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Abstract

Considering the importance of migrants' remittances as a vital source of financing economic development and foreign exchange in Sudan's economy, this study investigated the role of macroeconomic environment in attracting migrants' remittances into Sudan. To do so, the study used the Autoregressive Distributed Lag (ARDL) to cointegration method, Impulse Response Functions (IRSs) and Variance Decomposition (VDC) techniques. The empirical results indicate that macroeconomic policy variables play an important role in encouraging the flow of remittances via formal channels. The inflation rate and the black market exchange rate premium have a negative and significant effect on remittances in both the short and long-run. The home income variable is found to be discouraging for the flow of remittances, supporting the altruistic behaviour of emigrants in transferring money. Moreover, the study found that trade openness and foreign income exerts positive effects on remittances. Based on these findings, the paper concludes with some policy implications regarding the improvement of the macroeconomic environment as a necessary condition to facilitate the flow of remittances through official channels.

JEL Classification: J1, J6

Keywords: Migrants, Remittences Flow, Macroeconomy, Sudan

ملخص

نظراً لأهمية تحويلات المهاجرين باعتبارهامصدراً مهماً لتمويل التنمية الاقتصادية وتوفيرالعملات الأجنبية في الاقتصاد السوداني، تناولت هذه الدراسة دور البيئة الاقتصادية الكلية في استقطاب تحويلات المهاجرين عبر القنوات الرسمية. وقد استخدمت الدراسة نموذج الانحدار الذاتي ذو الفجوة الموزعة (ARDL)، ودوال الاستجابة للصدمات ونموذج مكونات التباين. أشارت النتائج إلى ان متغيراتالسياسة الاقتصادية تلعب دوراً مهماً في تشجيع تدفق التحويلات إلى السودان. وقد وجد أن معدل التضخم وعلاوة سعر الصرف فى السوق السوداء لهما تأثير سلبي على التحويلات في الاجلين القصير والطويل. وتم التوصل ايضاً الى ان متغيرالدخل المحلى يثبط تدفق التحويلات، وهذا ما يدعم دافع الإيثار في تحويل الأموال من قبل المهاجرين. وبالاضافة الى ذلك، توصلت الدراسة الى أن متغيرى الانفتاح التجاري والدخل الخارجى يمارسانآثاراً إيجابية على التحويلات المالية.استناداً إلى هذه النتائج، اختتمت الورقة ببعض التوصيات المتعلقة بالسياسات الاقتصادية التى يجب اتباعها لتحسين بيئة الاقتصاد الكلي كشرط ضرورى لتسهيل تدفق التحويلات المالية عبر القنوات الرسمية.

1. Introduction

The interaction between the macroeconomic environment and migration has been an interesting topic that received considerable debate in the literature. In particular, during the last two decades, migrants' remittances to their countries of origin have become an important source of external finance for development, particularly in developing countries. Indeed, the amount of the workers' remittances inflow to developing countries represents the largest source of the international capital flows after foreign direct investment (FDI), (World Bank 2011). Accordingly, most of the countries that export labor have paid considerable attention to improving their macroeconomic environment with the aim of attracting remittance flows.

As in many other developing countries, Sudan has heavily relied on migrant remittances. In the last two decades, workers' remittances flow to Sudan has increased dramatically, from US$ 61 million in 1990 to more than 3 billion dollars in 2008 and constituted a considerable share in the foreign capital components (see Appendix (C). The current situations in Sudan also indicate that in the future the economy is expected to rely even more on workers' remittances as a vital source of foreign exchange, particularly after the country lost most of its oil revenues due to the secession of South Sudan.[1] Therefore, this implies the importance of investigating the potential effects of macroeconomic variables on remittance flow. This will be useful to create an appropriate macroeconomic environment that attracts the flow of remittances. In addition, like in other many labor-exporting countries, more than half of remittances to Sudan are estimated to be transmitted through informal channels, particularly the black market; thus, it is important to examine the factors determining the transfer of remittances via official channels.

Based on the above, this paper provides an important contribution and fills the gap in the Sudanese literature by explaining the role of macroeconomic policy variables in attracting the remittance flows into Sudan, since there is no recent study in the Sudanese literature regarding this issue. Moreover, Sudan has witnessed many economic transformations in the last decades owing to the exploitation of oil and changes in the macroeconomic landscape; therefore, identifying the factors affecting remittance flows could reveal the importance of some variables that may be subject to the control of policy makers.

This paper is organized in six sections, as follows: the next section discusses some stylized facts about migrant's remittances in Sudan's economy. Section three briefly presents a literature review on the macroeconomic determinants of workers' remittances. While section four describes the data and methodology, section five presents the empirical results. Section six ends with a conclusion and some policy implications.

2. Some Stylized Facts about the Trend and Importance of Migrants' Remittances in Sudan's Economy

As in other poor countries, unfavorable economic and institutional conditions in Sudan have forced a considerable portion of inhabitants to leave their home to seek a higher income. The migration of Sudanese workers began at the end 1960s, due to two crucial reasons. First, the high labor demand in the Arab Gulf area after oil exportation in the late 1960s and early 1970s has constituted an essential motive for Sudanese workers to leave their home seeking high wages. Second, in the early 1970s the Sudan economy suffered from severe economic problems such as high inflation rates, internal and external imbalances; all theses economic bottlenecks forced a substantial size of workers to find work abroad.

