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Do Remittances Have a Real Impact on Economic Performance: Evidence from Côte d'Ivoire

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Abstract

The paper investigated the impact of international remittances inflow on Côte d'Ivoire's economic performance using per capita gross domestic product (GDP) growth. Data ranging from 1975 to 2016 was used within an autoregressive distributed lag (ARDL) model framework. The aim is to establish whether there exist long-run dynamics between remittances, the country's per capita GDP and selected control variables. The empirical findings suggest a long-run relationship between remittances, remittances square, per capita GDP, investment, openness, education, and population size. Interestingly, the paper found that remittances do not significantly impact economic performance however, there exists a nonlinear relationship between remittances and growth. This invariably implies that there is a threshold beyond which, remittances will positively affect per capita growth. This tipping point stands at 1.068% of GDP. The overall implications of the findings are discussed.

Keywords: Remittances, Economic Growth, ARDL Approach, Côte d'Ivoire

JEL Classification: C32, F24, F43

1. Introduction / Background

The World Bank in its publication of Remittances factbook 2016 indicated that worldwide remittance flows had exceeded \$601 billion in 2015. Of that amount, developing countries were said to have received about \$441 billion, nearly three times the amount of official development assistance (ODA). The true size of remittances, including unrecorded flows through formal and informal channels, is believed to be significantly larger (World Bank, 2016). This increasing trend in remittances is not new. Indeed, already in 2006, recorded remittances sent home by migrants from developing countries reached \$206 billion, more than double the level in 2001 (Ratha, 2007).

In sub-Saharan Africa, remittances are also on the rise. Indeed, formal remittances inflows were observed to increase from US\$ 34 billion in 2016 to over US\$ 38 billion in 2017 (World Bank, 2018). The flow of remittances is directly linked to the level of migration. Indeed, as people migrate in search of greener pastures, they often send resources to those left in the home country. This movement of people could be the consequences of many situations including but not limited to economic hardship, social unrest/conflicts, civil war, etc.

In Cote d'Ivoire for instance, a country known before as land of immigration, with an immigrant population representing 16.4% of the total population in 1988 (INS, 2008 and 2015), has become a country of origin of many migrants gradually. Indeed, the emigration movement that started timidly in the early 1980s with the oil shocks followed with the subsequent economic hardship, gained momentum gradually over the years. Data available showed that emigration from the country stood at 370,866 in 1990 and climbed to 841,241 in 2015 (United Nations, 2017) representing a 126.8 % increase over a period of 15 years.

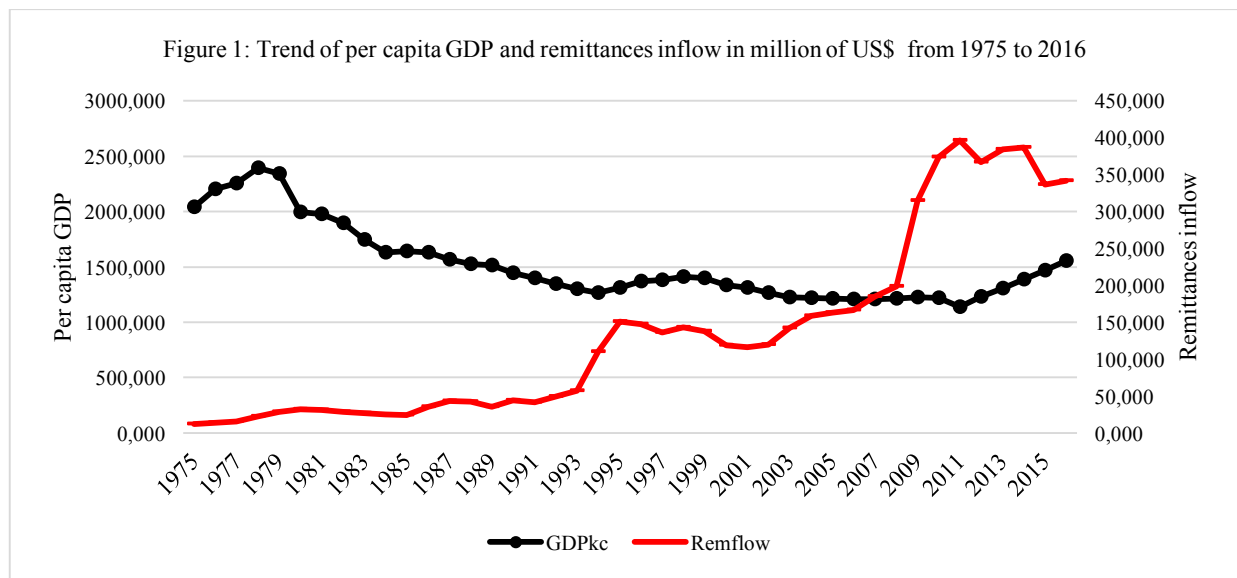
This increase in the stock of emigrants paralleled the increase in remittances received. Indeed, inward transfers increased from \$ 32.185 million in 1980 to \$ 336.247 million in 2015 with peaks at \$ 373 million and \$ 397 million in 2010 and 2011 respectively. These two peaks coincide with the period of civil unrest / civil war in the country. These peaks are in line with the arguments that workers remit more during times of hardship (Ratha, 2013, Edelbloude and al., 2017) as it was the case in Cote d'Ivoire. The increase of remittances inflow over the period ranging from 1980 to 2015 was 944%.

