markets, and the unpaid but time-consuming work of women within households, can however prevent households for choosing types of enterprises with high profits but also high risks, in favor of less risky and time-consuming, but also less profitable enterprises (Serra, 2009; Keats, 2013).

Following McFadden (1973) and others, random utility models have been estimated using the multinomial logit model (MNLM). For a recent example see Keats (2013). The MNLM can be seen as estimating, simultaneously, binary logit regressions for all the categories or alternatives of the dependent categorical variable. More formally we estimate,

$$\ln \Omega_{m|b}(x) = \ln \frac{\Pr(y = m|x)}{\Pr(y = b|x)} = x\beta_{m|b} \quad \text{for} \quad m = 1 \text{ to } J \tag{1}$$

where b is the base category and also referred to as the comparison group. The log odds of an outcome compared with itself are always 0, as $\ln \Omega_{m|b}(x) = \ln(1) = 0$. In the above equation, $x\beta_{m|b}$ is a vector containing our independent variables (determinants) of interest.

The J equations are solved as follows, to compute the predicted probabilities:

$$\Pr(y = m|x) = \frac{exp(x\beta_{m|b})}{\sum_{j=1}^{J} exp(x\beta_{j|b})} \tag{2}$$

The predicted probabilities will be the same regardless of the base outcome. While the estimated parameters are different, only the parameterizations are different (Long and Freese, 2006).

Based on the literature survey we include the following variables: as the dependent variable we use the categorical variable "type of business activity", divided into eight

categories: agribusiness, non-agricultural business, trade, sales, professional services, transport, bars and restaurants, and other.[4] As independent variables we include individual characteristics of the enterprise owner (gender, age, education), household characteristics (household size, shocks, distance to next population center[5]), and enterprise characteristics (number of workers[6], access to credit).

Tables 1 and 2 report the results using MNLM for non-farm enterprises in rural areas in Ethiopia and Malawi. The base category for both regressions is "agribusiness" and the other types of business activities are compared to this type of business in the regression outcome. The coefficients are reported using relative risk ratios and can be read as odds ratios for a logistic regression. Significant coefficients can be found with all variables for Ethiopia, that are however not significant in each category. In Malawi the variable distance does not show significant results for any of the types of business activities and only few significant outcomes at the 10 percent level for idiosyncratic shocks and credit.

Table 1: Multinomial Logit Model - Ethiopia (Rural)

	(1) Non-Ag.	(2) Trade	(3) Sales	(4) Prof. Serv.	(5) Transp.	(6) Bars & Res.	(7) Other
Female	0.039***	0.351***	0.150***	0.129***	0.005***	0.235	0.251***
	(0.01)	(0.12)	(0.05)	(0.08)	(0.01)	(0.22)	(0.07)
Age	1.014	1.032***	1.010	1.039	0.957	0.968	1.004
	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.04)	(0.01)
Read & Write	1.211	2.019**	0.365**	0.753	1.655	1.015	1.928**
	(0.39)	(0.67)	(0.16)	(0.53)	(0.92)	(0.65)	(0.57)
HH Size	1.173**	1.072	1.195**	0.536***	1.373**	0.850	1.166**
	(0.09)	(0.07)	(0.10)	(0.09)	(0.21)	(0.14)	(0.09)
Shock (idiosyn.)	0.431*	0.566	0.532	3.603	0.009***	1.236	0.321**
	(0.20)	(0.22)	(0.24)	(2.95)	(0.01)	(1.15)	(0.15)
Shock (geogr.)	1.459	2.894**	2.648**	10.835***	0.721	0.182*	1.404
	(0.60)	(1.25)	(1.09)	(6.65)	(0.78)	(0.17)	(0.69)
Shock (other)	2.776	4.897	6.670*	0.000***	0.000***	0.000***	2.076
	(3.38)	(5.14)	(7.20)	(0.00)	(0.00)	(0.00)	(2.42)
Number of Worker	0.799*	0.602***	0.911	0.222*	0.518*	0.745	0.921
	(0.10)	(0.08)	(0.09)	(0.19)	(0.19)	(0.32)	(0.12)
Credit	0.723	1.366	0.411**	0.015***	0.296	1.062	0.608
	(0.27)	(0.48)	(0.17)	(0.02)	(0.34)	(1.02)	(0.22)
Distance	1.015**	0.978*	0.988	1.009	0.984	0.994	0.995
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.01)
N	915						

Exponentiated coefficients; Standard errors in parentheses; Survey weights included.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We take the variable "household size" in Ethiopia to explain how to interpret the estimated coefficients in Tables 1 and 2: if the coefficient is greater than 1, the relative risk

[4] Summary statistics can be found in Appendix B.
[5] Distance to the next population center is defined as distance to the next town in km with +20,000 inhabitants.
[6] Number of workers include both household and non-household workers.

to enter this type of business activity compared to the dependent variable "agribusiness" increases by this factor, for example by 1.17 in the case of "non-agricultural business". If the coefficient is smaller than 1, the relative risk to enter this type of business activity compared to the dependent variable "agribusiness" decreases by this factor, for example by 0.54 in the case of "professional services". Interesting results are, for example, the outcomes for the ability to "read & write" in both countries: it seems to be relatively more important for sales (Ethiopia) or trade (Malawi) compared to "agribusiness", but relatively less important for "professional services" in Malawi. The outcome for "professional services" has to be however interpreted with care, as only very few businesses can be found in this sector (13 in Ethiopia and 8 in Malawi, see also Table 6 in Appendix B).

