The impacts of mobile phone coverage expansion and personal networks on migration: evidence from Uganda

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Abstract

Personal networks can help rural workers find urban jobs. Moreover, when the information flow increases due to the mobile phone coverage expansion, the new information flow may strengthen the existing personal networks or bypass them, helping those who were previously outside the networks in the latter case. We examine the combined impact of mobile phone coverage expansion and personal networks by using panel data of 856 households in 94 communities in rural Uganda, where the number of communities covered by mobile phone coverage increased from 41 to 87 communities over a two-year period between first and second surveys in 2003 and 2005, respectively. We first find that, when the household head's ethnicity belongs to a larger ethnic group in Kampala, an individual's chance of leaving his or her rural village to find a job increases while controlling for the distance from Kampala and other variables. The mobile phone network expansion increases the chance of choosing migration to find a job, and this impact is larger for individuals who belong to a larger ethnic group in Kampala. These findings suggest that mobile phone coverage strengthens the existing majority ethnic network with regard to the decision to migrate to find a job.

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THE IMPACTS OF MOBILE PHONE COVERAGE EXPANSION AND PERSONAL NETWORKS ON MIGRATION: EVIDENCE FROM UGANDA

1. Introduction

An important route to reducing poverty in rural areas is to increase non-agricultural employment (World Bank, 2007; Otsuka, Estudillo and Sawada, 2009). Although previous studies stress the role of education in increasing non-farm labor earnings (Otsuka and Yamano, 2006; Matsumoto, Kijima and Yamano, 2006), how to stimulate non-farm labor earnings, other than promoting education, remains an important policy question. In this study, we focus on non-farm labor earnings through migration, and examine whether mobile phone coverage expansion, personal network, or the combination of both affect migration decision. Better access to information, either through personal networks or technology such as mobile phones, is expected to reduce the search cost of finding jobs and thus encourage migration.

People rely on personal networks to obtain job related information (Kajisa 2007). Many previous studies also find that previous migrants may increase the employment probability of recent migrants if the network of previous migrants from the same origin helps the recent migrants find jobs (Banergee, 1984; Banergee, 1991;

Munshi, 2003; Yamauchi and Tanabe, 2006). At the same time, the previous literature on Africa finds that ethnic networks are significantly related to the occupational choices in the labor market (Barr and Oduro, 2002). Therefore, in the context of Africa, previous migrants from the same ethnic network may be a key to understand occupational choices.

In recent years, mobile phone networks have been expanding in many African countries, including Uganda. In 2004, the average number of mobile cellular units per 100 inhabitants in Africa reached 9.1, with the annual growth rate during 1999 to 2004 being 59.7% (ITU 2006). Increased access to information via mobile phones can potentially increase rural-to-urban migration by providing job-related information to people in rural areas. When mobile phones are introduced, the new technology may strengthen the existing personal networks and help those who are well connected to find jobs in urban centers. Furthermore, it is also possible that the new technology helps those who are outside of the networks to find jobs by obtaining job-related information through new channels. To date, however, there have been no studies testing the combined impact of mobile phone coverage expansion and personal networks on migration.

The purpose of this study, therefore, is to assess the impact of mobile phone coverage expansion, personal networks, and the interaction between these two on

migration in Uganda. In Uganda, as a consequence of an innovative regulatory reform in the telecommunications sector, the mobile phone network expanded from 46.0 percent of the population in 2003 to 70.0 percent of the population in 2005 (ITU 2007). In this study, we use panel data of 856 households in 94 communities across the country, except the north regions. During the two year period between the first survey in 2003 and the second survey in 2005, we find that the mobile phone network expanded from 41 to 87 communities out of the 94 sample communities. At the same time, the majority (62 percent) of those looking for a job in Uganda are reported to use personal networks in search of work (Uganda Bureau of Statistics, 2003). Under such setting, we first find that, when the household head belongs to a large ethnic group in Kampala, an individual's chance of choosing migration to find a job as opposed to on-farm activities and migration with other purposes increases while controlling for the distance from Kampala and other variables. The mobile phone network expansion increases the probability of choosing migration to find a job, and this impact is larger for individuals who belong to a larger ethnic group in Kampala. These findings suggest that mobile phone coverage strengthens the existing majority ethnic network with regard to the decision to migrate to find an urban job.

