Internal Mobility and Likelihood of Skill Losses in Localities of Emigration: Theory and Preliminary Empirical Application to Some Developing Economies

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Abstract: An economic model is introduced to discuss the impacts of rural migration on skills in source and destination localities and regions. Two versions of the model are used without and with risks. In this context, the model considers that rural migration is determined by the demand for education and urban rural wage differences. The optimal decision rules attained are tested against available aggregate data for series of developing countries. The preliminary empirical results show the existence of country variations of rural emigration with varied impacts on education with likely losses in localities of emigration. Economic and social policies are to account for these impacts mainly when emphasis is placed on regional and local development programs.

Keywords: Rural migration; bias; education; skilled labor; local development

JEL : C_0-D_4-I_3-J_6-Q_1-R_0

Introduction

Skilled labor is known to be mobile, as it tends to move form locations with lower opportunities to those with higher outcomes and better operating and living conditions. This applies for both internal and cross-border migrations as those skilled workers move from poorer to richer areas, from rural to urban locations, and also to other countries that offer better opportunities. These movements while ensuring better conditions to the skilled labor emigrant and to the destination areas, may contribute to lowering the human capital availability for the localities of origin implying that human capital loss can occur at the levels of places that are source of emigration. It is expected that rural areas in developing countries be those locations that are the most affected by any likely loss of skilled labor and thus human capital. But, as recognized by the new economics of brain drain, the local educational systems of the locations of origin may exhibit some gains that can compensate for the direct loss of skills. The new economics of skilled labor emigration has been providing new evidence to support the existence of human capital gains not only in the destination but also in the sources of emigration. Yet, there has been no final position with regard to the magnitude of the potential gains and losses achieved by the countries and locations source of emigration because remittances and skills may not be complements (G. Ranis, 2007). Also lower gains have been observed when accounting for risk aversion (Driouchi et al, 2009; M. Schiff, 2005).
The major issue raised in this paper is related to the existence or absence of human capital gains and losses in localities sources of skilled labor mobility and emigration.

The purpose of this paper is to assess whether or not the human capital gains in the localities of origin can be similar to those related to cross-border migration. Can one expect that poorer localities be likely to enhance their educational systems in order to cope with the emigration of their skilled labor, or does skilled labor mobility only generates further poverty as skills are progressively drained from the source localities?

The above purpose is achieved through looking at rural emigration at the level of any given developing country. Three sections are respectively introduced in this paper. The first one is a literature review on the matter. The second is the theoretical model suggested to capture the processes under study. The last section focuses on some preliminary empirical findings related to the implementation of the theoretical model.

I. Literature Review

Some authors have developed models and assessments of human capital gains and losses over different economies accounting for skilled labor migration (M. Beine et al, 2001, 2003, 2006; F. Docquier and H. Rapoport, 2003, 2005, 2007; F. Docquier, O. Lohest and A. Marfouk, 2005, 2007; F. Docquier and K. Sekkat, 2006; F. Docquier, B. Lindsay Lowell and A. Marfouk, 2007). Most of these authors have recognized the likely positive impacts of skilled labor emigration on the source countries.

Important results have been attained within the new economics of skilled labor migration. Besides showing the existence of brain gains, the findings include also the factors that affect migration and the magnitude of human capital gains and losses. Given the multiplicity of factors that have an impact on human capital gains and losses in the countries source of skilled labor migration, domestic, regional and international policies have benefited from further investigations and more practical evidences (F. Docquier and K. Sekkat, 2006). In this process series of contributions are still developing (Peter Schaeffer, 2005; B. C. Chakraborty, 2006 and Hung-Ju Chen, 2006). So far, the above-mentioned studies have dealt with skilled labor mobility from developing to developed countries.

Others however have focused on skilled labor mobility within the same country namely, rural-urban migration. In this case, the generalization of brain gains and human capital formation improvements to the case of rural-urban migration remains a source of controversy in the related literature. For instance, Stark & Fan (2007) have used a model that links three key factors: the process of migration from the rural area to the urban area, the externality effect of the average level of human capital, and agglomeration economy. The research implies that in case of free movement of labor, all skilled workers will cluster in the urban area, leaving the rural area with an average level of human capital that is below the social optimum. The authors emphasize that unrestricted rural-to urban migration reduces the average income of both rural and urban residents in equilibrium.

They explain that as skilled workers are likely to concentrate in the cities, the wage rate of the unskilled workers in the rural areas will be low, which in turn will induce a large number of unskilled rural workers to leave for the cities. With free labor mobility, urban wage will decline continuously with the in-migration of unskilled workers which, in turn, will reduce the average level of human capital in the city. Along with this idea, Lucas (2001) states that larger expenditures on education result in a lower level of human capital in the city and the same level of human capital in the countryside, which will reduce the economic prosperity of the entire economy. Thus with respect to unrestricted rural-urban migration, in a developing country where unskilled workers far outnumber skilled workers, increasing the human capital stock through education will not by itself reverse the inefficient allocation of the average human capital between the rural and urban areas.

Other empirical findings suggest a positive impact of rural migration on human capital formation in the localities of origin. The new economics of labor migration approach established that migrants' remittances impacts are conceived in term of risk management, income diversification and alleviation of liquidity constraints at household level in the locality of origin (Stark and Bloom, 1985; Stark, 1991). In parallel, the question of whether or not such alleviation of liquidity constraints results in investment in productive or merely consumption activities was largely explored. In a study by De Brauw et al. (2003), evidence was provided that the remittances sent by rural migrants partially compensate for the lost-labor effect, contributing to household incomes directly and also indirectly by stimulating crop production. Likewise, Rozelle et al. (1999) have shown the growth potential of migration in rural China whereby remittances accumulated compensate for labor loss and allow households to improve their agricultural productivity. In this sense, rural households benefiting from remittances tend to call upon external labor for agricultural activities to replace the absence of household members. This does not only imply job creation but more importantly the preservation and perpetuation of skills and local know-how in agriculture. Moreover, the local skills might even improve as new technologies and new crops are introduced in relation to the risk diversification and effects of remittances.

Also, a recent study on Guatemala, for example, Adams (2005) finds that households receiving remittances actually spend less at the margin on consumption and tend to spend a larger amount of remittance on investment goods, in particular education and housing. Furthermore, expenditure on house construction through remittances can stimulate local construction enterprises, growing demands for services and boosting labor demand. Overall, there are important indirect effects that spread from migrants to non-migrant households within the locality of origin. Expenditure and income linkages at the village-level in sending regions create a 'remittance multipliers' on local incomes, labor and employment. Migration may also influence rural production and expenditures by altering the prices of local goods and production factors and migrants may encourage investments in their area of origin by others through demand-side spillovers (Lucas 2005). In general, Taylor and Martin (2001) suggest that migration is likely to have the largest positive effect on rural source economies when the losses of human and other capital are small. The authors suggest also that these these positive effects take place when the benefits of migration accrue disproportionately to households that face the greatest initial constraints to local production and when households that receive remittances have expenditure patterns that produce the largest rural income multipliers.