Table 2: Multinomial Logit Model - Malawi (Rural)

	(1) Non-Ag.	(2) Trade	(3) Sales	(4) Prof. Serv.	(5) Transp.	(6) Bars & Res.	(7) Other
Female	0.051***	0.375***	0.125***	0.458	0.014***	0.280***	0.451***
	(0.01)	(0.08)	(0.03)	(0.26)	(0.01)	(0.10)	(0.08)
Age	0.995	0.984**	1.015**	0.983	0.941***	0.954**	0.993
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Read & Write	1.471*	1.798***	0.839	0.240**	1.376	0.918	1.668***
	(0.31)	(0.36)	(0.17)	(0.15)	(0.71)	(0.32)	(0.33)
HH Size	1.152***	1.119***	1.089*	0.655***	1.268***	1.044	1.164***
	(0.06)	(0.05)	(0.05)	(0.09)	(0.10)	(0.09)	(0.05)
Shock (idiosyn.)	0.825	0.685*	1.182	2.460	1.097	0.519*	0.989
	(0.19)	(0.15)	(0.27)	(1.56)	(0.52)	(0.20)	(0.21)
Shock (geogr.)	1.204	0.994	2.560***	0.418	1.647	0.818	0.728
	(0.28)	(0.20)	(0.67)	(0.25)	(0.90)	(0.32)	(0.15)
Shock (other)	4.134*	1.462	2.643	0.000***	0.000***	6.287	3.217*
	(3.52)	(1.08)	(1.74)	(0.00)	(0.00)	(8.94)	(2.23)
Number of Worker	0.959	0.988	0.716***	1.248	0.770	1.098	1.011
	(0.07)	(0.07)	(0.09)	(0.17)	(0.17)	(0.09)	(0.07)
Credit	0.815	1.492*	0.862	2.174	0.608	2.148*	1.471*
	(0.24)	(0.35)	(0.25)	(1.76)	(0.34)	(0.86)	(0.33)
Distance	1.001	1.002	0.997	0.981	0.997	1.003	0.997
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N	1,861						

Exponentiated coefficients; Standard errors in parentheses; Survey weights included.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Summarizing we can say that different factors are significant for the household's choice to operate a certain type of business and that this choice also depends on the country-specific context. We however have only a few observations in the higher productivity sectors as transport and bar and restaurants in Ethiopia, or professional services in Malawi, to safely identify determinants for the selection into a certain type of business activity.

4.2 What Determines the Productivity of Non-Farm Rural Enterprises?

To answer this question we use two estimation strategies, firstly a Heckman selection model using data from Ethiopia and Malawi, and secondly a fixed-effects panel data regressions to make use of the panel data properties in Nigeria and Uganda. Using various estimation strategies and different country data allow us to also check on the robustness of the basic results.

4.2.1 Heckman Selection Model

We make use of a Heckman selection model since the determinants of non-farm enterprise productivity may be subject to selection effects. For instance, the motivation for starting an enterprise can determine the subsequent productivity of this enterprise. For instance, if households are pushed into entrepreneurship due to shocks and uncertainty in farming (as a risk-management tool), we expect that they enter relatively low-risk, but also low-productive type of activities.[7] If we do not control for this selection effect when estimating the determinants of productivity levels, we might get biased estimates as a result.

We thus estimate a discrete-choice model wherein each household first makes the decision whether or not to start a non-farm enterprise. The most appropriate estimator in this case is a sample selection estimator. We decide to apply a Heckman two-step estimator. The use of this model can take into account the difference between the probability that a particular household starts a non-farm enterprise (called the selection stage), and the level of labor productivity in the subsequent enterprises, called the outcome stage.

More formally, we estimate:

$$Z_i^* = Q_i\delta + \varepsilon_i \tag{3}$$

representing the selection stage of the model, where Z_i^* is a latent variable corresponding to the "outcome" productivity level, which will only be observed once a household has decided to start a non-farm enterprise, thus $Z_i = 0$ if $Z_i \leq 0$ and $Z_i = 1$ if $Z_i^*>0$. Also, Q_i is a vector containing the possible determinants of productivity as discussed in the literature survey in section 2.

Once Z_i is known, the outcome stage, which corresponds to the dependent variable being the log of gross labor productivity, can be modeled as:

$$X_i^* = Q_i\beta + u_i \tag{4}$$

with $X_i = X_i^*$ if $Z_i = 1$ and X_i not observed if $Z_i = 0$.

[7] See also Nagler and Naudé (2014).

In Table 3 we run three different regressions for Ethiopia and Malawi, respectively. The first regression for each country can be considered as the base specification, the second regression adds dummy variables accounting for the agro-ecological zones, and the final regression splits the dummy variable "shock" into three sub-variables: idiosyncratic shocks, geographical shocks and other shocks. In the first part of the table (the second stage of the estimation) the dependent variable is log productivity and the independent variables entail possible determinants of log productivity. In the second part of the table (the first stage of the estimation) the dependent variables is the binary variable NFE, indicating if the household operates a non-farm enterprise and the independent variables entail determinants for the household decision to operate a non-farm enterprise. For the selection stage we make the assumption that household size selects households into the enterprise business, as surplus labor is allocated into this sector, while it does not determine productivity. In the selection stage we can observe that "household size" is significant and positive for all regressions. The reported results in the second stage can be interpreted as though we observed data for all households in the sample.

The coefficients represent the estimated marginal effects: in Ethiopia the only significant variable is "read & write" indicating that education has a positive association with enterprise productivity; this is also the case in Malawi. The results in the table suggest that there is a certain degree of heterogeneity across the two countries. For instance, in Malawi the variables "rural", "female" and "shocks" have a negative and significant impact on productivity (as expected). In column (6), idiosyncratic and geographical shocks both have a negative and significant impact on enterprise productivity, confirming that external shocks limit the performance of non-farm enterprises in Africa. We further deduct that the lack of insurance can be another important factor in limiting entrepreneurship.

Given our discussion in the literature survey on the importance of location and agglomeration for enterprise productivity, it is interesting to note that the variable "distance" is positive in the outcome stage of the estimation. In the selection stage the "distance" variable is negative and significant for Malawi. This means that more isolated households are less likely to operate a non-farm enterprise, but if they operate one, distance to the next population center is associated with higher productivity. One explanation for this counter-intuitive finding is that such enterprises are better protected from competition of urban areas, and that the geographic extent of positive spillover effects in African towns and cities may be rather limited.

More difficult to explain is the "credit" variable, which has a positive and significant impact on the household decision to start up a non-farm enterprise, but once the enterprise exists, access to credit seems to be associated with a lower productivity level. Our tentative explanation of this (requiring further research) is that households use their access to credit (e.g. through micro-credit lending schemes that have increasingly been established in rural Africa) to start household enterprises, but they do so in less risky activities, which are also less productive. In other words, due to lack of insurance in agriculture, households diversify their activities into less risky non-farm activities if they have access to micro-credit. Micro-credit may present a substitute for failures in the insurance market.