In the next section, we review previous studies on migration and personal networks, followed by a discussion of the conceptual framework. Section 3 presents the

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descriptive statistics, and the estimation methods. The estimation results are provided in Section 4, followed by the conclusion in Section 5.

2. Mobile phones and migration

2.1 Literature Review

Migrants may be classified into two groups: those who search for urban employment from rural areas and migrate once pre-arranged jobs are found, and those who decide in favor of urban-based search activity (Banerjee, 1991). In the former case, a personal recommendation from someone who knows the prospective migrant is especially important in the context of Africa. Such personal recommendations and word-of-mouth communications are widely observed in African countries where institutions supporting the job market are underdeveloped, as they can reduce screening costs (Fafchamps, 2006). Access to personal recommendations is expected to be highly dependent on the personal networks to which people belong (Barr and Oduro, 2002). Mobile phone networks can improve person to person communications and facilitate exchanges of recommendations within personal networks across space.

Several previous studies have investigated the relationship between personal networks and migration choice in the context of developing countries, but not in relation to the mobile phone technology. Munshi (2003), Kajisa (2007), and Yamauchi and

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Tanabe (2008) find the positive returns from network externality on migration choice through information provided by previous migrants belonging to the same ethnic group or the same geographical group. Other studies have investigated the relationship between access to telephones and labor market participation, but not controlling for personal networks such as ethnicity (Tolero et al.,2006).

Therefore, no studies have examined how the use of mobile phones augments the returns from existing personal networks or, instead, provide opportunities to those who are outside such networks. The present study is one of the pioneering studies to investigate whether the introduction of new information technology expands or decreases the existing difference in personal networks among the people in labor markets.

2.2 Conceptual framework

In this section, we develop a model of migrants' learning behavior based on a simple model developed by Yamauchi and Tanabe (2008). The central questions are whether previous migrants influence the probability to migrate to find a job for the members from the same personal network and, subsequently, how the mobile phone network changes that relationship. Previous migrants create useful information on job search from which prospective migrants can benefit. Furthermore, greater market

information increases the likelihood of receiving an effective job offer and decreases its variance (Daneshvary et al., 1992). Therefore, we assume that information from previous migrants increases the probability of migration choice to find a job by the members of the same personal network.

Assume that a prospective migrant receives new information on the destination labor market, which is useful to find a job, from a previous migrant {j} from the same personal network. The previous migrant j creates a signal $\tilde{q}_{j,s} = \theta + \varepsilon_{j,s}$ where θ, an unknown parameter, determines the best job-search strategy; $\varepsilon_{j,s}$ is stochastic noise following iid $N(0, \sigma^2(s))$; and s is an indicator that measures the size of the personal network. It is assumed that $\sigma^{2'}(s) < 0$. This indicates that the variance of the information error is smaller for those in larger personal networks. Further, assume that the number of people from whom prospective migrants collect information, $n(t)$, is a function of the information technology, t, and that an increase in t increases n:

$$\frac{\partial n(t)}{\partial t} > 0.$$

In the destination, the previous migrants send specific information about jobs to the prospective migrant who makes a guess on θ, utilizing all the information available from the previous migrants. $n(t)$ is the number of previous migrants that the prospective migrant contacts through mobile phones. Let z^* denote his or her best estimate for θ. The prospective migrant makes the best guess on θ and minimizes

$E(\tilde{q}-z^*)^2$ which is:

$$E(\tilde{q}-z^*)^2 = \sigma^2 + \frac{1}{n\ (t)}\sigma^2(s). \qquad (1)$$

The impact of the larger personal network can be seen in an increase in *s*:

$$\frac{\partial E(\hat{q}-z^*)^2}{\partial s} = \frac{1}{n\ (t)}\sigma^{2'}(s) < 0\ . \qquad (2)$$

The sign is negative, implying that lower error increases probability of migrating to find

a job if the prospective migrant belongs to a larger personal network.

Next, the impact of the mobile phone network expansion can be seen by

examining the effect of an increase in *t*:

$$\frac{\partial E(\hat{q}-z^*)^2}{\partial t} = -\frac{1}{[n\ (t)]^2}\sigma^2(s) < 0. \qquad (3)$$

This negative impact means that an increase in person to person communication due to

new technology decreases the error, which will increase the probability to migrate to

find a job.