All these, definitely point to a potential increase in the human capital in localities of origin; be it through the increase in education expenditures, or through the emergence of new skills related to the reshaping of the local economy fostered by remittances.

II. Theoretical Model

The suggested theoretical economic model considers that candidate migrants move from location A (say rural) to location B (urban) with decisions based on the needs for education and for extra-income. These are assumed to be provided at higher levels in the destination region.

In this context, the variable ω measures labor productivity and is assumed to be equivalent to the wages prevailing in a given economy. This variable takes two values as in Stark et al., (2005) that are ω_r and ω_u for rural and urban sectors respectively.

Individuals are assumed to migrate from rural to urban areas if ($\omega_u > \omega_r$). In practice this is often the case but decisions of migrating or staying are related to the probability m and $(1-m)$ respectively. Furthermore, decision makers are supposed to seek education level s at the cost $C(s) = c.s$, $c > 0$ (Patrinos et al., 2006) with related benefits from education represented by $g(s) = a.s^{\gamma}$ with $0 < \gamma < 1$, $g^{'}(s) > 0$, $g^{''}(s) < 0$ and where 'a 'defines the basic talent of the individual. Decisions consist in maximizing $V(s)$ that accounts for the expected net benefits that are based on ensuring with probability m and (1-m) the benefits from rural migration where $(g(s))$ and $(C(s))$ are as defined previously.

In case of risk neutrality, the decision is based on selecting s to maximize $\omega.g(s)$ based on m and $(1-m)$ besides the costs of education. This is given by:

$$V(s) = m\,\omega_u g(s) + (1-m)\omega_r g(s) - cs$$
$$V(s) = m\,\omega_u a s^{\gamma} + (1-m)\omega_r a s^{\gamma} - cs$$

Given the conditions imposed on the parameter,γ the necessary and sufficient condition for a maximum is given by:

$$V^{'}(s) = a\gamma s^{\gamma-1}\left[m\left(\omega_u - \omega_r\right) + \omega_r\right] - c = 0 \qquad (1)$$

The optimal level of education is then given by:

$$s^{*} = \left[\frac{c}{\gamma a\left[m(\omega_u - \omega_r) + \omega_r\right]}\right]^{\frac{1}{\gamma-1}} \qquad (2)$$

Internal migration with probability m leads to the optimal level of education (s^{*}) as given by (2).

In case of staying in the rural area ($m = 0$), the optimal level of education is given by:

$$s_0^{*} = \left[\frac{c}{a\gamma\omega_r}\right]^{\frac{1}{\gamma-1}} \qquad (3)$$

This implies that emigrants (1>m>0) achieve higher levels of education as shown by:

$$\frac{s^*}{s_0^*} = \left\{ \frac{\left[m\,(\omega_u - \omega_r) + \omega_r \right]}{\omega_r} \right\}^{\frac{1}{1-\gamma}} > 1 \qquad (4)$$

Proposition 1:

The optimal level of education of an individual who decides to emigrate is higher than that of an individual who decides to remain in his area of origin (say rural area) ($s^* > s_0^*$).

Individual labor supply in the presence of rural emigration:

The individual labor supply corresponding to this emigration is obtained by replacing s^* in $g(s)$ as in equation (5):

$$l_u = g\left(s^*\right) = a.\left[\frac{c}{\gamma a\left[m(\omega_u - \omega_r) + \omega_r \right]} \right]^{\frac{\gamma}{\gamma-1}}$$

For the individual who chooses to remain in the rural area of origin, the individual labor supply is given by equation (6):

$$l_r = g\left(s_0^*\right) = a^{\frac{1}{1-\gamma}} \left[\frac{c}{\gamma \omega_r} \right]^{\frac{\gamma}{\gamma-1}}$$

Based on the above, it can be noted that :

- $\frac{dl_u}{dc} < 0$ and $\frac{dl_u}{d\,(\omega_u - \omega_r)} > 0$
- When $m = 0$, $\underset{m=0}{l_u} = a.\left[\frac{c}{\gamma a \omega_r} \right]^{\frac{\gamma}{\gamma-1}} = l_r$

Proposition 2:

l_u is an individual function of the labor supply. This supply decreases (increases) when the cost of education increases (decreases) and increases (decreases) when the difference between urban and rural salaries increases (decreases). In the absence of migration, the labor supply is equal to that prevailing in the rural area.

Aggregated labor supply in the presence of rural emigration

With emigration at probability m, the total labor supply in the urban area with N_u and N_m respectively representing the initial population and the emigrants with N_m=m.N_r and N_r being the rural labor force, is given by:

$$L_u = N.l_u = \left(N_u + N_m\right).l_u = \left(N_u + mN_r\right).a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma\left[m(\omega_u - \omega_r) + \omega_r\right]}\right]^{\frac{\gamma}{\gamma-1}} \qquad (7)$$

Given formulation (7), the aggregated labor supply in the absence of emigration ($m = 0$) is given by (8):

$$L_{u_0} = N_u.l_u = N_u.a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma\omega_r}\right]^{\frac{\gamma}{\gamma-1}}$$

The optimal value L_u (equation 9) is related to the emigrants. For those who choose to stay, the aggregated labor supply is given by:

$$L_r = (1-m)N_r l_r$$

$$L_r = (1-m)N_r.a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma\omega_r}\right]^{\frac{\gamma}{\gamma-1}} \qquad (9)$$

Equation (9) reflects the labor supply in the rural area in case of migration.

Based on the sensitivity of the results (see Appendix I), the maximum value of the migration rate arises when the second derivative of the labor supply in the urban area is negative:

$$m^* = \frac{\left(\gamma-1\right)\omega_r}{(\omega_u - \omega_r)} - \gamma\frac{N_u}{N_r}.$$

Yet, this optimal migration value is not part of the definition interval of the migration rate ($m \in \left[0,1\right]$) as it is negative.

The first derivative of the total labor supply in the urban area (see Appendix I) is always positive when $m \in \left[0,1\right]$, which implies that the labor supply in the urban area increases with the increase of the migration rate.

