

REMITTANCES, INVESTMENTS OF RURAL HOUSEHOLDS AND RURAL-URBAN MIGRATION: EVIDENCE FROM SIX CENTRAL AFRICA COUNTRIES

By: Frank Audrey TCHOKONTHE¹ and Honore MIMCHE²

¹Phd Student in Population and Development (tchokontefrank@gmail.com / Institut de Formation et de Recherche Démographiques, University of Yaounde II- Cameroon)

²Professor of Sociology (h_minche@yahoo.fr / Institut de Formation et de Recherche Démographiques, University of Yaounde II- Cameroon)

I. INTRODUCTION

Migration, one of the major demographic phenomenon, source of population dynamic, hold the attention of international scientific community since several decades concerned both about their causes and their consequences on origin or arrival places. Besides, international aspects of this phenomenon, internal migration take an important place in middle income countries because of their constant increase and their impacts on public keys infrastructures in arrival cities such as water and energy provision, housing, exacerbating thereby already existing inequalities between rural and urban areas.

Especially in Africa, urbanization is growing fast and is expected to reach the level of 50% approximately by 2030, and even if from data of United Nation World Urbanization Prospects (2014) rural-urban migration trend in Central Africa region is the lone under the Africa urbanization trend, the same tendency of increase is observed. Indeed, in cities in this region will count more than 50% of the whole population (World Urbanization Prospects, 2014 cited by Burak Güneralp and *al.*, 2017).

Looking at consequences of internal or international migration, remittances are increasingly focused attention due to their sustained increase. Indeed, remittances to middle-and low income countries has grew very fast in last decades: For World Bank Migration and Development Brief 29 (2018), remittances flow to low and middle-income countries is actually estimates to 466 billion of USD and is expected to pursue their growth which have made them comparable to Foreign Direct Investment (FDI) and much larger than Official Development Assistance (ODA) flows to these countries.

Even presenting the lowest level, Sub-Saharan Africa follow the global trend of remittances observed at whole world and they grew from \$30 billion in 2010 to \$38 billion in 2017, and are expected to continue to grow into 2019 (Migration and Development Brief 29, 2018).

Specifically, in Central Africa countries, even if remittances doesn't overpass ODA and are least high than those of the five others Caribbean Asia and Pacific regions, the same trend of increase is observed. From World Bank (2010) analysis, Cameroon is the main beneficiary of fund receipts (estimated to 125.3 million euros, either 86% of the global receipts transfer in the region), and most of these funds are send to rural areas (International Fund for Agricultural Development, 2007).

This paper aim to shed the light on the more important channel by which remittances act on rural-urban migration.

II. LITERATURE REVIEW

From Acosta and *al.* (2008), remittances affect household behaviors by three ways, namely: patterns of expenditures, the time they keep children in school and the labor supply behavior of individuals living in the household. More globally, Evans Jadotte and Xavier Ramos (2015) in their study found that, remittances can in some cases foster household farm investment and agricultural production, while in others, remittances may reduce agricultural labor and production, by increasing non-farm activities and limiting people's willingness to low-paid agricultural activities.

Adams (2005) examining the impact of remittances on the spending behavior of households for consumption and investments, in both rural and urban Guatemala find that the households receiving international remittances spend more at the margin on investment goods, especially, on housing and education, and spend less, at the margin, on food items. Similarly, Yang (2004) analyses how the exchange rate shocks during 1997 due to the Asian Financial Crisis affected the expenditure pattern of 1,646 Filipino households receiving international remittances, one of its findings shows that favorable exchange rate shocks increases the investment of remittances receiving household in entrepreneurial activities specifically in transportation, communication and manufacturing enterprises.

Regarding specifically investment in youth education, literature can emphasize remittances effects of agricultural productivity and non-farm activities on rural-urban migration. First, Lututala M. (1995) underline the fact that when education level of youth increase, they move towards urbans areas which offer more employment opportunities – several non-farm activities - to valorize their knowledges. So, if an important part of

remittances is oriented towards investment goods such as education, it could, by this way, increase rural-urban migration.

Also, education can affect the amount of effort expended on the job. This is difficult to measure for regular employment, but some studies that focus on agriculture find evidence that remittances through education change the effort that farmers put in their activity because of improved labor productivity (Misbah T. C., 2009; Polyzos A. and Arabatzis G., 2005). Since the seminal work of Schultz (1964), education can enhance the farming skills and productive capabilities of the farmers (Weir 1999), enabling them to follow some written instructions about the application of adequate and recommended doses of chemical and other inputs (Appleton and Balihuta 1996; Huang and Luh 2009).

The labor force underemployed because of this enhanced agricultural labor productivity can be allowed to others economic activities (it is the virtuous mechanism for development developed by Jorgenson, 1961; Johnston and Mellor, 1961; Schultz, 1964 cited by Titus O. Awokuse, 2009), even if some studies held that employment participation could finally decrease (Acosta and *al.*, 2008; Funkhouser, 1992). In this regard, Khanal and *al.* (2015) find that remittance receipt among rural families in Nepal increases the amount of land that farmers abandon, while Damon (2010) finds that remittances receipt increases the amount of land that farmers devote to subsistence crops and reduces the amount devoted to cash crops. However These important results it would be interesting to make a comparison of the effect of remittances on involvement into different economic sectors in developing countries, regarding the importance of agriculture development and structural economic transformations for development.

Rural exodus can result from different mechanisms in literature review. In economics development literature, the *push and pull factor* theory developed by Lee, (cited by Lututala M., 1995, p. 403) appear as a general frame to explain this phenomenon by measuring the effect living conditions in arrival and departure areas on mobility. In this theory environmental condition take an important place by pushing people to move in case of natural disasters and also because of decrease of crops yields due to climate change (Ekpenyong and Ogbuagu, 2015; Dawit and *al.*, 2016; Edoja and *al.*, 2016 showed a negative effect of Carbone Emissions on agricultural productivity).