The number of Sudanese emigrants to mid and high-income countries represent a considerable portion of population in Sudan. Despite the lack of official statistics, the number

[1] - As a result of a referendum that took place in February 2011, South Sudan separated. It is worth mentioning that before the secession, South Sudan is a source of about 75% of oil resources.

of Sudanese living abroad is estimated around four million, i.e. 10% of total population (Secretariat of Sudanese Working Abroad (SSWA) 2010). Almost 80 percent of the migrants have left Sudan throughout the last three decades, particularly at the end of 1970s. Most of the Sudanese migrant workers live in Gulf oil-export countries, such as Saudi Arabia, UAE, Oman, Qatar and Bahrain. However, a few of them live in neighboring African countries, East Asia, Europe and North America (Migration Horizons 2011).

Migrants with substantial amounts of remittances live in Arab Gulf countries, particularly Saudi Arabia. According to SSWA statistics, the number of recorded expatriates is about 1,338,000 economic migrants, over half of which are working in Saudi Arabia and the rest are distributed among other Arab countries and a smaller proportion in the Western countries and North America. About 80% of Sudanese migrants in Arab countries are male single workers with a low education level. While migrants in high skilled occupations accounted for about 20%, including medical specialists, engineers, university professors, teachers, lawyers, legal advisers, and managers; this suggesting the existence of a brain drain in some professional categories such as health. Notably, it is difficult to estimate the size of the Sudanese diaspora in the Western countries and North America, due to different national definitions and the prevalence of dual nationality, particularly for those living in older destination countries such as United States and United Kingdom.

With respect to the evolution of the remittances flow, we observe that the absolute amount of remittances has increased steadily in the last two decades. Figure 1 below presents the trend of remittances flow into Sudan's economy over the period 1977-2008.

It is clear that during the decades of the 70s and 80s, remittances reported were low and fluctuated in some years. This because, the stock of migrants during such periods was small and the country witnessed many economic and political transformations, which affected the transmission of remittances. Notably, throughout 1970-1990 the country saw many waves of drought and famines as well as the eruption of civil war in South Sudan. Nevertheless, during the period 1978-1982 remittances increased slightly, attributed to some changes in the laws pertaining to foreign currencies, which allowed emigrants and residents to deal with hard currency in terms of foreign exchange without restrictions, and open bank accounts in foreign currency (Central Bank of Sudan 2005). Interestingly, over the period (1992-1994) the country had received a low amount of remittances, despite the reform policies launched by the government in the early 1990s. This is because, during the Second Gulf War in 1990-1991, a huge number of migrants in the Arab Gulf states returned to Sudan. In addition, the unfavorable macroeconomic environment in the first half of 1990s in terms of high inflation, expansion of parallel activities and high black exchange premium, negatively affected the flow of remittances through official channels.

By the end of the 1990s and following the commercial exploitation of oil, the amount of remittances has increased dramatically, contributing on average about 5% to the total GDP in the last ten years (see Appendix, C). The boost in remittances has been attributed mainly to the improvement of the macroeconomic environment due to huge oil windfalls. Notably, in the last decade, the country has achieved a high and positive growth rate in the region with an average growth of 7% during (2000-2008), the inflation rate also registered as a single digit with an average of 9% in this period (Central Bank of Sudan 2009). Moreover, the influx of oil mitigated the exchange rate volatility via reducing the black market premium. All these variables had a clear impact on the increase of remittances, with an average of US$ 1271.5 million over the period (1999-2008). Oil revenues contributed to stabilizing the macroeconomic environment, which helped in the attraction of a considerable amount of remittances, totaling more than 3 billion in 2008.

In accordance with the contribution of remittances to total capital flows, Figure (2) reveals that remittances sent home by Sudanese nationals working abroad is the largest source of external capital, after foreign direct investment (FDI). Moreover, the recorded remittances received by the country during the last two decades are equal to the amount of official development assistance, being nearly one third of the total capital flows. Therefore, this implies that the inflow of remittances represents an important source of external finance in Sudan.

Given that this amount of remittances reflects only officially recorded transfers, the actual amount transferred through informal channels is expected to be significantly larger, which making the total remittances flow the largest source of external capital in the country[2]. It is worth mentioning that, most of the remittances are transmitted through the unofficial channels and in kind, but a few of these are transmitted via formal channels such as banks and money exchange companies. Generally, there are no official data on the size of unrecorded remittances in Sudan; however, according to the earlier study of Elbadawi (1992), the amount of remittances flow into Sudan transmitted via official channels during (1970-1989) did not exceed 23 percent of total remittances.

The significant role of remittances in the Sudan's economy is shown through its contribution to income and foreign trade. Figure (3) illustrates the contribution of remittances as a source of foreign exchange compared with other relevant indicators in the economy such as exports, imports and GDP. The figure shows that remittances flow has a considerable contribution to the Sudan's economy. The share of remittances with respect to the GDP, total export and imports on average was 3.26%, 35% and 19.33%, respectively, over the period 1990-2008 (see Appendix (C)). Over the period 1980-1994, the contribution of remittances to GDP, exports and imports was lower, with an average of 3.6%, 39% and 14.4%, respectively. This is due to the low remittances flow, which resulted from economic distortions in terms of high inflation rates and instable exchange rates, during this period. Interestingly, after the second half of 1990s, the contribution of remittances to other variables had reported an upward trend, influenced by the improvement of macroeconomic performance that accompanied oil exploitation. Thus, the share of remittances in the total exports reached its peak in 1998 with 91% and maintains an average of 40% over the period 2000-2008.