Implicit biases, imperfections, and risks:

Risks related to agriculture and biases against agriculture (K.Anderson and J.L Croser, 2010; K.Anderson, 2010) supposedly affect the level of salaries in the rural areas, the latter decreases to level ω_r^*, and hence the value ω_r becomes lower than the initial value. The sharp decrease in salaries and hence in revenue is expressed through the variable $0 < t < 1$ such as :

$$\omega_r^* = (1-t)\omega_r$$

Also, urban salaries or revenue are supposedly represented by minimum guaranteed level ω_u^* such as ω_u^* is related to the initial wage with a coefficient α with $0 < \alpha < 1$ and:

$$\omega_u^* = (1+\alpha)\omega_u$$

Optimal level of education

In order to obtain the rural optimal level of education induced by rural migration, the implicit biases and risks related to agriculture $V(s_B)$ should be maximized:

$$V(s_B) = m(1+\alpha)\omega_u a s_B^{\gamma} + (1-m)(1-t)\omega_r a s_B^{\gamma} - c s_B$$

The necessary and sufficient condition for a maximum V is given by:

$$V'(s_B) = a\gamma s_B^{\gamma-1}\left\{m\left[\left(1+\alpha\right)\omega_u - \left(1-t\right)\omega_r\right] + \left(1-t\right)\omega_r\right\} - c = 0$$

This allows to obtain the optimal level of education at departure of the migrant when the implicit biases and risks related to agriculture are introduced:

$$s_B^* = \left[\frac{c}{\gamma a\left\{m\left[\left(1+\alpha\right)\omega_u - \left(1-t\right)\omega_r\right] + \left(1-t\right)\omega_r\right\}}\right]^{\frac{1}{\gamma-1}} \qquad (10)$$

The difference between the individual level of education of those who decide to migrate in the presence of implicit biases and risks related to agriculture, and those who migrate by the absence of these conditions, is represented by:

$$\frac{s_B^*}{s^*} = \left\{ 1 + \frac{m\alpha\omega_u - (1-m)t\,\omega_r}{\left[m(\omega_u - \omega_r) + \omega_r \right]} \right\}^{\frac{1}{1-\gamma}} \tag{11}$$

When $\frac{\omega_u}{\omega_r} > \frac{(1-m)t}{m\alpha}$, the level of education in the presence of the effects induced by the introduction of implicit biases is lower compared to the level of education in the absence of these conditions.

<u>Labor supply</u>

The individual labor supply corresponding to a new structure of incentives to migration is obtained by:

$$l_u^* = a^{\frac{1}{1-\gamma}} \left[\frac{c}{\gamma} \right]^{\frac{\gamma}{\gamma-1}} \left\{ m\left[(1+\alpha)\omega_u - (1-t)\omega_r \right] + (1-t)\omega_r \right\}^{\frac{\gamma}{1-\gamma}}$$

The corresponding aggregated labor supply becomes:

$$L_u = (N_u + mN_r).a^{\frac{1}{1-\gamma}} \left[\frac{c}{\gamma} \right]^{\frac{\gamma}{\gamma-1}} \left\{ m\left[(1+\alpha)\omega_u - (1-t)\omega_r \right] + (1-t)\omega_r \right\}^{\frac{\gamma}{1-\gamma}} \tag{12}$$

The comparison between the aggregated labor supply, when the minimum urban salary is guaranteed, and the initial value of the labor supply is given by:

$$\frac{L_u^*}{L_u} = \frac{l_u^*}{l_u} = \left\{ 1 + \frac{m\alpha\omega_u - (1-m)t\,\omega_r}{\left[m(\omega_u - \omega_r) + \omega_r \right]} \right\}^{\frac{\gamma}{1-\gamma}} \tag{13}$$

This aggregated labor supply, when a minimum urban salary is guaranteed, is higher than the initial value of the labor supply only when $\frac{\omega_u}{\omega_r} > \frac{(1-m)t}{m\alpha}$

For those who choose to stay in the rural area, the supply labor become equal to :

$$l_r^* = a^{\frac{1}{1-\gamma}} \left[\frac{c}{\gamma} \right]^{\frac{\gamma}{\gamma-1}} \left[(1-t)\omega_r \right]^{\frac{\gamma}{1-\gamma}}$$

The aggregated labor supply in the rural area is:

$$L_r^* = (1-m)N_r.a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}\left[(1-t)\,\omega_r\right]^{\frac{\gamma}{1-\gamma}} \quad (14)$$

The comparison between the aggregated labor supply, when a sharp decrease in salaries in the rural areas exists, and the initial labor supply in the same area is given by:

$$\frac{L_r^*}{L_r} = \frac{l_r^*}{l_r} = (1-t)^{\frac{\gamma}{1-\gamma}} < 1 \quad (15)$$

Following Harris- Todaro model (Espindola et al, 2006), a migration flow takes place between the rural and the urban area where the minimum salaries exceed rural salaries that are declining due to the risks related to agriculture and to the biases against agriculture. The migrants who fail to obtain jobs in the urban formal economy where revenues are fixed, seek employment in the informal urban economy where salaries are flexible but higher than those prevailing in the rural areas. Hence, migrants would have a tendency to opt for the informal urban economy where they are motivated by revenue ω such as $\omega_r < \omega \leq \omega_u$. While fixed revenue ω_u^* is reserved to individuals belonging to the formal urban economy, their individual labor supply is given by l_u^* and their aggregated labor supply is L_u.

The labor supply is hence distributed according to the revenues of individuals in relation with the appropriate areas. The labor supply of the itinerant individuals between the rural and informal urban economy is given by $l_r < l < l_u$ or $L_r < L < L_u$ such as $L = l.N_c$ and N_c is the active unemployed population after migration to the urban area.

Proposition 3 :

The excess of migrants as well as any person unable to access the minimum guaranteed salary, might engage in the informal sector. The informal sector is hence attractive for rural migrants.

Urban poverty originates in part from rural migration. The latter gives birth to population flows that migrate towards the cities in the absence of an urban economy that is well prepared to receive these populations. Also, access to urban jobs in the modern sector is not easy, which translates into the development of an informal sector that is often less demanding in terms of human and physical capital. This attracts even more rural migratory flows as the level of education required by the formal modern urban sector is not often required by the informal sector.

The following table summarizes the different impacts of rural migration with and without the introduction of implicit biases and risks related to agriculture on the level of education, the labor force, and the development of informal urban economy.