Finally remittance is a wealth or income and generally speaking, it is when income or wealth increases above a specific threshold that migration becomes more likely (Alonso,

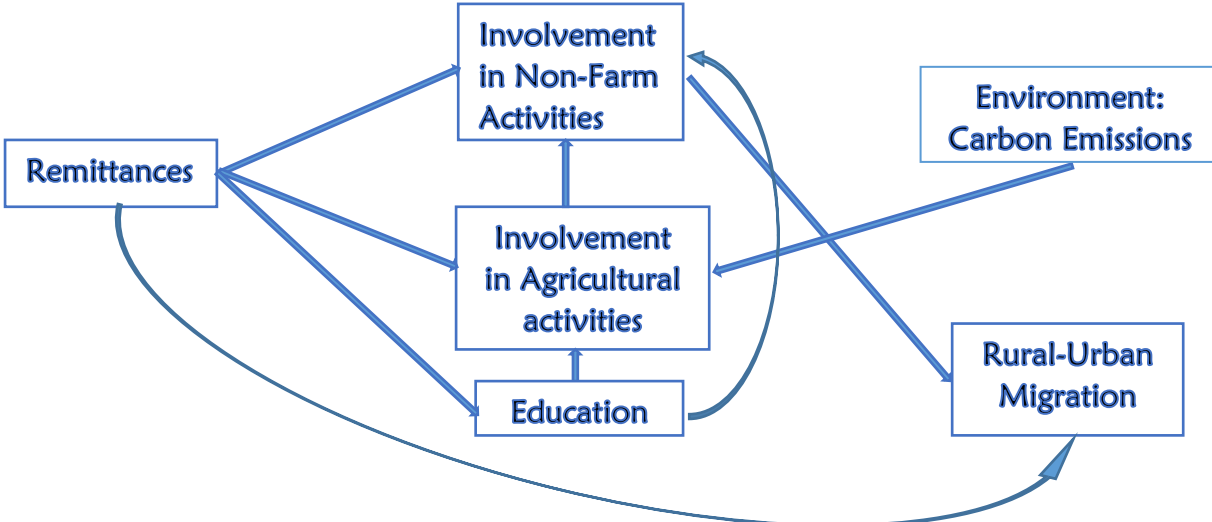
2004; McKenzie and Rapoport, 2004; Hatton and Williamson, 2004; Skeldon, 2002). So, if remittances allow to can finance rural-urban migration by reducing cost of transport and installation in cities.

Rural people are at the center of migration. Even if generally speaking, it is when income or wealth increases above a specific threshold that migration becomes more likely, while acquisition of high levels of income or wealth makes migration unnecessary (Alonso, 2004; McKenzie and Rapoport, 2004; Hatton and Williamson, 2004; Skeldon, 2002), evidence from India and sub-Saharan Africa indicates that poor people have higher migration propensity (Waddington and Sabates-Wheeler 2003). So, if remittances allow wealth of rural household to overpass a certain threshold it will reduces migration, if not it will just encourage migration.

From this literature review it comes that remittances can affect rural urban migration by three ways: Remittances can increase investment in agriculture, and hiring laborers, and the development in agriculture freely people for modern sector in urban spaces, it is the virtuous mechanisms; remittances can also directly finance involvement in non-farm activities, through investment in education, which are mostly located in urban areas in sub-Saharan Africa countries and finally remittances can finance directly migration and installation in cities.

We can schematize mechanisms by which remittances could affect rural-urban migration as follow:

Figure 1: Interaction mechanisms between Remittances and Rural-Urban Migration



Sources: Constructed by authors regarding literature review.

Looking at these mechanisms by which remittances affect rural-urban migration, many researchers have proposed to use mediation analysis to tackle such type of interaction. However, since the seminal work of Baron and Kenny (1986) that proposed a procedure to identify mediator variables in four steps, many further researches have pointed out limitations of this procedure (Pardo Antonio and *al.*, 2013). At the end of their synthesis Pardo Antonio and *al.* (*op.cit.*) recommended the use of Structural Equation Modelling.

III. DATA AND ECONOMETRIC MODELLING

Data are issue from World's Bank World Development Indicators (WDI) and US Department for Agriculture (USDA, 2014). This study concern seven central Africa countries named Cameroon, Central Africa Republic, Democratic Republic of Congo, Chad, Equatorial Guinea and Gabon from 2000 to 2010 (13 years) either 78 observations to implement econometric procedure. Missing data on variables are replaced using linear interpolation.

For our analysis, we consider the following definitions of indicators and variables:

Involvement in Agriculture is measured by *Food Production Index*: Is measured by Food Production Index in constant 2004–2006 International dollars (I\$). It is plausible to do such approximation because in central Africa agriculture is yet largely dependent from human energy (65% from Food Agriculture Organization data, 2006).

Education is also taking into account in our study, because remittances can finance it. There exist different measure of education among studies, but in central African countries where literacy is not yet at 100% this simple indicator can be used to measure this socioeconomic variable. Again, numeracy helps them to calculate the costs and benefits of adopting a particular farming technology.

Labor: As defined in Nin-Pratt (2015), labor is the total economically active population in agriculture (in thousands) engaged in or seeking work in agriculture, hunting, fishing, or forestry, whether as employers, own account workers, salaried employees, or unpaid workers. This measure of agricultural labor input, also used in other cross-country studies, is an uncorrected measure that does not account for hours worked or labor quality (education, age, experience, and so forth);

The *Involvement in non-farm activities* is measured by the percentage of active population living in rural area non engaged in agriculture. This variable is calculated assuming that

active population is the same in rural and urban area, make use of age dependence ratios old and young in the country, population of the country and economically active persons in agriculture at almost 15 years old (Labor).

$$\text{Involvement in Non farm activities} = \frac{(100 + x + y) \times \text{Labor}}{(100 + y) * \text{population}} \quad (1)$$

Where x represent age dependence ratio young and y age dependence ratio old in percentage.

