Returns to migration : the role of educational attainment in rural Tanzania

INSTITUTE OF DEVELOPING ECONOMIES

IDE Discussion Papers are preliminary materials circulated
to stimulate discussions and critical comments

IDE DISCUSSION PAPER No. 322

Returns to Migration: The Role of Educational Attainment in Rural Tanzania

Yuya KUDO *

February 2012

Abstract

Given the migration premium previously identified in an impact evaluation approach, this paper asks the question of why migration is not more prominent, given such high premium associated with it. Using long-term household panel data drawn from rural Tanzania, Kagera for the period 1991-2004, this study aims to answer this question by exploring the contribution of education in the migration premium. By separating migrants into those that moved out of original villages but remained within Kagera and those who left the region, this study finds that, in consumption, the return on investment in education is higher at both destinations. However, whilst the higher return on education fully explains the gains associated with migration within Kagera, it only partly explains those of external migration. These findings suggest that welfare opportunities are higher at the destination and that an individual's limited investment in education plays a major role in preventing short-distance migration from becoming a significant source of raising welfare, which is not the case for long-distance migration. While education plays a role, it appears that other mechanisms may prohibit rural agents from exploiting the arbitrage opportunity when they migrate to the destination at a great distance from the source.

Keywords: Africa, Internal migration, School Investment, Return to education, Welfare growth

JEL classification: I25, J61, J62, O15, R23

---

* Research Fellow, Microeconomic Analysis Studies Group, Development Studies Centre, IDE (Yuya_Kudo@ide.go.jp)

The Institute of Developing Economies (IDE) is a semigovernmental, nonpartisan, nonprofit research institute, founded in 1958. The Institute merged with the Japan External Trade Organization (JETRO) on July 1, 1998. The Institute conducts basic and comprehensive studies on economic and related affairs in all developing countries and regions, including Asia, the Middle East, Africa, Latin America, Oceania, and Eastern Europe.

INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO
3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI
CHIBA 261-8545, JAPAN

Returns to Migration: The Role of Educational Attainment in Rural Tanzania*

Yuya Kudo†

February 8, 2012

Abstract

Given the migration premium previously identified in an impact evaluation approach, this paper asks the question of why migration is not more prominent, given such high premium associated with it. Using long-term household panel data drawn from rural Tanzania, Kagera for the period 1991-2004, this study aims to answer this question by exploring the contribution of education in the migration premium. By separating migrants into those that moved out of original villages but remained within Kagera and those who left the region, this study finds that, in consumption, the return on investment in education is higher at both destinations. However, whilst the higher return on education fully explains the gains associated with migration within Kagera, it only partly explains those of external migration. These findings suggest that welfare opportunities are higher at the destination and that an individual's limited investment in education plays a major role in preventing short-distance migration from becoming a significant source of raising welfare, which is not the case for long-distance migration. While education plays a role, it appears that other mechanisms may prohibit rural agents from exploiting the arbitrage opportunity when they migrate to the destination at a great distance from the source.

Keywords: Africa, Internal migration, School Investment, Return to education, Welfare growth
JEL classification: I25, J61, J62, O15, R23

1 Introduction

Whilst rural-to-urban migration has traditionally been seen as a way out of poverty for most people living in agrarian societies in developing world, only recently economists have started providing rigorous empirical evidence supporting the notion that migration, indeed, positively affects income and consumption (McKenzie et al., 2010; Beegle et al., 2011).[1] However, this significant migration effect leads to the question of why not more people choose this option, if the benefits are so high.

*I thank Ian Crawford, Stefan Dercon, Christopher Heady, Seiro Ito, Tomohiro Machikita, Thomas Melonio, Francis Teal, Kazunari Tsukada, and participants at the 3rd International Conference: Migration & Development (Paris, 2010), the Royal Economic Society Annual Conference (Egham, 2011), and a seminar at the IDE for valuable comments and suggestions. All errors remain my own.

†Institute of Developing Economies (IDE-JETRO), 3-2-2 Wakaba, Mihama-ku, Chiba-shi, Chiba 261-8545, Japan, Yuya_Kudo@ide.go.jp, +81-43-299-9697.

[1]Two types of difficulties may account for this, namely collecting micro-level data tenable to a rigorous empirical analysis (usually collected at either migrants' origin or destination), and effectively controlling for unobserved heterogeneity driving migrants' self-selection (Borjas, 1987, 1994; Hartog and Winkelmann, 2003; Chiquiar and Hanson, 2005).

Many policy considerations highlight this question. Given the remarkably high return, for example, supporting rural agents' migration might have a higher potential to improve their welfare than any other development policy would (McKenzie and Gibson, 2010). In addition, many social, economic, and political problems in an urban area (e.g., high unemployment rate, high food prices, housing shortages, health problems driven by air pollution, and political instability) might be associated with the substantial rural-to-urban migration (Todaro, 1969; Stark, 1982). Hence, having a full understanding of mechanisms discouraging (or encouraging) rural agents' mobility should provide policymakers challenging these issues with an appropriate theoretical background to do so.

One simple reason for this puzzle is that, typically researchers provide the evidence indicating benefits of migration by taking an impact evaluation approach, which does not address the underlying mechanisms that benefit migrants. If the higher return on some capital at the destination is the source of the migration premium, then the reasons for the limited mobility may no longer be a mystery. The answer would simply be that those who do not possess those capital resources would choose not to migrate. In fact, a variety of potential resources might be valued at migrants' destination - from human capital (e.g., education, healthy body and mind), to physical capital (e.g., business equipment, vehicles) as well as social capital (e.g., business network).

Broadly speaking, two approaches may be available to address the question of why migration is not more prevalent, one of which is investigating what capital endowments limit or drive rural agents' mobility in migration decision equation, as done previously (e.g., Banerjee and Kanbur, 1981; Daveri and Faini, 1999). Whilst the evidence of migrants' requirements in relation to relocation is explicit, it fails to identify the extent to which migrants' endowments can explain the migration premium and even whether the migration premium exists. Consequently, any interpretation of data in terms of welfare gain is impossible in this approach. Alternatively, estimating an outcome equation (income and/or consumption) might lead to new insights with respect to factors that contribute to realization of migration premium. If the migration premium is entirely attributed to the higher return on some capital at the destination in an outcome equation, then it is likely that those lacking it would choose not to migrate. Whilst this approach is only suggestive about factors limiting rural agents' mobility, it can directly link the return on capital to the migration premium. Although, clearly both approaches have pros and cons, the second approach has not been implemented in previous studies. Most likely, such work has been lacking due to the difficulty in indentifying the migration premium. As described above, because only recently, economists have started to provide rigorous empirical support for the positive migration effect, it is not surprising that no one has ever attempted to quantify the source of migration premium. The current study fills this gap by taking the second approach with a scope of migrants' educational attainment.

The approach and scope of this study were chosen as, firstly, they allow for explicit testing of the extent to which rural agents' capital endowments benefit them, likely, by encouraging their resettlement. Identifying the key capital in this process, as well as the extent to which it explains the migration premium enables us to predict how welfare distribution in an economy will be affected by encouraging or discouraging rural agents' capital acquisition. For practitioners who intend to manage the distribution pattern of welfare and population, this information should be highly helpful in scoping out the most cost-effective policy intervention. Regarding the scope, previous

research provided much evidence that migrants are positively selected from rural surroundings in terms of both observed and unobserved skills (Barnum and Sabot, 1977; Lanzona, 1998; Robinson and Tomes, 1982; McKenzie et al., 2010). Closely related to the current study, Dahl (2002) also showed that state differences in the return on investment in education significantly influence migration flows of college-educated individuals in the United States. As all these findings suggest that human capital is important for migrants' success at the destination, education should be a natural starting point to consider.

Given the existent migration premium identified in an impact evaluation approach, the aim of this study is to test to what extent the premium can be explained by education. It is expected that, if the migration premium is entirely attributed to the higher return on investment in education at the destination, less educated individuals will choose not to migrate. Using long-term household panel data drawn from rural Tanzania, this study shows that education, indeed, plays a role in explaining the gains from migration, indicating an interesting trade-off between the importance of education and the distance to the destination.

This paper uses data sourced from the Kagera Health and Development Survey (KHDS). The KHDS is a five-wave long-term household panel survey conducted in the rural region in northwest Tanzania, Kagera. The first four waves were carried out between 1991 and 1994 at 6- or 7-month intervals, with the final wave carried out in 2004. As approximately 35% of initial respondents moved out of their original communities during the sample periods, the data set used in this study contains a good variation of migrants and non-migrants that will be useful in the subsequent analysis.[2] The data also allows us to investigate rural agents' long-term *investment* in education, which cannot normally be observed in short-term panel surveys. In addition to the long-term and highly resourceful data it yields, one of the most important advantages of using the KHDS as a data source for this study is that it dispenses with the need to find an answer for the question of whether the migration premium exists. By applying an impact evaluation approach to the KHDS data, Beegle et al. (2011) found that moving out of original communities added 36 percentage points to consumption growth from wave 1 to 5 on average.[3] Thus, their study confirms the existence of migration premium, allowing this study to focus on the question of why migration is not more widespread, as well as on identifying the source of this consumption growth with an emphasis of the role of education. In addition, examining the process of migration taking place in Africa is particularly meaningful because Africa recorded the highest annual rate of growth of urban population in the world between 1975 and 2007 (United Nations, 2008).[4]

This study contributes to development research, as it takes the migration premium identified in Beegle et al. (2011) as given and extends the research into the question of why the migration of rural agents is not more prominent. To address this question, overhauling the underlying mechanisms and testing them one by one is necessary.[5] Thus, the findings of this study should be a good starting point for further work on this topic. In this sense, the current study also attempts to shift

[2] In addition, almost half the initial respondents moved out of their original households.

[3] Before commencing the current study, the attempt was made to replicate their findings by adopting the strategy the authors employed, differences-in-differences OLS (DID-OLS) and DID-2SLS, to the measure of consumption implemented here. Pooling migrants into one group, the effect of migration on consumption growth was estimated to be approximately 0.34, which is insignificantly different from their point estimate of 0.36.

[4] By 2050, Africa is projected to be second to Asia as a region to accommodate a large number of urban inhabitants (United Nations, 2008).

[5] For example, researchers in the field of microcredit have done so for its business model over the last decade to explain the high rate of repayment (e.g., Bauer et al., forthcoming).

away from a fully reduced-form approach, which solely identifies the gains from migration. Whilst the paper does not intend to provide a fully structural interpretation of data, it crosses an ongoing debate about model effectiveness of 'structural' versus 'reduced-form' by giving some consideration to the underlying economic model that may explain the data (e.g., Todd and Wolpin, 2006; Kennan and Walker, 2011). In addition, this research links to studies investigating the reasons behind slow adoption of beneficial technology, such as high-yield crops and fertilizers, in developing world (e.g., Dercon and Christiaensen, 2011; Suri, 2011). This paper explores the role of educational attainment in the context of limited investment in migration. Finally, studying internal migration is *per se* another significant contribution, because researchers have tended to explore international migration despite a great number of internal migrants in the world.

This paper is organized in six sections. In Section 2, a simple rural-to-urban migration model is presented to motivate an empirical analysis. Section 3 describes an empirical strategy, whereas Section 4 presents an overview of data, briefly checking whether the theoretical model fits the empirical data. The estimation results are reported in Section 5, followed by the conclusions summarized in Section 6.

2 Conceptual Framework

In contrast to previous studies estimating migration decision equation, this study aims to answer the question of why migration is not even more pronounced by exploring to what extent the migration premium can be explained by education. The underlying presupposition for taking this approach is that if the premium is entirely attributed to the higher return on investment in education at the destination, those uneducated individuals (i.e., those who cannot afford the cost of schooling as well as that associated with migration) would choose not to migrate. To formalize this idea, this section develops a simple rural-to-urban migration model. For expositional simplicity, the model assumes absence of any uncertainty. As discussed in Appendix A.3, however, introducing uncertainty into the model would not seriously affect implications derived from the model. While the model is static and non-stochastic, it can provide a fundamental mechanism for explaining the relationship between migration, educational attainment, occupational choice, and earnings.

By using a similar framework, two types of mobility are delineated in the model, namely migrating to cities to achieve higher education (and work there) (subsection 2.1), and migrating to cities to find jobs after completing education in rural surroundings (subsection 2.2). In the model, urban jobs reward migrants for their education ($\alpha > 0$). The positive return on education gives rural agents an incentive to migrate, encouraging the less educated to invest in further schooling before joining the labor force, conditional on the initially endowed level of education. Depending upon where learning opportunities are available, some individuals migrate in order to seek more education, whilst others do so after obtaining it. The investment process of migration and schooling is expected to eventually result in higher earnings.

The initial level of education plays a role of credit in the model and, at equilibrium, in which the credit constraint is binding, not all agents can migrate and not all migrants can achieve the education of their choice. The model yields three main predications at the equilibrium. Firstly, migrants are more likely to be in the upper tail of the initial educational distribution (positive selection into migration). Secondly, initially better-educated agents seek more education (positive selection into education). Thirdly, initially better-educated agents eventually achieve higher

earnings. To see the goodness of fit of the model to empirical data, subsection 4.4 checks if these assumptions and predictions are broadly consistent with data. The model also establishes how the migration premium should be linked to education in an outcome equation in the subsequent empirical analysis, showing the importance of allowing for the difference in the return on investment in education between the origin and the destination in the empirical outcome equation.

2.1 Migration for Education

2.1.1 Environment

Consider a rural economy (origin) in which a large population (a continuum) of risk-neutral agents with identical preferences exists. The population is characterized by a distribution function $G(\bar{s})$, which provides the measure of the population with the initial educational level at the origin less than $\bar{s}$.[6] Here, it is assumed that $\bar{s}$ is distributed in the interval $[0, \bar{s}_u]$. Moreover, agents have the freedom to decide whether to migrate into an urban area (destination) or not. If they prefer to stay in the rural sector, they simply choose their occupations from those available at the source. On the other hand, the urban economy gives them opportunities to attain a higher education before joining the labor force. Since the model is static, it implies that the migrants simultaneously choose the level of education $s \in R_+$, as well as occupations, once they migrate.