Table 1: Summary of results and comparison of situations and impacts of rural migration

	Urban Area	**Rural Area**
Rural migration in the absence of implicit biases and risks related to agriculture		
Salaries	ω_u	ω_r
Initial labor force	N_u	N_r
Migrating labor force (probability of migration)	$m = N_m / N_r$	$N_m = mN_r$
Labor force after migration	$N = N_u + mN_r$	$(1-m)N_r$
Optimal level of education at departure	$s^* = \left[\dfrac{c}{\gamma a[m(\omega_u - \omega_r) + \omega_r]}\right]^{\frac{1}{\gamma-1}}$	$s_0^* = \left[\dfrac{c}{a\gamma\omega_r}\right]^{\frac{1}{\gamma-1}}$
Individual labor supply	$l_u = a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma[m(\omega_u - \omega_r) + \omega_r]}\right]^{\frac{\gamma}{\gamma-1}}$	$l_r = a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma\omega_r}\right]^{\frac{\gamma}{\gamma-1}}$
Aggregated labor supply	$L_u = (N_u + mN_r).a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma[m(\omega_u - \omega_r) + \omega_r]}\right]^{\frac{\gamma}{\gamma-1}}$	$L_r = (1-m)N_r.a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma\omega_r}\right]^{\frac{\gamma}{\gamma-1}}$
Rural migration in the presence of implicit biases and risks related to agriculture		
Salaries	$\omega_u^* = (1+\alpha)\omega_u$	$\omega_r^* = (1-t)\omega_r$
Optimal level of education with implicit biases and risks related to agriculture	$s_B^* = \left[\dfrac{c}{\gamma a\{m[(1+\alpha)\omega_u - (1-t)\omega_r] + (1-t)\omega_r\}}\right]^{\frac{1}{\gamma-1}}$	$s_{B_0}^* = \left\{\dfrac{c}{\gamma a[(1-t)\omega_r]}\right\}^{\frac{1}{\gamma-1}}$
Individual labor supply under these conditions	$l_u^* = a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}\{m[(1+\alpha)\omega_u - (1-t)\omega_r] + (1-t)\omega_r\}^{\frac{\gamma}{1-\gamma}}$	$l_r^* = a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}[(1-t)\omega_r]^{\frac{\gamma}{1-\gamma}}$
Aggregated labor supply under these conditions	$L_u^* = (N_u + mN_r).a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}\{m[(1+\alpha)\omega_u - (1-t)\omega_r] + (1-t)\omega_r\}^{\frac{\gamma}{1-\gamma}}$	$L_r^* = (1-m)N_r.a^{\frac{1}{1-\gamma}}\left[\dfrac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}[(1-t)\omega_r]^{\frac{\gamma}{1-\gamma}}$

III. Preliminary Empirical Implications

The previous models allow for observing the effects of macroeconomic distortions, among others, on levels of education, on rural migration, and on the increase of labor force in the urban side. The latter increase being difficult to observe directly in fact given the levels of formal urban demand for labor generates an informal side of the system that might possibly control the levels and mechanisms of governance in the economy.

Accordingly, for the specific values of the parameters, different scenarios of rural migration were considered with different levels of distortions. The results obtained for the group of developing countries studied, with and without accounting for distortions, are summarized in tables A, B, and C in Appendix 2. Each country is considered to have an urban and a rural sector. Comparisons with the simulated and observed levels are essential to understanding the importance of the theoretical structure that explains the macroeconomic effects on rural migration, employment, and education.

Description of the variables and data used:

Urban salaries (ω_u) are obtained from the International Labor Office (Saget, 2006). Rural salaries (ω_r) are fixed at a proportion of 70% of urban salaries. The urban labor force (rural) (N_u, N_r) was deduced based on the ratio of urban population (rural) to the total population multiplied by the total labor force. The data related to rural, urban, and total population are published by the World Bank. The total labor force appears as well in the World Bank database. Series of rural migration rates (m) are used (between 0.02 and 0.1). Similarly, different values of distortion effects on the rural side were selected ($0 < t < 1$) to conduct the simulations. In order to facilitate the estimation process, the remaining values were fixed as follows:

The level of individual talent, $a = 1$, the unit cost of education, $c = 1$, the valorization coefficient of education level, $\gamma = 0.5$, and the coefficient related to the distortions on the urban side $\alpha = 0$. The comparison between the theoretical results and the observed data requires the use of the observed average schooling years and the unemployment rate.

The optimal level of education and the aggregated labor supply

Based on the above table of results, and comparing the different situations and effects of rural migration from rural to urban areas, the calculations of the optimal level of education, with and without distortions, in the rural and the urban sides are performed using the data and variables described earlier. These calculations are based in the theoretical results. Accordingly, the optimal level of education is found to be higher in the case where rural migration exists relative to its absence. In opposition to that, the results related to the comparisons aggregated labor supply, in the presence of biases, risks, and imperfections, are higher in the urban side, compared to the when implicit biases, imperfections and agricultural risks are absent. In rural areas, these results are inversed: in the case where risks and imperfections are present, the aggregated labor supply is lower compared to the case where these risks and imperfections are absent.

Comparisons with real data

In a first step, the relations between the different base variables are established: the initial urban salary (ω_u), the urban labor force (N_u), the unemployment rate and the average schooling years. The following relations are obtained:

Table 2: Relationships between urban labor force, unemployment rate and urban wage

Equations	R²	Observations
$\ln(N_u) = \underset{(37.22)}{15.93} + \underset{(2.29)}{0.7} \times \ln(\omega_u)$	0.104	47
$\ln(\text{Averageschoolingyears.}) = \underset{(39.24)}{2.56} + \underset{(2.78)}{0.13} \times \ln(\omega_u)$	0.146	47
$\ln(\text{Nu}) = \underset{(50.4)}{6.22}.\ \ln(\text{Averageschooling years})$	0.982	47
$\ln(\text{unemploymentrate}) = \underset{(4.27)}{5.4} - \underset{(-2.52)}{0.21} \times \ln(N_u)$	0.170	33

t-stat at 5 % significance levels are shown in parenthesis below each estimated coefficient

Based on these results, the data on the employment rate are linked to the aggregated labor supply in the presence of biases (and even for different levels of distortions; Tables 4, Appendix 2). Further, the average schooling years is an inverse function of the labor force in the urban side and is linked as well to the optimal level of education in case of migration (Appendix II). The results show that the optimal schooling and aggregated labor supply conditions are affected by the distortions mentioned above.