It is well known that inwards remittances provide additional revenues to recipients. These additional revenues could be invested in productive activities and hence fuel economic growth (El-Sakka and McNabb, 1999) or could also be used for schooling thereby improving the quality of the human capital. In so doing, remittances inflow could exert a counterbalancing effect against the negative shocks resulting from the various crises (economic, social, military, political) that the country experienced on one hand. This argument is supported by Fayissa and Nsiah (2010); Jayaraman and al (2012); Shera and Meyer (2013) just to cite a few, who called for actions towards structuring the flow as well as the costs of remittances. On the other hand, remittances inflows could be detrimental to the receiving country's economic performance especially when remittances are spent on consumption dominated in general by foreign goods than on productive investment. When this is the case, remittances will tend to undermine productivity and growth in less developed countries (Giuliano and Ruiz-Arranz, 2006). Given that many empirical studies on the remittances and economic growth nexus are inconclusive (Rao and Hassan, 2011; Gapen and al., 2009; Giuliano and Ruiz-Arranz, 2009; Ziesemer, 2012; Barajas and al., 2009; Nwaogu and Ryan, 2015; Ghosh, 2017), the Ivorian evidence presented in this paper could contribute to the debate since no such evidence has been provided on this country to our knowledge. Moreover, the country in an attempt to harness and structure remittances inflow has instituted a special event since 2012 called the "Diaspora for Growth Forum." It is in line with all the above that we investigated the extent to which remittances inflow has impacted the country's economic performance? Our findings' contributions to existing literature are threefold.

First, there is a long-run dynamic between the remittances variables (remittances, remittances square), per capita Gross Domestic Product (GDP) and some control variables (investment, openness, education and population size). Remittances have a negative and non-significant impact on economic growth. However, remittances square have a positive and significant effect on economic growth, implying a nonlinear relationship between these two variables. This is evidence of a threshold beyond which each dollar received will positively impact economic growth. Second, the investment variable has a positive and significant impact on economic growth in the long-run. The Openness variable proxied by Imports of goods and services also has a positive and significant effect on growth in the long-run. Third, the population variable has a negative and significant impact on economic growth in the short run.

The rest of paper is organized as follows: Section II presents the stylized facts on the country's trends of remittances inflow together with its economic performance captured through per capita GDP. Section III briefly reviews selected literature on the relationship between remittances and economic growth. Section IV presents the Data used including the analytical framework. Sections V and VI present and discuss the empirical findings of the study while section VII concludes the paper.

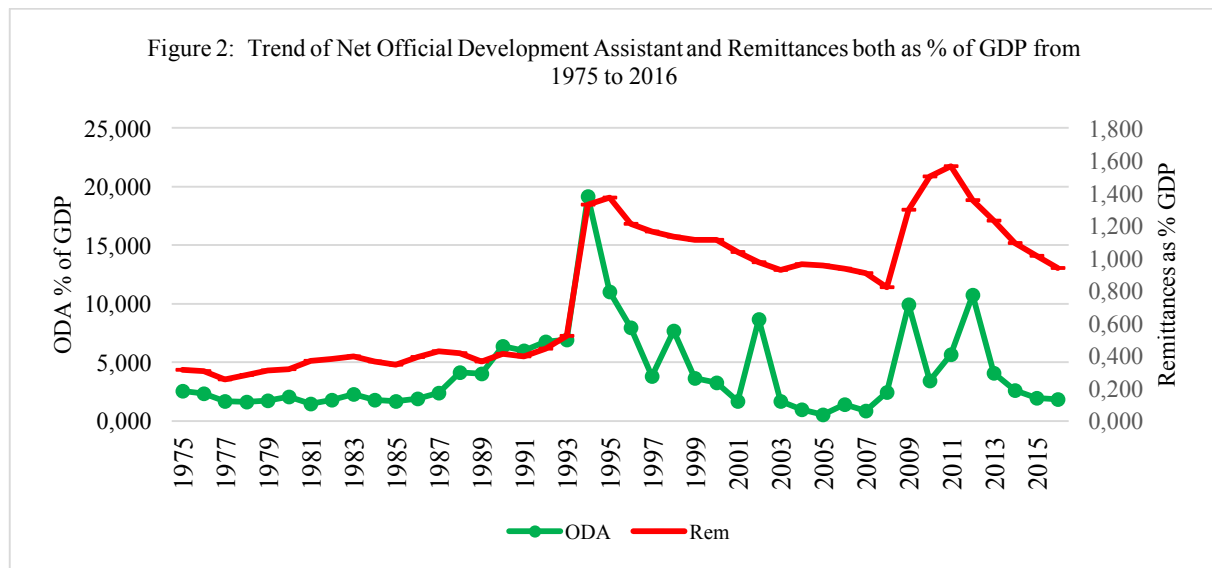
2. Stylized facts



Source: Authors

Data on remittances inflow retrieved from the World Bank (2018) indicate an upward sloping trend throughout the period of analysis. Despite this global upward sloping trend, three sub-periods could be considered very noticeable. These are 1975-2008, 2008-2011 and 2011-2016. During the first episode (1975 – 2008) average annual growth rate of remittances was 9%. However, the country registered a sharp increase from 1993 to 1995 in line with the devaluation of the country's currency (CFA franc). Indeed, remittance inflows stood at \$57,564 in 1993 and jumped to over \$151,000 in 1995 after the currency devaluation that took place in 1994. This jump represented a 162% increase in the volume of inflow into the country. As observed in Figure 1, after 1995 there was a slight decline in the inflow of remittances. The trend continued till 2002, where it reached \$ 120,000, before resuming an upward trend. In the next phase corresponding to 2008-2011, remittances grew at an annual average rate of 26%. It is important to recall that this episode coincides not only with economic hardship (per capita GDP was on a downward sloping trend which started in 1999, see figure 1 above) but also with social unrest. This increased level of remittances inflow could be a clear indication of altruism as argued by Ratha (2013), Edelbloude and al. (2017) in Tunisia during Arab Spring and Koczan (2016) in ex-Yugoslavia. In the last episode (2011-2016), the amount of remittances received though high, exhibits a downward sloping trend even if the decline is not smooth. The civil war ended in 2011 and the country embarked on an economic recovery program with significant and visible results. Indeed, per capita GDP moved from its lowest level ever \$1,139 (2011) to \$1,229.778 in 2012 and continued its rise to \$ 1,553 in 2016.

Figure 2 presents together the trends of both Net Official Development Assistance (ODA) and remittances from 1975 to 2016. The two move closely together although ODA seems to be more volatile than remittance. This is in line with Stojanov and al., (2019).



Sources: Authors

3. Brief review of selected literature

The present section presents a brief review of selected literature. Several scholars have analyzed the relationship between remittances and growth. This section reviews works that found positive impact of remittances on growth as well as works that found negative or no impact at all on economic growth.