3. Literature Review

Given the importance of remittances flows in financing economic growth and development of the recipient countries, the issue of the role of macroeconomic conditions in attracting workers' remittances has received a huge attention from policy makers over the last four decades in labor exported-countries. From an academic perspective also, this issue has gained considerable momentum and a large body of theoretical and applied research has grown, particularly in the aftermath of the emergence of the pioneering work of Lucas and Stark (1985), which created a concrete base for studying the factors affecting remittances flows to the home countries.

The literature has identified the factors influencing workers' remittances in two main categories, which are: the microeconomic characteristics of migrants and their families, and the macroeconomic characteristics of the home and host country. According to the first category, there are two common reasons that motivate migrants to remit earnings to their native country: altruism and self interest motives (Lucas and Stark 1985). Altruism indicates, for example, emigrants send remittances to enhance their family's social status or to help

[2] - In most developing countries more than half of remittances transferred through unofficial channels (World Bank 2007). However, Sudan is not an exception; the percentage of remittances flows through unofficial channels is larger, particularly during times of economic crises. Therefore, the role of remittances in Sudanese economy is underestimated.

their families meet their consumption expenses. While in the case of self-interest, migrants transfer remittances with the aspiration to inherit, to demonstrate laudable behavior as an investment for the future or with the intent to return home (Carling 2008).

On the other hand the macroeconomic determinants involve many macroeconomic conditions that are hypothesized to explain the growth of the flow of remittances, among them are: domestic price level; black exchange rate premium; inflation rate; income in the host and home countries; interest rate differential between the home and host countries; and the number of workers and wage rates (see Russell1986). Therefore, we find that most of the empirical studies have been concentrated on the macroeconomic conditions as main factors that motivate migrants to send money home. In this regard, briefly we review some empirical evidence relevant to macroeconomic determinants.

Elbadawi and Rocha (1992) examine the determinants of migrants' remittances for six labor-exporting countries in North Africa and Europe. Their results show that the length of stay and macroeconomic variables play an important role in determining remittance flows. They found that the real income in the host country positively affect the flow of remittances, while inflation and black market premium in the home country are found to negatively influence the variation in workers' remittances. Moreover, they concluded that policy-makers in the labor-exporting countries should correct macroeconomic imbalance policies before considering special incentive schemes to attract remittances.

El-Sakka and McNabb (1999) studied the macroeconomic determinants of the total inflow of remittances through official channels in Egypt. They found that the levels of income in both the host and home countries have a positive impact on the inflow of remittance to the home county. They also found that remittance flows are highly responsive to black market premiums. Their results also support the idea that interest differentials at home and abroad have a negative impact on the inflow of remittances through official channels. Moreover, the study concluded that imports financed by remittances have higher income elasticity and relatively lower price elasticity as compared to other imports.

Higgins and others (2004) investigate the effect of real exchange rate depreciation on remittances, using fixed effect panel estimation techniques. They found that the real exchange rate depreciation of the home currency has a positive effect on remittances. They also found that the home country income is negatively related to remittances, indicating the behavior of altruism in the countries receiving remittances. Moreover, their results show that unemployment in the host country and the exchange rate are significantly and negatively related to remittances.

Gupta (2005) analyzed the determinants of remittances to India and their impact on economic growth. He found that the economic environment in the source countries positively influences remittances. His result revealed that remittances flow is countercyclical to the growth of the home income; that is, they are higher during periods of low economic growth and lower in periods of high income in India. Moreover, none of the remaining economic or political variables considered in his paper, including political uncertainty, interest rates, or exchange rate depreciation, are found to affect remittances significantly.

Recently Shahbaz and Aamir (2009) estimated a macro model of migrants' remittances flows to Pakistan. The inflation rate and home income are found to be positively correlated with the flows of migrants' remittances to their families in the home country. Contrary to this, the increase in the world interest rate and the improved level of education lowers the inflows of foreign remittances to Pakistan. They also found that the improvement in the world's economic situation and depreciation of the home country's exchange rate serves as

stimulating factors for the inflows of international remittances to the country through employment generation.

In the same vein, Singh and others (2009) examined the determinants and macroeconomic impact of migrants' remittances, using panel data for 36 Sub-Saharan African countries over the period 1990-2005. They found that the remittances are positively affected by the number of expatriates, financial deepening, the host country income and institutional quality. Their results also indicate that remittances flow vary countercyclically with the variations in GDP per capita, supporting the hypothesis that the inflow of remittances can help mitigate economic shocks. Moreover, they found that the real exchange rate appreciation reduces the flow of remittances.

More recently, Lin (2011) studied the factors affecting the flow of remittances into Tonga, employing quarterly data over the period 1994 - 2009. The study finds that the macroeconomic conditions in host countries and exchange rate fluctuations are the most important factors influencing the remittance flow. He found that the remittances flow declines when the Tongan currency appreciates, but increases with higher real GDP growth and lower unemployment in remitting countries. Moreover, his analysis investigates the impact of remittances on exchange rates; the result does not find evidence on the incidence of the Dutch disease in Tonga. Lin concluded that most of remittances are used for consumption purposes.