Table 3: Heckman Selection Model

	Ethiopia			Malawi		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Ln Prod.						
Rural	0.110	0.014	-0.002	-0.715***	-0.690***	-0.641***
	(0.39)	(0.32)	(0.31)	(0.13)	(0.14)	(0.14)
Female	-0.150	-0.174	-0.165	-0.333***	-0.344***	-0.334***
	(0.21)	(0.21)	(0.21)	(0.10)	(0.09)	(0.09)
Age	0.010	0.009	0.009	-0.004	-0.003	-0.003
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
Read & Write	0.359	0.386*	0.393*	0.420***	0.413***	0.414***
	(0.22)	(0.21)	(0.20)	(0.08)	(0.09)	(0.08)
Credit	-0.004	0.082	0.093	-0.139*	-0.142*	-0.113
	(0.19)	(0.16)	(0.17)	(0.08)	(0.08)	(0.08)
Shock	-0.334	-0.306		-0.389***	-0.391***	
	(0.22)	(0.22)		(0.09)	(0.09)	
Distance	-0.001	-0.002	-0.002	0.005**	0.005***	0.005**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Shock (idiosyn.)			-0.185			-0.283***
			(0.20)			(0.09)
Shock (geogr.)			-0.184			-0.310***
			(0.23)			(0.08)
Shock (other)			-0.224			0.187
			(0.45)			(0.26)
Dependent NFE						
HH Size	0.035**	0.036**	0.037**	0.067***	0.065***	0.065***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Rural	-1.031***	-1.054***	-1.040***	-0.481***	-0.488***	-0.465***
	(0.14)	(0.14)	(0.14)	(0.07)	(0.07)	(0.07)
Female	0.084	0.105	0.102	-0.081	-0.075	-0.100*
	(0.10)	(0.10)	(0.10)	(0.05)	(0.05)	(0.05)
Age	-0.011***	-0.011***	-0.011***	-0.007***	-0.006***	-0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Read & Write	0.165*	0.167*	0.176*	0.224***	0.237***	0.221***
	(0.10)	(0.10)	(0.10)	(0.04)	(0.04)	(0.04)
Credit	0.318***	0.328***	0.325***	0.214***	0.218***	0.195***
	(0.08)	(0.08)	(0.08)	(0.05)	(0.05)	(0.05)
Shock	0.044	0.057		0.084*	0.083*	
	(0.11)	(0.11)		(0.04)	(0.04)	
Distance	-0.003	-0.004*	-0.004**	-0.003***	-0.003***	-0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Shock (idiosyn.)			0.087			0.283***
			(0.09)			(0.04)
Shock (geogr.)			-0.043			-0.077*
			(0.12)			(0.04)
Shock (other)			0.439*			0.030
			(0.24)			(0.15)
Agro-Ecological Zone	No	Yes	Yes	No	Yes	Yes
N	3,984	3,984	3,984	12,578	12,578	12,579
rho	-0.312	-0.220	-0.219	-0.451	-0.477	-0.477
sigma	1.682	1.626	1.628	1.425	1.437	1.431
lambda	-0.524	-0.357	-0.356	-0.643	-0.685	-0.683

Standard errors in parentheses; Survey weights included.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Shocks can present significant and important determinants of the households' decision to start a non-farm enterprises. The results for Malawi indicate that idiosyncratic shocks can push households to start a non-farm enterprise, perhaps as a risk coping or management strategy. This kind of shock is however associated with a reduced enterprise productivity. This is consistent with the explanation in the previous paragraph about the role of micro-credit: if households start an enterprise to manage risk, they may prefer to start an enterprise in a low-risk, but also low-productivity type of business area.

4.2.2 Panel Data Analysis

Due to the shortcomings of a cross-sectional analysis, we also use the availability of panel data to identify the determinants of productivity of non-farm enterprises. We estimate the following panel data regression models, using data from Nigeria and Uganda:

$$
\begin{aligned}
Y_{eht} &= \mathbf{x}'_{eht}\boldsymbol{\beta}^1 + \mathbf{w}'_{ht}\boldsymbol{\gamma}^1 + \mathbf{z}'_{eht}\boldsymbol{\delta}^1 + \mu^1_h + \lambda^1_t + u^1_{eht} && (5)\\
\bar{Y}_{ht} &= \bar{\mathbf{x}}'_{ht}\boldsymbol{\beta}^2 + \mathbf{w}'_{ht}\boldsymbol{\gamma}^2 + \bar{\mathbf{z}}'_{ht}\boldsymbol{\delta}^2 + \mu^2_h + \lambda^2_t + u^2_{ht} && (6)\\
\bar{\bar{Y}}_{ct} &= \bar{\bar{\mathbf{x}}}'_{ct}\boldsymbol{\beta}^3 + \bar{\bar{\mathbf{w}}}'_{ct}\boldsymbol{\gamma}^3 + \bar{\bar{\mathbf{z}}}'_{ct}\boldsymbol{\delta}^3 + \mu^3_c + \lambda^3_t + u^3_{ct} && (7)
\end{aligned}
$$

where $\{Y_{eht}, \bar{Y}_{ht}, \bar{\bar{Y}}_{ct}\}$ is firm productivity at the enterprise level, averaged at the household level, and averaged at the community level, respectively. The set $\{\mathbf{x}'_{eht}, \bar{\mathbf{x}}'_{ht}, \bar{\bar{\mathbf{x}}}'_{ct}\}$ contains vectors of individual characteristics of the enterprise owner at the enterprise level, averaged at the household level, and averaged at the community level. The set $\{\mathbf{w}'_{ht}, \bar{\bar{\mathbf{w}}}'_{ct}\}$ contains vectors of household characteristics observed at the household level and averaged at the community level. Finally, $\{\mathbf{z}'_{eht}, \bar{\mathbf{z}}'_{ht}, \bar{\bar{\mathbf{z}}}'_{ct}\}$ is a set of vectors of enterprise characteristics at the enterprise level, averaged at the household level, and averaged at the community level. Let $\{\boldsymbol{\beta}^j, \boldsymbol{\gamma}^j, \boldsymbol{\delta}^j\}$ denote the associated vectors of coefficients for equation j, where $j = 1, 2, 3$. The μ^j_k are fixed effects at level $k \in \{h, c\}$ for equation j, λ^j_t are time effects for equation j, and u^j_l are idiosyncratic errors for equation j at level $l \in \{eht, ht, ct\}$.