Positive link between remittances and growth

Jayaraman and al (2012) analyzed the role of remittances on India's economic growth. Authors used data ranging from 1970 to 2009 and allowed interaction between remittances and financial sector development. They found that remittances and the interaction between remittances and financial sector development had a positive and significant effect on growth over the period of analysis.

Kumar (2013) investigated the relationship between remittances and economic growth in Guyana. Using an augmented Solow framework and an ARDL bounds test for cointegration, he explored the short- and long-run effects of remittances, aid and financial deepening on growth with annual data for the period 1982–2010. His results showed a positive and significant effect of remittances on economic growth both in the short and the long-run.

Goschin (2013) analyzed whether remittances could be a potential economic growth resource for Romania. He used data from 1994 to 2011. He used multi-factorial regression models and found a significant positive impact of remittance inflows on the economic growth in Romania.

Ncube and Brixiova (2013) examined macroeconomic trends, drivers and impact of remittances on African countries from 1990-2011 using a pooled OLS. They established a positive linkage between GDP and remittances.

Vukenkeng A: W: and Ongo N. B. E. (2013), assessed the effect of remittances on the economic growth of Africa through the experiences of Cameroon, Kenya, Lesotho, Morocco, and Nigeria. Using data covering a time period from 1980 to 2010 and multiple regression analysis they found that remittances have a positive and significant effect on economic growth.

Kumar and Stauvermann (2014) used ARDL cointegration and Granger causality test to investigate the cointegration relationship, the short-run, and long-run effects and the causality nexus between remittances per worker, capital and output per worker in Bangladesh over the period 1979-2012. They found positive relationships between remittances and economic growth in the long-run and bidirectional causality.

Konte (2014) re-examined the impact of remittance inflows on growth using data for developing countries over the period 1970-2010. He tried to understand reasons why it has been so difficult to find a positive impact of remittances on growth despite the growing amount of remittances in many developing countries and the different studies that have emphasized the positive effect of remittances on poverty and inequality. He used a bias-adjusted three-step finite mixture approach, which incorporates corrections into the different steps of the estimation. He found that his data are best described by an econometric model with two different growth regimes: one in which remittances have a positive and significant impact on growth and another in which the effect of remittances is insignificant. The analysis of the determinants of the probability of being in the remittances growth-enhancing regime shows that an increase in the level of financial development decreases the probability of a country being in this growth regime, while being a Sub-Saharan African country increases this probability.

Karamelikli H. and Bayar Y. (2015) in a study on remittances and economic growth in Turkey examined the relationship between economic growth, remittances, foreign direct investment inflows, and gross domestic savings. Their data ranged from 1974 to 2013. They used Autoregressive Distributed Lag approach and found that remittances, foreign direct investment, and gross domestic savings had a positive impact on economic growth.

Sebil and Abdulazeez (2015) investigated the relationship between remittances and economic growth in Nigeria, using an error correction modeling approach for the period 1981 to 2011. They found that remittances positively impacted the economic growth of Nigeria in the long-run whereas it as a negative impact in the short run.

Jebran and al (2016) investigated the effects of remittances on per capita economic growth of Pakistan for the period 1976 to 2013. They used an Auto Regressive Distributed Lag (ARDL) Bounds testing model to explore both short and long-run relationships between remittances and per capita economic growth. They found significant positive long-run and short-run impacts of remittances on per capita economic growth.

Matuzeviciute K. and Butkus M. (2016) investigated the impact of remittances on long-run economic growth. They used an unbalanced panel data covering a sample of 116 countries with different development levels and time ranging from 1990 to 2014. They found that in general remittances have a positive impact on long-run economic growth, but the impact differs based on the country's level of economic development and the abundance of remittances in the economy.

Abdelhadi and Bashayreh (2017) investigated whether remittances have a significant role in promoting economic growth in Jordan or not. Their data ranged from 1972 to 2016. They used cointegration and error correction modeling to assess the short and long-run relationship between remittances and growth. They found a stable long-run relationship between GDP per capita and remittances in Jordan as well as in the short run and confirmed the positive significant effect of remittances on economic growth.

Hassan and Shakur (2017) examined the impact of inward remittances flows on per capita gross domestic product (GDP) growth in Bangladesh using data ranging from 1976 to 2012. They found that the growth effect of remittances is negative at first but becomes positive at a later stage, evidence of a non-linear relationship. They argued that their findings suggest a U-shaped relationship between remittances and per capita GDP growth.

Meyer and Shera (2017) investigated the impacts of remittances on economic growth, using panel data set of six high remittances receiving countries: Albania, Bulgaria, Macedonia, Moldova, Romania, and Bosnia Herzegovina during the period 1999–2013. They established a positive and significant impact of remittances on the economic growth of the above countries.

Negative link between remittances and growth

Chami and al. (2003) modeled the causes of remittances and traced their effects through the economy to examine the eventuality of remittances to be a source of capital for development. They established that remittances have a negative significant effect on economic growth because of the existence of moral hazard issues that come from the asymmetric information and uncertainty which underlie remittances. In fact, this negative effect of remittances is explained by the labor decrease due to the reduction of work incentive for receivers and the initial loss of

workforce of the senders. Furthermore, Chami and al (2005) using a new panel dataset on remittances, provide another explanation of the negative effect. Indeed, they argued that remittances are not profit-driven but represent compensatory transfers. They are used to support poor families in crises/ recession times. Thus, remittances flows seem to be countercyclical. Therefore, remittances can't play the same role in economic development as foreign direct investment or other sources of capital.

Andersson and Karpestam (2013) using a macroeconomic panel with consumption and remittances data from 50 low and middle-income economies over the period 1980 and 2006, showed evidence of a negative long-run relationship between consumption and remittances, in favor of altruism.

Alkhatlan (2013), did a study in which he used ARDL and error correction model (ECM) techniques to test the relationship between economic growth and outflows of workers' remittances in Saudi Arabia from 1970 to 2010. He showed that there is a negative and insignificant relationship in the long-run and negative and significant relationship in the short term between remittances and economic growth.