Further, the combined impact of the mobile phone network and the personal

network can be shown as:

$$\frac{\partial^2 E(\hat{q}-z^*)^2}{\partial t \partial s} = -\frac{1}{[n\ (t)]^2}\sigma^{2'}(s) > 0. \qquad (4)$$

The sign is positive meaning that when person to person communication improves

through new technology, the error increases as the personal networks become large.

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Among several types of personal networks, the present study focuses on ethnic networks. Previous migrants from the same personal network group are identified as the previous migrants from the same ethnic network. New migrants in a large ethnic group at an urban destination are expected to receive more information on the labor market through the large number of previous migrants. Thus, the error term decreases as s increases.

In contrast, individuals that belong to an ethnic network that is small in the urban destination have less information on the labor market because of the smaller number of previous migrants. Thus, the error term increases as s decreases.

Next, we discuss the relationship between mobile phone coverage expansion, and the error term ε. Mobile phone coverage expansion facilitates the person to person exchange of information through the use of community telephone shops or mobile phone handsets and increases the amount of information exchanged. Therefore, the error term decreases when the mobile phone coverage expands.

Mobile phone coverage can accelerate the flow of information regarding such means as job referrals within ethnic networks. Because of the wider network among each other through the existing institutions, those in a larger ethnic group are not expected to increase job referrals due to the introduction of the new technology. For example, even without mobile phones, those in a large ethnic group can obtain

information about urban job opportunities from a previous migrant through a third party such as a trader from the same ethnic network. They can also arrange referrals through this network. However, those in a small ethnic group rely more on the direct information through the previous migrant from the same ethnic group. Direct rural-urban communication through mobile phone thus facilitates the information flow and referral within the smaller ethnic network. Therefore, those in a smaller ethnic group are expected to increase job referrals due to the introduction of new technology. The size of the error term decreases more sharply for those in a smaller ethnic network when communication through a new technology is introduced.

Therefore, the first hypothesis is that being in a larger ethnic network in the urban destination enhances the probability of choosing migration to find a job due to focused information about the destination labor market through previous migrants.

The second hypothesis is that as a result of mobile phone coverage expansion, we expect to find an increase in the probability to choose migration to find an urban job due to improved access to information related to job opportunities.

The third hypothesis is that as a result of mobile phone coverage expansion, we expect to find an increase in the probability to choose migration to find an urban job by those in smaller ethnic networks in the urban destination due to improved access to information related to job opportunities.

3. Data, descriptive analysis and estimation method

3.1 Data and descriptive analysis

This paper uses data from household and community surveys in Uganda collected as part of the Research on Poverty, Environment, and Agricultural Technology (RePEAT) project. The surveys were jointly conducted by Makerere University, the Foundation for Advanced Studies on International Development (FASID), and National Graduate Institute for Policy Studies (GRIPS) in 2003 and 2005. The surveys covered 29 districts in West, Central, and East regions of Uganda, representing the major farming systems of the country. The dataset is unique in covering information on mobile phone network expansion as well as mobile phone possession by households. In 2003, the baseline survey collected information from 94 Local Counsel 1s[1] and ten households from each LC1, making a total of 940 households. In 2005, we conducted a follow-up survey and interviewed 856 households successfully. In both surveys, we conducted both household and community surveys.

As an indication of a personal network, we focus on ethnic networks. An ethnic network, especially one that spreads between rural and urban areas, can channel information related to labor markets or specific job opportunities in the urban area to

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[1] LC1 is the smallest administrative unit in Uganda.

rural residents in the same ethnic group. In the context of Uganda, ethnic networks are

expected to play a large role in conveying such information. Ethnic networks can be

identified by the ethnicity of the household head. In the capital city Kampala, which we

consider as the largest urban destination for migrants, the Baganda group constitutes

almost 57 percent of the population since they are originally from that area (2002

Census data). This is followed by Bayankore, Basoga, Batoro, Iteso, Bagisu, Bafumbira,

and Banyarwanda. The ethnic groups mentioned here are geographically scattered

(Figure 2). At the national level, there is no majority ethnic network.

We first stratify our samples by the mobile network coverage in Table 1. We

find that about 42 percent of the sample households were already covered by the mobile

phone network at the time of the 2003 survey. By the time of the second survey in 2005,

92 percent of the total households were covered by the mobile phone network. As for

the household mobile phone ownership, only 4.3 percent of the households possessed at

least one unit in 2003, while in 2005 the percentage increased to 11.5 percent.