In the case of Sudan, Elbadawi (1994) studied the impact of the exchange rate premium on remittances transferred by expatriate Sudanese working abroad, during the period 1970-1990. He found that the black market exchange rate premium is a significant factor affecting the flow of migrant remittance through the official channels. He argues that an increase in the exchange premium during this period, led to many deleterious effects, such as the reduction in official exports and acceleration of capital flight as well as diversion of workers' remittances from official market exchange rates. Finally, the study concluded that improving the macroeconomic situation in terms of a credible exchange rate and trade reform is a necessary condition for the realization of the full potential from migrant's remittances.

4. Data and Methodology

4.1. Data and model specification

Based on the literature review discussed above, we observe that there are many economic variables influencing the flow of migrants' remittance to their country of origin. However, for the purpose of this paper we will focus on the macroeconomic variables, which will be chosen for their relevance, especially for the case of Sudan and availability of reliable data[3]. Thus, the estimable econometric equation of remittances determinants could be expressed as follows:

$$REM_t = \beta_0 + \beta_1 DY_t + \beta_2 INF_t + \beta_3 PRM_t + \beta_4 OPN + \beta_5 FD_t + \beta_6 FY_t + \varepsilon_t \quad \ldots (1)$$

The model implies that the ratio of remittances to GDP (REM) is influenced by the domestic income measured by GDP per capita (DY), inflation rate (INF), black exchange rate premium (PRM), trade openness (OPN), financial development (FD) and foreign income (FY). All variables are expressed in natural logarithm.

According to the theoretical and empirical evidence, sign of the home income is inconclusive; some studies (e.g. Gupta (2009) and Hacker et al. (2009)) found that the impact of home income is negative, indicating the altruism behaviour of remitters, while others (e.g. El-Sakka and McNabb (1999) and Shahbaz, et al (2009)) found that the relationship is positive. The coefficient of the inflation is expected to be negative; this is because during high inflation

[3] - see appendix (A)

periods remitters tend to transfer money through informal channels. The coefficient of the black market premium would be negative as reported in most empirical studies (e.g. Elbadawi (1994) and El-Sakka and McNabb (1999)). The signs of trade openness and financial development coefficients are expected to be positive, since the development of financial and foreign trade sectors would improve the macroeconomic environment and hence, encourage the transferring of remittances through formal financial channels. Finally, the sign of foreign income would be positive, this is because an improvement of economic conditions in the host country allows migrants to increase their employment and to remit more money home.

Due to the availability of estimates of migrants' remittances flows to Sudan from 1970, the empirical analysis uses annual time series data, covering the period of 1970-2009. The data is collected from various sources, as presented in the appendix (A).

4.2 Econometric methodology

In order to investigate the role of macroeconomic environment in the migrant's remittances flow into Sudan's economy, the study uses the bound test or Autoregressive Distributed Lag (*ARDL*) technique to cointegration developed by Pesaran (1997). This procedure has three advantages over the traditional cointegration approaches of Johanson (1988) and Johanson and Jseilus (1990). Firstly, the bound test technique is simple. As opposed to other multivariate cointegration techniques such as Johansen and Juselius, it allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, the bounds testing procedure does not require a pre-testing of the variables included in the model for unit roots contrasting to other techniques such as in the Johansen approach. It is applicable irrespective of whether the underlying regressors are purely *I(0)*, purely *I(1)*, or a mixture of both. Finally, the test is relatively more efficient in small or finite sample data sizes.

The *ARDL* method yields consistent and robust results because it allows describing the existence of an equilibrium-relationship in terms of long and short-run dynamics without losing long-run information (Pesaran et al. 2001). Thus, this study tests the existence of the long-run relationship (cointegration) using the *ARDL* technique. Following Pesaran and Pesaran (1997), Pesaran and Shin (1999) and Pesaran and Smith (2001), the unrestricted error-correction version of the *ARDL* framework for equation *(1)* can be written as follows:

$$\Delta REM_t = \alpha + \sum_{i=1}^{n} \gamma_i \Delta DY_{t-i} + \sum_{i=1}^{n} \theta_i \Delta INF_{t-i} + \sum_{i=1}^{n} \rho_i \Delta PRM_{t-i} + \sum_{i=1}^{n} \omega_i \Delta \mathrm{OPN}_{t-i} + \sum_{i=1}^{n} \delta_i \Delta FD_{t-i} + \sum_{i=1}^{n} \vartheta_i \Delta FY_{t-i} + \lambda_1 DY_{t-1} + \lambda_2 INF_{t-1} + \lambda_3 PRM_{t-1} + \lambda_4 OPN_{t-1} + \lambda_5 FD_{t-1} + \lambda_6 FY_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots (2)$$