Rural-urban migration is simply measured by the proportion of urban population in global population of the country.

Be given the above precision on variables of analyze, we can write the econometric modeling as follow:

$$\text{Education}_{it} = \theta_0 + \theta_1 \text{remitt}_{it} + \theta_2 \text{GDP}_{it} + \varepsilon_{3,it} \quad (1)$$

Remittances is just a supplement that can be mobilized by household to invest in consumption and investment goods, but GDP seize the whole part of household resources, so we control the effect of remittances on education by introducing GDP in the models, such that:

$$\text{fpi}_{it} = \delta_0 + \delta_1 \text{remitt}_{it} + \delta_2 \text{Education}_{it} + \delta_3 \text{CE}_{it} + \varepsilon_{2,it} \quad (2)$$

Using the sum of the three popular GHG emission (CO₂, methane and nitrous oxide emissions) or simply CO₂ emissions, Ekpenyong and Ogbuagu (2015) found that climate and further, Dawit and *al.* (2016) founded a negative effect of climate change on agricultural performance and household welfare for the period. From these results we can consider in our econometric modelling CEs as an agriculture non desirable inputs.

$$\text{INFA}_{it} = \gamma_0 + \gamma_1 \text{fpi}_{it} + \gamma_2 \text{remitt}_{it} + \gamma_3 \text{Education}_{it} + \varepsilon_{1,it} \quad (3)$$

$$\text{Urbanprop}_{it} = \alpha_0 + \alpha_1 \text{nonfarmactiv} + \alpha_2 \text{remitt}_{it} + \alpha_3 \text{GDP}_{it} + \alpha_4 \text{GDP}^2_{it} + \varepsilon_{4,it} \quad (4)$$

In these equation *nonfarmactiv* refer means Involvement in Non-Farm Activities, *remitt* refer to remittances, and *urbanprop* refer to urbanization, CE is Carbon Emissions and *fpi* is Food Production Index.

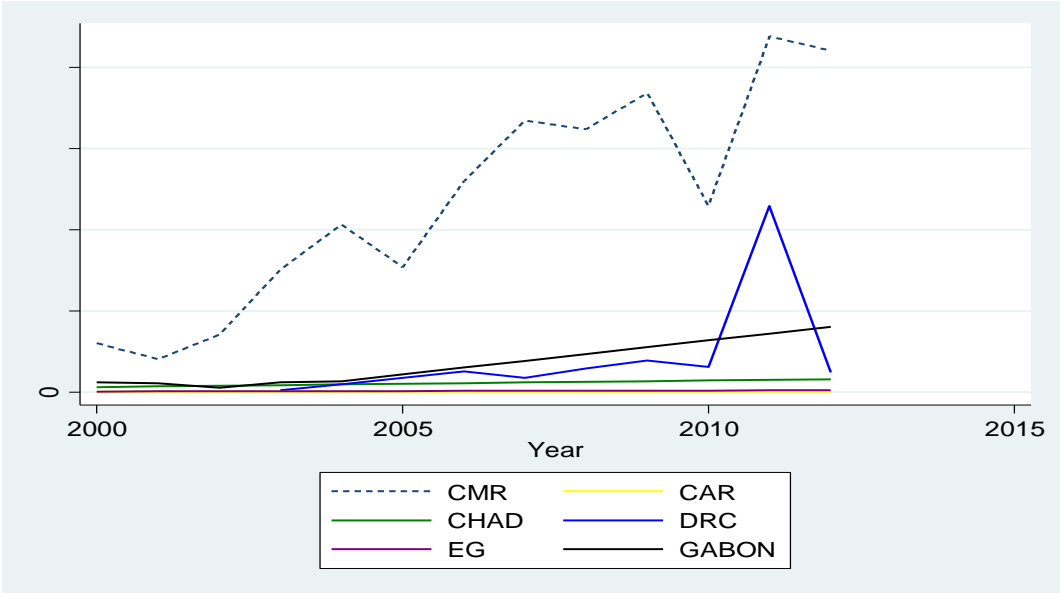
IV. DESCRIPTIVE STATISTICS

The **Tables and Graphics** below give for each variable descriptive statistics. First we present the descriptive statistics of the keys variables of our study which are remittances,

percentage of active population involved in non-farm, literacy and rural population proportion. For that variables we present evolution in each countries, to better understand the general tendency in the sub-region. The other variables are simply described in one table, presenting tendency and variation numerical characteristics.

Indeed, this graphic allow us to remark that Cameroon is the lone country where remittances increase exponentially in tendency. The pick of remittances observed in Democratic Republic of Congo appear as a transitory phenomenon, as such that Gabon exhibit in tendency an increase of remittances higher than him, even if the pace and the level of evolution are not greatly different.