No impact of remittances on growth

Barajas et al. (2009) in a paper titled "Do worker's remittances promote economic growth," after a review of past work on remittances and growth estimated a remittances-growth relationship. They argued that when remittances are properly measured and the growth equations well specified, there is no positive impact of remittances on long-term growth. They rather found often time a negative relationship between remittances and growth.

Ofeh and Muandzevara (2017), investigated the effects of migrant remittances on the economic growth of Cameroon. They used data ranging from 1980 to 2013 in a multiple regression setting and found that although migrant remittances are positively associated with economic growth, their relationship is not significant.

Lim and Simon (2015) investigated the economic importance of remittances in the Caribbean Community and Common Market over the period 1975-2010, using panel cointegration tests. They showed that there exist no relationships between remittances and economic growth or investment. However, there is a long-run relationship between remittances and consumption, suggesting that remittances received in this region are used for consumption purposes.

Jouini (2015) investigating the causal links between economic growth and remittances for Tunisia over the period 1970-2010 through two specific transmission channels (development and investment) using a ARDL cointegration approach, found no evidence of impact on economic growth in the long-run, but established a bidirectional causality between remittances and growth in the short run.

Rao and Hassan (2011) on a panel study on 40 receiving countries with remittances ratio to GDP of 1% or more on the period 1960-2007, used panel data estimation and GMM approach to testing the direct growth effects of remittances and the channels through which these remittances affect growth. They showed evidence of insignificant direct growth effects of remittances, but these remittances have indirect growth effects through investment and financial development.

4. Data and method of analysis

The data used for this study is time series obtained from World Development Indicators of the World Bank (World Bank, 2018) and cover period ranging from 1975 to 2016. Taking stock of past work, we use a conventional growth model augmented with a set of control variables. Thus, we have:

$$Y_t = f(L_t, K_t, Z_t) \quad (1)$$

Where Y_t is output measured as per capita Gross Domestic Product (GDP) at time t ; L_t is a measure of labor at time t , and it is captured here through the economically active population as a percent of total population, that is the

population aged between 15 to 64 years ($Pop64_t$); K_t is capital, and it is captured through the gross fixed capital formation in percent of GDP at time t ($GFCF_t$), and Z_t is the set of control variables and are all transformed into logarithm. The set of control variables includes remittances ($lnrem_t$) is measured in percent of Gross Domestic Product (GDP); Human capital development, captured through two variables, i.e. life expectancy ($lnlife_t$) and gross primary school enrolment ($lneduc_t$); Openness of the country ($lnopen_t$) captured through the country's export and import as percentage of GDP; Official Development Assistance ($lnODA_t$) also measured as percentage of GDP; and two financial development variables i.e. Domestic credit provided by the financial sector as percentage of GDP ($lnfd1_t$) and Domestic credit to private sector by banks as percentage of GDP ($lnfd3_t$). Thus, equation 1 is rewritten below with all the variables.

$$lngdpk_t = f(lnpop64_t, lninv_t, lnlife_t, lneduc_t, lnopen_t, lnODA_t, lnrem_t, lnfd1_t, lnfd3_t) \quad (2)$$

Given the time series nature of the data, it is critical to investigate its characteristics. Thus, we need to find out whether the variables to be analyzed are stationary or not. This is done using the traditional Unit Root test, i.e. the Augmented Dickey-Fuller (ADF) and the Philip Perron (PP) Unit Root Tests. This is important since a regression of nonstationary variables on other nonstationary variables give rise to what is known as spurious regression.

Following the results on the time series characteristics of the data, whether Integrated of order 0 or 1 ($I(0)$ or $I(1)$), we will investigate the short and long-run dynamics of the variables of interest using the Bounds test approach suggested by Pesaran and al (2001). To do that, we need to reformulate our model in a way that shows both the short run and long-run dynamics. The Autoregressive Distributed Lag ($ARDL$) model allows us to do that. The generalized $ARDL(p,q)$ model is given below:

$$Y_t = \alpha + \sum_{i=1}^p \delta_i Y_{t-i} + \sum_{i=0}^q \beta'_i X_{t-i} + \varepsilon_{jt} \quad (3)$$

Where Y_t is the endogenous variable, X_t represents the explanatory variables and are all allowed to be $I(0)$ or $I(1)$; α is the constant, δ and β are parameters to be estimated; p and q are optimal lag orders. For the Bounds Test we use the Akaike Information Criterion (AIC) to determine the optimal lag which gives us the unrestricted Error Correction Model (Pesaran and al. 2004 called it conditional ECM) or put differently, conditional $ARDL(p,q)$ presented below:

$$\begin{aligned} \Delta lngdpk_t = & \alpha + \delta_1 lngdpk_{t-1} + \delta_2 lnlife_{t-1} + \delta_3 lninv_{t-1} + \delta_4 lnpop64_{t-1} + \delta_5 lnopen_{t-1} + \\ & \delta_6 lnODA_{t-1} + \delta_7 lneduc_{t-1} + \delta_8 lnrem_{t-1} + \delta_9 (lnrem_{t-1})^2 + \delta_{10} lnfd1_{t-1} + \delta_{11} lnfd3_{t-1} + \\ & \sum_{i=0}^q \beta_{1i} \Delta lngdpk_{t-i} + \sum_{i=0}^q \beta_{2i} \Delta lnlife_{t-i} + \sum_{i=0}^q \beta_{3i} \Delta lninv_{t-i} + \sum_{i=0}^q \beta_{4i} \Delta lnpop64_{t-i} + \\ & \sum_{i=0}^q \beta_{5i} \Delta lnopen_{t-i} + \sum_{i=0}^q \beta_{6i} \Delta lnODA_{t-i} + \sum_{i=0}^q \beta_{7i} \Delta lneduc_{t-i} + \sum_{i=0}^q \beta_{8i} \Delta lnrem_{t-i} + \\ & \sum_{i=0}^q \beta_{9i} \Delta (lnrem_{t-i})^2 + \sum_{i=0}^q \beta_{10i} \Delta lnfd1_{t-i} + \sum_{i=0}^q \beta_{11i} \Delta lnfd3_{t-i} + \varepsilon_t \end{aligned} \quad (4)$$