We stratify our sample of working age individuals into ethnicity groups as shown

in Table 2. We also present the choice of migration with the objective to find a job in

2003 and 2005. First, Table 2 suggests that between 2003 and 2005, migration to find an

urban job increased, in the Baganda, Bayankore and Basoga categories, which

constitute 56.5 percent, 6.4 percent and 4.4 percent of the Kampala population

respectively.

We expect that the impacts of the increased flow of information can be large on individuals in ethnic networks better represented in Kampala. This is because mobile phone coverage can accelerate the person to person exchange of job information and referrals across space. The increase of migration to find a job by those individuals from Baganda, Bayankore and Basoga categories suggests this effect.[2]

3.2 Estimation Method

In the following sections, we estimate the determinants of migration choice. We estimate the following model for the decision to migrate to find a job. Those migrants who left to attend school or left to stay with other relatives are excluded from the analysis.

$$
\begin{aligned}
\Pr(migration)_{it} = {} & \beta_0 + \beta_1 LC1mob_{jt} + \beta_2 LC1mob * network \\
& + \beta_k X_{ht} + \beta_l Y_{it} + \beta_m Z_{jt} + \alpha + \varepsilon_{it}
\end{aligned}
,
$$

where t =2003 and 2005, X_{ht} represents the household characteristics, Y_{it} represents the individual characteristics, Z_{jt} represents the community characteristics, and α represents the time-invariant unobserved household, individual, and community

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[2] Among the migrants to find a job, only around 5 percent in 2003 and 3 percent in 2005 were engaged in farm related employment, suggesting that the majority of the migrants to find a job are bound to urban areas. The majority of migrants in farm related employment in this data are included in the "migrate to stay with other relatives" category.

characteristics. For household characteristics, we include the log of farm assets, the log of cultivated land, as well as the number of male/female adult members. *LC1mob* is a dummy variable for the mobile phone coverage at the community level. We add an interaction term between the mobile phone coverage dummy and the time invariant ethnic network variable, *LC1mob*network,* to identify the combined impact of the mobile phone coverage and ethnic network. For the ethnic network variable, we take the proportion of the household head's ethnicity in Kampala based on the official census data in 2002. We assume that if the proportion of one ethnic group in Kampala is high, then the personal network is strong.

For migration choice at the individual level, we first perform a Probit estimation to identify the characteristics of those who migrate to find a job. If a household member leaves his or her own rural household and spends more than a month in the last 12 months finding a job, we define him or her as a migrant to find a job. The dependent variable is a dummy variable, which takes one if the individual leaves the rural household for more than a month to find a job. We also use a Probit estimation with 2005 data only to examine the relationship between the number of previous migrants at 2003 and the new migrants from the same village in 2005.

Next, we conduct household level fixed effects (FE) estimations on the migration choice to estimate more precisely the effects of the mobile phone coverage.

By estimating the FE model, we eliminate any biases caused by the time-invariant unobserved household characteristics, including the characteristics of the household location which may be correlated with the placement of the mobile phone coverage.

Finally, we also undertake a Two-step Heckman estimation on the individual income level (INC) to estimate the effects of personal networks and mobile phone coverage expansion on the income level of migrants. At the second step which estimates the determinants of the individual income level for migrants, we explicitly exclude the household level variables not related to individual income level such as the log of farm assets, the log of cultivating land, as well as the number of male/female adult members for identification purposes.

$$INC_{it} = \beta_0 + \beta_1 LC1mob_{jt} + \beta_2 LC1mob * network + \beta_k X_{ht} + \beta_l Y_{it} + \beta_m Z_{jt} + \alpha + \varepsilon_{it} ,$$

where t =2003 and 2005, X_{ht} represents the household characteristics, Y_{it} represents the individual characteristics, Z_{jt} represents the community characteristics, and α represents the time-invariant unobserved household, individual, and community characteristics. *LC1mob* is a dummy variable for the mobile phone coverage at the community level. Similar to the estimation on migration choice, we add an interaction term between the mobile phone coverage dummy and the time invariant ethnic network variable, *LC1mob*network,* to identify the combined impact of the mobile phone

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coverage and ethnic network.