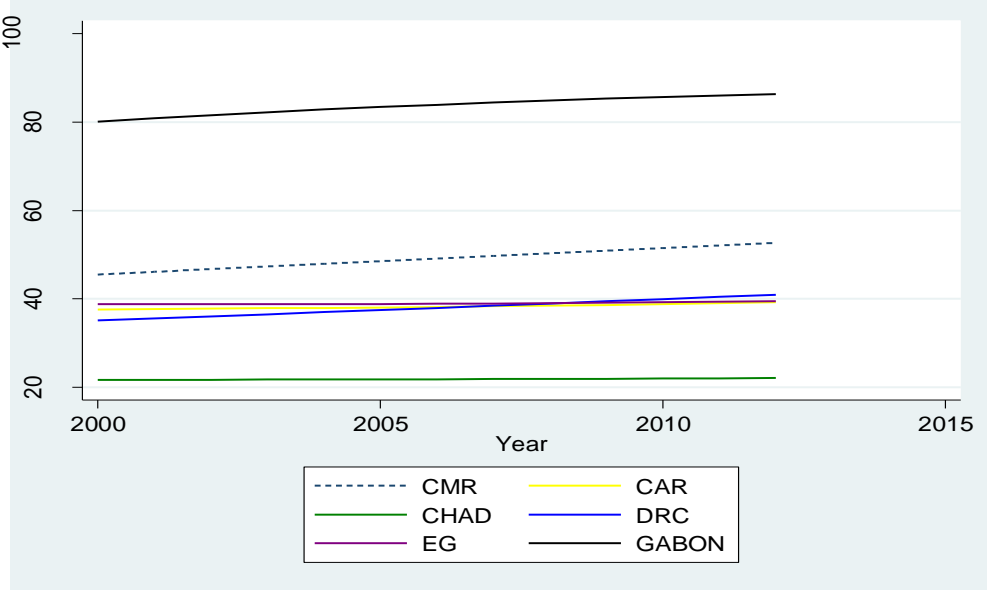
Graphic 1: Evolution of remittances for each country (in current US dollars)



Sources: Descriptive statistics on STATA/SE 14.

Besides remittances, **Graphic 2** reveal a tendency to increase of urban population in all central Africa countries, but at different levels and paces. The most important levels (higher than 70% since 2000) are observed in Gabon, while Cameroon (CMR), Democratic Republic of Congo (DRC) and Equatorial Guinea (EG) present the middle level of the region (between 60% and 70% in 2014), and finally Chad and Central Africa Republic (CAR) with the lowest levels in 2014.

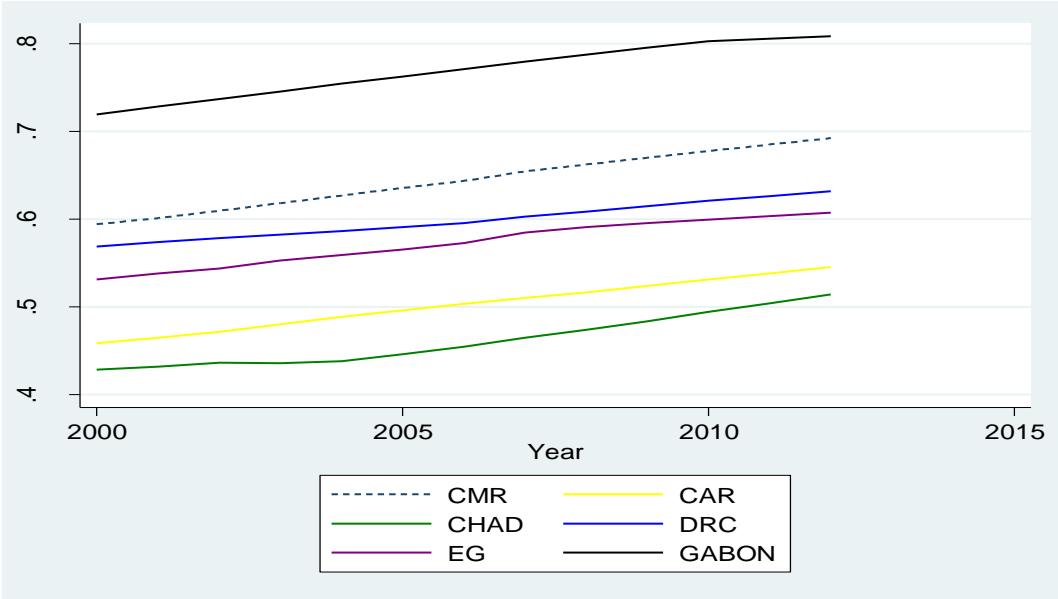
Graphic 2: Evolution of urban proportion (%) in each country



Sources: Descriptive statistics on STATA/SE 14.

As underlined by literature review, the proportion of rural population is strongly related to development of non-farm activities and the **Graphic 3** present the evolution of involvement in non-farm activities. The most important level (upper than 80% since 2000) is observed in Gabon, Cameroon present the middle level of the region (between 40% and 60%), while Equatorial guinea, Democratic Republic of Congo (DRC) and Central Africa Republic (CAR) present a similar level and evolution around 40%. Chad exhibit the lowest level and variation with around 20% of urban population.

Graphic 3: Evolution of active population involved in non-farm activities (%)

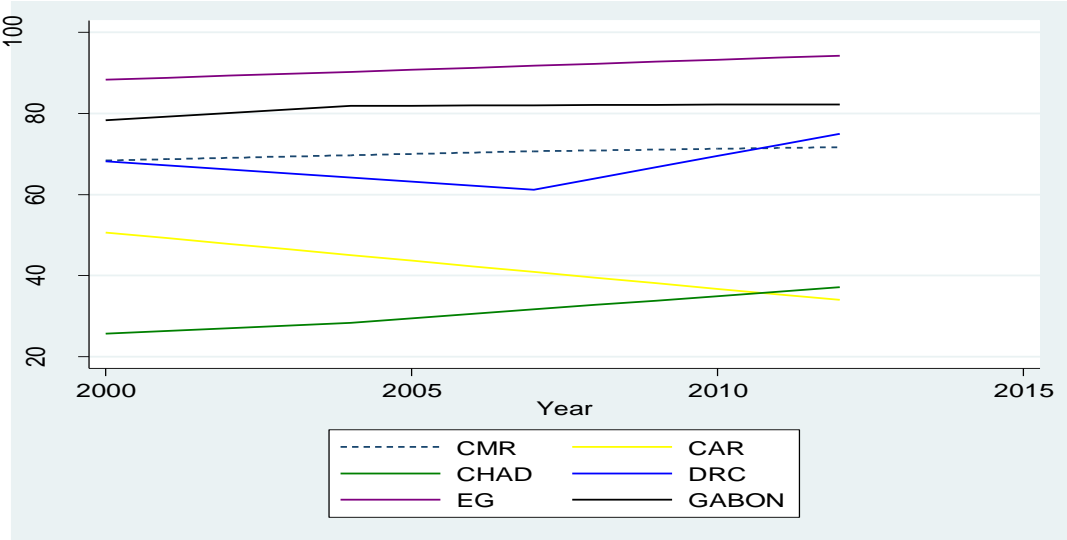


Sources: Descriptive statistics on STATA/SE 14.