The Bounds test is equivalent to testing the following hypotheses for the above equation:

$$\begin{cases} H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10} = \delta_{11} = 0 \\ H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq \delta_7 \neq \delta_8 \neq \delta_9 \neq \delta_{10} \neq \delta_{11} \neq 0 \end{cases} \quad (10)$$

The null hypothesis H_0 test the absence of a long-run equilibrium relationship between the dependent variable and the explanatory variables. The statistics underlying this hypothesis test is the familiar Wald or F-statistics in a Generalized Dickey Fuller type regression used to assess the significance of lagged levels of variables under consideration in an unrestricted equilibrium error correction regression (Pesaran and al 1999). Thus, if we accept H_0 we can conclude that there is no long-run relationship between the variables and that they are not cointegrated. However, if we reject the null hypothesis, then, we conclude that there is a long-run relationship between the variables. A key assumption in the $ARDL$ Bounds Testing methodology of Pesaran and al (2001) is that the error terms in the above equation be serially independent, i.e. no autocorrelation. Once this condition is satisfied we need to ensure that the model is dynamically stable.

The asymptotic distribution of both Wald and F-statistics are nonstandard under the null hypothesis of no long-run relationship irrespective of whether the variables are $I(0)$, $I(1)$ or mutually cointegrated. However, Pesaran and al (2001) have provided asymptotic critical values bounds for all classifications of the regressors into $I(1)$ and/or $I(0)$. Thus, if the computed F-statistics fall below the lower bound, we accept the null hypothesis of no cointegration. In such a situation, we proceed to estimate the short-run dynamics using Ordinary Least Squares (OLS) regression technic. If the F-statistics is greater than the upper bound, we reject the null hypothesis and conclude that there exists a long-run relationship between the variables. When this is the case, the estimation of the ARDL model provides us with both the long-run (levels equation) and short-run dynamics (difference equation). If the F-statistics fall between the bounds, the test is inconclusive. In this case, knowledge of the cointegration rank of the forcing variables (explanatory variables) is required to proceed further (Pesaran and al 1999).

In addition to the F-test above, we can also perform a “Bounds t-test” to cross-check the results. The test is as follows for:

$$\begin{cases} H_0: \delta_1 = 0 \\ H_1: \delta_1 < 0 \end{cases} \quad (11)$$

Here also, the null hypothesis, H_0 tests the absence of a long-run equilibrium relationship between the dependent variable and the explanatory variables. If the t-statistics is greater than the $I(0)$ bound, tabulated by Pesaran and al (2001; pp 303-304) and Kripfganz and al (2018; pp 30-33), accept the null hypothesis and conclude that there is no cointegration between the variables. If the t-statistics is less than the $I(1)$ bound, reject the null hypothesis and conclude that there is a long-run relationship between the variables. Here again, if the t-statistics falls between the two bounds, the test is inconclusive. All computations were done using the statistical software Stata 14.2.

5. Empirical results

This section presents the empirical findings of the relationship between Cote d'Ivoire's economic performance and remittances inflow. We start with the descriptive statistics (tables 1 and 2). In Table 1, we observe that over the period of analysis, the country's per capita GDP averaged US\$ 1,517, and the highest level stood at US\$ 2,391 in 1978. The lowest per capita GDP was registered in 2011 during the civil war. Investment is proxied by Gross Fixed Capital Formation (*GFCF*) as a percentage of GDP. It stood on average at 14.5% with its highest level being 29.66% in 1978. This was achieved during the period characterized as the Ivorian Miracle. Unfortunately, the miracle did not last. Investment embarked in a sharp downward sloping trend to reach its lowest level in 2003 at 8.253% of GDP when the regional threshold is set at 20%. Imports of goods and services (*M*) stood on average at 34.463%. Life expectancy at birth (*life*) in the country stood on average at 50 years, with the highest level being 53 years. This is an indication of low human capital development. Workers remittances (*Rem*) represented, on average 0.78% of GDP over the period of analysis. The highest contribution of remittances to GDP stood at 1.563%. We also looked at an indicator of financial development, i.e. Domestic Credit provided by the Financial Sector (*DCficial*) it stood on average at 31.5% of GDP with its highest level being 51.26%.

Table 1: Descriptive statistics of selected variables

Variable	Obs	Mean	Std. Dev	Min	Max
X	42	40.533	6.596	29.442	53.820
GDPkc	42	1517.235	343.464	1138.665	2391.924
GFCF	42	14.535	5.913	8.253	29.661
M	42	34.463	5.849	20.198	44.332
Life	42	50.178	2.161	46.597	53.078
ODA	42	4.150	3.688	0.534	19.170
pop1564	42	52.840	0.808	51.715	54.513
educp	42	73.861	6.961	63.928	93.634
Upop	42	42.796	6.088	32.229	54.869
Remflow	42	135.868	124.465	12.132	396.604
Rem	42	0.784	0.412	0.253	1.563

DCFcial	42	31.545	10.706	14.415	51.260
DCPr	42	25.277	11.312	9.748	42.264
DCBks	42	24.948	11.099	9.668	41.871

Authors' calculation

Table 2 presents pairwise correlation between the variables of interest. This table gives an indication of the degree of association between the variables. We can observe from the table that there is a strong negative association between remittances and growth. Indeed, the correlation coefficient is -0.819 and significant. This variable also has strong positive association with the size of the active population. The remittances variable has negative association with investment and life expectancy. The ARDL estimation will enable a better understanding of these associations.