2.1.2 Occupational Choice and Educational Attainment

Gross income from occupations is defined as $2\alpha q + \delta$, where $q \in R_+$ describes occupations. It is assumed that $\alpha > 0$ and $\delta > 0$. The positive α is a crucial assumption in the model, and will be explained shortly. While only one occupation ($q = 0$, self-employed farming) is available in the rural sector, heterogeneous set of jobs exists in the urban economy ($q \in R_{++}$). This specification ensures that gross income from urban jobs increases as q increases. We might be able to interpret a lower q as non-farm self-employed petty trading and higher q as non-farm formal wage jobs. Alternatively, a higher q might suggest that the job pays workers more, since it is a complex task that requires a higher level of skills or technologies. Any urban job requires agents to have the skills (measured by education, s) that suit it. Thus, if agents do not have the skills necessary to perform their occupations, they would lose income. This monetary cost is $\alpha(q-s)^2$.[7] With these assumptions, agents' labor income y can be written as

$$y = \begin{cases} y_r = \delta & \text{if agents do not migrate,} \\ y_u = \alpha\left[2q - (q-s)^2\right] + \delta & \text{if agents migrate.} \end{cases} \tag{1}$$

As already mentioned in the previous subsection, migrants have opportunities to obtain a higher education. In that case, migrants with the initial level of education $\bar{s}$ have to pay the difference between the cost (e.g., tuition fees) required to achieve the target level of education (s) and the cost already incurred to obtain the current level of education ($\bar{s}$). Assuming that the cost of education is convex, we define it as $\beta(s^2 - \bar{s}^2)$, where $\beta > 0$.

[6] In the context of wealth distribution, similar settings can be seen in Banerjee and Newman (1993) and Ghatak and Jiang (2002).

[7] A similar setting can be seen in Yamauchi (2004), where skill requirement has multiple dimensions. As multiplying $(q-s)^2$ by α is just for computational simplicity, the manipulation unaffects implications derived from the model.

For expositional simplicity, unemployment or withdrawal from the labor market is excluded from this model. In addition, the opportunities for additional schooling are assumed to be guaranteed, as long as migrants seek them, and there are no school dropouts in the economy. Whilst it is assumed that $\bar{s}$ is distributed with variation in the absence of return on investment in education in the rural sector, this may be justified for many reasons. As the complete absence is chosen in this model mainly for simplicity's sake, it is possible to, for example, introduce a small return on investment in education into rural jobs without seriously affecting implications arising from the model. Alternatively, the initial level of schooling can be seen as basic education supplied by the government (e.g., elementary). As some children might have difficulty in attending school for some reason (e.g., household budget, school location), the difficulty might generate small dispersion, even at this level of education.

2.1.3 Wealth, Cost of Migration and Credit Rationing

Each agent has his/her own wealth as endowments, which are expected to positively correlate with the initial level of schooling. This assumption is important because it enables the initial educational level to play the role of credit in the model. Thus, the initial level of wealth is defined as $\gamma\bar{s} + \rho$, where $\gamma > 0$ and $\rho > 0$. In addition, it is assumed that the fixed cost of migration m is greater than ρ ($\rho < m$), which means that the agent with no initial education ($\bar{s} = 0$) is not able to migrate unless he/she obtains a loan.

Agents can afford the cost of migration and additional schooling through loan contracts with rural lenders before they migrate. However, there is the possibility that borrowers can default on a debt, as they may avoid meeting any outstanding obligations by migrating. With the lack of alternative enforcement mechanism, this results in credit rationing, whereby only agents with wealth greater than a certain threshold can obtain a loan. This credit rationing is incorporated into the model by adopting the approach proposed by Ghatak and Jiang (2002), where migrants that failed to fulfill their contracts might be caught with some probability π and have to receive a nonmonetary punishment F, such as imprisonment or social sanctions. Hence, denoting one plus the rate of interest as r, lenders will make only loans that satisfy

$$r[m + \beta(s^2 - \bar{s}^2) - \gamma\bar{s} - \rho] \leq \pi F. \tag{2}$$

Here, it is assumed that $r(m - \rho) > \pi F$, implying absence of any loan contracts in the economy, which would enable the agent with no initial education to migrate. In addition, throughout the section, it is assumed that the return on choosing urban jobs with additional schooling is sufficiently high in the sense that

$$\frac{m - \rho - \frac{\pi F}{r}}{\gamma} < \frac{\alpha}{\beta(1 + r)}. \tag{3}$$

Below, $\pi = 0$ is set without loss of generality. Consequently, migration will be a strategy only for those who are able to finance their migration and additional education with their own wealth.

2.1.4 Equilibrium

In this subsection, a particular equilibrium is presented, by sketching a solution of the model. For details of the solution, see Appendix A.1.

In the urban economy, migrants choose their occupations and new skills they acquire. Note that, given obtained human capital (s), migrants' optimal occupation simply maximizes their labor income; thus, $q^* = 1 + s^*$. Throughout this paper, the superscript asterisk (*) refers to the optimal value chosen by each agent at equilibrium. Substituting this into (1), migrants' optimal labor income becomes

$$y_u^* = \underbrace{\alpha\left(2 + \frac{1}{s^*}\right)}_{\text{Average return to schooling}} \times s^* + \delta. \tag{4}$$

Earlier, an assumption of a positive α was made. In the model, this parameter captures the return on investment in education in an urban area. Thus, a positive value implies that the return is higher in a city, given the assumption made in the model that the return on investment in education is zero in a rural area. If α were zero, migrants would obtain the same level of earnings as non-migrants, δ, and, thus, have no incentive to migrate. In this sense, the higher return on investment in education in an urban area drives rural-to-urban migration in this model.

Knowing the optimal level of education and preferred occupation chosen in cities, agents decide to migrate if and only if the net gains from migration are positive. The model potentially generates multiple equilibria regarding those that migrate, and their level of education and preferred occupation. As delineating all potential equilibria is outside the scope of this paper, the focus is on a certain type of equilibrium, namely that in which agents are credit-constrained, by hereinafter assuming

$$\frac{m - \rho}{\gamma} < \bar{s}_u \leq \hat{s}, \tag{5}$$

and

$$\frac{(1 + r)m}{\alpha} < 1 + \frac{2(m - \rho)}{\gamma}, \tag{6}$$

where $\hat{s} \equiv \frac{-\gamma + \sqrt{\gamma^2 - 4\beta(\rho - m) + (\frac{2\alpha}{1+r})^2}}{2\beta}$ is the level of initial education below which the credit constraint is binding. The first assumption can reflect the real situation in most less developed economies, where the highest level of education attainable in the rural sector is relatively low and most rural agents are credit-constrained. The second assumption can be supported by significantly higher return on investment in education (large α) at the destination.

Given these assumptions, the following equilibrium predictions can be made.

Prediction 1 *The initially educated ($\bar{s} \in [\frac{m-\rho}{\gamma}, \bar{s}_u]$) are willing to migrate (positive selection into migration).*

Prediction 2 *Initially better-educated agents acquire more years of additional education (For non-migrants, $\Delta s^* = 0$. For migrants, $\Delta s^* \geq 0$ and $d\Delta s^*/d\bar{s} > 0$) (positive selection into education).*

Prediction 3 *Initially better-educated agents choose higher-income occupations (For non-migrants, $q^* = 0$ and $y_r^* = \delta$. For migrants, $q^* \geq 1 + \frac{m-\rho}{\gamma}$, $y_u^* > y_r^*$, $dq^*/d\bar{s} > 0$, and $dy_u^*/d\bar{s} > 0$).*

The prediction 1 is empirically supported by many authors (Barnum and Sabot, 1977; Lanzona, 1998; Robinson and Tomes, 1982; McKenzie et al., 2010). Whilst testing these predictions is not the aim of this paper, these are consistent with the data, as seen in subsection 4.4.

2.2 Migration for Jobs after Completing Education

In addition to the mobility described in the preceding subsection 2.1, another type of mobility can also relate the educational attainment to migration. It is recognized that people move to cities after they acquire in the rural sector skills necessary to succeed at their destination. As explained in Appendix A.2, the equilibrium in this type of mobility can easily be shown by slightly changing the model structure, whereby opportunities for learning are supplied only in the rural sector with the remaining assumptions unchanged. Hence, if agents prefer to migrate, they simply choose occupations in cities, based on the human capital they would import from their origins. On the other hand, in the rural sector, they have to choose between engaging in self-employed farming and migrating after completing the education valued in the urban sector. The equilibrium predictions of this new model structure are exactly the same as those in the previous mobility (i.e., migration for education).

2.3 From Theory to Empirics

It is shown from the model that while higher earnings can be achieved by migrating, it, in itself, does not guarantee the expected gains, which are driven by education. Moreover, the education generates the gains because the rate of return on education is higher in an urban area, compared to a rural area. These thus point towards the notion that the migration effect is, in fact, the educational effect, which is more apparent when the earnings of agents are written in the form of

$$y^* = \underbrace{\alpha\left(2+\frac{1}{s^*}\right) \times \quad s^* \times M}_{\text{Migration effect}} \quad + \quad \delta, \tag{7}$$

where M is a migration dummy, equal to one for a migrant and zero otherwise. This equation presents that the gains from migration are small for the less educated, and that clearly, the positive α is a source of increased migrants' earnings. Taking this together with the above equilibrium predictions, the model eventually suggests that

Claim *If the migration premium is entirely attributed to the higher return on investment in education at the destination, no direct effect of migration on outcomes (income and consumption) would exist after controlling for the current level of education and allowing for the difference in the return on investment in education between the origin and the destination. Then, uneducated individuals would not migrate. On the other hand, if a significant migration effect remains even after controlling for education in an outcome equation, it would suggest that an individual's limited investment in education may not play a major role in preventing the internal migration.*

This is an underlying presupposition formally established in the model, which validates empirically exploring the contribution of education in the migration premium for the question of why not more people migrate, given so high premium.

3 Empirical Strategy

The empirical goal of this paper is to show to what extent the migration premium can be explained by education. This section outlines the empirical strategy chosen for testing this. Throughout the section, it is assumed that migration occurs between periods t and $t+1$ and that the effect is

realized in the period $t+1$. In the subsequent empirical analysis, the framework is fitted to waves 1 and 5 of the data set used. Equation (7) suggests the need to estimate the following earnings function (whereby the framework can directly be applied to consumption),

$$\log y_{it+1} = \alpha_0 + \alpha_1 M_{it+1} + \alpha_2 s_{it+1} M_{it+1} + \alpha_3 s_{it+1} + \alpha'_{\mathbf{y}} \mathbf{z}_{\mathbf{y}} + \epsilon_{it+1}, \tag{8}$$

where y_{it+1} is an individual i's earnings in the period $t+1$; M_{it+1} takes the value of one if he/she lives outside the original community in the period $t+1$ and zero otherwise (note that $M_{it} = 0$ for everyone); s_{i+1} is his/her attained educational level (years); vector $\mathbf{z}_{\mathbf{y}}$ contains other determinants of earnings, such as age and gender; and ϵ_{it+1} is a stochastic error. To the extent that the gains from migration are entirely attributed to the higher return on investment in education at the destination, it can be expected that $\alpha_1 = 0$ and $\alpha_2 > 0$.

Empirical difficulty arises from the potential correlation between ϵ_{it+1} and M_{it+1}, s_{it+1}, and/or $s_{it+1}M_{it+1}$, because migration and education are structurally determined, as suggested in Section 2 and are thus endogenous. Suppose that this potential correlation stems from any unobserved time-invariant factors contained in the stochastic error ϵ_{it+1} (e.g., ability not only to achieve higher level of education and earnings but also to migrate), taking the first difference of (8) can solve this problem as

$$\Delta \log y_{it+1} = \alpha_0 + \alpha_1 M_{it+1} + \alpha_2 s_{it+1} M_{it+1} + \alpha_3 \Delta s_{it+1} + \alpha'_{\mathbf{y}} \mathbf{\Delta z}_{\mathbf{y}} + \Delta \epsilon_{it+1}. \tag{9}$$

This is a standard differences-in-differences (DID) specification (Wooldridge, 2002. p.284). If time-varying components in ϵ_{it+1} correlate with migration and education in the earnings function, however, the differenced stochastic error in (9) will still have correlation with them. Since there is more than 10-year gap between waves 1 and 5, this is quite likely.

One possible solution to this problem is to use an instrumental variable. Since the KHDS data is comprehensive, finding variables that can explain M_{it+1} and s_{it+1} with strong power might be possible. As reported in Appendix Table 7, for example, estimating the probability of migration shows that the young in wave 1 living in a village that experienced the rainfall shock were more likely to migrate. Similarly, being the household head or spouse in wave 1 reduced the probability of migration. Finally, young females in wave 1 showed a greater propensity to migrate as a result of their marriage. Regarding educational attainment, the data also suggested that, in wave 1, the young with better educated parents have achieved higher level of education by wave 5. Although these variables might arguably be able to satisfy exclusion restriction, it is still difficult to find good instruments for $s_{it+1}M_{it+1}$. One might want to instrument $s_{it+1}M_{it+1}$ with the interactions between two separate instruments for s_{it+1} and M_{it+1}. Since this makes predicted values of M_{it+1}, s_{it+1} and $s_{it+1}M_{it+1}$ highly correlated, however, it is not an optimal strategy for the current study.

Alternatively, it is possible to control for original household heterogeneity by including over 800 dummies for initial households in equation (9). Whilst the estimation result, which uses within initial household variation, might not entirely be free from the endogeneity bias, controlling for attributes specific to a migrant's original household in the growth equation is likely to absorb a major source of potential bias. As a matter of fact, when Beegle et al. (2011) estimated the impact of migration on consumption growth by applying an impact evaluation approach to the KHDS data, the authors did not find a significant difference in the estimated migration effect between DID-OLS and DID-2SLS after controlling for the initial household fixed effects in the

growth equation. With a control of the growth fixed effects, it appears that migrants are randomly selected at least in the growth equation of consumption.