Table 3 : Relationships between unemployment rate and the calculated urban unemployment under different distortions and rural migration rates

	t	R²	Observations	m
$\ln(unemploymentrate) = \underset{(13.65)}{0.164} \times \ln(L_u^*)$	0.1	0.854	33	0.02
$\ln(unemploymentrate) = \underset{(13.62)}{0.163} \times \ln(L_u^*)$	0.1	0.853	33	0.06
$\ln(unemploymentrate) = \underset{(13.57)}{0.169} \times \ln(L_u^*)$	0.4	0.852	33	0.02
$\ln(unemploymentrate) = \underset{(13.48)}{0.17} \times \ln(L_u^*)$	0.55	0.850	33	0.06

t-stat at 5 % significance levels are shown in parenthesis below each estimated coefficient

Tableau 4 : Average years of schooling and calculated supply of skilled labor under different levels of distortions and migration rates

	t	R²	Observations	m
$\ln(Averageschoolingyears) = \underset{(19.47)}{2.79} + \underset{(2.78)}{0.065} \ln(s_B^*)$	0.55	0.147	47	0.04
$\ln(Averageschoolingyears) = \underset{(20.79)}{2.65} + \underset{(2.78)}{0.065} \ln(s_B^*)$	0.4	0.147	47	0.02
$\ln(Averageschoolingyears) = \underset{(23.64)}{2.78} + \underset{(2.78)}{0.065} \ln(s_B^*)$	0.1	0.147	47	0.04
$\ln(Averageschoolingyears) = \underset{(22.59)}{2.72} + \underset{(2.78)}{0.065} \ln(s_B^*)$	0.25	0.147	47	0.08

t-stat at 5 % significance levels are shown in parenthesis below each estimated coefficient

The above results show that the available data on unemployment rate can be used as instrument for unemployment rate obtained from the theoretical model. Similarly the average years of schooling can be used as instrument for the supply of skilled labor, knowing that relationship is not linear.

Conclusion

The theoretical model used appears to be promising in explaining the likely knowledge losses and reduction of skills in the population remaining in locations that are sources of rural migration. These losses appear to be varying with countries in relation to the magnitude of internal rural migration. But, on the other hand skilled migrants do not often contribute to urban development given the limited urban demand for skills and the high level of competing previous urban segments of the population. These processes are accelerated when accounting for agricultural risks and macroeconomic distortions against rural areas. The preliminary empirical assessments based on developing countries with appropriate data, have shown promising directions for the application of the above theoretical models.

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Appendix I

Sensitivity of results :

$$L_u = a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}(N_u + mN_r)\left[m(\omega_u - \omega_r) + \omega_r\right]^{\frac{\gamma}{1-\gamma}}$$

$$m = 0\,, L_{u_0} = N_u . a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma\omega_r}\right]^{\frac{\gamma}{\gamma-1}} = N_u . l_u = N_u . l_r$$

$$m = 1 \text{ implies } L_u = N . a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma\omega_u}\right]^{\frac{\gamma}{\gamma-1}}$$

Since $\mathrm{m} \in [0,1]$

$$L_u = a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}(N_u + mN_r)\left[m(\omega_u - \omega_r) + \omega_r\right]^{\frac{\gamma}{1-\gamma}}$$

$$\frac{\partial L_u}{\partial m} = a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma}\right]^{\frac{\gamma}{\gamma-1}}\left[(N_u + mN_r)\frac{\gamma}{1-\gamma}(\omega_u - \omega_r)\left[m(\omega_u - \omega_r) + \omega_r\right]^{\frac{\gamma}{1-\gamma}-1} + N_r\left[m(\omega_u - \omega_r) + \omega_r\right]^{\frac{\gamma}{1-\gamma}}\right]$$

$$\frac{\partial L_u}{\partial m} = (N_u + mN_r).a^{\frac{1}{1-\gamma}}\left[\frac{c}{\gamma\left[m(\omega_u - \omega_r) + \omega_r\right]}\right]^{\frac{\gamma}{\gamma-1}}\left[\frac{\gamma}{1-\gamma}\frac{(\omega_u - \omega_r)}{\left[m(\omega_u - \omega_r) + \omega_r\right]} + \frac{N_r}{(N_u + mN_r)}\right]$$

$$\frac{\partial L_u}{\partial m} = L_u\left[\frac{N_r(1-\gamma)\left[m(\omega_u - \omega_r) + \omega_r\right] + \gamma(\omega_u - \omega_r)(N_u + mN_r)}{(N_u + mN_r)(1-\gamma)\left[m(\omega_u - \omega_r) + \omega_r\right]}\right]$$

$$\frac{\partial L_u}{\partial m} = L_u\left[\frac{(\omega_u - \omega_r)(\gamma N_u + mN_r) + (1-\gamma)N_r\omega_r}{(1-\gamma)(N_u + mN_r)\left[m(\omega_u - \omega_r) + \omega_r\right]}\right] > 0$$

The second derivative of human capital stock in urban area (L_u) is given by:

With setting $A = \frac{\gamma}{1-\gamma}\frac{(\omega_u - \omega_r)}{\left[m(\omega_u - \omega_r) + \omega_r\right]} + \frac{N_r}{(N_u + mN_r)}$, $\frac{\partial L_u}{\partial m} = L_u . A$

$$\frac{\partial^2 L_u}{\partial m^2} = L_u . A' + L_u' . A$$

$$\frac{\partial^2 L_u}{\partial m^2} = L_u(A' + A^2)$$

$$A^2 = \frac{\gamma^2(\omega_u - \omega_r)^2}{(1-\gamma)^2\left[m(\omega_u - \omega_r) + \omega_r\right]^2} + \frac{N_r^2}{(N_u + mN_r)^2} + \frac{2\gamma(\omega_u - \omega_r)N_r}{(1-\gamma)\left[m(\omega_u - \omega_r) + \omega_r\right](N_u + mN_r)}$$

$$A^{'} = -\frac{\gamma(\omega_u - \omega_r)^2}{(1-\gamma)\left[m(\omega_u - \omega_r) + \omega_r\right]^2} - \frac{N_r^2}{\left(N_u + mN_r\right)^2}$$

$$A^2 + A^{'} = \frac{\gamma^2(\omega_u - \omega_r)^2\left(N_u + mN_r\right) + 2\gamma(\omega_u - \omega_r)N_r(1-\gamma)\left[m(\omega_u - \omega_r) + \omega_r\right] - \gamma(\omega_u - \omega_r)^2(1-\gamma)\left(N_u + mN_r\right)}{(1-\gamma)^2\left[m(\omega_u - \omega_r) + \omega_r\right]^2\left(N_u + mN_r\right)}$$

$$A^2 + A^{'} = \gamma(\omega_u - \omega_r)\left\{\frac{2(1-\gamma)\omega_r N_r + (\omega_u - \omega_r)\left[(2\gamma - 1)N_u + mN_r\right]}{(1-\gamma)^2\left[m(\omega_u - \omega_r) + \omega_r\right]^2\left(N_u + mN_r\right)}\right\}$$

$$\frac{\partial^2 L_u}{\partial m^2} = L_u.\gamma(\omega_u - \omega_r)\left\{\frac{2(1-\gamma)\omega_r N_r + (\omega_u - \omega_r)\left[(2\gamma - 1)N_u + mN_r\right]}{(1-\gamma)^2\left[m(\omega_u - \omega_r) + \omega_r\right]^2\left(N_u + mN_r\right)}\right\}$$