These results corroborate *a priori* the fact that non-farm activities are mostly located in urban area, although it not insure that this movement to urban area occur after a certain level of agriculture development. This study aim to test this mechanism.

The Graphic 4 below shows an important disparities in the evolution of literacy rates in the seven selected central African countries. Indeed, when in Democratic Republic of Congo (DRC) the evolution is irregular with a decrease between 2000 and 2007, and an increase between 2008 and 2013, it permanently decrease in Central Africa Republic (CAR). Additionally, even if in the others five countries literacy is increasing the level and the pace of this increase vary among them. Chad exhibit the fastest pace of increase but with the lowest level in the region. The highest level of literacy is observed in Equatorial Guinea, followed Gabon and Cameroon.

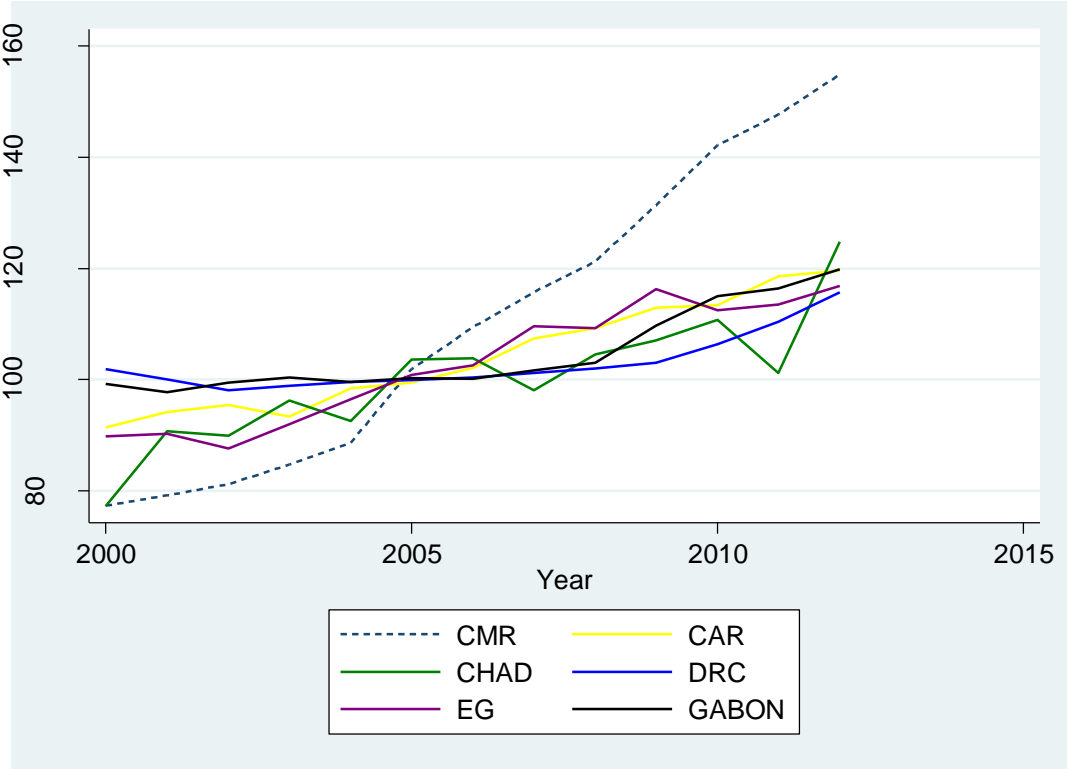
Graphic 4: Evolution of literacy in the countries



Sources: Descriptive statistics on STATA/SE 14.

Following remittances, food production index is growing faster than urbanization, suggesting thereby, the virtuous process of development through structural economic transformation, and especially agricultural development is going on. As in remittances Cameroon exhibit the fastest evolution. The other five countries seems to follow similar paces and levels.

Graphic 5: Evolution of Agricultural Productivity (Food Production Index)



Sources: Descriptive statistics on STATA/SE 14.

V. ECONOMETRIC RESULTS AND DISCUSSION

Be given the panel nature of data, Fisher and Hausman tests has been performed for each equation of the simultaneous model, and suggested the presence of fixed effect for all the equations (The results of the tests are presented in annex). So dummies variables are created and introduced in equations of the system to take into account countries effects. Considering simultaneity of the equations, we observe each equation satisfy rank condition.

The model is launched only on 78 observations for which no missing values were found. Globally the model is strongly significant looking at p-value (**0.000**) of chi-square statistics testing overall goodness-of-fit, with a R-squared of all the equation of the model equal to **0.9999967**.