4 Data

The data used in this paper is drawn from the Kagera Health and Development Survey (KHDS). The KHDS is a longitudinal household panel survey that consists of five waves[8] and started in the rural region in northwest Tanzania, Kagera, as a part of a research project on adult mortality in Sub-Saharan Africa launched by the World Bank in 1991.

The first four surveys were conducted between 1991 and 1994 at 6- or 7-month intervals. With stratification based on geography and mortality risk, the KHDS sample households were randomly drawn from the 1988 Tanzanian Census. Since the chosen sampling procedure eventually generated a sample where households with a high risk of an adult death were overweighted, the findings reported in the subsequent sections should be treated with caution for generalization when those health characteristics affect the decision of migration, the choice of occupations, and the attainment of education. Based upon the sampling strategy, a total of 840 households were interviewed in the first wave, with the 759 households continuously contacted in the subsequent three waves. Since, in the subsequent three waves, the households that left the study were replaced, the first four waves eventually covered 912 households in total.

After a 10-year gap from wave 4, approximately 91% of the 912 baseline households were recontacted in 2004 (wave 5), even if located outside their original villages. The significantly high recontact rate is one of many successes and contributions of this long-term panel survey. When previous members moved out of their original households, their new households were traced. This exercise generated 2719 household surveys in wave 5, based on the original 832 recontacted households. Of the 2719 households, only half stayed in the village they resided in 10 years previously. This suggests a substantial demographic mobility in this region during one decade.

While the KHDS is a household panel survey, it allowed constructing unbalanced panel data from wave 1 to 5 at individual level, as the survey collected the information of all household members in all waves. It was noted that the rate of sample attrition in the KHDS was very low even on an individual basis. Based upon the careful examination of sample attrition by Beegle et al. (2011), excluding individuals that died, about 82% of 5394 original respondents interviewed in the first four waves were successfully recontacted in wave 5.

Throughout the waves, a standardized survey questionnaire was used, although several changes were made in wave 5. This allows collected information to be highly comparable across waves. In addition, the data contains a variety of information related to a household and its members, such as education, health conditions, income-generating activities (e.g., hours worked, earnings), economic shocks, and expenditures, which makes the KHDS highly valuable resource for an empirical study.

4.1 Migration

In this study, migrants are defined as those that changed residence by year 2004, which corresponds to wave 5. Since the strategy does not include respondents that migrated during the sample periods

[8] Wave 1, September 1991 to May 1992; wave 2, April 1992 to November 1992; wave 3, November 1992 to May 1993; wave 4, June 1993 to January 1994; wave 5, January 2004 to August 2004.

but did not participate in wave 5,[9] the sample is limited only to respondents that participated in both wave 5 and one of the earlier four waves. In this paper, these individuals are referred to as 'panel individuals'. In other words, respondents interviewed only in the earlier four waves and new respondents interviewed only in wave 5 are excluded from the analysis,[10] leaving 4476 panel individuals in this study. Of those panel individuals, 1644 moved out of their original communities between 1991 and 2004 and are referred to as migrants. In addition, migrants can be split into those who moved out of their community, but remained within Kagera (1289 internal migrants) and those that moved further away (355 external migrants), i.e. elsewhere in Tanzania and Uganda.[11]

Whilst not reported here, data show that approximately 51% and 27% of internal migrants moved out of their original communities between the ages of 7 to 20 years and 21 to 30 years, respectively. The corresponding figures for external migrants are about 55% and 27%. In addition, the distribution of migrants was analyzed by year of migration. As shown in Figure 1, they are distributed over the entire sample periods with reasonable variation, although 1994 is seen as the peak year of migration in data, which may be related to an economic trough in that year. As the survey followed the same individuals over the 13-year period, it is likely that migrants were mostly young at the start of the KHDS.

[Here, Figure 1]

4.2 Occupational Mobility

While Kagera is a rural area, it has seemingly been difficult for people only to survive on self-employed farming. Figure 2 plots each income-generating activity's share of weekly hours worked in total by migration status. In all groups of panel individuals, farming self-employment gradually lost the leading position, whereas non-farm wage employment and non-farm self-employed businesses started to become more important.[12] In particular, external migrants spend more than 90% of total hours worked on non-farm wage employment and non-farm self-employment in wave 5 and, as a result, farming self-employment ceased to be a primary income source.

However, Figure 2 does not allow to distinguish between two potential mechanisms driving this trend. For example, panel workers across age groups may uniformly be moving away from farming self-employment to non-farm activities. Alternatively, only new participants in a labor market (i.e., those that were children in wave 1) might exclusively be entering into non-farm employment once they become working-age adults, whereas the previous elderly did not change the type of jobs that they engaged in. More careful examination of data, which is available from the author, supports the latter explanation.

[Here, Figure 2]

[9] Attrition could happen for several reasons, e.g., the difficulty in tracing individuals, or death of the previous elderly. See Beegle et al. (2011) for the issue of sample attrition in the KHDS.

[10] Approximately 22% of a total of 23,915 observations of person-wave units in all five waves, excluding new respondents in wave 5, were removed from the data set.

[11] Those who migrated to other countries were not traced, although there were not too many.

[12] One caution regarding the trend in the early 1990s is that part of the occupational mobility may be generated by an individual's response to economic recession (income smoothing) (Kochar, 1999). This supposition may be supported by the fact that the proportion of new non-farm businesses (aged 3 months below) was greater in waves 2 to 4, compared to other two waves.

4.3 Welfare Changes

Following Beegle et al. (2011), this study uses per capita annual consumption, the average of the total annual consumption of a household, as a primary individual welfare measure. In addition to this consumption measure, the KHDS enabled the construction of two income measures - per worker weekly income, which is computed as the sum of wage earnings, farming self-employment income, and non-farm self-employment income for panel individuals aged 7 years or older; and per capita weekly income, which is the average of the total weekly income of a household. After careful examination of data, however, it was evident that migrants' earnings were measured with excessive noise in wave 5 to be tenable to an empirical analysis. Consequently, the subsequent analysis applies the analytical framework presented in Section 3 to consumption only.

In contrast to the income measures, the gains from migration might only indirectly be reflected in consumption, provided that those gains are transitory to migrants' earnings. As it appears that most migrants in this study moved out of their original communities in their youth with strong determination to live long and succeed at the destination, however, the shock to migrants' earnings is more likely to be permanent. In this case, consumption could be a plausible proxy for earnings. Another concern regarding using consumption arises from the possibility that rural households might diversify income risks by letting some of their members migrate from their original villages (e.g., Stark, 1981; Stark and Levhari, 1982; Rosenzweig and Stark, 1989). If income gains from migration are shared with migrants' original families through the form of remittances, using the consumption measure implicitly underestimates the gains from migration. Thus, in order to mitigate this potential problem, the subsequent analysis includes remittance expenditures in consumption.

Since the economic recession in the early 1990s, which followed the second oil shock and the subsequent world recession, the Tanzanian economy has been recording a consolidating economic improvement. While Kagera is one of the remotest regions from the administrative centre of Dar es Salaam, a similar economic trend can be seen in the data reported in Table 1. The mean of per capita annual consumption declines from wave 1 to 4, increasing in wave 5. The pattern is consistent with the movement of national GDP.[13] While there is almost no change in non-migrants' consumption between waves 1 and 5, migrants have achieved positive growth. In particular, the consumption growth of external migrants is outstanding, as the level has more than doubled from wave 1 to 5. As a result, external migrants enjoy a higher level of consumption than do internal migrants in wave 5, who, in turn, enjoy a higher level compared to non-migrants.

[Here, Table 1]

4.4 Goodness of Fit of the Theoretical Model to Data

This paper aims to answer the question of why migration is not more prevalent by estimating equation (8). This approach is based upon the presupposition derived from the theoretical model presented in Section 2. However, if the model cannot describe the empirical data with satisfactory fit, there is danger in estimating a completely meaningless empirical equation, as well as misinterpreting the estimation results. While the purpose of this study is not to prove the model, this

[13] According to World Economic Outlook Database (IMF, September 2004), GDP per capita gradually declined from 1990 to 1994 and has been recording a continuous growth since then (as of 2005) - `http://www.imf.org/external/pubs/ft/weo/2004/02/data/`.

section reports on checks performed in order to verify whether the data bear several assumptions and predictions explained in the theory. In the model, it was assumed that (1) the return on investment in education was higher at the destination than was at the origin and (2) the initial educational level was positively correlated with the pre-migration level of wealth. The model also showed that (3) at equilibrium, in which a credit constraint was binding, those who were initially educated were more likely to migrate (positive selection into migration); (4) those who were initially educated were more likely to invest in further education (positive selection into education); (5) some individuals chose to migrate in order to attain further education, whereas others migrated after obtaining it; and (6) those who were initially educated would be better off in the end. The assumption (1) is a part of the hypothesis tested in this paper, and is thus discussed in Section 5. The other assumptions and predictions are briefly checked in this subsection before moving onto estimation results.

Since the data set contains several indicators of wealth, such as non-food expenditures, land area cultivated by households, household livestock, and household capital for farming (e.g., farm buildings, hand mills, tractors) and non-farming (e.g., buildings, vehicles, bicycles, tools), a simple way of testing for presence of positive correlation between the pre-migration educational level and wealth is to regress these wealth variables on either individual or household average education by exploiting data in wave 1. However, as there is a large number of missing observations for the livestock and capital stocks, this exercise was possible only for the non-food expenditures and cultivated land. The log of per capita non-food consumption and land area cultivated by households, measured by acres, were estimated in Appendix Table 6, where an individual's education is measured by years based upon the highest grade that he/she completed by the time of each wave. Firstly, the significantly positive correlation between the pre-migration level of non-food consumption and education was identified in columns (a) and (b). Using the log of per capita consumption as a dependent variable also identified the strong positive correlation in columns (c) and (d). Turning to the cultivated land area, columns (e) and (f) show that it positively correlates with the pre-migration level of education with the conventional level of significance.

In Table 2, panel respondents who were interviewed in both waves 1 and 5 are categorized by age in wave 1 and migration status to see how both the initial completed level and the subsequent attainment of education (years) are related to migration. It can be seen from the table that migrants in wave 5 are more educated than non-migrants and that this is true even before they migrate. With the exception of the youngest cohort in wave 5, a clear positive trend in the level of education from external migrants to non-migrants exists in both waves and in all age categories. In addition, it seems that external migrants under the age of 20 years in wave 1 have acquired a greater amount of new skills and knowledge over time than did non-migrants and internal migrants. For example, the mean number of attained years of education was 5.7 for external migrants aged 7 to 15 in wave 1, which is more than one year longer than that of non-migrants and internal migrants. Similarly, external migrants' educational attainment was 1.4 years in the age category of 16 to 20 years, whereas that of non-migrants and internal migrants was less than one year. These observations are broadly compatible with the above predictions (3) and (4). More formally, the estimation results in Appendix Table 7 also support these predictions.

As data presented in Table 2 does not indicate when (before or after migration) and, hence, where (origin or destination) migrants have acquired the additional education. Thus, in order to

establish this, we compared the reasons for migration of those who have acquired education greater than the mean attainment of non-migrants and those who have not, and this is shown in Table 3. About a quarter of external migrants in the group of greater educational attainment migrated for the purpose of attaining further education, which is the most important reason for this group of migrants (column (c)). On the other hand, migration for sole purpose of gaining education is less important for internal migrants (column (a)). The table suggests that most internal migrants who acquired greater education during the sample periods moved out after completing schooling in their origins. This difference between internal and external migrants can broadly be mirrored in the two types of mobility described in the above prediction (5).

It was shown in subsection 4.3 that external migrants were better off than were internal migrants in wave 5, as well as that internal migrants were better off than non-migrants in terms of consumption. Table 2 also shows that there was a clear declining trend in the pre-migration level of education, from external migrants to non-migrants in each age cohort. These observations point to the above prediction (6).

[Here, Tables 2 and 3]

5 Estimation Results

Pooling migrants into one group, columns (a) and (b) in Table 4 report the estimation result of (9) with either initial village fixed effects or initial household fixed effects. After controlling for education and allowing for the difference in the return on investment in education between migrants' origin and destination, no significant migration effect was found. As anticipated, the return on an additional year of schooling is higher at migrants' destination by about 3-4%. As an individual's consumption is measured through the level of household average in this paper, alternatively, columns (c) and (d) exploited the average level of household education as a proxy for an individual's education. Implications from the analysis are unchanged, i.e. there is no migration premium. In these columns, one additional year of educational attainment (in terms of household average) now adds about 10 percentage points to migrants' consumption, which almost doubles non-migrants' return on investment in education. As the sample mean of migrants' education is 5.95 years (4.36 years in case of household average) in wave 5, these results suggest that migrating out with this level of education can result in an increase in consumption of approximately 21-25 percentage points.[14] No migration premium with higher return on investment in education at the destination suggests that those who have no education will choose not to migrate.

Migrants are split into two groups in columns (e) and (f). In case of internal migration, as before, there is no significant migration effect and the return on investment in migrants' education is higher than that of non-migrants. Regarding external migration, education is, again, more valuable at the destination, although the significance is rather weak, probably due to a relatively small number of external migrants (just about 7% of total observations). In contrast to internal migration, however, a large significant effect of external migration remains. This suggests that limited educational attainment only partly plays a role in preventing external migration. Using the average level of household education hardly affects these findings in columns (g) and (h). With 5.63 (individual level) and 3.95 (household average) years of the mean level of internal migrants'

[14] In column (b), for example, 0.036×5.95 years ≈ 0.21, whereas 0.057×4.36 years ≈ 0.25 in column (d).

education in wave 5 (7.01 and 5.73 years for external migrants, respectively), these results suggest that internal (external) migrants achieve consumption growth by about 17% (20-25%) if they migrate with the mean level of education.