In the first part of equation (2) the summation signs represent the error correction dynamics while the second part (with λs) correspond to the long run relationship. According to Pesaran and Pesaran (1997), there are two steps for implementing the ARDL approach to cointegration procedure. First, we test the existence of the long run relationship between the variables in the system. In particular, the null hypothesis of having no integration or long run relationship among variables in the system, $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = 0$, is tested against the alternative hypothesis $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq 0$ by judging from the F-statistics. Since the distribution of the F-statistics is non-standard irrespective of whether the variables in the system are *I(0)* or *I(1)*, we use the critical values of the F-statistics provided in Pesaran and Pesaran (1997) and Pesaran et al (2001). Pesaran and others (2001) tabulated two sets of appropriate critical values, one set assumes all variables are *I(1)*

and another assumes that they are all *I(0)*. For each application, the two sets provide the bands covering all the possible classifications of the variables into *I(0)* or *I(1)*, or even fractionally integrated ones. According to Pesaran and Pesaran (1997) if the calculated F-statistics is higher than the appropriate upper bound of the critical value, the null hypothesis is rejected, indicating cointegration. If the value of F-statistics falls below the appropriate lower bound, the null hypothesis cannot be rejected, supporting lack of cointegration. Finally, if the computed F-statistics lies within the lower and upper bounds, the result is inconclusive.

After the existence of the cointegration between variables is confirmed, the second step is to estimate the long run coefficients and the error correction representation through the ARDL approach to cointegration and the use of OLS[4]. The long run coefficients are derived from the estimation of the first part of equation (2) with the level, whereas the short-run error correction estimators are estimated using the first difference of the first part of that equation. The lag order of the *ARDL* specification is chosen using Akaike Information Criteria (*AIC*). To ascertain the robustness of the *ARDL* estimations, the stability tests, namely Cumulative Sum of Recursive Residuals (*CUSUM*) and Cumulative Sum of Square of Recursive Residuals (*CUSUMQ*) tests are conducted.

For further robustness analysis, we examine the dynamic relationship between the flow of remittance and its determinants using the analysis of the relative change of the dependent variable in response to its own innovations and shocks to other variables in the system. For this purpose, the study employs Forecast Error Variance Decomposition (*VDC*) and the Impulse Response Functions (*IRFs*), based on restricted Vector Autoregression Model (*VAR*). The variance decomposition approach identifies the proportion of the movements in the dependent variable (remittances) that are due to their own shocks and the shocks of the other variables. On other hand, impulse response functions examines the effect of a one standard deviation shock to the orthogonalized residuals of equation on current and future values of the endogenous variables. Impulse responses measure the responsiveness of the dependent variables in the *VAR* to shocks to each of the variables.

It is important to note that the forecast error variance decompositions (*VDCs*) and the impulse-response functions (*IRFs*) are derived from the vector autoregression model (*VAR*). Specifically, *VDCs* and *RIFs* are the transformation of *VAR* model into its moving average (*MA*) representation (Sims 1980). In addition, one challenge facing employing the *VDCs* is the selection of the order of the variable in the *VAR* system; this is because orthogonalisation involves the assignment of contemporaneous correlation only to specific series. In other words, the first variable in the ordering is not contemporaneously affected by shocks to the other variables, but shocks to the first one do affect the other variables in the system; the second variable affects contemporaneously the other variables (except the first one), but it is not contemporaneously affected by them; and so on. Accordingly, we follow Sims (1980:21) work, which suggested starting with the most exogenous variable in the system and ending with the most endogenous one.

5. Empirical Results and Discussions

Before using the ARDL bounds analysis, we tested all variables for the presence of the unit root to determine their order of integration. Although the ARDL approach does not require a stationarity test, in the case of *I(2)* variables the computed F-statistics provided by Pesaran et al (2001) are not valid, because the bounds test is based on the assumption that the variables are *I(0)* or *I(1)* (Ouattara 2004). Therefore, we implemented the stationarity tests in the *ARDL* method to ensure that none of the variable is integrated of order more than *I(1)*. The test of

[4] - The long run coefficients are calculated from the estimated respective coefficients of the one-lagged level explanatory variables.

the order of integration for each variable is conducted using the Augmented Dickey-Fuller (*ADF*) and Phillips Perron (*PP*) tests[5]. The results of the unit root test for each variable with and without trend are presented in Table (1) below:

The result of the unit root test indicates that all the variables are nonstationary at level except when foreign income has an order of *I(0)*. When taking the variables in the first difference, the results show that all are *I(1)*, by both Augmented Dickey-Fuller or Philips-Perron test. Therefore, we can conclude that the series are a mixture of *I(1)* and *I(0)*. This constitutes a suitable justification for using the *ARDL* for the cointegration method since the conventional test of Johanson and Jiusles (1990) requires that all variables must have the same order of integration.

The next step in the *ARDL* analysis is to test for the existence of a long-run casual relationship between the variables using the bounds test approach developed by Peasran et al (2001). Since the test is sensitive to the lag length we used lag 3 as determined by Akaike Information Criterion (*AIC*). The result of cointegration test with restricted constant and no trend is reported in Table 2.

The result shows that the calculated F-statistic (F-statistic = 4.04) is higher than the upper bound critical value at a 1% level of significance (3.90). This indicates that the null hypothesis of no cointegration between the variables is rejected. In other words, there is a long relationship between the flow of migrant's remittances and their major macroeconomic determinants in Sudan.

Having the existence of a cointegration relationship between the variables, we have estimated the second part of equation (2) using the *ARDL* method. The results of the long-run *ARDL* model using the specification of (2,1,0,0,0,0,0) selected based on *AIC*, are reported in Table (3).