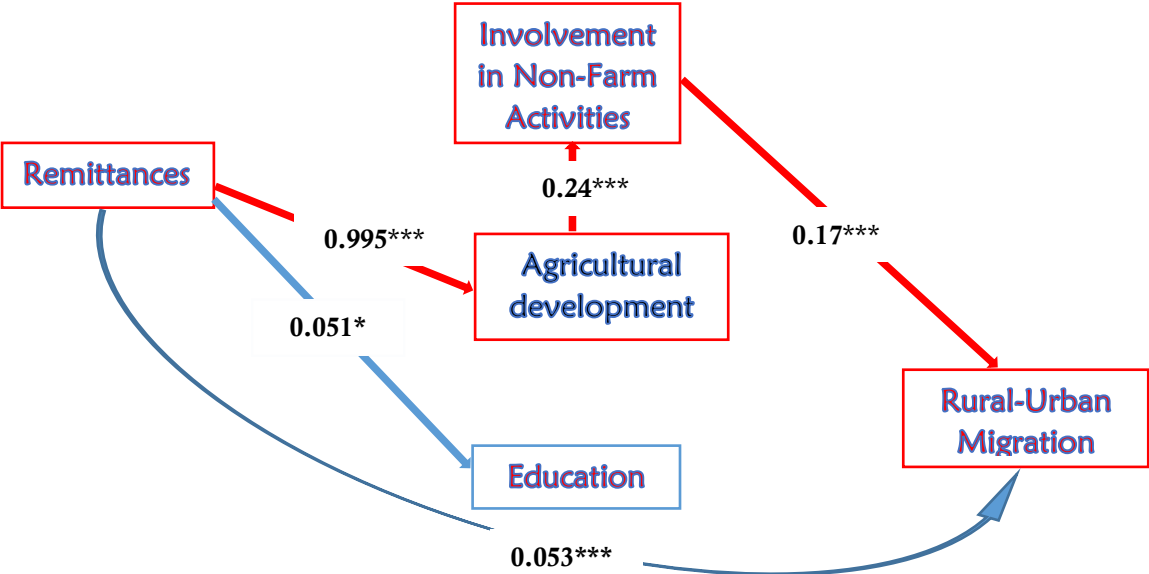
The output is easier to interpret when we display standardized values for paths rather than path coefficients. A standardized value is the change in one variable given a change in another, both measured in standard deviation units. We obtain standardized values by specifying *sem's* standardized option. The standardized coefficients for this model can be interpreted as the correlation coefficients between the indicator and the output.

The results of the two firsts regressions shows that, remittances strongly and positively affect investments education and permit at the same time to increase food production index, implying hiring of labor force for agriculture and other inputs, and the highest value of standardized coefficients for the second effect suggest that remittances act quasi-totally through agriculture development.

Then improvement of agriculture productivity increase significantly involvement in non-farm activities, but involvement in non-farm activities doesn't seems affected by education enhancement. So, remittances seems to affect involvement in non-farm activities by investment agriculture development in central Africa region. This results shed the light on the virtuous effect of remittances on structural economic transformation and development through agricultural development in central African region.

Looking at the last regression we can see that remittances directly increase urban population it means that the level of amounts transferred finance displacement to cities and installation during the period of job seeking. It can be explained by the fact that the amount received doesn't allow wealth of rural households to reach a certain level that makes migration unnecessary as suggested by Alonso, 2004; McKenzie and Rapoport, 2004; Hatton and Williamson, 2004; Skeldon, 2002, in their investigations on the link between wealth and rural-urban migration.

Figure 2: Significant standardized coefficients of our estimation representing the effect of remittances in rural urban migration.



Sources: Designed by authors.

Globally we can tell that, remittances by the development of agriculture, which development increase involvement in non-farm activities, mostly located in cities, as the highest level of its standardized coefficient suggest, allow the sustainable development through economic structural transformation. **Figure 2** represents results of our estimation, we have in red color pathway by which remittances act on rural urban migration more importantly, and only significant results involving our main variables are reported in this figure.

VI. CONCLUSIONS

As many sub-Saharan Africa countries, central Africa countries face a growing urbanization, and this phenomenon reduce population involved in agriculture and then its effective contribution to economic development. Besides that we observe a constant raise in the fund receipts by households – mostly rural - from migrants. So it appears important to know if remittances contribute to a sustainable development through structural economic transformation.

Implementing a structural equation model we found that even if remittances promote agriculture development by investment in agricultural inputs, notably hiring of labor force, and thereby allow an increasing involvement in non-farm activities. So, remittances is a factor that help central African countries through structural economic transformation in their walk through sustainable development. However the positive and direct effect of remittances on rural-urban migration mitigate this virtuous effect of remittances.

Globally, looking at the magnitude of standardized coefficients, even if remittances worsening rural-urban migration, it allow that this phenomenon occur after a certain level of agriculture and rural development as prescribe in socioeconomic literature on development steps. From these results, it appear relevant for central African governments to pursue their promotion of agriculture involvement in rural areas, but also create an appropriate environment to facilitate commercialization of agricultural products. To reduce use of remittances in financing displacement and installation of rural laborers in cities, public policies can create an appropriate environment to development of services in rural areas, such as services that put in relation farmers and agro industries.

VII. REFERENCES

- Amuedo-Dorantes, Catalina & Pozo, Susan (2006a). "Remittances receipt and Business Ownership in the Dominican Republic". *The World Economy*, 29(7): 939-956.
- Amuedo-Dorantes, Catalina & Pozo, Susan (2006b). "Migration, remittances, and male and female employment patterns". *American Economic Review Papers & Proceedings*, 96(2):222–226.
- Atamanov, A. & Van Den Berg, M. (2012). Heterogeneous effects of international migration and remittances on crop income: Evidence from the Kyrgyz Republic. *World Development*, 40(3):620–630.
- Awokuse Titus O. (2009). Does Agriculture Really Matter for Economic Growth in Developing Countries? Department of Food & Resource Economics University of Delaware, Newark, DE 19717, USA.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Binzel, C. & Assaad, R. (2011). Egyptian men working abroad: Labor supply responses by the women left behind. *Labor Economics*, 18, Supplement 1(0):S98–S114.
- Chung, H., (2005). 'Different Strategies for Flexibility Employment protection and temporary employment: A study of cross-national variance on temporary employment in 19 OECD countries'. Paper presented at the TLM.NET conference: Managing Social Risks through Transitional Labor Markets, 19 - 21 May 2005 (Draft).
- Dawit, W. M., Zerayehu, S. E., & Tsegaye, G. G. (2016, March). *The impact of CO2 emissions on agricultural productivity and household welfare in Ethiopia: A computable general equilibrium analysis* (p. 23, Discussion Paper Series EfD DP 16-08). Sweden: Environmental Economics Unit, University of Gothenburg.
- Démurger Sylvie & Li Shi (2012). Migration, Remittances and Rural Employment Patterns: Evidence from China.