The remaining premium associated with external migration might be due to the analysis not accounting for the heterogeneity of migrants. Table 5 groups migrants by destination in order to reveal the reasons for migration. At both destinations, marriage is a primary reason for the migration of females. On the other hand, economic motives largely appear to drive the migration of males. Seeking business opportunities and better jobs are the key reasons for external migration of males. The lack of arable land is also an important reason for internal male migrants. The recent increase in population in this region might have caused this trend (Mitti and Rweyemamu, 2001). Seeking a higher level of education is another common reason for external migration, accounting for about 15% of the movement of such migrants. Pooling internal and external migrants, about 48% of male migrants moved for economic or educational reasons, whereas about 47% of female migrants moved for marriage. Apart from natural disasters, it seems that marriage, economic motives, and education are key factors driving an individual's self-selection into migration.

As the analytical framework adopted in this paper is based upon economic or educational migration, migrants that moved for the purpose of marriage were excluded in Appendix Table 8 as a robustness check.[15] The estimation results are almost unaffected. Even after limiting the number of migrants, it seems that education does not fully account for the gains from external migration.

Similarly, another exercise excluded migrants aged 20 years or above in wave 1, given that the analytical framework in this paper is more likely to be true of young respondents at baseline, which did not make difference in implications from the analysis, however (Appendix Table 9).

The higher return on some non-education capital at the destination, which rural agents need to succeed, may account for the remaining premium of external migration. In case of wage jobs, for example, non-cognitive skills, such as dependability, self-discipline, persistence, sociability and docility may be valued at the destination (e.g., Heckman et al., 2006). Starting and running a non-farm self-employed business may also require a broad range of resources, including facilities and personal capabilities (e.g., self-determination, business acumen). Our findings show an interesting education-distance trade-off, whereby education can fully explain the gains associated with internal migration, but only partly those of external migration. This trade-off suggests that acquiring any capital, other than education, becomes more important if rural agents migrate farther away from their origin. Since it appears that destination located at a greater distance from the origin is more developed and offers jobs that require complex skills and technologies, this trade-off might highlight the importance of having skills not simply attained through acquiring formal education and/or physical capital (as well as education) in case of long-distance migration. Alternatively, social capital (e.g., friends and relatives living at the destination) that can provide rural agents with adequate information about destination markets may also be rewarded at the destination (Munshi, 2003; Yamauchi and Tanabe, 2008). Given that the more distant the destination is, the more uncertain rural agents are about earnings opportunities at the destination, the trade-off might underscore the role of social capital in mitigating information asymmetry between the origin and the destination. Exploring these alternatives can be a topic for future research.

[15] Whilst not reported here, another exercise excluded migrants forced to relocate due to natural disasters as well as migrants solely motivated by marriage. Implications remained unchanged.

[Here, Tables 4 and 5]

6 Conclusion

While the impact evaluation approach can give us a reduced-from interpretation of migration effect, it fails to answer an important question of why migration is not more widespread if it provides such high returns. Using long-term household panel data drawn from rural Tanzania, this paper attempted to answer this question by exploring to what extent the migration premium can be explained by education. Initially, it was expected that, if the premium is eliminated by controlling for the current level of education and allowing for the difference in the return on investment in education between migrants' origin and destination in an outcome equation, those uneducated individuals would choose not to migrate. On the other hand, if a significant migration effect remains, despite the presence of a full set of controls, the evidence would indicate that limited investment in education might not be a major factor in preventing internal mobility from becoming a source of raising welfare.

Identifying the returns on migration and investment in education in an outcome equation is a hard empirical task because migration and education are structurally determined and thus endogeneous. To address this endogeneity, this study took a differences-in-differences approach with a control of initial household fixed effects. Separating migrants into those who moved out of original villages but remained within Kagera and those that left Kagera, we found that, in consumption, the return on investment in education was, indeed, higher at both destinations and that higher returns fully explained the gains from internal migration but only partly explained those associated with external migration. These findings suggest that welfare opportunities are higher at the destination and that an individual's limited investment in education plays a major role in preventing short-distance migration, but not long-distance migration. While education plays a role, other mechanisms may prohibit rural agents from exploiting the arbitrage opportunity when they migrate to the destination located at a great distance from their origin.

Apart from general equilibrium effects, these findings yield two closely related policy implications regarding the distribution of welfare and population in an economy. Firstly, providing rural peasants with small credit, just enough to cover the cost of resettlement without relaxing their constraint to invest in education, may not considerably influence the distribution. This is because successful migration has to be associated with sufficient investment in education. Secondly, while promoting rural agents' educational attainment can, indeed, change the distribution pattern by encouraging their migration, the impact may be limited when they relocate to highly advanced areas. In the context of this study, moving outside Kagera was seen as migrating to more developed areas, compared to those internal migrants could choose as their destination. Our findings showed an interesting trade-off between the importance of education and the distance to the destination. This might highlight that having a variety of capital (e.g., skills not measured by education, business facilities, or social networks), as well as education, becomes more important as migrants move to the destination at a greater distance from their origin.

A Appendix: Model in Section 2

A.1 Solution of the Model in Section 2.1

A.1.1 Migrants' Occupation and Schooling Decision

In the urban economy, migrants choose their occupations and new skills they acquire, so their decision problem could be

$$\max_{\{q,s\}} \quad \alpha\left[2q-(q-s)^2\right]+\delta-\beta(s^2-\bar{s}^2)-m+r[\gamma\bar{s}+\rho-m-\beta(s^2-\bar{s}^2)] \tag{A.1}$$

subject to $\Delta s \geq 0$ (non-negativity constraint of additional schooling, $\Delta s \equiv s-\bar{s}$) and $m+\beta(s^2-\bar{s}^2) \leq \gamma\bar{s}+\rho$ (credit constraint).

As already described in subsection 2.1.4, firstly, note that given obtained human capital (s), an optimal occupation simply maximizes migrants' labor income; thus $q^*=1+s^*$.

The first order condition of migrants' schooling decision is

$$\underbrace{\frac{\partial y_u}{\partial s}}_{\text{MB of schooling}} = \underbrace{2\beta s}_{\text{MC of schooling (direct cost)}} + \underbrace{2\beta r s}_{\text{MC of schooling (opportunity cost)}} - \lambda_1 + 2\beta\lambda_2 s, \tag{A.2}$$

where $\lambda_1 \geq 0$ and $\lambda_2 \geq 0$ are Lagrange multipliers for the non-negativity constraint of additional schooling and credit constraint, respectively. Marginal benefit and marginal cost are abbreviated as "MB" and "MC," respectively. The marginal cost of schooling includes the opportunity cost of foregone interest income, as well as direct cost (e.g., tuition fees). Appendix Figure 3 precisely shows the entire path of the optimal value of occupation, schooling, and additional schooling of migrants, where $\hat{s} \equiv \frac{-\gamma+\sqrt{\gamma^2-4\beta(\rho-m)+(\frac{2\alpha}{1+r})^2}}{2\beta}$.[16] When $\bar{s} \in [0, \frac{m-\rho}{\gamma})$, no one can afford the cost of migration, m; therefore, the figure omits this group of people from the optimal path.

Suppose a migrant's initial level of schooling is in the interval $\bar{s} \in (\frac{m-\rho}{\gamma}, \hat{s}]$, the marginal benefit of schooling is greater than the marginal cost of schooling, $\frac{\partial y_u}{\partial s} > 2\beta s + 2\beta r s$. Thus, migrants are willing to obtain additional education, leading them to higher income jobs. However, since they do not have sufficient wealth to achieve the schooling level of their first best, they attempt to obtain as much additional education as possible ($\lambda_1 = 0$, $\lambda_2 > 0$). As a result, migrants acquire more new skills to get higher income jobs, as they are initially more educated (wealthier). In the interval $\bar{s} \in (\hat{s}, \frac{\alpha}{\beta(1+r)}]$, migrants are no longer credit constrained ($\lambda_1 = 0$, $\lambda_2 = 0$). Everybody whose initial level of schooling falls in this range acquires new skills to achieve the same level of education $\frac{\alpha}{\beta(1+r)}$ and to choose the same level of occupation $1+\frac{\alpha}{\beta(1+r)}$, so that $\frac{\partial y_u}{\partial s} = 2\beta s + 2\beta r s$. Since the optimal level of schooling is the same between migrants, their educational attainment is smaller, as they are initially more educated. In the case where $\bar{s} \in (\frac{\alpha}{\beta(1+r)}, \infty)$, the marginal cost of attaining additional education is significantly large, $\frac{\partial y_u}{\partial s} < 2\beta s + 2\beta r s$ because they are already highly educated in the rural economy. Then, they optimally choose not to acquire new skills and select occupations in accordance with their initial level of schooling ($\lambda_1 > 0$, $\lambda_2 = 0$).

[16] Optimal solutions of q^*, s^*, and Δs^* are

$$(q^*, s^*, \Delta s^*) = \begin{cases} (1+\frac{m-\rho}{\gamma}, \frac{m-\rho}{\gamma}, 0) & \text{for } \bar{s} = \frac{m-\rho}{\gamma} \\ (1+\sqrt{\frac{\beta\bar{s}^2+\gamma\bar{s}+\rho-m}{\beta}}, \sqrt{\frac{\beta\bar{s}^2+\gamma\bar{s}+\rho-m}{\beta}}, \sqrt{\frac{\beta\bar{s}^2+\gamma\bar{s}+\rho-m}{\beta}}-\bar{s}) & \forall\ \bar{s} \in \left(\frac{m-\rho}{\gamma}, \hat{s}\right] \\ (1+\frac{\alpha}{\beta(1+r)}, \frac{\alpha}{\beta(1+r)}, \frac{\alpha}{\beta(1+r)}-\bar{s}) & \forall\ \bar{s} \in \left(\hat{s}, \frac{\alpha}{\beta(1+r)}\right] \\ (1+\bar{s}, \bar{s}, 0) & \forall\ \bar{s} \in \left(\frac{\alpha}{\beta(1+r)}, \infty\right) . \end{cases}$$

This diversity in the relationship between the initial level of schooling and the optimal behavior avoids providing an unique answer for the question of whether it is the more (or less) educated in the rural economy who attain more additional education in cities, depending on where $\bar{s}_u$ is located in the distribution of the initial schooling. To the extent that $\frac{m-\rho}{\gamma} < \bar{s}_u \leq \hat{s}$, then it will be those in the upper tail of the distribution $\bar{s} \in (\frac{m-\rho}{\gamma}, \bar{s}_u]$ who acquire more new skills in the urban sector. To the contrary, if $\frac{\alpha}{\beta(1+r)} < \bar{s}_u$, those who are relatively educated at the origin $\bar{s} \in (\frac{\alpha}{\beta(1+r)}, \bar{s}_u]$ will be reluctant to attain additional education once they migrate. In the case where $\hat{s} < \bar{s}_u \leq \frac{\alpha}{\beta(1+r)}$, migrants who are initially in the intermediate level of schooling distribution are more likely to acquire new skills. All these possibilities, together with the migration decision explained in the next subsection, potentially generate multiple equilibria regarding those that migrate, and their level of education and preferred occupation. While it might not be impossible to describe them comprehensively, doing so is outside the scope of this paper. In the main body of this paper, thus, the focus was on a certain type of equilibrium, namely that in which agents are credit-constrained, by assuming that $\frac{m-\rho}{\gamma} < \bar{s}_u \leq \hat{s}$. However, this should not be interpreted as an artifact just for computational reasons. Rather, this reflects the real situation in most less developed countries, where the highest level of education attainable in the rural sector is relatively low.

[Here, Appendix Figure 3]

A.1.2 Selection into Migration

Knowing the optimal level of education and preferred occupation chosen in cities, agents will decide to migrate if and only if the net gains from migration, $v^*(\bar{s})$, are positive:

$$v^*(\bar{s}) = y_u^* - y_r^* - \underbrace{\beta(s^{*2} - \bar{s}^2)}_{\text{Direct cost of schooling}} - \underbrace{m}_{\text{Moving cost}} - \underbrace{r\beta(s^{*2} - \bar{s}^2)}_{\text{Opportunity cost of schooling}} - \underbrace{rm}_{\text{Opportunity cost of movement}} > 0 \quad \text{(A.3)}$$

where $y_u^* = \alpha\left(2 + \frac{1}{s^*}\right)s^* + \delta$ and $y_r^* = \delta$. Suppose there exists $\bar{S}_m \equiv \{\bar{s} \in R : v^*(\bar{s}) > 0\}$, an answer for the questions of who migrates and who chooses what level of occupations and education depends upon where $\bar{S}_m$ and $\bar{s}_u$ lie in the distribution of initial schooling. As already mentioned, delineating all potential equilibria is outside the scope of this paper. In subsection 2.1.4, thus, a particular equilibrium was shown by additionally assuming $\frac{(1+r)m}{\alpha} < 1 + \frac{2(m-\rho)}{\gamma}$.

A.1.3 Equilibrium

Given all assumptions made in the model, the following lemma could simplify the task to demonstrate equilibrium predictions presented in subsection 2.1.4.

Lemma *For all $\bar{s} \in \left[\frac{m-\rho}{\gamma}, \hat{s}\right]$, if an agent of type $\bar{s}'$ prefers to migrate, all agents $\bar{s} > \bar{s}'$ are strictly better-off in the urban sector.*

Proof The proof is by contradiction. See Appendix A.1.4.

Proposition *All agents $\bar{s} \geq \frac{m-\rho}{\gamma}$ optimally choose to migrate into the urban sector in equilibrium, whereas agents $\bar{s} < \frac{m-\rho}{\gamma}$ stay in the rural sector.*

Proof See Appendix A.1.4.