4. Results

We first present the results for the Probit estimation model on the determinants of migration choice in Table 3. The first and second columns of Table 3 for migration to find a job show a significant and positive relationship between migration to find a job and the proportion of the ethnicity of the household head in Kampala. The dummy on the mobile phone network coverage does not show a significant result. The result, however, could be affected due to unobserved time invariant household level factors such as the characteristics of the location of the household associated with the placement of the mobile phone coverage. As for individual characteristics, we find positive impacts of education and being male on migrants. Both the numbers of adult males and adult females in the household increase the probability of choosing migration to find a job. The initial result supports the first hypothesis that being in a majority ethnic network enhances the migration choice to find a job due to access to more information related to the destination labor market through previous migrants.

Next, the third and fourth columns of Table 3 show the results of the Probit estimation on the decision to migrate to find a job in 2005 excluding those who were already migrants in 2003. Therefore we can focus on the new migrants between 2003

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and 2005. We have added as an explanatory variable the number of migrants in 2003 at the village level to examine if previous migrants from the same geographical locality affect the decision to migrate. The results do not suggest any significant relationship between the previous migrants from the same locality and the new migrants. Also, we have added the ratio of the household head's ethnicity at the region where the household is located. Similarly, we do find any significant relationship between the ethnicity ratio at the region and the new migrants.

Table 4 shows the results of the household level fixed effects (FE) estimation regarding migration choice to find a job, eliminating the effect of household level time invariant fixed effects. First, the coefficient on the mobile phone coverage dummy shows a positive and significant effect on migration choice to find a job. This supports the second hypothesis that as a result of mobile phone coverage expansion, we expect to find an increase in the probability to choose migration to find a job due to improved access to information related to job opportunities.

Secondly, the interaction term combining mobile phone coverage and the percentage of ethnicity in Kampala has a positive and significant coefficient with regard to migration to find a job. This result suggests that the combination of being in a larger ethnic network in Kampala and mobile phone coverage expansion enhances the probability of migration to find a lucrative job. Thus, the FE estimations on the

migration to find a job is contradictory to the third hypothesis where we expect that as a result of mobile phone coverage expansion, there would be an increase in the probability to choose migration to find a job by those in smaller ethnic networks in the urban destination.

In deriving the third hypothesis, we assumed that due to the wider network among each other through existing institutions, those in a larger ethnic group do not increase job referrals due to the introduction of the new technology. Rather, we assumed that those in a smaller ethnic group increase job referrals more sharply due to the introduction of the new technology. However, the estimation results suggest that the ones who increase the probability to migrate to find a job are those from the larger ethnic groups. The result implies that the existing institutions in the larger ethnic group, which help to match individuals and job opportunities, are strengthened by the mobile phone network. This suggests that even when such institutions that help job matching exist, their potentials are not fully exploited because of the lack of communication technology. At the same time, our results imply that the smaller ethnic groups that do not have existing institutions do not significantly benefit from the mobile phone network.

In addition, we have applied in Table 5 a two-stage Heckman analysis for income. The first-stage selection regression indicates that education, gender (male), and

age are significantly related to obtaining at least a positive income. Neither the ratio of the ethnicity of the household head in Kampala nor the mobile network coverage is significant. The second stage regression on income shows that the level of education is significant in earning higher income. These results do not change even after introducing village level dummies to control for village level fixed effects. Therefore, Table 5 suggests that while the larger ethnic network, mobile phone coverage, and the combination of both enhances the probability of choosing migration to find a job, these factors are not related to the level of income. Instead, the education level is positively and significantly related to the income level of migrants.

5. Conclusion

Increasing non-agricultural employment is considered an important policy target to reduce rural poverty in Africa. Personal networks can help rural workers find jobs in urban centers. When the information flow increases due to mobile phone coverage expansion, it is not clear if the new information flow strengthens the existing personal network or bypasses it and helps those who were previously outside of the personal networks. We examine the combined impact of mobile phone coverage expansion and personal networks by using panel data of 856 households in 94 communities in rural Uganda, where the number of communities covered by mobile phone coverage

increased from 41 to 87 communities over a two-year period between the first and second surveys in 2003 and 2005, respectively. We first find that when the household head belongs to a large ethnic group in Kampala, an individual's chance of leaving his or her rural village to find an urban job increases while controlling for the distance from Kampala and other variables. The mobile phone network expansion increases the probability of choosing migration to find a job, and this impact is larger for individuals who belong to a larger ethnic group in Kampala. These findings suggest that mobile phone coverage strengthens the role of the existing majority ethnic network in the decision to migrate to find a job.