For the selection of the independent variables we follow the literature on productivity determinants based on the literature, as well as on the descriptive statistics we report earlier. We expect that enterprise productivity depends on individual characteristics, specifically on gender, possibly reflecting discrimination and time-use of women in the household. We further expect that access to credit, the experience of shocks, as well as location (rural/urban and distance to the next population center) and the month an enterprise operate have an impact on enterprise productivity.

We use panel data from Nigeria and Uganda to estimate the equations. For Nigeria we have data for four survey rounds: post-planting and post-harvest data for the years 2010/11 and 2012/13. Due to a limited questionnaire for the post-planting interviews, we use the data of the post-harvest round only. In the case of Uganda, we have data for four survey rounds: 2005/06, 2009/10, 2010/11, and 2011/12.

Table 4: Panel Regressions

Dependent	Nigeria	Nigeria	Nigeria	Uganda	Uganda	Uganda
Ln Prod.	Enterprise	Household	Community	Enterprise	Household	Community
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.505***	-0.548***	-0.499	-0.097	-0.238	0.171
	(0.13)	(0.19)	(0.43)	(0.24)	(0.24)	(0.42)
Age	0.040***	0.007	0.081*	0.059**	0.019	0.080*
	(0.01)	(0.02)	(0.04)	(0.03)	(0.02)	(0.05)
Age ^{2}	-0.000***	-0.000	-0.001*	-0.001***	-0.000	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married	0.313**	0.219	0.137	0.647***	0.330	0.610*
	(0.12)	(0.17)	(0.41)	(0.18)	(0.23)	(0.34)
Female x Married	-0.400***	-0.218	0.061	-0.567**	-0.305	-0.833*
	(0.15)	(0.21)	(0.52)	(0.26)	(0.26)	(0.45)
HH Size	0.037	0.042	0.040	0.046**	0.055***	0.031
	(0.05)	(0.03)	(0.04)	(0.02)	(0.01)	(0.03)
Share of Employees	-0.992***	-1.156***	-1.301***	0.653***	0.508**	0.332
	(0.17)	(0.16)	(0.41)	(0.25)	(0.21)	(0.41)
Credit	0.398***	0.220*	-0.473	0.435***	0.365***	0.664***
	(0.13)	(0.13)	(0.29)	(0.10)	(0.09)	(0.18)
Rural	-0.234	-0.452**	-0.686**	-0.073	0.019	-0.255
	(0.28)	(0.21)	(0.33)	(0.43)	(0.42)	(0.48)
Shock (idiosyn.)	-0.050	-0.011	0.089	0.072	-0.021	-0.150
	(0.10)	(0.07)	(0.22)	(0.13)	(0.08)	(0.20)
Shock (geogr.)	0.127	0.149**	0.161	-0.108	-0.170**	-0.038
	(0.10)	(0.07)	(0.17)	(0.09)	(0.07)	(0.15)
Shock (other)	0.140	0.102	0.201	-0.221	-0.192	0.184
	(0.24)	(0.17)	(0.66)	(0.28)	(0.18)	(0.43)
Primary Education				-0.016	-0.226**	-0.248
				(0.14)	(0.11)	(0.22)
Secondary Education				0.033	-0.235	0.594**
				(0.21)	(0.16)	(0.27)
Higher Education				0.532*	-0.005	0.955**
				(0.30)	(0.19)	(0.39)
Migration				0.139	0.177**	-0.315*
				(0.11)	(0.08)	(0.17)
Months in Operation				0.069***	0.064***	0.079***
				(0.02)	(0.01)	(0.02)
Constant	7.699***	8.533***	6.981***	8.363***	9.446***	7.918***
	(0.38)	(0.40)	(0.93)	(0.62)	(0.45)	(1.03)
Time FE	YES	YES	YES	YES	YES	YES
FE	YES	YES	YES	YES	YES	YES
N	8,237	5,247	776	6,295	5,005	1,218

Standard errors in parentheses; Household weights included.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In Table 4 the results of the panel analysis are reported. As expected gender is significant in both countries (for Uganda it is captured in the interaction term "female x married"). If the enterprise owner is female, productivity is significantly lower compared to a male-owned enterprise, holding other factors constant. Also, the interaction term is significant in some of the regressions, and returns negative coefficients, suggesting that women might also face discrimination or a different role with respect to her time-use (e.g. unpaid care and household work). Age returns positive coefficients, and suggests that older owners have more productive enterprises, possibly reflecting business experience. Education seems to have limited impact on the enterprise productivity, a surprising outcome that we may explain with the fact that most enterprises are rather small household businesses that do not require high skilled enterprise owners in terms of schooling. Other abilities, that can be learned outside of school, might be of higher importance for enterprise productivity. The "share of employees", defined as the relation of household to non-household workers, returns contracting outcomes: while significant in the majority of the regressions, the coefficients are negative in Nigeria, but positive in Uganda. Having taken out credit to expand the business is positive and significant in most regression results, while the enterprise location in rural areas returns a lower productivity for Nigeria. Shocks are not significant in most cases. The variable "migration" indicating if the enterprise owner moved from another district or country to the current place of residence, returns a positive coefficient on the household level, but a negative coefficient on the community level in Uganda. One interesting and significant variable is "months in operation": the more months an enterprise operates its business, the higher its productivity.[8]

4.3 Survival and Exit

Our interest in the productivity of rural non-farm enterprises is further based on the assumption (backed up by the firm-level literature), that more productive enterprises are more likely to grow, survive and create the quantity and quality of employment necessary for development and structural change. In this section we analyze, to the extent possible, the survival and exit of non-farm rural enterprises. As previously mentioned, the LSMS-ISA data is not ideal to study this area of enterprise behavior. After all, the surveys were not designed as enterprise surveys. We therefore present various types of descriptive data analyses to learn more about the patterns of survival and exit of enterprises in our sample. In this regard we hope that our work will contribute in the future to a different design of the questionnaires used in these surveys, to improve our understanding of the patterns and determinants of enterprise development and survival in rural Africa.