A.1.4 Proof

Proof of Lemma: Suppose the contrary. If an agent of type $\bar{s}'$ prefers to migrate and all agents $\bar{s} > \bar{s}'$ are weakly better-off in the rural sector, it must be that $v^*(\bar{s}') > 0$ and $v^*(\bar{s}) \leq 0$. This means that $v^*(\bar{s}') > v^*(\bar{s})$. Denoting $s^*(\bar{s}')$ as $s^{*\prime}$ and $s^*(\bar{s})$ as s^*, it can be shown that for all $\bar{s} \in \left[\frac{m-\rho}{\gamma}, \hat{s}\right]$,

$$v^*(\bar{s}') - v^*(\bar{s}) = (s^{*\prime} - s^*)\left[2\alpha - \beta(1+r)(s^{*\prime} + s^*)\right] + \beta(1+r)(\bar{s}' + \bar{s})(\bar{s}' - \bar{s}). \tag{A.4}$$

From Appendix Figure 3, it is clear that $s^{*\prime} < s^*$ and $\frac{s^{*\prime}+s^*}{2} < \frac{\alpha}{\beta(1+r)}$. Hence, this results in $v^*(\bar{s}') < v^*(\bar{s})$, which is a contradiction.

Proof of Proposition: In order to show that all agents $\bar{s} \geq \frac{m-\rho}{\gamma}$ optimally choose to migrate, it is enough to show that an agent $\bar{s} = \frac{m-\rho}{\gamma}$ is willing to migrate by lemma.

$$v^*\left(\frac{m-\rho}{\gamma}\right) = \alpha\left[1 + \frac{2(m-\rho)}{\gamma}\right] - (1+r)m. \tag{A.5}$$

Under my assumption, this is positive. Hence, all agents $\bar{s} \geq \frac{m-\rho}{\gamma}$ prefer to migrate. Also, it is straightforward that agents $\bar{s} < \frac{m-\rho}{\gamma}$ stay in the rural sector because they cannot afford the cost of migration.

To claim that this is the mobility in equilibrium, I have to ensure that parameters exist to satisfy all preceding restrictions: (a) $\frac{m-\rho}{\gamma} < \frac{\alpha}{\beta(1+r)}$, (b) $\frac{m-\rho}{\gamma} < \bar{s}_u \leq \frac{-\gamma+\sqrt{\gamma^2-4\beta(\rho-m)+(\frac{2\alpha}{1+r})^2}}{2\beta}$, and (c) $\frac{(1+r)m}{\alpha} < 1 + \frac{2(m-\rho)}{\gamma}$. Since seven unknown parameters (α, β, γ, ρ, r, m, $\bar{s}_u$) exist, it is possible to find parameters that simultaneously satisfy these restrictions.

A.2 Migration for Jobs after Completing Education

In addition to the mobility described in subsection 2.1, another type of mobility can also relate the educational attainment to migration. It is recognized that people move to cities after they acquire in the rural sector skills necessary to succeed at their destination. The equilibrium in this type of mobility can easily be shown by slightly changing the model structure, whereby opportunities for learning are supplied only in the rural sector with the remaining assumptions unchanged. Hence, if agents prefer to migrate, they simply choose occupations in cities, based on the human capital they would import from their origins. On the other hand, in the rural sector, they have to choose between engaging in self-employed farming and migrating after completing the education valued in the urban sector.

A.2.1 Migrants' Occupational Choice

Migrants' decision problem in the urban economy simply becomes

$$\max_{\{q\}} \quad \alpha\left[2q - (q - s^*)^2\right] + \delta, \tag{A.6}$$

where s^* is the equilibrium level of education imported from their origins. Solving this yields $q^* = 1 + s^*$.

A.2.2 Schooling Decision

In the rural economy, no one invests in schooling if they do not migrate, and non-migrants simply engage in self-employed farming. This is because education is not rewarded in the rural area. On the other hand, if agents prefer to migrate, they have to decide how many new skills to acquire before migrating. The decision problem is

$$\max_{\{s\}} \quad \alpha\left[2q-(q-s)^2\right]+\delta-\beta(s^2-\bar{s}^2)-m+r[\gamma\bar{s}+\rho-m-\beta(s^2-\bar{s}^2)] \tag{A.7}$$

subject to $q = 1 + s$, $\Delta s \geq 0$ and $m + \beta(s^2 - \bar{s}^2) \leq \gamma\bar{s} + \rho$.

A.2.3 Equilibrium

The solution of (A.6) and (A.7) is exactly the same as one in the previous mobility (i.e., migration for education). Given the solution, agents decide whether to migrate based upon (A.3). Thus, the equilibrium predictions are the same as before, except for migrants attaining additional education before migrating.

A.3 Uncertainty

Since the model has assumed no uncertainty, how its inclusion into the model would affect an empirical strategy drawn from the model is a natural concern. Three main uncertainties may exist, namely those with respect to the return on investment in education, gaining employment (e.g., Mountford, 1997; Beine et al., 2001), and skill matching.[17] Two words deserve mentioning. Firstly, as an agent's decision to invest in migration and education is now affected by their expectation, there is a concern that a systematic pattern about an individual's selection into migration and education predicted in the model may no longer hold. It is now possible that those who originally did not migrate in a non-stochastic world would do so, expecting to achieve higher income, or vice versa (as long as credit constraint is not binding). As seen in subsection 4.4, however, data appears to be relatively consistent with original predictions. This suggests that the expectation effect on an individual's investment decision may not be so strong to break the model's fit to the empirical data. Secondly, equation (7) may not be affected by the first two types of uncertainties, as nothing changes about the actual return realized, although migrants' education level achieved at the equilibrium differs from that in a non-stochastic world. In case of the last uncertainty, migrants may lose income if available urban jobs are limited and they failed to attain optimal education and skills required to obtain those jobs because of inaccurate information they possess. In this case, migration itself reduces earnings after controlling for education in an income equation. In fact, this can be tested by introducing a migration dummy into (7), as well as its interaction with education, although an empirical analysis rejected it.

[Here, Appendix Tables 6, 7, 8, and 9]

[17] One simple way of introducing the first uncertainty is just to use the expected value of α. Regarding the second, the model can assume that migrants can obtain jobs with some positive probability p. The third uncertainty can be introduced by changing the model structure. For example, it could be assumed that only one urban job (q_u) exists and that rural agents have only a belief about it, e.g., $N(\bar{q}, \sigma^2)$. The σ^2 will capture the accuracy of information owned by each agent.

B Appendix: Data (Not for Publication)

B.1 Sampling Procedure

With stratification based on geography and mortality risk, the KHDS sample households were randomly drawn through two stages: selection of clusters and selection of households. In the first stage, 550 geographical areas (communities) delineated by the 1988 Tanzanian Census were initially classified into eight strata defined over four agronomic zones and the level of adult mortality (high and low) in each zone. Then, six or seven communities were selected from each stratum, which generated 51 clusters (of 49 communities). In the second stage, 16 sample households were drawn from each of the 51 clusters. In order to draw the sample, households in each selected cluster were enumerated, which amounted to more than 29,000 in all selected clusters, and were sorted into two groups according to information on adult mortality and morbidity within households: sick or well. In every cluster, 14 households were finally selected at random from the sick group and 2 from the well group. See *User's Guide to the Kagera Health and Development Survey Datasets*, 2004; *Kagera Health and Development Survey* 2004 − *Basic Information Document*, 2006 for more detailed sampling design.

The first four surveys were conducted between 1991 and 1994 at 6- or 7-month intervals. Based upon the sampling strategy explained in the previous paragraph, a total of 840 households were interviewed in the first wave,[18] with the 759 households continuously contacted in the subsequent three waves. Since the subsequent three waves replaced households that dropped from the sample,[19] the first four waves eventually covered 912 households in total. By the number of interviews conducted, the 912 households can break down into: 39 households interviewed once, 45 households twice, 69 households three times, and 759 households interviewed throughout the waves.

After a 10-year gap from wave 4, approximately 91% of the 912 baseline households were recontacted in 2004 (wave 5), even if located outside their original villages. The significantly high recontact rate is one of many successes and contributions of this long-term panel survey. When previous members moved out of their original households, their new households were traced. This exercise generated 2719 household surveys in wave 5, based on the original 832 recontacted households.

B.2 Income Measurement Issues

Whilst this study constructed income measures, those measures could not be used in an empirical analysis because of excessive noise in wave 5. This section summarizes several issues in measuring earnings from the KHDS. More formal and exhaustive discussions, including empirical evidence, are available from the author.

The survey questionnaire allowed me to construct two possible income measures for each individual: per worker weekly income and per capita weekly income (average of the total labor income of a household), both of which are computed as the sum of wage earnings, farming self-employment income, and non-farm self-employment income. As the reference periods of recorded income were

[18] The 840 households consist of 816 original households selected from the enumeration based upon the sampling strategy explained in the previous paragraph (16 households × 51 clusters) and extra 24 households taken from the list of replacement. The extra sample was added when the field team sensed that some original households were likely to drop out or to provide poor information.

[19] Approximately 80% of the attrition was due to the relocation of households.

different between income generating activities in the questionnaire: 1 week for wage employment, 1 year (or 6 months in waves 2 to 4) for farming self-employment, and 2 weeks for non-farm self-employment, the time average was simply taken to compute weekly income. As opposed to wage earnings that respondents aged 7 years or older individually reported, both farming and non-farm self-employment incomes were collected on a household basis. Thus, in per worker income measure, they were assigned to each household member in proportion to hours worked on those activities in the past 7 days, which were individually reported by respondents aged 7 years or older in a different section from sections collecting household-level self-employment income.[20] As a result, per worker income measure is constructed only for panel individuals aged 7 years or older.

The two income measures show a substantial difference. In contrast to per worker income (and per capita consumption presented in Table 1), noticeably, non-migrants achieved the highest earnings in wave 5 in terms of the median of the per capita income. After the exhaustive examination of the accuracy of these income measures, I found myself seriously underestimating the income of migrants' *household* (in particular, external migrants) in wave 5 relative to its actual amount. In other words, household income (latent income) that is not contained in these income measures exists in wave 5 and this problem is more serious for migrants. To see this more formally, household (annual) consumption was regressed on household (weekly) income with the control of remittances received and other non-labor income earned in the past 6 months in Appendix Table 11. Here, households are defined as migrants in waves 1 to 4 if they supply at least one member who moved out of his original community between 1991 and 2004, and in wave 5 if they contain at least one panel migrant as a member. Suppose that a household's income is correctly measured, it is expected that the elasticity of consumption with respect to labor income is almost identical in all groups (and, probably, over time). While the estimated coefficients are relatively stable between groups in waves 1 to 4, the results show a large variation in columns (d) to (f) in wave 5. The elasticity is much smaller in migrants' regressions in wave 5 and, in particular, the null of zero correlation is not rejected in case of external migrants.

Two main reasons account for this latent income problem: firstly, given the way of constructing income measures, I systematically failed to capture household workers engaged in wage employment and non-farm self-employment due to the difference in the periodicity between income generating activities in the survey questionnaire. For example, if one does not happen to engage in those activities at the point of survey, I lose his contribution to household income, even though he usually makes a living from wage jobs or non-farm self-employed activities. In this case, I will underestimate household income more seriously as the household's main economic activities concentrate more on wage employment, and non-farm self-employment and as the access to such activities becomes more irregular. Taking into account the occupational mobility towards non-farm activities and generally episodic urban occupations, it is highly likely that I failed to capture the full extent of workers available to (in particular, external) migrants' households in wave 5. The other reason is that a relatively large number of households did not report the fortnightly income from non-farm self-employed businesses in wave 5 despite some of their members reporting positive hours worked on those activities in the past 7 days.

After recognizing these problems, I realized that per worker weekly income was more accurate than per capita income for two reasons: firstly, the latent income problem conceptually unaffects per

[20] Thus, adult and child workers are equally weighted in terms of their efficiency in the analysis.

worker income and, hence, it is accurate as long as the reported income is correct. This is because the way of constructing per worker measure ensures that collected household income is allocated only to those who actually earned it in accordance with their contribution. On the other hand, per capita income is very vulnerable to the problem. Since we are not correctly measuring earnings at the household level, neither are we at the per capita level. Secondly, I expect that per capita income measure is generally very sensitive to the demographic structure of the household. Data show that the proportion of workers is smaller in external migrants' households than in the other groups in wave 5, which implies lower per capita income. On the other hand, the size of migrants' households is smaller than that of non-migrants in wave 5 and that it is likely to increase per capita income. As a result, it seems that how the demographic structure of household influences per capita income is more complicated than I think and that it more easily detracts from the comparability between individuals and waves when there is a large heterogeneity in the household structure and the pattern of individual labor allocation between activities. In fact, I found a large number of unreasonable observations in wave 5: many migrants (in particular, external migrants) with lower per capita weekly income but higher per capita annual consumption.

Unfortunately, however, even the per worker income is still unreliable in wave 5. Firstly, per worker income does not contain many external migrants in wave 5 (approximately 3.8% of total panel workers earning income), and even when it does, external migrants' per worker income is mainly calculated from earnings information on non-farm wage activities (approximately 67% of total external migrant workers earning income), not on non-farm self-employed activities. In addition, the accuracy of measured per worker income is not guaranteed either. Whilst the results are not reported to save spaces, I estimated per worker earnings functions by activity (wage employment, farming self-employment, and non-farm self-employment), group (non-migrants, internal migrants, and external migrants), and wave (pooled waves 1 to 4 and wave 5) to test the accuracy of reported income. The estimation results suggest that migrants' earnings functions in both wage employment and non-farm self-employment are poorly identified relative to those of non-migrants in wave 5.

B.3 Descriptions of Welfare Variables

Per Capita Annual Consumption

Per capita annual consumption is the average of the total annual consumption of a household. The processed household-level consumption is publicly available and composed of food consumption (seasonal and non-seasonal) and non-food consumption (education and health expenditures, miscellaneous non-food expenditures, etc.). See *Kagera Health and Development Survey – Consumption Expenditure Data* for details at `http://www.edi-africa.com/research/khds/introduction.htm`.

Per Worker Weekly Income

Per worker weekly income is the sum of the following individual income: wage earnings, non-farm self-employment income, and farming self-employment income. The KHDS collected individual wage earnings in the past 7 days. This includes salary after deduction of all taxes, per diem allowances, bonuses, incentives, gratuities, overtime income, payment in kind, and so forth. Non-farm self-employment income is the sum of net profits from all non-farm household businesses.