Lastly, while the larger ethnic network, mobile phone coverage, and the combination of both enhance the probability of choosing migration, these factors are not related to the level of income. Instead, the education level is positively and significantly related to the income level of migrants.

The above findings suggest that the existing institutions in the larger ethnic group, which help to match individuals and job opportunities, are strengthened by the mobile phone network. At the same time, it implies that the smaller ethnic groups that do not have existing institutions do not significantly benefit from the mobile phone network. Therefore, an important policy area to improve labor market efficiency in Uganda is to design an institutional framework that matches individuals and job

opportunities regardless of ethnicity.

One possible explanation to the existing inefficiency in labor market is local language. In Uganda, English is the official language, followed by Swahili which has been an official language for a limited period. However, the Ugandan workplaces are dominated by the local languages that vary among ethnicities. The matching between prospective migrants and job opportunities, including personal referrals, may be conducted within each ethnic group with the shared local language. If the urban job opportunities are mostly created in Kampala city, then, information about job opportunities is more frequently conveyed among the ethnic group more prevalent in Kampala. Therefore, those in an ethnic group better represented in Kampala obtain more information and increase referral to urban job opportunities with the introduction of the mobile phone. On the other hand, those in an ethnic group less represented in Kampala do not increase access to job information even after the mobile phone coverage since the job information itself is originated in another local language and it is also difficult to make personal referrals across ethnicities. These are important areas for further research.

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Table 1: Mobile Phone Network Coverage and Ownership

Region	Number (%) of households	Number (%) of sample households by mobile phone network coverage			Proportion (%) of households who own mobile phone units	
		2003 and 2005	**Only in 2005**	**Never covered**	**2003**	**2005**
Eastern	383	133	221	29	2.6	8.6
	(44.7)	(34.7)	(57.7)	(7.5)		
Central	250	123	127	0	8.0	17.6
	(29.2)	(49.2)	(50.8)	(0)		
Western	223	107	77	39	3.1	9.8
	(26.0)	(47.9)	(34.5)	(17.4)		
Total	856	363	425	68	4.3	11.5
	(100)	(42.4)	(49.6)	(7.9)		

Table 2: Proportion of Migrants to Find a Job by Ethnic Group

Ethnic group	Proportion in Kampala population in 2002 (%)	Proportion in RePEAT data		Proportion of migrants to find an urban job among the surveyed individuals	
		2003 (%)	2005 (%)	2003 (%)	2005 (%)
Baganda	56.5	21.2	20.6	9.5	9.9
Bayankore	6.4	12.6	12.2	9.7	10.4
Basoga	4.4	14.6	14.1	2.5	5.4
Batoro	3.0	1.3	1.1	5.1	22.8
Iteso	2.5	6.1	7.3	5.5	5.9
Bagisu	2.3	11.9	10.9	4.5	3.7
Bafumbira	1.3	4.2	3.7	2.4	6.3
Banyarwanda	1.1	1.9	2.2	7.0	6.0
Others	22.5	26.2	27.9	4.8	6.8
Total	100	100	100		