Table 2. Pairwise correlation of variables of interest

	<i>lngdpk</i>	<i>lnlife</i>	<i>lninv</i>	<i>lnpop64</i>	<i>lnopen</i>	<i>lnoda</i>	<i>lneduc</i>	<i>lnupop</i>	<i>lnrem</i>	<i>lnremsq</i>	<i>lnfd1</i>	<i>lnfd3</i>
<i>lngdpk</i>	1.000											
<i>lnlife</i>	0.181 (0.252)	1.000										
<i>lninv</i>	0.816* (0.000)	0.135 (0.394)	1.000									
<i>lnpop64</i>	-0.654* (0.000)	-0.266 (0.088)	-0.213 (0.176)	1.000								
<i>lnopen</i>	-0.220 (0.161)	-0.506* (0.000)	-0.035 (0.828)	0.146 (0.356)	1.000							
<i>lnoda</i>	-0.318* (0.040)	0.108 (0.494)	-0.253 (0.106)	0.207 (0.188)	-0.201 (0.202)	1.000						
<i>lneduc</i>	-0.228 (0.146)	0.362* (0.019)	0.152 (0.337)	0.612* (0.000)	-0.085 (0.593)	0.047 (0.767)	1.000					
<i>lnupop</i>	-0.744* (0.000)	-0.008 (0.957)	-0.334* (0.031)	0.871* (0.000)	0.238 (0.129)	0.069 (0.663)	0.704* (0.000)	1.000				
<i>lnrem</i>	-0.819* (0.000)	-0.340* (0.027)	-0.407* (0.008)	0.877* (0.000)	0.370* (0.016)	0.335* (0.030)	0.445* (0.003)	0.822* (0.000)	1.000			
<i>lnremsq</i>	0.887* (0.000)	0.305* (0.050)	0.538* (0.000)	-0.838* (0.000)	-0.216 (0.170)	-0.230 (0.143)	-0.428* (0.005)	-0.826* (0.000)	-0.934* (0.000)	1.000		
<i>lnfd1</i>	0.586* (0.000)	0.764* (0.000)	0.337* (0.029)	-0.656* (0.000)	-0.622* (0.000)	0.148 (0.350)	-0.053 (0.741)	-0.591* (0.000)	-0.712* (0.000)	0.688* (0.000)	1.000	
<i>lnfd3</i>	0.783* (0.000)	0.646* (0.000)	0.503* (0.001)	-0.769* (0.000)	-0.509* (0.001)	-0.039 (0.806)	-0.179 (0.257)	-0.713* (0.000)	-0.865* (0.000)	0.866* (0.000)	0.946* (0.000)	1.000

The time series characteristics of the data were analyzed via the Unit Root test. The results of these tests are presented in Table 3 below.

Table 3. Results of Unit Root Test using ADF and Philip Perron

Variables	Levels		1 st Difference		
	ADF	PPerron	ADF	PPerron	
Conclusion					
<i>lngdpk_v</i> , lag(2)	-2.447 (0.129)	-1.568 (0.499)	-3.133* (0.024)	-4.113* (0.001)	I(1)
<i>lnlife_v</i> , lag(1)	-7.600 (0.000)	-1.086 (0.721)	-1.102 (0.714)	-1.456 (0.555)	I(0)
<i>lninv_v</i> , lag(1)	-1.769 (0.396)	-1.549 (0.509)	-3.794* (0.003)	-4.961* (0.000)	I(1)
<i>lnpop64_v</i> , lag(2)	-0.516 (0.889)	0.661 (0.989)	-2.903* (0.045)	-2.885* (0.047)	I(1)
<i>lnopen_v</i> , lag(1)	-1.326	-1.258	-3.536*	-5.251*	I(1)

	(0.617)	(0.648)	(0.007)	(0.000)	
$lnoda_t, lag(2)$	-2.169	-2.851	-4.053*	-8.572*	I(1)
	(0.218)	(0.051)	(0.001)	(0.000)	
$lneduc_t, lag(2)$	-1.161	-0.395	-2.966*	-3.814*	I(1)
	(0.690)	(0.911)	(0.038)	(0.003)	
$lnupop_t, lag(1)$	1.014	-0.705	-4.890*	-3.927*	I(1)
	(0.994)	(0.846)	(0.000)	(0.002)	
$lnrem_t, lag(1)$	-1.551	-1.398	-4.240*	-5.191*	I(1)
	(0.508)	(0.583)	(0.001)	(0.000)	
$lnremsq_t, lag(1)$	-1.494	-1.330	-5.631*	-5.965*	I(1)
	(0.537)	(0.615)	(0.000)	(0.000)	
$lnfd1_t, lag(1)$	-1.204	-1.077	-4.207*	-4.239*	I(1)
	(0.672)	(0.724)	(0.001)	(0.001)	
$lnfd3_t, lag(1)$	-1.080	-1.053	-5.352*	-5.333*	I(1)
	(0.723)	(0.734)	(0.000)	(0.000)	

Schwartz-Bayesian Information Criterion (SBIC) was used to determine the optimal lag order

Source: Authors' calculation

With the exception of the life expectancy variable, which is stationary at level, i.e. I(0), the remaining variables are all stationary after first difference. They are thus I(1). This is a good reason to use the Bounds test to assess the long-run dynamics of the model. The results of the Bounds test are presented in Table 3. Here we considered three specifications of our equation of interest. The first specification (Model 1) is our full model with all the variables of interest. The second specification (Model 2) is the full model without the financial development variables ($lnfd1_t$ and $lnfd3_t$). The last specification (Model 3) is the full model without the financial variables as well as the life expectancy ($lnlife_t$) and the official development assistant ($lnoda_t$) variables. Model 1 is an $ARDL(1,0,0,1,0,0,0,0,0,0)$. The F-statistic calculated is **7.827**, which is greater than the critical value at 5% level (**3.24**) of the upper bound $I(1)$. We, therefore, reject the null hypothesis.

Table 4. Results of the Bounds test.

Dependent Variable: $lngdpk$ (model 1)	$lngdpk$ (model 2)	$lngdpk$ (model 3 ^a)
Bounds Test $ARDL(1,0,0,1,0,0,0,0,0,0)$	$ARDL(1,0,0,1,0,0,0,0,0)$	$ARDL(1,0,1,0,0,0,0)$
$H_0 \rightarrow$ No levels relationship		
F-stat = 7.827	F-stat = 9.877	F-stat = 13.519
Critical Value at 5% [I(0) I(1)]	[I(0) I(1)]	[I(0) I(1)]
k=10 [2.06 3.24]	k=8 [2.22 3.39]	k=6 [2.45 3.61]
Reject H_0 if $F_{stat} > F_{\alpha}$ for I(1)	Reject H_0	Reject H_0
t-stat = -3.488	t-stat = -4.173	t-stat = -6.568
Critical Value at 5% [I(0) I(1)]	[I(0) I(1)]	[I(0) I(1)]
k=10 [-2.86 -5.03]	k=8 [-2.86 -4.72]	k=6 [-2.86 -4.38]
Inconclusive if $t_{\alpha,I(0)} < t_{stat} < t_{\alpha,I(1)}$	Inconclusive	Reject H_0 if $t_{stat} < t_{\alpha,I(1)}$