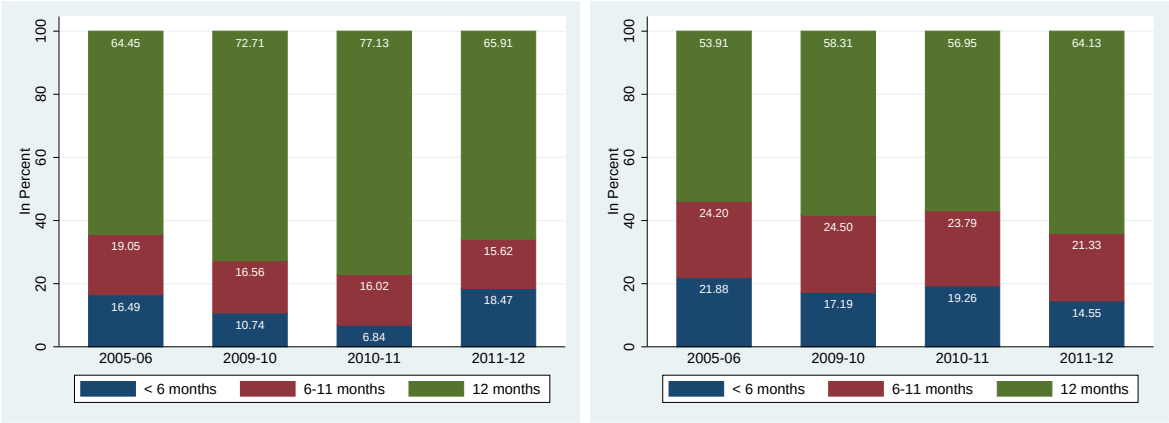
The surveys capture useful information about the number of months non-farm enterprises are in operation during the year. Figure 4 depicts these number of months, divided into three categories, using data from Uganda. It shows the distribution in the four different survey years of urban and rural areas: if the enterprise was operating for all 12 months, less than 12 months but for at least half of the year, and finally if the enterprise was less than 6 months in operation.

We notice the difference between rural and urban enterprises: in all four survey years,

[8] See also Table 11 in Appendix C for the same set of panel regressions using rural households only.

Figure 4: Non-Farm Enterprises: Months in Operation

(a) Uganda - Urban **(b)** Uganda - Rural



Source: Authors' calculations based on LSMS-ISA data (weighted shares). Enterprises that have been started less than one year ago are excluded.

the share of enterprises operating throughout the year is higher in urban compared to rural areas. From this follows that rural enterprises have higher shares of enterprises operating less than 6 months or less than 12 months, but for more than half a year. In Table 4 (panel data analysis) we can also see that months in operation have a positive and significant coefficient. We assume that seasonal work, especially in agriculture, is a possible explanation for this finding. Seasonality in agriculture causes a mismatch between household consumption and income, hence engaging in non-farm activities can be a consumption-smoothing strategy. It is also due to the fact that while household labor is needed on the fields during planting and harvest, surplus labor can be allocated to non-farm enterprises during the low season and explains the higher share of intermittent operation in rural compared to urban areas. We can also see a rising share of enterprises operating throughout the year in urban areas, that was however reverted during the last survey round of 2011-12. In rural areas the shares remain similar over the survey years, with a slight expansion of year-long enterprise operation during the last survey round.

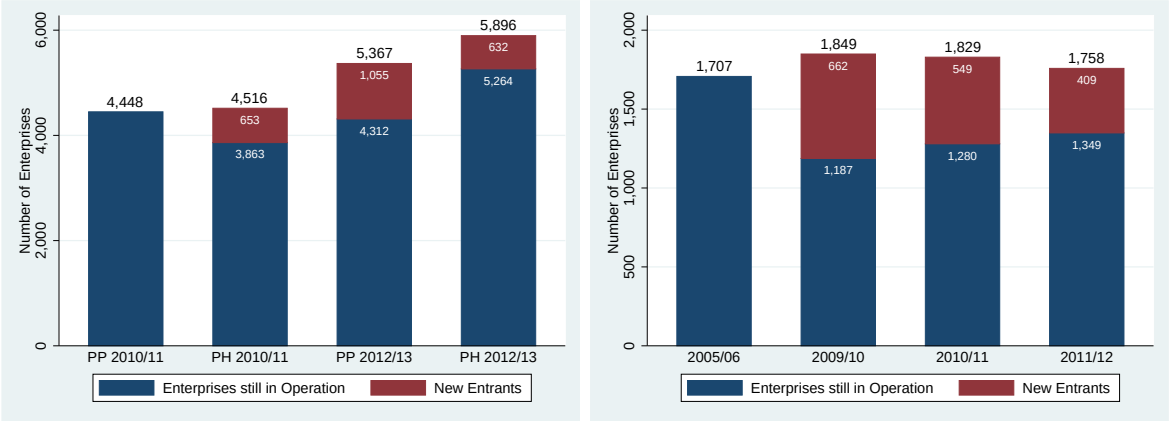
In addition to the months of enterprise operation, the surveys also capture information about the numbers of non-farm enterprises operated across the various waves. Figure 5 shows the number of enterprises counted for Nigeria and Uganda in each of the survey years. In Nigeria the number of new business activities is accounted for in one specific question, in Uganda enterprises from previous rounds that are no longer operating are included in the consecutive rounds as "empty" observations. The data can be used to obtain insight of entry and exit numbers into and from the non-farm enterprise sector. Hence in the second, third and fourth survey round we include the number of enterprises that "survived" in between the surveys, with the previous survey round as the baseline survey.

Figure 5 shows that the number of enterprises has continuously increased in Nigeria over the four survey rounds, while the number has been more stable, with a tendency to decline, in Uganda. We have to note that numbers of the same or close survey years are more similar, as less time has passed for a change in the number of enterprises. Nigeria has not only seen a steady increase in the number of enterprises, but also a lower share of

new entrants when comparing to Uganda. It seems that Uganda has a more dynamic and innovative environment, if seen from a positive angle, or a less stable environment, if seen from a more negative angle, where a high number of enterprises enter and exit the market. At this level of the analysis we cannot conclude if the higher share of new entrants should be considered as a positive or negative trait of the non-farm entrepreneurship sector in Uganda.

Figure 5: Entries and Exits into the Rural Non-Farm Enterprise Sector

(a) Nigeria **(b)** Uganda



Source: Authors' calculations based on LSMS-ISA data. PP = Post-Planting, PH = Post-Harvest.