Table 3: Determinants of Migration Choice（Probit）

	Migration to find a job (absent from home more than a month)			
	Probit (using both 2003 and 2005)		Probit (2005 only)	
Education	0.007***	0.007***	0.004***	0.004***
	(9.36)	(9.37)	(4.06)	(4.00)
Gender (male=1)	0.046***	0.046***	0.033***	0.034***
	(7.12)	(7.14)	(3.88)	(3.96)
Age	0.001	0.001	0.002	0.001
	(1.24)	(1.23)	(0.86)	(0.81)
Age squared	-0.000***	-0.000***	-0.000*	-0.000*
	(2.65)	(2.64)	(1.74)	(1.69)
Log of farm assets	0.000	0.000	-0.001	-0.000
	(0.42)	(0.40)	(0.33)	(0.25)
Log of cultivated land	0.005*	0.005*	-0.000	-0.001
	(1.71)	(1.70)	(0.08)	(0.27)
Number of adult male	0.018***	0.018***	0.020**	0.019**
	(2.79)	(2.78)	(2.28)	(2.16)
Number of adult female	0.015**	0.015**	0.006	0.007
	(2.15)	(2.17)	(0.66)	(0.73)
Ethnicity ratio at Kampala (Ratio of household head's ethnic group at Kampala)	0.0005**	0.0006*	0.0000	0.000
	(1.98)	(1.85)	(0.53)	(0.45)
Mobile network coverage X Ethnicity ratio		-0.000		0.000
		(0.58)		(1.49)
Mobile network coverage	0.002	0.005	-0.005	-0.014
	(0.28)	(0.53)	(0.66)	(1.39)
Number of migrants from the same LC1 in 2003			0.000	0.000
			(0.84)	(1.00)
Ethnicity ratio at the Region (Ratio of household head's ethnic group in the Region)	0.00	0.000	0.000	0.000
	(0.96)	(0.91)	(0.60)	(0.45)
Distance from Kampala (km)	0.001***	0.001***	0.000	0.000
	(4.83)	(4.81)	(1.16)	(0.96)
Year 2005	0.013*	0.013*		
	(1.81)	(1.81)		
# of observations	4313		1937	

Numbers in parentheses are absolute t-values. * , **and *** indicate the 10 percent, 5 percent and 1 percent significance levels, respectively.

Table 4: Determinants of Migration Choice (Fixed Effects)

	Migration to find a job (absent from home more than a month)	
	Household level fixed effects	
Education	0.011***	0.011***
	(7.11)	(7.06)
Gender (male=1)	0.516***	0.052***
	(6.26)	(6.33)
Age	-0.030**	-0.002**
	(2.30)	(2.15)
Age squared	0.00	0.00
	(0.32)	(0.19)
Log of farm assets	-0.010	-0.009
	(1.49)	(1.37)
Log of cultivated land	0.004	0.005
	(0.56)	(0.57)
Number of adult male	0.039*	0.039*
	(1.81)	(1.83)
Number of adult female	-0.014	-0.013
	(0.85)	(0.81)
Mobile network coverage X Ethnicity ratio		0.090*
		(1.71)
Mobile network coverage	0.020*	0.008
	(1.94)	(0.68)
Year 2005	0.151**	0.137*
	(2.14)	(1.93)
# of observations	4532	4512

Numbers in parentheses are absolute t-values. * , **and *** indicate the 10 percent, 5 percent and 1 percent significance levels, respectively. The t-values use robust standard errors.

**Table 5: Determinants of Migration and Income** (Heckman Two Step Model)

	Income (without LC1 dummies)		Income (with LC1 dummies)	
	First step	Second step- ln (income)	First step	Second step- ln (income)
Education	0.086***	0.216*	0.106***	0.370*
	(6.62)	(1.89)	(6.57)	(1.81)
Gender (male=1)	0.461***	0.526	0.529***	1.393
	(4.11)	(0.81)	(4.15)	(1.11)
Age	0.072***	0.195*	0.089***	0.433
	(2.72)	(1.70)	(2.94)	(1.44)
Age squared	-0.000***	-0.002	-0.001***	-0.005
	(2.81)	(1.45)	(3.02)	(1.46)
Number of adult male	0.120		0.185	
	(1.08)		(1.38)	
Number of adult female	0.129		0.206	
	(1.16)		(1.56)	
Ethnicity ratio at Kampala	-0.002	0.011	-0.004	0.529
	(0.32)	(0.48)	(0.50)	(1.42)
Mobile network coverage X	0.007	-0.005	0.007	-0.536
Ethnicity ratio	(1.20)	(0.19)	(0.95)	(1.46)
Mobile network coverage	-0.012	-0.196	-0.132	0.821
	(0.08)	(0.45)	(0.56)	(0.52)
Ethnicity ratio at the	-0.002	-0.008	-0.011*	-0.008
Region	(0.48)	(0.82)	(1.94)	(0.11)
Distance from Kampala	0.021***	-0.004	0.002	0.060
(km)	(6.16)	(0.15)	(0.14)	(0.74)
Year 2005	0.118	-0.221	0.193	0.669
	(0.99)	(0.59)	(1.28)	(0.75)
Inverse mills ratio		1.17 (0.73)		3.85 (1.48)
Constant	-4.46***	5.055	-9.76	-2.49
	(7.16)	(0.67)	(0.00)	(0.23)
# of observations		4313		4313

Numbers in parentheses are absolute t-values. * , **and *** indicate the 10 percent, 5 percent and 1 percent significance levels, respectively.