The results of the long-run estimation show that all estimated coefficients carry the expected signs except the financial development. The result reveal that the inflow of remittances of Sudanese working abroad through official channels in the long-run is influenced negatively by the level of GDP per capita, inflation rate and black market exchange rate premium, and financial deepening. On the other hand, trade openness and foreign weighted average income positively attract the migrants' remittances in the long run.

As expected, the coefficient of the inflation rate is negatively and significantly affects the inflow of remittances to Sudan in the long run; indicating that an increase in the inflation rate discourages the remittances flow to Sudan's economy. This result is consistent with the situation in Sudan, since during the time of hyperinflation in the first half of 1990s, the country reported low flow of remittances through official channels.

Like other empirical studies, our result indicates that the coefficient of the black exchange premium is negative and statistically significant with the highest elasticity (-0.86), implying that an increase in the exchange premium by one unit will decrease the size of remittances by 86%. This finding confirms the result in the previous studies in the Sudanese literature, mainly; Elbadawi (1992, 1994) who argued that the rising of the black market exchange premium reduces the remittance flows through formal channels.

The coefficient of the home income is negative and significantly affected the remittances flow, implying that an improvement in the per capita income discourages remittances in the long run. This result supports the hypothesis that transferring money to the home is motivated by the altruistic behavior of the remitter; that means Sudanese emigrants send more (less)

[5] - Although the ARDL framework does not require the pre-testing of variables, the unit root test could help in determining whether or not the ARDL model should be used.

money to their home country if home country income is low (high). This finding is consistent with most empirical studies on remittances determinants (e.g. Gupta (2005), Chami et al (2005) and Singh et al (2009)).

Surprisingly, the coefficient of financial development is negative, indicating that the development of the financial sector discourages the flow of remittances through official channels. This result is contrary to the empirical evidence of Singh et al (2009). In our view, this finding has two possible explanations pertaining to the case of Sudan. First, the development of the financial sector as measured by the ratio of banks credit to GDP does not imply the promotion of the sector itself, in terms of expansion of financial services, but rather it reflects the expansion of money supply, which increases the inflation and black market premium and hence, discourages remittances flow. Second, the growth of the black exchange market and the steady increase in the premium diverts almost all of the remittances to informal channels. Therefore, in the presence of the black market the development of the financial sector will remain with no significant influence on remittances.

With regard to trade openness, our result shows that there is a positive and significant relationship between the degree of trade openness and the flow of remittances. This implies that an increase in the degree of trade openness encourages the flow of the migrants' remittances into Sudan in the long run. This result is consistent with the findings in economic theory and it is very important for Sudan's economy, because it reflects the effect of the efforts exerted in trade liberalization since early 1990s. Finally, the coefficient of average foreign income is positive and significant, implying that an improvement in economic conditions of the host countries motivates emigrants to send more money. This finding corroborates the results presented in several empirical studies in the literature, such as Elbadawi and Rocha (1992) and Singh et al. (2009).

Overall, our results of long-run analysis indicates that macroeconomic policy variables as measured by the inflation rate, exchange rate and financial development play significant roles in encouraging the flow of remittances through the official channels. This implies that the macroeconomic policies are important determinants of migrant's remittances flow into Sudan's economy. These findings are consistent with the most previous studies in the literature, such as Gupta (2005), El-Sakka and Mcnabb (1999) and Elbadawi (1994) among others.

After estimation of long-run cointegration model we have estimated the short-run dynamics parameters within the ARDL framework. Table 4 reports the results of the error correction model of remittances in Sudan using the ARDL method.

Our results show that the error correction model has a good explanatory power with the adjusted R square= 0.57. The model also shows that there is no serial correlation problem, as indicated by the Durbin-Watson (*DW*) statistics, which are close to 2. Like the long-run analysis, the result of the ECM indicates that most of the estimated coefficients are significant and have their expected signs of financial development. Thus, the *ECM* findings fit well with the results of the long-run analysis.

Our results indicate that the error correction term (*ECT*) is negative and statistically significant at 1%, confirming the existence of a long-run equilibrium relationship between the flow of remittances and its explanatory variables. The high sign of the ECT (-0.77) indicates that the flow of remittances has a fairly high speed of adjustment to the long-run equilibrium. In other words, approximately 77% of long-run disequilibria from the previous year's shock converge back to the equilibrium in the current year.

Similar to the long-run analysis, our results of the short-dynamic model show that inflation and exchange rate premium significantly discourage the inflow of migrant's remittances into

Sudan's economy. The findings also suggest that home income and financial development negatively affect the inflow of remittances in the short run; this result also corroborates the long-run analysis. Moreover, the trade openness is found to have a positive effect on the migrants' remittances. Therefore, we can conclude that in the short and long run, the macroeconomic policy variables in Sudan plays a key role in attracting the flow of remittances via official channels.

For accuracy, we have examined the stability of the long-run relationship by using the Cumulative Sum (*CUSUM*) and Cumulative Sum of Squares (*CUSUMQ*), as shown in Figure (4) and (5) below. The plots of the *CUSUM* and *CUSUMQ* statistics stay within the critical values and indicate that all coefficients employed in the *ARDL* error correction equation are stable.

For further inference, we test the effect of shocks from the explanatory variables to the remittances flow, using variance decompositions *VDCs* and impulse response function *IRFs*. According to Sims' (1980) procedure of selecting order of the variables, we choose the following order: REM, DY, INF, PRM, OPN, FD and FY. Our results of the variance decompositions and impulse response function are reported in Table (5) and Figure (6), respectively.