Source: Authors' calculation

We conclude that the variables in Model 1 are cointegrated. However, the t-statistic associated with Model 1 does not yield the same result. Indeed, the value of the t-statistic (**-3.488**) falls between the bounds, and it is therefore inconclusive. We proceeded with Model 2. This is an $ARDL(1,0,0,1,0,0,0,0,0)$. In this case, the results are similar to that of Model 1. Indeed, the F-statistic (**9.877**) is greater than the critical value at 5% probability level for $I(1)$. We, therefore, reject the null hypothesis of no cointegration and conclude that the variables in that Model are cointegrated. As indicated above, like in Model 1, the t-statistic (**-4.173**) falls between the bounds, and it is

therefore inconclusive. Let's now turn to Model 3 which is an $ARDL(1,0,1,0,0,0,0)$. Here, the F -statistic (**13.519**) is greater than the critical value at 5% probability level for $I(1)$ hence, we reject the null hypothesis of no cointegration. Similarly, the t -statistic (**-6.568**) is less than the critical value at 5% probability level. Here we also reject the null hypothesis of no cointegration. These two results for Model 3 give support to the existence of a long-run relationship, i.e. the variables are cointegrated.

Based on the above results, we proceeded to estimate the ARDL in the Error Correction setting to determine the long and short-run dynamics. For comparison purpose, we estimated the three models and presented the results in Table 5. Model 1 is the $ARDL(1,10)$. The error correction coefficient is negative and significant as expected. It confirms the results of the Bounds test. In the long-run, we observe that the investment variable has the expected sign, and it is significant. Our variable of interest, i.e. remittances ($lnrem_t$), has a negative sign and is not significant. However, its quadratic term is positive and significant, indicating a nonlinear relationship between remittances and growth. This result indicates that remittances do not systematically impact economic growth. It is only up to a threshold that they will impact the country's growth. Using the empirical result, we estimated the threshold level to be around 1.068% of GDP holding other variables constant. In terms of value, remittances inflow should be at least up to 391.560 million US\$ to start positively impacting the country's economic growth. The results also indicate a negative impact of the population size on the country's economic performance in the short run. This is understandable especially in a situation where unemployment is rampant, increases in the size of the active population add more burden on the economic performance (having fewer individuals working to cater for an increasing population). Results also indicate model stability. Furthermore, we can infer from the results that there is short-run causality going from population size to growth economic. In Model 2 which is an $ARDL(1,8)$, although we remove the financial development variables, the results are not very different. Indeed, the error correction coefficient is **-0.569** and it is significant as expected, confirming the existence of a long-run relationship. The coefficients have the same signs as in Model 1. This Model 2 is also stable (See the CUSUMQ graph in the Annex). In Model 3, as indicated earlier we dropped not only the financial development variables but also the life expectancy and official development assistance variables. Thus, we have an $ARDL(1,6)$ model. The coefficient of the error correction term is also negative and significant. The model's results provide support for a nonlinear relationship between remittances and economic growth. The coefficient of the quadratic term of the remittances variable is positive and significant (**0.183**). The model is also stable (see the CUCUMSQ graph in the Annex).

Table 5. Results of the various ARDL models

	Model 1	Model 2	Model 3
	ARDL(1,0,0,1,0,0,0,0,0,0)	ARDL(1,0,0,1,0,0,0,0,0)	ARDL(1,0,1,0,0,0,0)
Long-run dynamics			
ECT_{t-1}	-0.537^{***} (0.002)	-0.569^{***} (0.000)	-0.563^{***} (0.000)
$lnlife_t$	0.085 (0.923)	-0.050 (0.936)	
$lninv_t$	0.336^{***} (0.000)	0.314^{***} (0.000)	0.315^{***} (0.000)
$lnpop64_t$	3.312 (0.392)	2.091 (0.492)	2.176 (0.193)
$lnopen_t$	-0.122 (0.342)	-0.164 (0.100)	-0.1695^{**} (0.023)
$lnoda_t$	0.001 (0.975)	0.002 (0.882)	
$lneduc_t$	-0.293 (0.432)	-0.186 (0.532)	-0.210 (0.131)
$lnrem_t$	-0.055 (0.545)	-0.031 (0.676)	-0.024 (0.668)
$lnremsq_t$	0.196^{**} (0.010)	0.178^{***} (0.004)	0.183^{***} (0.001)

$lnfd1_t$	0.157 (0.427)
$lnfd3_t$	-0.142 (0.534)

Short run dynamics			
Constant	-2.994 (0.719) ^a	-0.180 (0.981)	-0.410 (0.908)
$\Delta lnpop64_{t-1}$	-8.293 ^{**} (0.032)	-7.496 ^{**} (0.038)	-7.543 ^{***} (0.006)
Adj R-squared	0.651	0.665	0.685
$F_{(12, 28)} =$	7.210 ^{***} (0.000)	$F_{(10, 30)} =$ 8.940 ^{***} (0.000)	$F_{(8, 32)} =$ 11.90 ^{***} (0.000)
Breusch-Godfrey LM test for no autocorrelation			
$\chi^2_{(1)}$	0.913 (0.339)	0.224 (0.636)	$\chi^2_{(1)}$ 0.258 (0.611)
White's test for Ho: homoscedasticity			
$\chi^2_{(40)}$	41.000 (0.426)	41.000 (0.426)	41.000 (0.426)
CUSUMSQ ^b	Stable	Stable	Stable

For each equation we tested for the absence of serial correlation as well as homoscedasticity. The null of no autocorrelation and homoscedasticity could not be rejected.

^a Number in parenthesis are p-values; ^b Asterisk indicates significant levels i.e. * \rightarrow 10%, ** \rightarrow 5% and *** \rightarrow 1%.

^b Graphs of CUSUMSQ are presented in the Annex.