Figure 1:   Mobile Phone Network Coverage Expansion in Uganda

Figure 2: Map of Ethnic Groups in Uganda
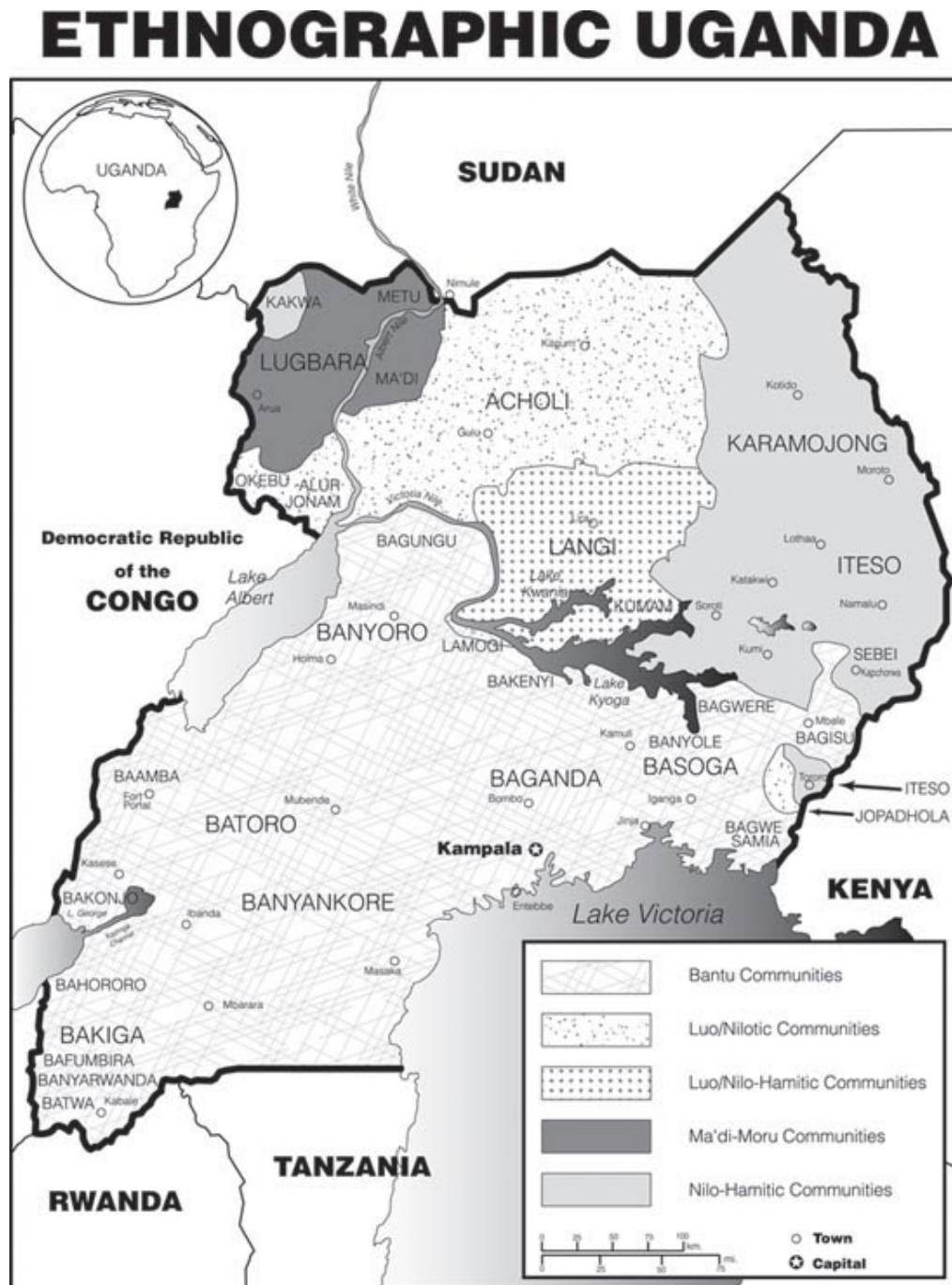
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