The results of variance decomposition analysis in Table 5 show that the macroeconomic variables have a considerable impact on the inflow of Sudanese remittances. The exchange premium is the second greatest source of shock to the remittance flow after the foreign income variable, with an average of 11 over the entire periods. The response of remittances to the shocks of inflation and trade openness is relatively small. These findings are consistent with the previous analysis of the *ARDL* technique. The variation in Sudanese remittances, thus, relies mainly on its own shocks, the black market premium and home income shocks.

Regarding the analysis of impulse response functions, our result in Figure 6 indicates that the effect of one standard error shock on each independent variable confirms the results of the *ARDL* and *VDC* analysis[6]. The response of remittances to GDP per capita is negative supporting the previous finding that remittances are countercyclical to home income and motivated by altruistic behavior. On the other hand, the response of remittance to foreign income is positive during the entire time horizon indicating that remittances are procyclical to foreign income. The response of remittance to the inflation and black market premium are negative, confirming the findings of the *ARDL* and *VDC* analysis.

6. Conclusion and Policy Recommendations

Considering the importance of migrants' remittances as source of financing economic growth and foreign exchange in Sudan's economy, this study investigates the role of the macroeconomic environment in attracting migrants' remittances. For this purpose, the study used the ARDL for cointegration method, variance decompositions and impulse response functions, over the period 1970-2008.

Our empirical results are consistent with the findings in the most empirical studies on remittances, such as, Elbadawi (1994), El-Sakka and Mcnabb (1999), and Gupta (2005). The results indicate that macroeconomic policy variables are very important determinants of attracting the flow of remittances, via official channels, of Sudanese nationals working abroad. We find that the inflation rate and black market exchange rate premium exert a negative and statistically significant effect on the remittance flow in both the short and long run. The home income variable is found to significantly discourage the flow of remittances,

[6] - Since our VAR system contains seven variables, a total of 42 impulses could be generated. As long as, the purpose of the study is to examine the impact of macroeconomic variables on the remittances flow, we traced out only the responsiveness of the remittances to the shocks in the macro variables.

implying that in the case of Sudan altruistic behavior is an important factor that motivates emigrants to transfer their money. Our results also revealed that foreign income and trade openness have a positive impact on attracting immigrants' remittances through official channels. Unexpectedly, the impact of financial development is negative, implying that an improvement in the financial sector discourages the amount of remittances transferred through official channels.

Based on the above findings, it is important for policy makers to adopt the necessary policy measures that would lead to creation of a favorable macroeconomic environment for remittances flow. That is, the significant macroeconomic determinants like inflation and black exchange rate premium should be paid considerable attention from policy makers. In this respect the government should fight the black market through various administrative and policy measures. This is quite necessary in order to remove the increasing black market premium. There is also need for adopting restrictive fiscal and monetary policies to curtail the steady increase in the general price level, which creates deep distortions in the overall macroeconomic environment. The role of the financial sector in attracting migrant remittance should also be revisited. This would require undertaking serious reforms that would enhance the efficiency and effectiveness of the banking sector in attracting remittances. Besides, more incentives should be offered for expatriates to encourage them to invest in their home country. These incentives are quite important as it would transform the direction of remittances from consumption to production.

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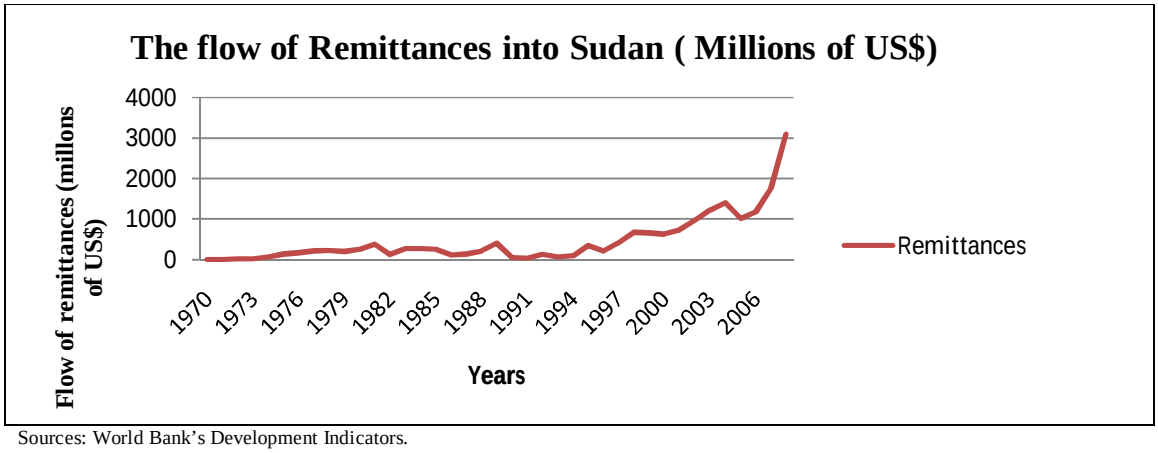
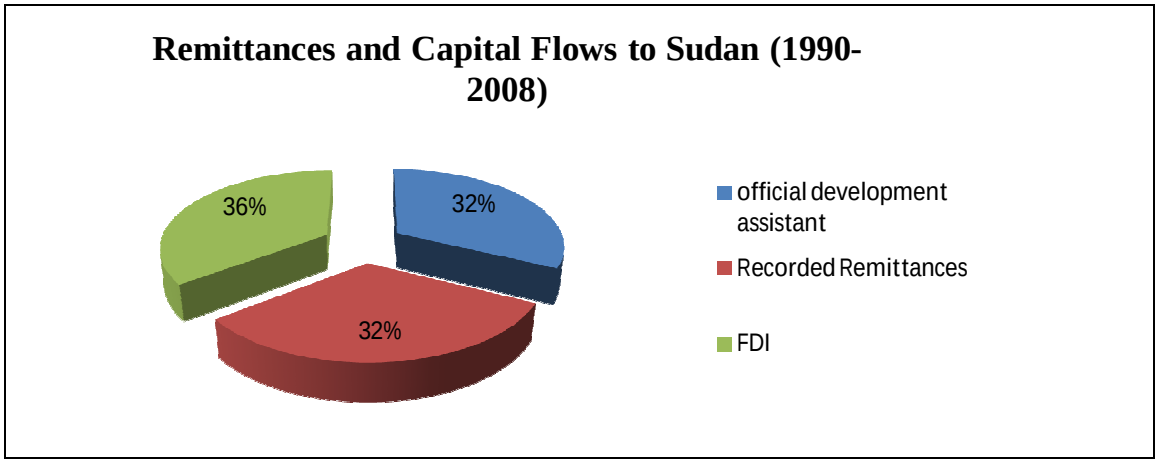
Figure 1: The Trends of Remittances Flow into Sudan (1970-2008)