6. Discussions and recommendations

Remittances do not exert any significant impact on per capita GDP growth in the long-run and this is in line with Chami and al. (2003, 2005), Rao and Hassan (2011). Indeed, most of the remittances sent to Côte d'Ivoire promote and enhance consumption (Konan, 2017) like among others in Tunisia (Jouini, 2015), in the Caribbean (Lim and Simmons, 2017). Thus, remittances may be compensatory transfers (Chami and al., 2005) and are then countercyclical. As an illustration, peaks of remittances over the study period were obtained in 2011 during the post-electoral crisis in which more than 3,000 people died. Money sent during these hard times by migrants provided support to families left behind.

However, the positive and significant value of the remittances square reflects the existence of a threshold from which remittances can positively impact growth. The mean average of the remittances to GDP ratio is 0.78%. This average is too low and it should be noticed that remittances used here are those sent through formal channels and does not take into account the important amount of remittances sent through informal channels. Actions need to be taken to better-channeled remittances towards investments purposes rather than consumption purposes by involving diaspora associations, banking sector. In addition, the promotion of formal channels could provide better estimations of remittances and their impact on economic growth.

The positive and significant value of the investment on GDP is expected and is consistent with investment theory and in line with studies by (Jouini, 2015; Nyamongo and al., 2012; Ghosh, 2017; Goschin, 2014). Furthermore, the negative and significant value of Error Correction Term (ECT) means that there is an adjustment to the long-run equilibrium. The adjustment speed from the short-run disequilibrium towards the long-run is faster when ECT is close to -1. In our case, ECT is equal to -0.537 in model 1 and -0.563 in model 3, that means that a deviation from the equilibrium this year will be corrected by 56.3% in model 3 in the following year. So it will take about 2 years to restore the long-run equilibrium state. This result is coherent with that of Jouini (2015) who found a faster adjustment process (64.2%) in Tunisia.

The negative and significant impact of the population size on the country's economic performance in the short run should be linked to Demographic Dividend issues not discussed in this paper. However, computations done by Dramani and Oga (2017) using National Transfer Account (NTA) methodology, indicate that the support ratio (which is defined as the ratio of the effective number of producers (L) to the effective number of consumers (N).

for Côte d'Ivoire in 2016 is only 38.1%. This indicates that there are only 38 effective workers for 100 effective consumers. This ratio is 49% for Ghana and 50.8% for Senegal.

7. Concluding remarks

The objective of this study was to investigate the impact of remittances on economic growth. The data used range from 1975 to 2016. An *ARDL* model was used to assess the long-run relationship between *remittances*, per capita *GDP* and a set of control variables including investment, life expectancy, education, openness, and population size. We found, the existence of a long-run relationship between remittances, *remittances square*, per capita *GDP*, investment, education, openness and population size. Thus, they move together in the long-run. Remittances have a negative and non-significant impact on economic growth. However, remittances square affects positively and significantly economic growth. This is evidence of a nonlinear relationship between these two variables. Thus, beyond a threshold, each dollar received will have a significant impact on economic growth. We also found a positive and significant impact of investment, openness on economic growth in the long-run. Population has a negative and significant impact on economic growth in the short run.

In view of the above findings, it is recommended that Government and the banking system take actions to better structure the inflow of remittances and enable these external funds to be used for productive investment rather than consumption of goods and services. In that vein, the Ministry in charge of the Diaspora is called upon to put in place a mechanism via the "Diaspora for Growth Forum" not only to harness remittances but also to channel funds mobilized towards priority areas that could have a multiplying effect on other areas.

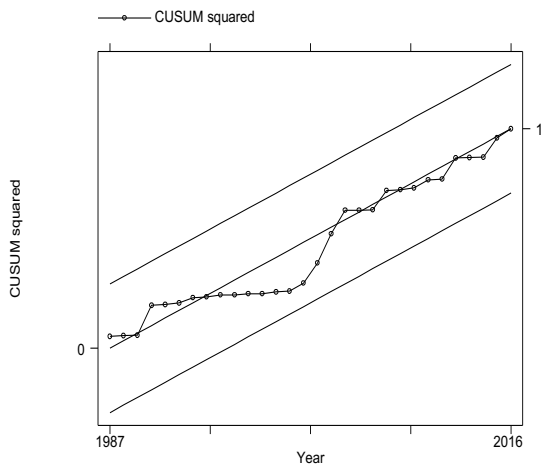
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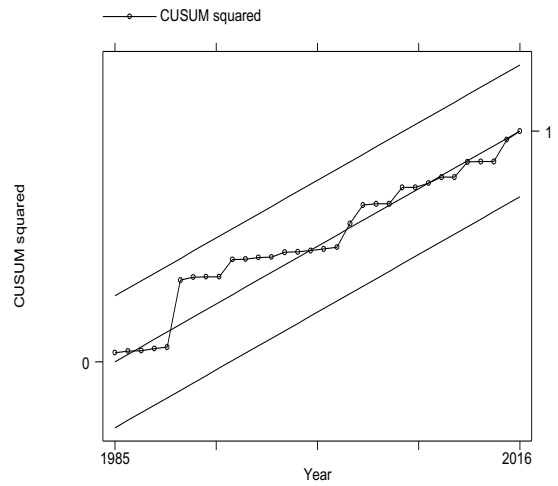
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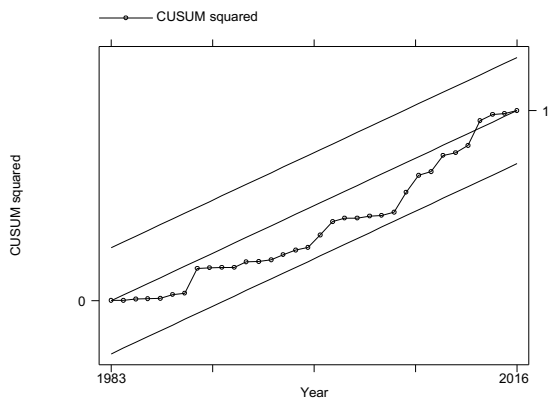
Annex



Model 1 for stability check



Model 2 for stability check



Model 3 for stability check