We present next descriptive statistics of exit reasons to understand why enterprises cease operations.[9] In the case of Uganda households were asked why their non-farm enterprises stopped operations during the previous year.[10] In Table 5 we summarize them, making a distinction between enterprises in urban and rural areas. The most important reasons why rural non-farm enterprises exit the market are the lack of profitability, lack of finance, as well as idiosyncratic shocks such as death or illness in the family. The latter is particularly more pronounced as one reason for enterprises to cease operations in rural areas. This may reflect the more generally lack of social protection in rural areas, including lack of insurance and social assistance measures, such as information and technical support for small businesses that tend to be more readily available in urban areas.

Among the enterprises that were discontinued during the previous twelve months in Uganda, the respondents were further asked whether or not they were planning to restart their enterprise. In 2010/11 57.34 percent did not plan a restart, 35.66 percent considered it probable, and the remaining 6.99 percent were certain of retaking operation. In 2011/12 73.19 percent did not plan a restart, 24.54 percent considered it probable, and the remaining 2.27 percent were certain of retaking operation (all shares are weighted). It therefore seems that in their majority enterprises were discontinued for good, and only a small share of firm had plans of retaking operations, indicating that many rural non-farm enterprises in Uganda are created, operated and stopped. This confirms our general story so far, namely that risks and market failures explain patterns of productivity and survival of non-farm enterprises in rural Africa.

[9] Unfortunately we do not have adequate data at present to estimate survival models to identify which characteristics determine the survival of enterprises in the survey.

[10] 768 observations are captured over two survey rounds.

Table 5: Reasons for enterprise exit (in %) - Uganda

Reason	2010-2011		2011-2012	
	Urban	Rural	Urban	Rural
Insecurity or theft	2.95	4.10	3.28	0.19
Lack of supply (inputs or raw material)	9.00	7.52	4.74	7.43
Lack of demand	5.14	6.04	5.84	1.50
Economic factors (profitability)	27.59	32.93	19.09	15.72
Technical issues	0.46	0.62	0.89	0.76
Labor related (death or illness)	5.57	9.00	5.68	7.07
Government regulation				0.89
Competition	1.79	1.67		3.30
Lack of electricity		0.15		
Lack of space or premises	0.55	0.29	0.43	1.47
Lack of transport	2.97	0.81		1.11
Lack of finance	29.33	23.59	34.63	31.37
Other	14.65	13.30	25.41	29.16

Source: Authors' calculations based on LSMS-ISA data (weighted shares).

5 Summary and Concluding Remarks

Non-farm enterprises in rural Africa are often expected to make significant contributions to the welfare and employment of these rural households in Africa (Barrett et al., 2001; Fox and Sohnesen, 2013; Fox et al., 2013). Given the empirical evidence presented in this paper and in our companion paper (Nagler and Naudé, 2014), we may need to slightly temper such expectations.

Non-farm enterprises are largely small, informal household enterprises operated for risk-management and risk-coping in a high-risk environment that lacks insurance schemes and social protection policies (Nagler and Naudé, 2014). Africa needs more productive enterprises that survive, grow and create more jobs to address its employment and development challenges. This requires, one the one hand, more productive enterprises that are more likely to survive and grow, and on the other hand, the creation of more jobs for workers from outside the household or immediate family. More productive enterprises are also more likely to provide better quality jobs over time, including jobs with better social protection, thereby reducing the large number of vulnerable workers in rural Africa.

We started this paper by pointing out that barely any scholarly work has attempted to measure and identify the productivity and performance of non-farm enterprises in rural Africa. We therefore make a first effort to address this lacuna by using the World Bank's LSMS-ISA database (2005 to 2013) for Ethiopia, Malawi, Nigeria, and Uganda. We provide a descriptive statistical analysis, as well as an econometric analysis using multinomial logit models of the determinants of household decision into various types of rural business activities. We further provide an analysis of the determinants of non-farm enterprise labor productivity using a Heckman selection model and panel data analysis.

To summarize our findings we start off by stating that rural non-farm enterprises are on average less productive than their urban counterparts. This is what we expected to find, *a priori*, and confirms a widely held "stylized fact" about African agriculture. This finding, or confirmation, is however not so simple. The profile of rural enterprises and their associated productivity levels are quite heterogeneous. We find a high degree of productivity dispersal among rural non-farm enterprises that depend on the type of business activity. Businesses in the transport sector or in bars and restaurants in Ethiopia, and professional services or the non-agricultural business in Malawi are more productive types of enterprises compared to agribusiness or the sales sector (in both countries). These types of business activity cater to the local consumer demand in Africa. Given that these services are largely non-tradable across the countries' regions, they tend to be more insulated from competition. Furthermore, there are higher positive sunk costs acting as barriers to entry in starting these types of businesses. Not all households can therefore enter into these types of businesses. Women may be additionally constrained, as businesses can be very time-consuming to run, and women tend to be more time-constrained due to pressures from duties in the household (see also Palacios-López and López, 2014). Moreover, these types of business activities tend to be more risky enterprises and would not attract households that enter into the non-farm enterprise sector with the purpose of minimizing the risks they face in agriculture. At least they would not do so unless they have the possibility to insure themselves against the higher risks involved in these types of enterprises.

We also find that women-headed enterprises are less productive than male-headed enterprises. This outcome was also expected based on the literature survey, and confirms another widely held "fact" that is in line with established notions about African agriculture, namely that women have less productive enterprises than men (Palacios-López and López, 2014). As before, our apparent confirmation of this "fact" also reveals a more complex and nuanced reality.

Furthermore, we establish that non-farm enterprises in rural areas are less likely than those in urban areas to operate continuously throughout the year. This finding reflects the "fact" of seasonality that has been well-described as a feature of African agriculture and rural life (Kaminski et al., 2014). We contribute to a better understanding of this "fact" by establishing that enterprises that do not operate continuously throughout the year are less productive than the ones that do so. This is another reflection to confirm our suspicion that these enterprises are operated due to riskiness in agriculture, and are considered as occasional opportunities that may arise or to allocate surplus labor during the low season. Low productivity enterprises imply however lower rates of return and lower wages, reflecting a lower marginal productivity of labor. If non-farm enterprises are operated not only for self-insurance, but also for the purpose of consumption smoothing due to seasonality in agricultural income, consumption may not coincide with capital market imperfections (Park, 2006). Their low productivity therefore results as a problem from a welfare perspective. Increasing the productivity of non-farm enterprises has therefore the possibility to improve consumption smoothing of (rural) households and compensate for their limited ability to engage in inter-temporal arbitrage.