The sign of the above expression is given by the sign of the numerator since the denominator is positive: $\left\{2(1-\gamma)\omega_r N_r + (\omega_u - \omega_r)\left[(2\gamma - 1)N_u + mN_r\right]\right\}$

The sign of the second derivative is negative under the condition: $\frac{\omega_u}{\omega_r} \le 1 - \frac{\left[2(1-\gamma)N_r\right]}{\left(2\gamma N_u + mN_r\right)}$

Under the above condition, the maximal rate of emigration is given by : $\frac{\partial L_u}{\partial m} = 0$ or:

$$m^* = \frac{(\gamma - 1)\omega_r}{(\omega_u - \omega_r)} - \gamma\frac{N_u}{N_r}$$

Appendix II

Table A

m = 0.02			Rural migration without biases			Rural migration with bias and, risks (t = 0.25)			Rural migration with bias and, risks (t = 0.55)		
PAYS	W_u	W_r	s*	L_u	L_r	s^*_B	L^*_u	L^*_r	s^*_B	L^*_u	L^*_r
Albania	0.33	0.23	0.014	67707.17	97216.73	0.008	51259.89	72912.55	0.003	31523.15	43747.53
Algeria	0.66	0.46	0.054	1253873.8	914217.16	0.031	949285.47	685662.87	0.012	583779.48	411397.72
Argentina	0.75	0.52	0.07	3481153.2	442700.46	0.04	2635518.9	332025.34	0.015	1620757.9	199215.21
Bangladesh	0.14	0.1	0.002	584030.97	1895241.7	0.001	442159.43	1421431.2	0	271913.57	852858.74
Benin	0.16	0.11	0.003	53038.91	84440.11	0.002	40154.82	63330.08	0.001	24693.9	37998.05
Botswana	0.28	0.19	0.01	29889.59	28652.59	0.006	22628.87	21489.45	0.002	13916.02	12893.67
Brezil	0.36	0.25	0.016	7550159.3	2000707.2	0.009	5716090.9	1500530.4	0.004	3515208.8	900318.24
Bulgaria	0.36	0.25	0.016	326529.8	147781.3	0.009	247209.88	110835.97	0.004	152025.99	66501.58
Cameroon	0.18	0.13	0.004	161620.48	178432.7	0.002	122359.98	133824.52	0.001	75247.38	80294.71
Chile	0.54	0.38	0.037	933059.87	163181.49	0.021	706402.98	122386.12	0.008	434414.7	73431.67
China	0.38	0.27	0.018	32405650	63397688	0.011	24533739	47548266	0.004	15087446	28528960
Colombia	0.68	0.48	0.058	2944401.8	1152415	0.033	2229154.1	864311.24	0.013	1370856.8	518586.74
Croatia	0.82	0.57	0.084	324930.59	253758.19	0.048	245999.15	190318.64	0.018	151281.43	114191.19
El Salvador	0.32	0.22	0.013	137927.94	108403.57	0.007	104422.78	81302.68	0.003	64216.59	48781.61

Ethiopia	0.18	0.12	0.004	250573.25	1322195.7	0.002	189704.54	991646.79	0.001	116662.08	594988.07
Ghana	0.28	0.2	0.01	332874.74	453151.91	0.006	252013.53	339863.93	0.002	154980.07	203918.36
Guatemala	0.37	0.26	0.017	189842.4	233525.44	0.01	143726.3	175144.08	0.004	88386.97	105086.45
Honduras	0.09	0.07	0.001	30485.86	38680.93	0.001	23080.3	29010.69	0	14193.63	17406.42
India	0.3	0.21	0.011	11030931	27732522	0.006	8351321.2	20799391	0.002	5135789.1	12479635
Indonesia	0.31	0.22	0.012	3683266.4	5922586	0.007	2788535.3	4441939.5	0.003	1714857.9	2665163.7
Jamaïca	0.27	0.19	0.009	57698.6	53182.92	0.005	43682.58	39887.19	0.002	26863.36	23932.31
Jordan	0.39	0.28	0.019	144676.02	37617.95	0.011	109531.64	28213.46	0.004	67358.37	16928.08
Kazakhstan	0.19	0.13	0.004	284159.05	213757.34	0.002	215131.74	160318.01	0.001	132298.98	96190.8
Kenya	0.13	0.09	0.002	114274.39	432547.04	0.001	86515.1	324410.28	0	53203.96	194646.17
Lebanon	0.34	0.24	0.014	118567.6	20196.14	0.008	89765.42	15147.11	0.003	55202.79	9088.26
Madagascar	0.13	0.09	0.002	80046.69	213628.32	0.001	60601.92	160221.24	0	37268.2	96132.75
Malawi	0.07	0.05	0.001	19422.37	105897.39	0	14704.33	79423.04	0	9042.68	47653.83
Malaysia	0.17	0.12	0.004	301871.45	219393.1	0.002	228541.49	164544.82	0.001	140545.53	98726.89
Mongolia	0.17	0.12	0.003	32875.99	23970.36	0.002	24889.83	17977.77	0.001	15306.43	10786.66
Morocco	0.66	0.47	0.055	1148968	990578.52	0.032	869863.14	742933.89	0.012	534937.35	445760.33
Mozambique	0.28	0.2	0.01	224833.94	557674.99	0.006	170217.76	418256.24	0.002	104678.35	250953.74
Nicaragua	0.26	0.18	0.009	78946.65	61654.26	0.005	59769.1	46240.7	0.002	36756.04	27744.42
Nigeria	0.2	0.14	0.005	1130671.1	1575587.7	0.003	856010.89	1181690.7	0.001	526418.67	709014.45
Pakistan	0.31	0.22	0.012	1476512.1	2916695.8	0.007	1117841	2187521.9	0.003	687435.6	1312513.1
Paraguay	0.98	0.69	0.12	381003.19	325902.12	0.069	288450.72	244426.59	0.026	177387.75	146655.95
Peru	0.44	0.31	0.024	1120060.8	446898.06	0.014	847978.03	335173.54	0.005	521478.73	201104.13
Philippines	0.55	0.38	0.037	3024125	2374903	0.021	2289511.1	1781177.2	0.008	1407974.4	1068706.3
Poland	0.76	0.53	0.072	2908779.6	1744565.3	0.041	2202185.1	1308424	0.016	1354271.7	785054.39
South Africa	0.6	0.42	0.045	2000040.6	1565684.2	0.026	1514195	1174263.2	0.01	931180.36	704557.89
Thaïland	0.44	0.31	0.024	1594435.6	3382523.1	0.014	1207118.7	2536892.3	0.005	742338.48	1522135.4
Turkey	1	0.7	0.125	5178885.2	2968436.7	0.071	3920841.6	2226327.5	0.027	2411189.2	1335796.5
Uganda	0.03	0.02	0	14175.9	89717.53	0	10732.32	67288.15	0	6600.03	40372.89
Uruguay	0.19	0.13	0.004	91238.41	9114.53	0.002	69074.97	6835.9	0.001	42478.85	4101.54
Venezuela	0.34	0.24	0.015	977327.33	122597.54	0.008	739917.08	91948.15	0.003	455024.78	55168.89
Vietnam	0.26	0.18	0.008	799993.46	2488863.3	0.005	605660.77	1866647.5	0.002	372461.54	1119988.5