This is calculated by adding the value of products consumed or used by households for their use to net cash revenues from those businesses. Since income reference periods for non-farm self-employed activities were the past 2 weeks, the time average was simply taken to compute weekly income. To construct an individual income measure, the household income was finally allocated to each household member in proportion to an individual's hours worked on those activities in the past 7 days, which were individually reported in a different section from sections collecting household-level self-employment income. Farming self-employment income is the household-level annual (or 6-month in waves 2 to 4) net profits from self-employed farming and livestock activities. This is calculated by adding the value of crops and crop- or livestock-related home products consumed or used by households or lost for some reasons (e.g., natural disasters, thefts) to net cash revenues from those activities. As in the case of non-farm self-employment income, the weekly income is the time average of annual (or 6-month) income and the household-level weekly income was assigned to each household member in proportion to an individual's hours worked on those activities in the past 7 days.

Per Capita Weekly Income

Per capita weekly income is the average of the total weekly income of a household. The household income consists of the income from the activities described before: wage employment, non-farm self-employment, and farming self-employment.

Price Index

All monetary values in this paper are transformed into baseline prices (1991 prices) by using the Laspeyres and Fisher indices, both of which are in the public domain and constructed by household-wave group. See *Kagera Health and Development Survey – Price index* for details at `http://www.edi-africa.com/research/khds/introduction.htm`.

References

Banerjee, Abhijit V. and Andrew F. Newman (1993) "Occupational Choice and the Process of Development," *Journal of Political Economy*, Vol. 101, No. 2, pp. 274-298, April.

Banerjee, Biswajit and S. M. Kanbur (1981) "On the Specification and Estimation of Macro Rural-Urban Migration Functions: With an Application to Indian Data," *Oxford Bulletin of Economics and Statistics*, Vol. 43, No. 1, pp. 7-29.

Barnum, H. N. and R. H. Sabot (1977) "Education, Employment Probabilities and Rural-Urban Migration in Tanzania," *Oxford Bulletin of Economics and Statistics*, Vol. 39, No. 2, pp. 109-126.

Bauer, Michael, Julie Chytilová, and Jonathan Morduch (forthcoming) "Behavioral Foundations of Microcredit: Experimental and Survey Evidence from Rural India," *American Economic Review*.

Beegle, Kathleen, Joachim De Weerdt, and Stefan Dercon (2008) "Migration and Economic Mobility in Tanzania: Evidence from a Tracking Survey," *Policy Research Working Paper*, Vol. 4798, December. World Bank, Development Research Group, Peverty Team.

——— (2011) "Migration and Economic Mobility in Tanzania: Evidence from a Tracking Survey," *Review of Economics and Statistics*, Vol. 93, No. 3, pp. 1010-1033.

Beine, Michel, Frédéric Docquier, and Hillel Rapoport (2001) "Brain Drain and Economic Growth: Theory and Evidence," *Journal of Development Economics*, Vol. 64, pp. 275-289.

Borjas, George J. (1987) "Self-selection and the Earnings of Immigrants," *American Economic Review*, Vol. 77, No. 4, pp. 531-553, September.

——— (1994) "The Economics of Immigration," *Journal of Economic Literature*, Vol. 32, No. 4, pp. 1667-1717, December.

Chiquiar, Daniel and Gordon H. Hanson (2005) "International Migration, Self-Selection, and the Distribution of Wages: Evidence from Mexico and the United States," *Journal of Political Economy*, Vol. 113, No. 2, pp. 239-280.

Dahl, Gordon B. (2002) "Mobility and the Return to Education: Testing a Roy Model with Multiple Markets," *Econometrica*, Vol. 70, No. 6, pp. 2367-2420, November.

Daveri, Francesco and Riccardo Faini (1999) "Where do Migrants Go?" *Oxford Economic Papers*, Vol. 51, pp. 595-622.

Dercon, Stefan and Luc Christiaensen (2011) "Consumption Risk, Technology Adoption, and Poverty Traps: Evidence from Ethiopia," *Journal of Development Economics*, Vol. 96, No. 2, pp. 159-173.

Fields, Gary S. (1975) "Rural-Urban Migration, Urban Unemployment and Underemployment, and Job-Search Activity in LDCs," *Journal of Development Economics*, Vol. 2, pp. 165-187.

Ghatak, Maitreesh and Neville Nien-Huei Jiang (2002) "A Simple Model of Inequality, Occupational Choice, and Development," *Journal of Development Economics*, Vol. 69, pp. 205-226.

Harris, John R. and Michael P. Todaro (1970) "Migration, Unemployment and Development: A Two-Sector Analysis," *American Economic Review*, Vol. 60, No. 1, pp. 126-142.

Hartog, Joop and Rainer Winkelmann (2003) "Comparing Migrants to Non-migrants: The Case of Dutch Migration to New Zealand," *Journal of Population Economics*, Vol. 16, pp. 683-705.

Heckman, James J., Jora Stixrud, and Sergio Urzua (2006) "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior," *Journal of Labor Economics*, Vol. 24, No. 3, pp. 411-482.

House, William J. and Henry Rempel (1980) "The Determinants of Interregional Migration in Kenya," *World Develoment*, Vol. 8, pp. 25-35.

Kennan, John and James R. Walker (2011) "The Effect of Expected Income on Individual Migration Decisions," *Econometrica*, Vol. 79, No. 1, pp. 211-251, January.

Kessy, Flora (2005) "Rural Income Dynamics in Kagera Region, Tanzania." A Report Prepared for the World Bank, Economic and Social Research Foundation (ESRF).

Kochar, Anjini (1999) "Smoothing Consumption by Smoothing Income: Hours-of-Work Response to Idiosyncratic Agricultural Shocks in Rural India," *Review of Economics and Statistics*, Vol. 81, No. 1, pp. 50-61, February.

Lanzona, Leonardo A. (1998) "Migration, Self-selection and Earnings in Philippine Rural Communities," *Journal of Development Economics*, Vol. 56, pp. 27-50.

Lucas, Robert E. B. and Oded Stark (1985) "Motivations to Remit: Evidence from Botswana," *Journal of Political Economy*, Vol. 93, No. 5, pp. 901-918.

McKenzie, David, John Gibson, and Steven Stillman (2006) "How Important is Selection?: Experimental vs Non-experimental Measures of the Income Gains from Migration," March. University of Waikato, Deparment of Economics, Working Paper in Economics 3/06.

McKenzie, David, Steven Stillman, and John Gibson (2010) "How Important is Selection? Experimental vs. Non-Experimental Measures of the Income Gains from Migration," *Journal of the European Economic Association*, Vol. 8, No. 4, pp. 913-945, June.

McKenzie, David and John Gibson (2010) "The Development Impact of a Best Practice Seasonal Woker Policy," *World Bank Policy Research Woking Paper*, Vol. 5488, November. World Bank, Development Research Group, Finance and Private Sector Development Team.

McKenzie, David and Hillel Rapoport (2007) "Network Effects and Dynamics of Migration and Inequality: Theory and Evidence from Mexico," *Journal of Development Economics*, Vol. 84, pp. 1-24.

Mitti, Respichius D. and Thadeus G. Rweyemamu (2001) "A Socio-Economic Profile of Nyakatoke," January. mimeo.

Mountford, Andrew (1997) "Can a Brain Drain be Good for Growth in the Source Economy?" *Journal of Development Economics*, Vol. 53, pp. 287-303.

Munshi, Kaivan (2003) "Networks in the Modern Economy: Mexican Migrants in the U.S. Labor Market," *Quarterly Journal of Economics*, pp. 549-599, May.

Robinson, Chris and Nigel Tomes (1982) "Self-selection and Interprovincial Migration in Canada," *Canadian Journal of Economics*, Vol. 15, No. 3, pp. 474-502.

Rosenzweig, Mark R. and Oded Stark (1989) "Consumption Smoothing, Migration, and Marriage: Evidence from Rural India," *Journal of Political Economy*, Vol. 97, No. 4, pp. 905-926, August.

Stark, Oded (1981) "On the Optimal Choice of Capital Intensity in LDCs with Migration," *Journal of Development Economics*, Vol. 9, pp. 31-41.

——— (1982) "Research on Rural-to-urban Migration in LDCs: The Confusion Frontier and why We Should Pause to Rethink Afresh," *World Develoment*, Vol. 10, No. 1, pp. 63-70.

Stark, Oded and David Levhari (1982) "On Migration and Risk in LDCs," *Economic Development and Cultural Change*, Vol. 31, No. 1, pp. 191-196, October.

Suri, Tanveet (2011) "Selection and Comparative Advantage in Technology Adoption," *Econometrica*, Vol. 79, No. 1, pp. 159-209, January.

Todaro, Michael P. (1969) "A Model of Labor Migration and Urban Unemployment in Less Developed Countries," *American Economic Review*, Vol. 59, No. 1, pp. 138-148.

——— (1976) "Urban Job Expansion, Induced Migration and Rising Unemployment," *Journal of Development Economics*, Vol. 3, pp. 211-225.

Todd, Petra E. and Kenneth I. Wolpin (2006) "Asssessing the Impact of a School Subsidy Program in Mexico: Using a Social Experiment to Validate a Dynamic Behaviral Model of Child Schooling and Fertility," *American Economic Review*, Vol. 96, No. 5, pp. 1384-1417, December.

United Nations (2008) "World Urbanization Prospects - The 2007 Revision," February. Population Division of the Department of Economic and Social Affairs, ESA/P/WP/205.

Weerdt, Joachim De (2008) "Defying Destiny and Moving out of Poverty: Evidence from a 10-year Panel with Linked Qualitative Data from Kagera, Tanzania," December. mimeo.

Wooldridge, Jeffrey M. (2002) *Econometric Analysis of Cross Section and Panel Data*: MIT Press. Cambridge, Massachusetts.

Yamauchi, Futoshi (2004) "Are Experience and Schooling Complementary?: Evidence from Migrants' Assimilation in the Bangkok Labor Market," *Journal of Development Economics*, Vol. 74, pp. 489-513.

Yamauchi, Futoshi and Sakiko Tanabe (2008) "Nonmarket Networks among Migrants: Evidence from Metropolitan Bangkok, Thailand," *Journal of Population Economics*, Vol. 21, pp. 649-664.

Table 1: Descriptive Statistics

	Non-migrants			Internal migrants			External migrants		
	Mean	Std.	No. of obs.	Mean	Std.	No. of obs.	Mean	Std.	No. of obs.
(1) Per capita annual consumption (US dollars, 1991 price)									
Wave 1	213.14	(139.26)	2426	221.23	(137.57)	972	229.20*	(142.52)	291
Wave 2	192.49	(144.01)	2422	184.70	(114.85)	924	192.62	(128.94)	276
Wave 3	176.16	(109.74)	2353	170.65	(97.44)	870	184.25	(107.77)	247
Wave 4	172.47	(99.93)	2223	171.27	(93.29)	797	173.55	(107.91)	222
Wave 5	214.91	(162.00)	2829	279.99***	(240.36)	1287	520.07***	(481.11)	352
(2) Gender (one if male)									
Wave 1-4	0.52	(0.49)	9425	0.37***	(0.48)	3564	0.48**	(0.50)	1038
Wave 5	0.52	(0.49)	2832	0.38***	(0.48)	1289	0.47	(0.50)	355
(3) Education (years)									
Own									
Wave 1-4	2.56	(3.08)	9426	2.73***	(3.15)	3564	3.12***	(3.34)	1038
Wave 5	4.69	(3.22)	2811	5.49***	(3.35)	1280	6.70***	(3.49)	350
Household average									
Wave 1-4	2.67	(1.46)	9426	2.74**	(1.49)	3564	2.99***	(1.45)	1038
Wave 5	3.48	(1.94)	2808	3.90***	(2.43)	1280	5.45***	(2.95)	347
(4) Age (years)									
Own									
Wave 1-4	22.29	(19.28)	9425	15.33***	(12.13)	3564	14.85***	(11.81)	1038
Wave 5	33.00	(19.36)	2832	26.99***	(12.33)	1289	26.26***	(11.29)	355
Household average									
Wave 1-4	21.66	(8.23)	9425	21.55	(7.12)	3564	21.82	(7.02)	1038
Wave 5	25.18	(11.11)	2832	21.79***	(9.23)	1289	21.43***	(7.15)	355
Household head									
Wave 1-4	48.16	(15.31)	9426	49.92***	(16.03)	3564	52.21***	(16.50)	1038
Wave 5	49.72	(17.52)	2811	39.48***	(15.22)	1280	35.62***	(13.56)	350
(5) Household size									
Wave 1-4	7.45	(3.66)	9424	7.74***	(3.58)	3564	8.47***	(4.45)	1038
Wave 5	5.92	(3.18)	2832	4.83***	(2.60)	1289	4.55***	(2.72)	355
(6) Proportion of household members aged 15 to 40									
Male									
Wave 1-4	0.03	(0.08)	9424	0.02***	(0.07)	3564	0.01***	(0.05)	1038
Wave 5	0.08	(0.17)	2832	0.10***	(0.23)	1289	0.17***	(0.30)	355
Female									
Wave 1-5	0.02	(0.07)	9424	0.03***	(0.07)	3564	0.02	(0.06)	1038
Wave 5	0.05	(0.11)	2832	0.13***	(0.17)	1289	0.15***	(0.24)	355

Notes: (1) Unit of observations is a person-wave. (2) In per capita measures, all members in the same household-wave group are recorded with the same numerical values. (3) The equality of means between non-migrants and internal migrants and that between non-migrants and external migrants are examined by T-tests, assuming unequal variance. The degree of freedom is approximated by Satterthwaite. *** denotes the rejection of equality at 1%, ** at 5%, and * at 10%.