Finally, we find that reasons for enterprise failure are a result of poor profitability and a lack of finance. Moreover, and a novel contribution we make, is to find that rural non-

farm enterprises are almost twice as likely to cease operations due to death or illness of a household member compared to urban enterprises. It is however not only idiosyncratic shocks that can lead to failure and poor performance of enterprises in rural Africa.

We further find that the local business environment, and hence location, also matter. In Uganda we see that non-farm enterprises located in regions that have not been subject to a history of violent conflict and insurgency show a better performance; and that non-farm rural enterprises that are located closer to urban areas or agglomerations have a higher productivity.

In summary, the story that the LSMS-ISA data tells us, is that rural households in Africa continue to be mainly engaged in farming. The agricultural sector is however risky, and in the presence of market imperfections households increasingly diversify income sources to reduce farming risk through non-farm entrepreneurship (see also Nagler and Naudé, 2014). Due to failures in credit and insurance markets most households operate enterprises in low-risk, low-productivity types of sectors, such as agribusiness and sales. Fewer households can start enterprises in more risky, but also more lucrative and productive sectors. Hence most non-farm enterprises do not grow sufficiently to contribute meaningfully to the employment transformation that most African countries need as part of the development process. If 38 percent of all new jobs will be in household enterprises between 2010 and 2020 (an estimated 65 million jobs) as Fox et al. (2013) predict, there is cause for concern. Even if the non-farm household enterprise sector can offer an escape from poverty in the best case scenario, it will only be able to offer vulnerable employment.

The performance and survival patterns of rural non-farm enterprises in Africa generally reflect a difficult business environment: a lack of adequate credit and insurance markets and a lack of social protection or social assistance, paired with continuing gender disparities. Promoting stability and providing infrastructure for rural markets, and developing better and novel financial products to deal with the need for (micro) credit and insurance in Africa's rural areas, are all policies that are supported by our study.

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A Appendix: Data

Households are visited and interviewed during the first survey round, and households operating a non-farm enterprise are registered in the respective section. Due to the panel design, the same households are visited again in the consecutive survey rounds. If a household of the previous round is no longer operating the non-farm enterprise, the household is still registered in the respective section, but does not fill out the questions on non-farm entrepreneurship. Therefore it is possible to identify if enterprises that were discontinued since the last survey round if the enterprises can clearly be tracked over the waves. If not, it is possible to know the number of enterprises that were discontinued.

In Uganda, however, various "empty" observations in follow-up surveys do not have observations in the previous survey round(s), and we decided to exclude these observations, as it is not clear what kind of information they present - if they are discontinued enterprises or false observations. We delete 980 observations out of 9,692 observations, resulting in a final database of 8,712 enterprises in the panel data set. We do not encounter this issue in Nigeria.

Further data manipulation included the following: prices are inflation deflated to prices of the first survey round of the respective country, using the IMF's inflation index of average consumer prices (percentage change). Furthermore prices were "winsorized" at 1 percent. We also "winsorized" the number of employees at 1 percent. For the binary variable NFE (if a household is operating a non-farm enterprise) we allocated NFE=1 for all observations in the first wave, and NFE=1 for observations with data entry in the consecutive survey rounds. In the Uganda 2010/11 survey, households which operated a non-farm enterprise at some point during the last 12 months, but are no longer operating the enterprise at the moment of the interview equally have NFE=1 allocated.

Further manipulation included the arrangement of the shock variables in three different sub-groups: idiosyncratic shocks, geographic shocks, and other shocks. While other shocks is given by the survey questionnaire, we allocate all shocks that are connected to the individual household in the category "idiosyncratic shocks"', as for example: death or illness of a household member, loss of employment, or experience of violence or theft. We allocate all shocks that are connected to the geography and that have a possible impact on agriculture to the category "geographical shocks", as for example: floods, droughts, pest attack or livestock epidemic. We also replaced the age of the household head or enterprise owner with the median age in case the age variables was below 15. This happened however only for very few observations, for example for 7 observations in Uganda 2005-6, or for 14 observations in Uganda 2009/10. We further replaced a few outlier values, for example if the months in operation exceeded 12 months. We also deleted duplicates.

B Appendix: Summary Statistics

Table 6 returns the number of enterprises (absolut number and in percent) for each of the types of business activity for Ethiopia and Malawi. In the sectors "professional services", "transport", and "bar and restaurants" we have very few observations compared to the other sectors in both countries.

Table 6: Types of Business Activity (Rural)

Type of Business Activity	Ethiopia		Malawi	
	N	In %	N	In %
Non-Agric. Business	156	16.83	301	16.17
Agribusiness	206	22.22	361	19.40
Trade	170	18.34	307	16.50
Sales	153	16.50	351	18.86
Professional Services	13	1.40	8	0.43
Transport	9	0.97	39	2.10
Bars and Restaurants	12	1.29	39	2.10
Other	208	22.44	455	24.45
Total	927	100.00	1,861	100.00

Table 7 returns the mean, minimum and maximum of the variables used in the multinomial logit models for Ethiopia and Malawi.

Table 7: Multinomial Logit Model (Rural)

Variable	Ethiopia			Malawi		
	Mean	Min	Max	Mean	Min	Max
Female	0.48	0	1	0.38	0	1
Age	33.92	15	87	37.57	16	96
Read & Write	0.49	0	1	0.69	0	1
HH Size	5.39	1	14	5.19	1	17
Shock (idiosyn.)	0.19	0	1	0.39	0	1
Shock (geogr.)	0.44	0	1	0.66	0	1
Shock (other)	0.05	0	1	0.02	0	1
Number of Worker	2.15	1	28	2.49	2	22
Credit	0.39	0	1	0.20	0	1
Distance	31.63	1.7	201.1	35.22	0.3	120.0

Notes: Survey weights included.

Table 8 returns the mean of the variables used in the Heckman selection model, divided by household that operate non-farm enterprises (NFE) compared to those that are not engaged in this sector. If averages are statistically different from each other, they are bolded.