Table B

m = 0.06			Rural migration without biases			Rural migration with bias and, risks (t = 0.1)			Rural migration with bias and, risks (t = 0.4)		
PAYS	W_u	W_r	s*	L_u	L_r	s^*_B	L^*_u	L^*_r	s^*_B	L^*_u	L^*_r
Albania	0.33	0.23	0.01	72928.06	93248.7	0.01	66244.68	83923.83	0.01	46194.54	55949.22
Algeria	0.66	0.46	0.06	1313460.6	876902.17	0.05	1193090.5	789211.96	0.02	831980.34	526141.3
Argentina	0.75	0.52	0.07	3558857	424631.05	0.06	3232711	382167.95	0.03	2254273.2	254778.63
Bangladesh	0.14	0.1	0	673303.82	1817884.9	0	611599.94	1636096.4	0	426488.27	1090730.9
Benin	0.16	0.11	0	57475.59	80993.57	0	52208.32	72894.22	0	36406.54	48596.14
Botswana	0.28	0.19	0.01	31597.19	27483.1	0.01	28701.52	24734.79	0	20014.49	16489.86
Brezil	0.36	0.25	0.02	7762252.1	1919045.7	0.01	7050892.5	1727141.1	0.01	4916813.7	1151427.4
Bulgaria	0.36	0.25	0.02	338266.88	141749.41	0.01	307266.93	127574.47	0.01	214267.1	85049.64
Cameroon	0.18	0.13	0	171837.81	171149.73	0	156090	154034.76	0	108846.57	102689.84
Chile	0.54	0.38	0.04	955750.99	156521.02	0.03	868162.67	140868.92	0.02	605397.7	93912.61
China	0.38	0.27	0.02	35610655	60810027	0.02	32347171	54729024	0.01	22556721	36486016
Colombia	0.68	0.48	0.06	3042695.2	1105377.6	0.05	2763852.1	994839.88	0.02	1927322.8	663226.58
Croatia	0.82	0.57	0.09	341077.31	243400.71	0.07	309819.8	219060.64	0.03	216047.3	146040.43
El Salvador	0.32	0.22	0.01	144810.73	103978.94	0.01	131539.78	93581.04	0.01	91726.91	62387.36
Ethiopia	0.18	0.12	0	310187.19	1268228.6	0	281760.56	1141405.7	0	196480.69	760937.13

Ghana	0.28	0.2	0.01	357504.28	434655.91	0.01	324741.35	391190.32	0	226452.57	260793.55
Guatemala	0.37	0.26	0.02	202845.94	223993.79	0.01	184256.43	201594.41	0.01	128487.93	134396.28
Honduras	0.09	0.07	0	32623.45	37102.11	0	29633.72	33391.9	0	20664.55	22261.27
India	0.3	0.21	0.01	12379473	26600582	0.01	11244975	23940524	0	7841482	15960349
Indonesia	0.31	0.22	0.01	3993825.9	5680847.7	0.01	3627817.9	5112763	0.01	2529793.9	3408508.7
Jamaïca	0.27	0.19	0.01	60905.86	51012.19	0.01	55324.24	45910.97	0	38579.37	30607.31
Jordan	0.39	0.28	0.02	148710.02	36082.52	0.02	135081.72	32474.27	0.01	94196.82	21649.51
Kazakhstan	0.19	0.13	0	297938.09	205032.55	0	270634.01	184529.3	0	188721.79	123019.53
Kenya	0.13	0.09	0	134325.7	414892.06	0	122015.63	373402.85	0	85085.41	248935.23
Lebanon	0.34	0.24	0.01	121428.45	19371.81	0.01	110300.32	17434.63	0.01	76915.96	11623.09
Madagascar	0.13	0.09	0	90350.99	204908.8	0	82070.92	184417.92	0	57230.69	122945.28
Malawi	0.07	0.05	0	24185.98	101575.05	0	21969.49	91417.55	0	15320.03	60945.03
Malaysia	0.17	0.12	0	316187.49	210438.28	0	287210.98	189394.45	0	200281.44	126262.97
Mongolia	0.17	0.12	0	34438.33	22991.98	0	31282.28	20692.78	0	21814.14	13795.19
Morocco	0.66	0.47	0.06	1209968.6	950146.74	0.05	1099082.9	855132.07	0.02	766425.8	570088.04
Mozambique	0.28	0.2	0.01	252003.04	534912.74	0.01	228908.61	481421.47	0	159625.32	320947.65
Nicaragua	0.26	0.18	0.01	82869.73	59137.76	0.01	75275.26	53223.99	0	52491.86	35482.66
Nigeria	0.2	0.14	0.01	1215852.7	1511278	0	1104427.7	1360150.2	0	770152.91	906766.78
Pakistan	0.31	0.22	0.01	1623718.7	2797647	0.01	1474915.5	2517882.3	0	1028505.9	1678588.2
Paraguay	0.98	0.69	0.12	401123.35	312599.99	0.1	364363.02	281340	0.05	254082.03	187560
Peru	0.44	0.31	0.02	1157808.4	428657.32	0.02	1051702.9	385791.59	0.01	733386.18	257194.39
Philippines	0.55	0.38	0.04	3174954	2277968.2	0.03	2883990.3	2050171.3	0.02	2011099	1366780.9
Poland	0.76	0.53	0.07	3031258.4	1673358.6	0.06	2753463.4	1506022.7	0.03	1920078.4	1004015.1
South Africa	0.6	0.42	0.05	2099584.4	1501778.7	0.04	1907171.2	1351600.9	0.02	1329931.7	901067.24
Thaïland	0.44	0.31	0.02	1763148.8	3244460.9	0.02	1601567.7	2920014.8	0.01	1116824.6	1946676.5
Turkey	1	0.7	0.13	5391187.9	2847276	0.11	4897120.8	2562548.4	0.05	3414919.6	1708365.6
Uganda	0.03	0.02	0	18172.95	86055.59	0	16507.52	77450.03	0	11511.23	51633.36
Uruguay	0.19	0.13	0	93170.79	8742.51	0	84632.3	7868.26	0	59016.82	5245.51
Venezuela	0.34	0.24	0.02	999071.79	117593.56	0.01	907513.4	105834.2	0.01	632838.23	70556.14
Vietnam	0.26	0.18	0.01	917789.55	2387277.1	0.01	833680.15	2148549.4	0	581351.94	1432366.3