Dolton P. J. & Kidd, M. P. (2001), 'Job changes, occupational mobility and human capital acquisition: An empirical analysis', *Bulletin of Economic Research*, Vol. 50, Issue 4, 1998, p. 265.

Edoja Prosper Ebruvwiyo, Goodness C. Aye & Orefi Abu (2016), Dynamic relationship among CO2 emission, agricultural productivity and food security in Nigeria, *Cogent Economics & Finance*, 4: 1204809.

Ekpenyong, I. U., & Ogbuagu, M. I. (2015). *Climate change and agricultural productivity in Nigeria: An econometric analysis*. doi:10.2139/ssrn.2636868. Retrieved from <http://ssrn.com/abstract=2636868>.

Funkhouser, Edward (1992). "Migration from Nicaragua: Some Recent Evidence". *World Development*, 20(8):1209-18.

Groot, Wim & Werbeme, Maartje (1997), "Aging, Job mobility and Compensation." *Oxford Economic Papers* 49: 380 – 403.

Hatton, Timothy, & Jeffrey Williamson (2004). ¿Cuáles son las causas que mueven la migración mundial? *Revista Asturiana de Economía* 30 (May-August).

Hersch, J. & Stratton, L. S., 'Housework, fixed effects, and wages of married workers', *The Journal of Human Resources*, Vol. 32, No. 2, 1997, pp. 285–307.

IFAD (2007). *Sending money home: Worldwide remittance flows to developing and transition countries*. Rome.

Jadotte, E. (2009) *International Migration, Remittances and Labor Supply: The Case of the Republic of Haiti*. WIDER Research Paper, No 2009/28. World Institute for Development Economic Research, United Nations University, Helsinki.

Lokshin, M. & Glinskaya, E. (2009). The effect of male migration on employment patterns of women in Nepal. *The World Bank Economic Review*, 23(3):481–507.

Lututala M., *Les migrations africaines dans le contexte socioéconomique actuel : une revue critique des modèles explicatifs*, dans Gérard H. and Piché V. (dir.), *La sociologie des populations*, Montréal, Les presses de l'université de Montréal, 1995.

McKenzie David & Hillel Rapoport (2004). *Network effects and the dynamics of migration and inequality: Theory and evidence from Mexico*. BREAD Working Paper No. 063. Cambridge,

MA: Bureau for Research and Economic Analysis of Development, hosted by the Center for International Development, Harvard University.

Misbah T. C. (2009). *Determinants of Labor Productivity: An Empirical Investigation of Productivity Divergence*. University of Groningen, The Netherlands.

Nin-Pratt, A. (2015). "Inputs, Productivity and Agricultural Growth in Africa South of the Sahara". Environment and Production Technology Division, INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE (IFPRI), Discussion Paper 01432.

Pardo Antonio & Román Marta (2013). Reflections on the BARON AND KENNY model of statistical mediation. *Anales de psicología*, vol. 29, n° 2 (mayo), 614-623.

Polyzos A. and Arabatzis G. (2005). Labor Productivity of the Agricultural Sector in Greece: Determinant Factors and Interregional Differences Analysis. *Discussion Paper Series*, 11(12): 209-226.

Waddington Hugh & Rachel Sabates-Wheeler (2003). *How does poverty affect migration choice?: A review of literature*. Brighton, UK: Institute of Development Studies, University of Sussex.

WORLD BANK GROUP (2018, April). *Migration and Remittances: Recent Developments and Outlook*. Migration and Development Brief 29. KNOMAD.

ANNEXES

ANNEX.1: Fisher tests for each equation

3 . xtreg education Remitt gdp, fe

```

Fixed-effects (within) regression      Number of obs   =      78
Group variable: id                    Number of groups =       6

R-sq:                                  Obs per group:
  within = 0.1112                       min =          13
  between = 0.6934                       avg  =         13.0
  overall = 0.4308                       max  =          13

corr(u_i, Xb) = 0.6161                  F(2, 70)        =       4.38
                                          Prob > F        =       0.0161

```

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education						
Remitt	2.16e-08	1.21e-08	1.78	0.079	-2.60e-09	4.57e-08
gdp	.0002404	.0001084	2.22	0.030	.0000242	.0004567
_cons	62.30677	.6091749	102.28	0.000	61.09181	63.52173
sigma_u	21.935254					
sigma_e	3.1791857					
rho	.97942603	(fraction of variance due to u_i)				

F test that all u_i=0: F(5, 70) = 347.43 Prob > F = 0.0000

4 . xtreg fpi education Remitt CE, fe

```

Fixed-effects (within) regression      Number of obs   =      78
Group variable: id                    Number of groups =       6

R-sq:                                  Obs per group:
  within = 0.5668                       min =          13
  between = 0.7225                       avg  =         13.0
  overall = 0.3084                       max  =          13

corr(u_i, Xb) = -0.8385                 F(3, 69)        =      30.10
                                          Prob > F        =       0.0000

```

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fpi						
education	-.0162426	.352221	-0.05	0.963	-.7189042	.6864191
Remitt	2.71e-07	4.00e-08	6.77	0.000	1.91e-07	3.51e-07
CE	.003927	.0012949	3.03	0.003	.0013437	.0065104
_cons	88.59422	21.86574	4.05	0.000	44.97326	132.2152
sigma_u	14.796954					
sigma_e	9.4661871					
rho	.70958932	(fraction of variance due to u_i)				