Table 2: Migration and Educational Attainment by Age in Wave 1

Age in wave 1		Wave 1 Mean	Wave 1 Std.	Wave 5 Mean	Wave 5 Std.	Growth Mean	Growth Std.	No. of panel individuals in wave 1
Below 7 years old	Non-migrants	-	-	4.40	(2.60)	4.40	(2.60)	609
	Internal migrants	-	-	4.27	(2.87)	4.27	(2.87)	198
	External migrants	-	-	4.91	(3.17)	4.91	(3.17)	58
7 to 15 years old	Non-migrants	1.56	(1.99)	6.05	(3.09)	4.49	(3.20)	587
	Internal migrants	1.68	(2.07)	6.15	(3.08)	4.47	(3.03)	427
	External migrants	2.00	(2.05)	7.73	(3.02)	5.73	(3.10)	134
16 to 20 years old	Non-migrants	5.75	(2.43)	6.52	(2.34)	0.77	(1.70)	253
	Internal migrants	6.20	(2.23)	7.17	(2.37)	0.97	(1.68)	174
	External migrants	6.84	(2.23)	8.26	(2.56)	1.42	(1.99)	50
21 to 30 years old	Non-migrants	5.84	(2.77)	6.17	(2.65)	0.33	(1.25)	277
	Internal migrants	6.02	(2.71)	6.32	(2.74)	0.30	(1.16)	82
	External migrants	7.24	(3.41)	7.36	(3.47)	0.12	(0.43)	25
31 years old or above	Non-migrants	3.11	(3.05)	3.53	(3.26)	0.42	(1.23)	680
	Internal migrants	3.88	(4.17)	4.49	(4.33)	0.61	(1.48)	85
	External migrants	4.84	(4.84)	5.31	(4.89)	0.47	(1.65)	19

Note: Individuals are panel respondents who were interviewed in both wave 1 and 5.

Table 3: Reason for Migration by Educational Attainment

Mean educational attainment	Internal migrants Above (a)	Internal migrants Below (b)	External migrants Above (c)	External migrants Below (d)
(1) Economic reason				
No job / wanted better job	0.05	0.04	0.05	0.06
Business opportunities	0.08	0.09	0.20	0.26
Land not available	0.05	0.11	0.00	0.11
(2) Schooling	0.08	0.00	0.24	0.04
(3) Family related reason				
Marriage	0.36	0.37	0.12	0.17
Divorce	0.01	0.03	0.00	-
Widowhood	0.05	0.02	0.04	-
Death of parents	0.00	0.00	-	0.00
Illness of household members	0.00	0.00	0.00	0.01
Other family problems	0.03	0.05	-	0.00
(4) Political reason				
Posted to new area	0.01	0.00	0.04	0.02
Political / economic problems	0.06	0.08	0.02	0.07
(5) Natural disasters	0.15	0.14	0.22	0.18
No. of migrants	469	453	170	113

Notes: (1) Migrants are panel respondents who were interviewed in both wave 1 and 5. (2) The number is the proportion relative to the total number of migrants in each category. (3) The mean educational attainment of non-migrants from wave 1 to 5 is 2.22 years.

Table 4: Results (DID-OLS)

Dependent variable:	Growth of log of per capita consumption (annual) from wave 1 to 5							
Education level:	Individual		Household		Individual		Household	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Migrants	0.069	0.057	0.011	0.017	-	-	-	-
	(0.063)	(0.063)	(0.071)	(0.098)				
Internal migrants	-	-	-	-	0.050	0.014	-0.008	0.014
					(0.068)	(0.065)	(0.073)	(0.098)
External migrants	-	-	-	-	0.386***	0.398***	0.396***	0.317*
					(0.141)	(0.166)	(0.138)	(0.173)
Migrants								
× Education	0.032***	0.036***	0.056***	0.057**	-	-	-	-
	(0.009)	(0.009)	(0.015)	(0.025)				
Internal migrants								
× Education	-	-	-	-	0.019**	0.031***	0.041**	0.043*
					(0.009)	(0.008)	(0.016)	(0.025)
External migrants								
× Education	-	-	-	-	0.036*	0.028	0.037	0.043
					(0.019)	(0.022)	(0.025)	(0.034)
Growth from wave 1 to 5								
Education	-0.001	-0.004	0.041***	0.046*	-0.001	-0.004	0.041***	0.048*
(years)	(0.005)	(0.004)	(0.012)	(0.024)	(0.005)	(0.004)	(0.012)	(0.024)
HH average age	0.011***	0.008*	0.007***	0.004	0.011***	0.008	0.007***	0.004
(years)	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)
HH head age	-0.002	-0.001	-0.001	0.000	-0.002	-0.001	-0.001	0.000
(years)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
HH size	-0.024***	-0.035*	-0.027***	-0.042**	-0.025***	-0.035*	-0.028***	-0.042**
	(0.007)	(0.018)	(0.007)	(0.017)	(0.008)	(0.019)	(0.007)	(0.018)
Proportion of male members	0.597***	0.385**	0.364***	0.120	0.561***	0.323**	0.362***	0.130
aged 15 to 40	(0.113)	(0.159)	(0.113)	(0.150)	(0.112)	(0.147)	(0.113)	(0.151)
Proportion of female members	0.169	-0.017	0.006	-0.204	0.135	-0.028	-0.008	-0.201
aged 15 to 40	(0.177)	(0.244)	(0.167)	(0.224)	(0.177)	(0.244)	(0.167)	(0.225)
Constant	0.080	-0.483***	0.067	-0.427***	0.092	-0.470***	0.076	-0.416***
	(0.236)	(0.085)	(0.240)	(0.102)	(0.234)	(0.085)	(0.239)	(0.103)
Initial village fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Initial household fixed effect	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.201	0.621	0.228	0.644	0.216	0.628	0.239	0.649
No. of obs.	3651	3651	3648	3648	3651	3651	3648	3648

Notes: (1) Unit of observations is a person. (2) Sample is panel individuals. (3) Figures ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (4) Standard errors are robust to heteroskedasticity and clustered residuals within each initial household.

Table 5: Reason for Migration by Destination-gender

	Pooling		Internal migrants		External migrants	
	Male	Female	Male	Female	Male	Female
	(a)	(b)	(c)	(d)	(e)	(f)
(1) Economic reason						
No job / wanted better job	0.07	0.02	0.06	0.02	0.08	0.03
Business opportunities	0.21	0.04	0.17	0.03	0.34	0.10
Land not available	0.11	0.03	0.13	0.03	0.04	0.03
(2) Schooling	0.09	0.06	0.06	0.04	0.17	0.14
(3) Family related reason						
Marriage	0.03	0.47	0.03	0.52	0.01	0.26
Divorce	0.00	0.03	0.00	0.03	-	0.02
Widowhood	0.05	0.02	0.06	0.02	0.04	0.01
Death of parents	0.00	0.00	0.00	0.00	-	0.00
Illness of household members	0.00	0.01	0.00	0.00	0.00	0.02
Other family problems	0.05	0.02	0.07	0.02	-	0.01
(4) Political reason						
Posted to new area	0.02	0.00	0.01	0.00	0.04	0.02
Political / economic problems	0.07	0.06	0.09	0.07	0.02	0.05
(5) Natural disasters	0.24	0.17	0.25	0.15	0.21	0.28
No. of migrants	626	955	459	770	167	185

Notes: (1) Migrants are panel individuals in wave 5 who migrated at some point between 1991 and 2004. (2) The number is the proportion relative to the total number of migrants in each destination-gender category.

Table 6: Appendix: Checking the Correlation between the Pre-migration Level of Schooling and Wealth in Wave 1 (OLS)

Dependent variables:	log of per capita non-food consumption (annual)		log of per capita consumption (annual)		log of per capita cultivated land (acre)	
	(a)	(b)	(c)	(d)	(e)	(f)
Education (years)						
Individual	0.017***	-	0.022***	-	0.011*	-
	(0.004)		(0.004)		(0.006)	
HH average	-	0.073***	-	0.093***	-	0.078***
		(0.015)		(0.013)		(0.021)
Age (years)	-0.003	0.000	-0.003**	0.000	-0.003	-0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Age squared	0.000**	0.000	0.000**	0.000	0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male dummy	0.016	0.018	0.006	0.009	0.036	0.034
	(0.016)	(0.015)	(0.014)	(0.013)	(0.022)	(0.023)
HH size	-0.031***	-0.031***	-0.024***	-0.024***	-0.054***	-0.054***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.009)	(0.009)
Constant	10.130***	9.961***	10.439***	10.222***	-0.253	-0.416**
	(0.191)	(0.201)	(0.146)	(0.157)	(0.172)	(0.183)
Village fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.260	0.279	0.291	0.330	0.292	0.314
No. of observations	3689	3689	3689	3689	3583	3583

Notes: (1) Unit of observations is a person. (2) Sample is panel individuals. (3) Figures in ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (4) Standard errors are robust to heteroskedasticity and clustered residuals within initial households.

Table 7: Appendix: Migration and Schooling Regressions (OLS)

Dependent variables:	Migrants in wave 5	Education in wave 5
	(a)	(b)
Age (years) in wave 1	-0.001***	-0.059***
	(0.000)	(0.003)
Education (years) in wave 1	0.022***	0.575***
	(0.002)	(0.014)
Male dummy in wave 1	-0.103***	0.621***
	(0.022)	(0.116)
HH head dummy in wave 1	-0.168***	0.280
	(0.030)	(0.171)
HH head's spouse dummy in wave 1	-0.205***	-0.031
	(0.029)	(0.168)
Aged 5 to 15 in wave 1		
× Female dummy	0.157***	0.439**
	(0.031)	(0.172)
× Father's education (years)	0.015***	0.101***
	(0.004)	(0.023)
× Mother's education (years)	-0.010**	0.182***
	(0.004)	(0.027)
× Rainfall shock in origin	0.000**	0.000**
	(0.000)	(0.000)
Constant	0.365	3.087*
	(0.247)	(1.776)
Initial household fixed effects	Yes	Yes
R-squared	0.453	0.666
No. of obs.	3689	3658

Notes: (1) Unit of observations is a person. (2) Sample is panel individuals. (3) Figures in ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (4) Standard errors are robust to heteroskedasticity and clustered residuals within initial households. (5) The rainfall shock is the deviation of the mean rainfall at the origin between 1986 and 2000 from the average of all sample clusters during the same periods. Monthly rainfall information between 1980 and 2004, sourced from Tanzania Meteorological Agency, is publicly available from EDI Ltd. (Economic Development Initiatives) - `http://www.edi-africa.com/research/khds/introduction.htm#data`. For each cluster, I exploited rainfall information at either the nearest or (if not available) the 2nd nearest rainfall station. In the case where the rainfall information is not available for some cluster in some year, it was interpolated by using the rainfall data in the nearest past or future.

Table 8: Appendix: Drop Marriage Migrants (DID-OLS)

Dependent variable:	Growth of log of per capita consumption (annual) from wave 1 to 5							
Education level:	Individual		Household		Individual		Household	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Migrants	0.144**	0.113	0.043	0.023	-	-	-	-
	(0.073)	(0.080)	(0.082)	(0.117)				
Internal migrants	-	-	-	-	0.092	0.012	0.001	-0.002
					(0.079)	(0.085)	(0.085)	(0.120)
External migrants	-	-	-	-	0.521***	0.560***	0.431***	0.362*
					(0.136)	(0.150)	(0.151)	(0.194)
Migrants								
× Education	0.027***	0.038***	0.052***	0.058**	-	-	-	-
	(0.010)	(0.010)	(0.017)	(0.028)				
Internal migrants								
× Education	-	-	-	-	0.013	0.033***	0.036**	0.041
					(0.011)	(0.011)	(0.017)	(0.029)
External migrants								
× Education	-	-	-	-	0.025	0.019	0.036	0.042
					(0.018)	(0.019)	(0.026)	(0.038)
Growth from wave 1 to 5								
Education	-0.000	-0.004	0.041***	0.046*	-0.000	-0.004	0.041***	0.049*
(years)	(0.005)	(0.005)	(0.013)	(0.028)	(0.005)	(0.005)	(0.013)	(0.028)
HH average age	0.010***	0.006	0.007***	0.002	0.010***	0.006	0.007***	0.003
(years)	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)
HH head age	-0.001	-0.000	-0.000	0.001	-0.001	0.000	-0.000	0.001
(years)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
HH size	-0.027***	-0.036	-0.028***	-0.039*	-0.028***	-0.037	-0.028***	-0.039*
	(0.007)	(0.023)	(0.007)	(0.022)	(0.007)	(0.023)	(0.007)	(0.022)
Proportion of male members	0.545***	0.355**	0.359***	0.147	0.525***	0.356**	0.363***	0.165
aged 15 to 40	(0.113)	(0.170)	(0.114)	(0.160)	(0.111)	(0.170)	(0.113)	(0.161)
Proportion of female members	0.104	-0.112	-0.033	-0.269	0.042	-0.139	-0.074	-0.283
aged 15 to 40	(0.195)	(0.275)	(0.185)	(0.254)	(0.194)	(0.274)	(0.184)	(0.254)
Constant	0.074	-0.509***	0.052	-0.454***	0.074	-0.495***	0.052	-0.443***
	(0.239)	(0.096)	(0.243)	(0.118)	(0.235)	(0.096)	(0.242)	(0.118)
Initial village fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Initial household fixed effect	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.208	0.645	0.231	0.659	0.225	0.653	0.242	0.664
No. of obs.	3270	3270	3268	3268	3270	3270	3268	3268

Notes: (1) Unit of observations is a person. (2) Sample is panel individuals. (3) Figures ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (4) Standard errors are robust to heteroskedasticity and clustered residuals within each initial household.