Table C

m = 0.1			Rural Migration without bias			Rural Migration with implicit bias and risks (t = 0.25)			Rural Migration with implicit bias and risks (t = 0.7)		
PAYS	W_u	W_r	s*	L_u	L_r	s^*_B	L^*_u	L^*_r	s^*_B	L^*_u	L^*_r
Albania	0.33	0.23	0.01	78285	89280.67	0.01	61394.75	66960.5	0	30992.28	26784.2
Algeria	0.66	0.46	0.06	1374326.8	839587.19	0.04	1077811.1	629690.39	0.01	544082.8	251876.16
Argentina	0.75	0.52	0.07	3637180.3	406561.65	0.05	2852446.2	304921.23	0.01	1439924.8	121968.49
Bangladesh	0.14	0.1	0	765228.91	1740528	0	600128.15	1305396	0	302946.79	522158.41
Benin	0.16	0.11	0	62030.42	77547.04	0	48647.15	58160.28	0	24557.25	23264.11
Botswana	0.28	0.19	0.01	33344.89	26313.61	0.01	26150.62	19735.21	0	13200.92	7894.08
Brezil	0.36	0.25	0.02	7977144.6	1837384.2	0.01	6256048.3	1378038.1	0	3158075	551215.25
Bulgaria	0.36	0.25	0.02	350210.76	135717.52	0.01	274651.59	101788.14	0	138645.08	40715.26
Cameroon	0.18	0.13	0	182304.85	163866.76	0	142971.95	122900.07	0	72172.74	49160.03
Chile	0.54	0.38	0.04	978670.46	149860.55	0.02	767518.96	112395.41	0.01	387446.25	44958.17
China	0.38	0.27	0.02	38904379	58222366	0.01	30510626	43666775	0	15401871	17466710
Colombia	0.68	0.48	0.06	3142601.3	1058340.3	0.04	2464574.3	793755.22	0.01	1244125.7	317502.09
Croatia	0.82	0.57	0.09	357579.13	233043.24	0.05	280430.21	174782.43	0.01	141562.15	69912.97
Dominican Republic	0.39	0.27	0.02	270831.97	153520.32	0.01	212399.04	115140.24	0	107219.78	46056.1

El Salvador	0.32	0.22	0.01	151845.23	99554.3	0.01	119084.1	74665.73	0	60114.07	29866.29
Ethiopia	0.18	0.12	0	371651.42	1214261.4	0	291466.36	910696.03	0	147133.24	364278.41
Ghana	0.28	0.2	0.01	382767.96	416159.92	0.01	300184.46	312119.94	0	151534.17	124847.98
Guatemala	0.37	0.26	0.02	216176.27	214462.14	0.01	169535.5	160846.61	0	85582.11	64338.64
Honduras	0.09	0.07	0	34815.16	35523.3	0	27303.67	26642.47	0	13782.99	10656.99
India	0.3	0.21	0.01	13766823	25468642	0.01	10796584	19101482	0	5450153.3	7640592.7
Indonesia	0.31	0.22	0.01	4312673.4	5439109.5	0.01	3382199.4	4079332.2	0	1707346.1	1631732.9
Jamaïca	0.27	0.19	0.01	64187.55	48841.46	0.01	50338.86	36631.09	0	25411.23	14652.44
Jordan	0.39	0.28	0.02	152796.65	34547.1	0.01	119830.25	25910.32	0	60490.73	10364.13
Kazakhstan	0.19	0.13	0	312016.26	196307.76	0	244697.69	147230.82	0	123524.25	58892.33
Kenya	0.13	0.09	0	154982.32	397237.08	0	121544.35	297927.81	0	61356.01	119171.12
Lebanon	0.34	0.24	0.02	124317.55	18547.48	0.01	97495.61	13910.61	0	49216.13	5564.24
Madagascar	0.13	0.09	0	100954.26	196189.28	0	79173.03	147141.96	0	39966.82	58856.78
Malawi	0.07	0.05	0	29097.79	97252.71	0	22819.84	72939.53	0	11519.53	29175.81
Malaysia	0.17	0.12	0	330810.56	201483.46	0	259437.05	151112.59	0	130964.73	60445.04
Mongolia	0.17	0.12	0	36034.21	22013.59	0	28259.71	16510.2	0	14265.6	6604.08
Morocco	0.66	0.47	0.06	1272355.5	909714.96	0.04	997840.44	682286.22	0.01	503713.34	272914.49
Mozambique	0.28	0.2	0.01	279952.56	512150.5	0.01	219551.83	384112.87	0	110830.53	153645.15
Namibia	0.24	0.17	0.01	17377.56	28025	0	13628.3	21018.75	0	6879.61	8407.5
Nicaragua	0.26	0.18	0.01	86879.09	56621.26	0.01	68134.63	42465.95	0	34394.6	16986.38
Nigeria	0.2	0.14	0.01	1303239.1	1446968.3	0	1022060.8	1085226.2	0	515939.88	434090.48
Pakistan	0.31	0.22	0.01	1775007	2678598.2	0.01	1392043.1	2008948.7	0	702708.24	803579.46
Paraguay	0.98	0.69	0.13	421699.58	299297.87	0.08	330716.45	224473.4	0.02	166946.82	89789.36
Peru	0.44	0.31	0.03	1196181.5	410416.58	0.02	938101.23	307812.44	0	473556.78	123124.98
Philippines	0.55	0.38	0.04	3329106.5	2181033.3	0.02	2610840.4	1635775	0.01	1317961.3	654310
Poland	0.76	0.53	0.08	3156178.5	1602151.8	0.05	2475222.2	1201613.9	0.01	1249500.8	480645.55
South Africa	0.6	0.42	0.05	2201319.2	1437873.3	0.03	1726377	1078404.9	0.01	871481.16	431361.98
Thaïland	0.44	0.31	0.03	1936595.6	3106398.7	0.02	1518768.4	2329799.1	0	766679.61	931919.62
Turkey	1	0.7	0.13	5607644.6	2726115.4	0.08	4397776	2044586.5	0.02	2220012.7	817834.6
Uganda	0.03	0.02	0	22295.56	82393.65	0	17485.22	61795.24	0	8826.6	24718.1
Uruguay	0.19	0.13	0	95115.93	8370.49	0	74594.34	6277.87	0	37655.49	2511.15
Venezuela	0.34	0.24	0.02	1020987.8	112589.58	0.01	800706.19	84442.18	0	404199.28	33776.87
Vietnam	0.26	0.18	0.01	1039068.6	2285690.8	0.01	814886	1714268.1	0	411357.3	685707.25