Table 8: Heckman Selection Model

Household operates NFE	Ethiopia		Malawi	
	No	Yes	No	Yes
Rural	**0.99**	**0.97**	**0.87**	**0.70**
Female	0.20	0.17	**0.25**	**0.18**
Age	**45.40**	**40.89**	**42.92**	**39.28**
Read & Write	**0.40**	**0.52**	**0.62**	**0.76**
Credit	**0.26**	**0.38**	**0.13**	**0.21**
Shock	0.50	0.52	0.67	0.65
Distance	36.79	32.55	**34.09**	**27.64**
Shock (idiosyn.)	0.18	0.19	**0.27**	**0.37**
Shock (geogr.)	0.43	0.43	**0.60**	**0.53**
Shock (other)	0.02	0.04	0.02	0.02
Household Size	**5.08**	**5.36**	**4.51**	**5.09**

Notes: Survey weights included.

Table 9 returns the mean, minimum and maximum of the panel regression variables for Nigeria, on the enterprise, household and community level.

Table 9: Panel Regression Nigeria

Variable	Enterprise			Household			Community		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Female	0.57	0	1	0.57	0	1	0.56	0	1
Age	41.95	15	98	43.05	15	98	42.66	23.25	67
Married	0.79	0	1	0.78	0	1	0.78	0	1
HH Size	6.68	1	31	6.13	1	31	6.38	1	15.33
Share of Employees	0.05	0	0.96	0.05	0	0.94	0.05	0	0.53
Credit	0.04	0	1	0.05	0	1	0.04	0	1
Rural	0.51	0	1	0.52	0	1	0.55	0	1
Shock (idiosyn.)	0.15	0	1	0.14	0	1	0.14	0	1
Shock (geogr.)	0.11	0	1	0.10	0	1	0.11	0	1
Shock (other)	0.01	0	1	0.01	0	1	0.01	0	0.42

Notes: Household weights included.

Table 10 returns the mean, minimum and maximum of the panel regression variables for Uganda, on the enterprise, household and community level.

Table 10: Panel Regression Uganda

Variable	Enterprise			Household			Community		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Female	0.46	0	1	0.47	0	1	0.43	0	1
Age	37.69	15	93	38.03	15	93	38.53	20.85	78
Married	0.75	0	1	0.74	0	1	0.76	0	1
HH Size	6.31	1	24	6.21	1	24	6.37	1	16
Share of Employees	0.08	0	0.91	0.08	0	0.91	0.08	0	0.83
Credit	0.12	0	1	0.13	0	1	0.12	0	1
Rural	0.75	0	1	0.76	0	1	0.78	0	1
Shock (idiosyn.)	0.18	0	1	0.17	0	1	0.17	0	1
Shock (geogr.)	0.34	0	1	0.32	0	1	0.31	0	1
Shock (other)	0.02	0	1	0.02	0	1	0.02	0	1
Primary Education	0.36	0	1	0.38	0	1	0.37	0	1
Secondary Education	0.14	0	1	0.14	0	1	0.15	0	1
Higher Education	0.06	0	1	0.06	0	1	0.06	0	1
Migration	0.39	0	1	0.41	0	1	0.39	0	1
Months in Operation	9.44	0	12	9.43	0	12	9.47	0	12

Notes: Household weights included.

C Appendix: Panel Regressions (Rural)

Table 11: Panel Regressions - Rural

Dependent	Nigeria	Nigeria	Nigeria	Uganda	Uganda	Uganda
Ln Prod.	Enterprise	Household	Community	Enterprise	Household	Community
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.458***	-0.283	-0.271	-0.116	-0.498*	-0.096
	(0.17)	(0.23)	(0.46)	(0.34)	(0.28)	(0.52)
Age	0.031***	0.004	0.113**	0.068**	0.031	0.121**
	(0.01)	(0.02)	(0.05)	(0.03)	(0.02)	(0.05)
Age ^{2}	-0.000***	-0.000	-0.001**	-0.001**	-0.000	-0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married	0.466***	0.363*	0.515	0.643**	0.134	0.664*
	(0.15)	(0.21)	(0.46)	(0.26)	(0.21)	(0.39)
Female x Married	-0.501**	-0.404	-0.465	-0.520	0.035	-0.545
	(0.20)	(0.26)	(0.55)	(0.36)	(0.29)	(0.54)
HH Size	-0.027	-0.009	0.027	0.050*	0.057***	0.003
	(0.05)	(0.04)	(0.04)	(0.03)	(0.02)	(0.04)
Share of Employees	-1.170***	-1.341***	-1.577***	0.577*	0.449*	0.538
	(0.20)	(0.21)	(0.48)	(0.31)	(0.27)	(0.54)
Credit	0.432**	0.395**	-0.069	0.405***	0.428***	0.723***
	(0.17)	(0.17)	(0.48)	(0.14)	(0.10)	(0.25)
Shock (idiosyn.)	-0.049	-0.039	0.287	0.078	0.025	-0.330
	(0.12)	(0.08)	(0.26)	(0.18)	(0.09)	(0.21)
Shock (geogr.)	0.196	0.172**	0.087	-0.075	-0.123*	0.104
	(0.12)	(0.08)	(0.20)	(0.10)	(0.07)	(0.16)
Shock (other)	0.069	-0.023	-0.022	-0.185	-0.193	-0.517
	(0.41)	(0.24)	(0.71)	(0.31)	(0.21)	(0.53)
Primary Education				0.087	-0.051	-0.132
				(0.20)	(0.13)	(0.22)
Secondary Education				0.072	-0.084	0.349
				(0.30)	(0.20)	(0.33)
Higher Education				0.591	0.191	0.443
				(0.48)	(0.27)	(0.63)
Migration				0.079	0.187*	-0.426*
				(0.14)	(0.10)	(0.22)
Months in Operation				0.046**	0.047***	0.062**
				(0.02)	(0.01)	(0.03)
Constant	7.729***	8.217***	5.456***	8.066***	9.043***	6.972***
	(0.41)	(0.41)	(1.02)	(0.78)	(0.47)	(1.04)
Time FE	YES	YES	YES	YES	YES	YES
FE	YES	YES	YES	YES	YES	YES
N	5,147	3,250	545	4,371	3,549	877

Standard errors in parentheses; Household weights included.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$