F test that all u_i=0: F(5, 69) = 8.72 Prob > F = 0.0000

5 . xtreg nonfarmactiv education fpi Remitt, fe

```

Fixed-effects (within) regression      Number of obs   =       78
Group variable: id                    Number of groups =        6

R-sq:                                Obs per group:
    within = 0.7114                    min =          13
    between = 0.5763                    avg  =         13.0
    overall = 0.2614                    max  =          13

corr(u_i, Xb) = 0.2997                 F(3, 69)        =       56.69
                                           Prob > F        =       0.0000

```

nonfarmactiv	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education	.0004305	.0005647	0.76	0.448	-.0006959	.001557
fpi	.0018174	.0001852	9.82	0.000	.001448	.0021868
Remitt	-9.90e-11	8.43e-11	-1.17	0.244	-2.67e-10	6.92e-11
_cons	.3770642	.0387658	9.73	0.000	.2997286	.4543998
sigma_u	.1003863					
sigma_e	.01549991					
rho	.97671495	(fraction of variance due to u_i)				

F test that all u_i=0: F(5, 69) = 281.64 Prob > F = 0.0000

6 . xtreg urbanprop nonfarmactiv Remitt gdp gdp2, fe

```

Fixed-effects (within) regression      Number of obs   =       78
Group variable: id                    Number of groups =        6

R-sq:                                Obs per group:
    within = 0.7723                    min =          13
    between = 0.7983                    avg  =         13.0
    overall = 0.7431                    max  =          13

corr(u_i, Xb) = 0.7954                 F(4, 68)        =       57.67
                                           Prob > F        =       0.0000

```

urbanprop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
nonfarmactiv	31.66489	4.624702	6.85	0.000	22.43644	40.89334
Remitt	1.99e-08	3.48e-09	5.72	0.000	1.29e-08	2.68e-08
gdp	.0000544	.0001076	0.51	0.614	-.0001602	.0002691
gdp2	-3.98e-09	4.05e-09	-0.98	0.330	-1.21e-08	4.11e-09
_cons	25.72709	2.572917	10.00	0.000	20.59292	30.86127
sigma_u	17.46336					
sigma_e	.73575695					
rho	.99822808	(fraction of variance due to u_i)				

F test that all u_i=0: F(5, 68) = 1078.28 Prob > F = 0.0000

ANNEX.2: Results of our estimation

Exogenous variables	Coef.	Std. Err.	P>z	[95% Conf.	Interval]
Dependent: Education (Adult literacy)					
Remittances	.0517229	.0275199	0.060*	-.002215	.1056609
Gross Domestic Product	.0651694	.0278219	0.019**	.0106396	.1196993
CMR	-.2052529	.0314395	0.000	-.2668732	-.1436327
CAR	-.6470918	.0219766	0.000	-.6901651	-.6040185
CHAD	-.850164	.0197146	0.000	-.888804	-.811524
DRC	-.2279822	.0240065	0.000	-.2750341	-.1809304
EG	.1587575	.0229843	0.000	.113709	.2038059
_cons	3.719841	.0705309	0.000	3.581603	3.858079
Dependent: Food Production Index					
Education	-.0248846	.5074959	0.961	-1.019558	.9697892
Remittances	<u>.9952328</u>	.1132043	0.000***	.7733564	1.217109
CE	-.8673857	.1749881	0.000***	-1.210356	-.5244154
CMR	.2735495	.3489742	0.433	-.4104274	.9575265
CAR	.1012702	.4483644	0.821	-.7775079	.9800482
CHAD	-.1020954	.1657995	0.538	-.4270564	.2228656
DRC	-.2324179	.1543054	0.132	-.5348508	.0700151
EG	.5809133	.1739127	0.001	.2400506	.921776
_cons	6.747268	1.964647	0.001	2.896631	10.59791
Dependent: Involvement in non-farm activities					
Education	.0888531	.1096177	0.418	-.1259937	.3037
Food Production Index	<u>.2448184</u>	.0275907	0.000***	.1907417	.2988951
Remittances	-.0490174	.0392738	0.212	-.1259926	.0279578
CMR	-.4357213	.0415016	0.000	-.5170629	-.3543797
CAR	-.9059518	.077459	0.000	-1.057769	-.7541349
CHAD	-1.004239	.0985998	0.000	-1.197492	-.8109872
DRC	-.5810872	.0351711	0.000	-.6500212	-.5121532
EG	-.7182912	.0293407	0.000	-.775798	-.6607845
_cons	5.2865	.4582295	0.000	4.388387	6.184613
Dependent: Proportion of Urban population					
Involvement in non-farm activities	<u>.1708724</u>	.0235277	0.000***	.1247589	.216986
Remittances	.0530799	.0086719	0.000***	.0360832	.0700765
Gross Domestic Product	.0164352	.0303249	0.588	-.0430005	.0758709
(Gross Domestic Product)^2	-.6328768	.0148304	0.000***	-.6619439	-.6038097
CMR	-.710642	.0196927	0.000	-.7492389	-.6720451
CAR	-1.008761	.0229573	0.000	-1.053757	-.9637655
CHAD	-.781594	.013695	0.000	-.8084357	-.7547522
DRC	-.7366878	.0180272	0.000	-.7720205	-.7013552
EG	-.0240384	.0228683	0.293	-.0688595	.0207827
_cons	3.077165	.1614956	0.000	2.760639	3.39369

***Significant at 1% threshold, ** significant at 5% threshold and * significant at 10% threshold
The standardized coefficient underlined is the most important one.

Sources: Econometric estimation on STATA/SE 14