Table 9: Appendix: Below 20 in wave 1 (DID-OLS)

Dependent variable:	Growth of log of per capita consumption (annual) from wave 1 to 5							
Education level:	Individual		Household		Individual		Household	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Migrants	0.080	0.079	0.039	0.044	-	-	-	-
	(0.074)	(0.086)	(0.088)	(0.140)				
Internal migrants	-	-	-	-	0.072	0.033	0.020	0.037
					(0.078)	(0.088)	(0.088)	(0.139)
External migrants	-	-	-	-	0.337*	0.401*	0.419**	0.312
					(0.182)	(0.217)	(0.170)	(0.224)
Migrants								
× Education	0.038***	0.038***	0.059***	0.058*	-	-	-	-
	(0.011)	(0.013)	(0.020)	(0.035)				
Internal migrants								
× Education	-	-	-	-	0.024**	0.034***	0.045**	0.046
					(0.010)	(0.012)	(0.020)	(0.035)
External migrants								
× Education	-	-	-	-	0.045*	0.027	0.037	0.045
					(0.025)	(0.030)	(0.031)	(0.037)
Growth from wave 1 to 5								
Education	-0.005	-0.000	0.038**	0.045	-0.005	-0.000	0.037**	0.045
(years)	(0.007)	(0.007)	(0.017)	(0.037)	(0.007)	(0.007)	(0.017)	(0.037)
HH average age	0.016***	0.013*	0.009**	0.005	0.015***	0.013*	0.009***	0.006
(years)	(0.003)	(0.007)	(0.003)	(0.008)	(0.003)	(0.017)	(0.003)	(0.008)
HH head age	-0.003**	-0.002	-0.002	-0.000	-0.003**	-0.002	-0.002	-0.000
(years)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)
HH size	-0.020**	-0.036*	-0.025***	-0.046**	-0.021**	-0.036	-0.025***	-0.045**
	(0.008)	(0.021)	(0.007)	(0.020)	(0.008)	(0.022)	(0.007)	(0.021)
Proportion of male members	0.550***	0.267	0.306**	0.015	0.516***	0.254	0.310**	0.025
aged 15 to 40	(0.139)	(0.234)	(0.148)	(0.230)	(0.140)	(0.235)	(0.148)	(0.232)
Proportion of female members	0.073	-0.178	-0.102	-0.349	0.041	-0.183	-0.114	-0.343
aged 15 to 40	(0.228)	(0.354)	(0.224)	(0.340)	(0.228)	(0.355)	(0.224)	(0.341)
Constant	0.071	-0.380***	0.066	-0.213	0.088	-0.359***	0.075	-0.188
	(0.228)	(0.104)	(0.226)	(0.151)	(0.224)	(0.105)	(0.224)	(0.154)
Initial village fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Initial household fixed effect	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.207	0.621	0.233	0.643	0.221	0.627	0.243	0.647
No. of obs.	2423	2423	2421	2421	2423	2423	2421	2421

Notes: (1) Unit of observations is a person. (2) Sample is panel individuals. (3) Figures ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (4) Standard errors are robust to heteroskedasticity and clustered residuals within each initial household.

Table 10: Appendix: Impact Evaluation Approach - Recovering Beegle et al. (2011) (Not for Publication)

Dependent variable:	Growth of log of per capita consumption (annual) from wave 1 to 5		
	OLS	2SLS	OLS
	(a)	(b)	(c)
Migrants	0.335***	0.340***	-
	(0.043)	(0.109)	
Internal migrants	-	-	0.237***
			(0.042)
External migrants	-	-	0.659***
			(0.083)
Individual characteristics at baseline (wave 1)			
Age (years)	0.003	0.003*	0.003
	(0.002)	(0.002)	(0.002)
Age squared	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Education (years)	0.003	0.003	0.003
	(0.005)	(0.004)	(0.005)
Male dummy	0.092***	0.093***	0.082***
	(0.030)	(0.026)	(0.030)
Constant	-0.497***	-0.499***	-0.463***
	(0.044)	(0.053)	(0.044)
Initial household fixed effects	Yes	Yes	Yes
T-test (p-value)	0.571	0.857	-
Joint significance of instruments in the first stage			
F-statistic	-	38.48	-
p-values	-	0.000	-
Sargan test (p-values)	-	0.198	-
R-squared	0.591	0.591	0.600
No. of obs.	3682	3682	3682

Notes: (1) Unit of observations is a person. (2) Sample is panel individuals. (3) Figures ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (4) Standard errors are robust to heteroskedasticity and clustered residuals within initial households. (5) T-test is the test for the null hypothesis that a coefficient on migrants is equal to the migration effect estimated in Beegle et al. (2011), 0.36. (6) Column (b) instruments migrants by using a similar set of excluded instruments exploited in Beegle et al. (2011): a dummy for a household head in wave 1; a dummy for a household head's spouse in wave 1; a dummy for females aged 5 to 15 years in wave 1; and a dummy for those who were aged 5 to 15 years in wave 1 and lived in a village which experienced the rainfall shock (see notes in Appendix Table 7 for precise explanation of the rainfall shock).

Table 11: Appendix: Correlation between Income and Consumption (OLS) (Not for Publication)

Dependent variable:	Log of household consumption (annual)					
	Wave 1 to 4			Wave 5		
	Non-migrants (a)	Internal migrants (b)	External migrants (c)	Non-migrants (d)	Internal migrants (e)	External migrants (f)
Log of household income (weekly)	0.589***	0.543***	0.500***	0.449***	0.249***	-0.026
	(0.020)	(0.025)	(0.040)	(0.032)	(0.028)	(0.030)
Remittances received in the past 6 months (dummy, one if exist)	0.058*	0.067**	0.102	0.105*	-0.091**	0.211
	(0.035)	(0.029)	(0.072)	(0.057)	(0.042)	(0.137)
Non-labor income in the past 6 months (dummy, one if exist)	0.123***	0.072***	0.134***	0.119***	0.118*	0.229
	(0.028)	(0.022)	(0.045)	(0.037)	(0.065)	(0.164)
Constant	7.190***	8.070***	8.166***	8.251***	9.861***	12.538***
	(0.159)	(0.225)	(0.328)	(0.268)	(0.207)	(0.231)
District fixed effects	Yes	Yes	Yes	Yes	Yes	-
Time (wave) fixed effects	Yes	Yes	Yes	-	-	-
R-squared	0.631	0.637	0.545	0.499	0.285	0.022
No. of obs.	1258	1803	607	1312	986	182

Notes: (1) Unit of observations is a household-wave. (2) Figures in ( ) are standard errors. *** denotes significance at 1%, ** at 5%, and * at 10%. (3) Standard errors are robust to heteroskedasticity and clustered residuals within current households. (4) Households are defined as migrants in wave 1 to 4 if they supply at least one member who moved out of original community between 1991 and 2004 and in wave 5 if they contain at least one panel migrant in them. (5) Remittances take the form of either gift or loan. (6) Non-labor income contains income from pension or retirement funds, insurances, interest, lottery winnings, dowry, inheritance, sale of durable goods, sale of house or land, and so on. (7) Except for columns (e) and (f), district is classified into 6 categories: Biharamulo, Bukoba Rural, Bukoba Urban, Muleba, Ngara, and Karagwe.

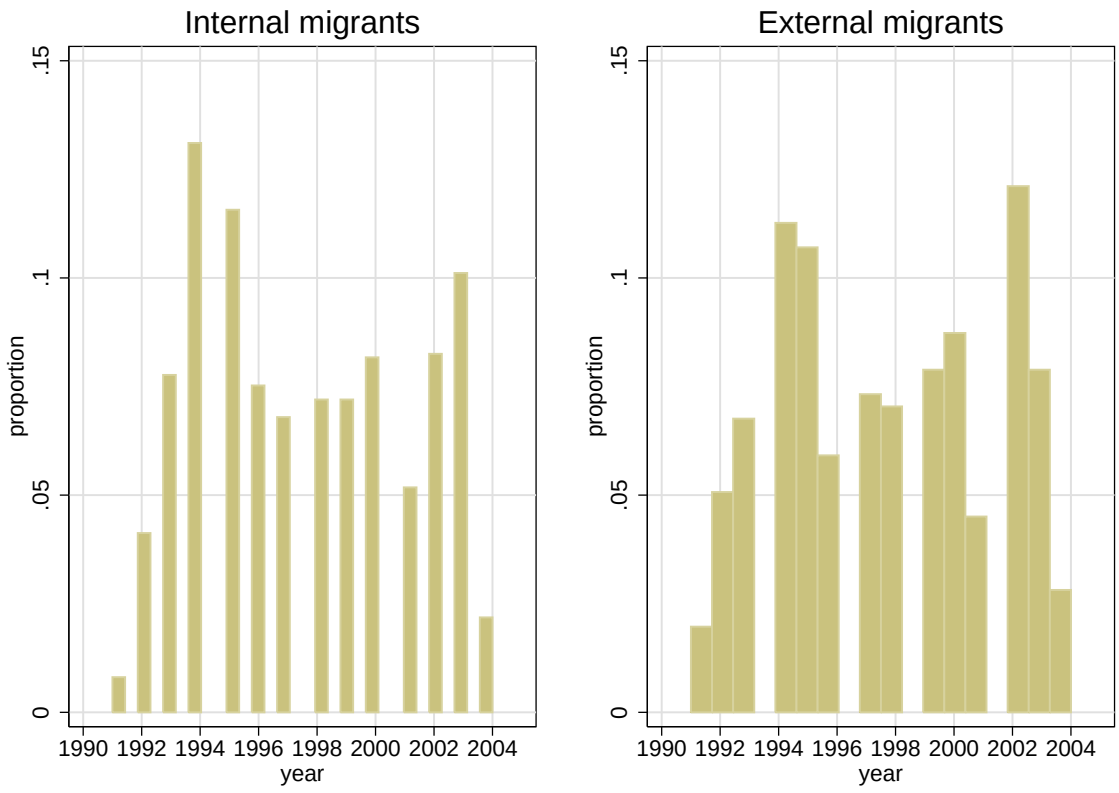

Figure 1: Distribution of Migrants by Year of Migration

Notes: (1) Migrants are panel individuals in wave 5 who migrated at some point between 1991 and 2004. (2) The proportion is relative to the total number of migrants in each destination category.

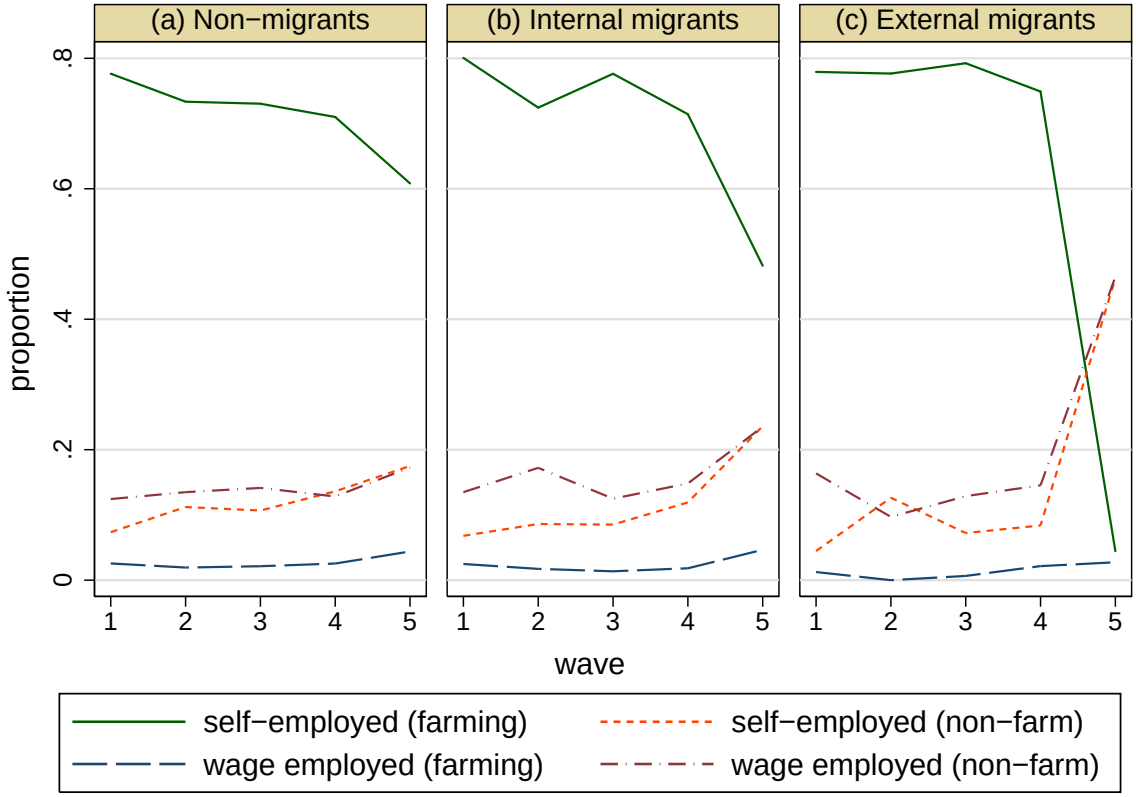

Figure 2: Transtion of Activity Shares in Total Hours Worked

Note: Activity shares are the proportion of weekly hours worked of each activity relative to the total weekly hours worked.

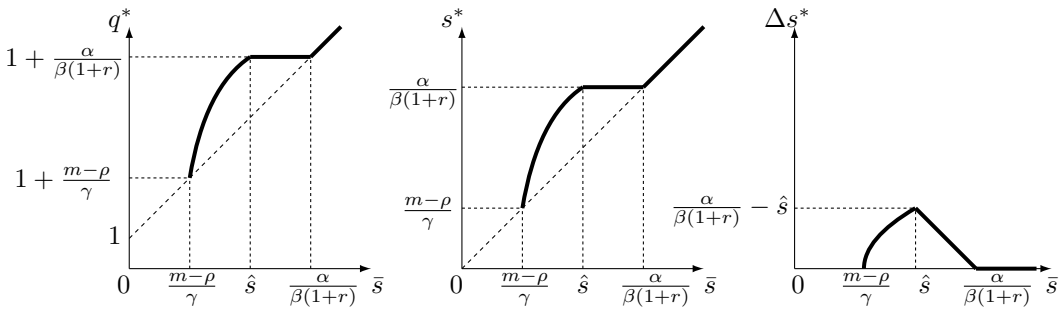

Figure 3: Appendix: Optimal Choice of Migrants