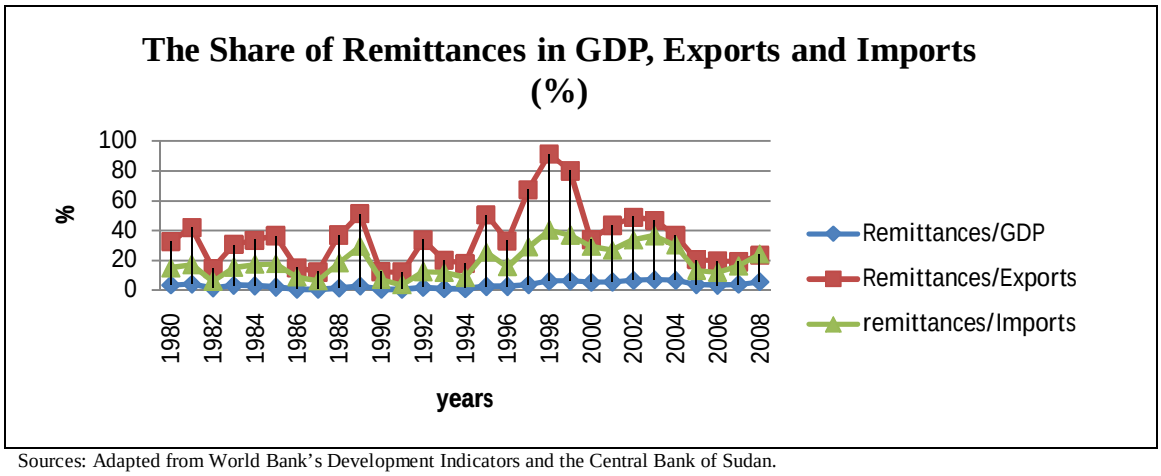
Sources: World Bank's Development Indicators.

Figure 2: Remittances and Distribution of Capital Flows (1990-2008)



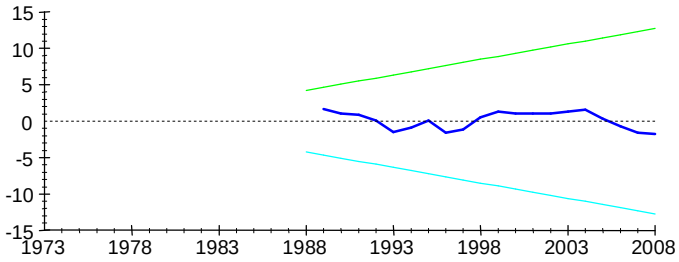
Sources: Central Bank of Sudan (CBOS) Annual Report- Various Issues

Figure 3: The Share of Remittances to GDP, Exports and Imports (1980-2008)



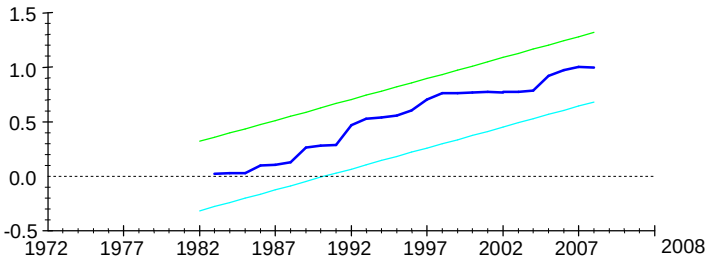
Sources: Adapted from World Bank's Development Indicators and the Central Bank of Sudan.

Figure 4: Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Figure 5: Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Figure 6: The Impulse Response Functions Results

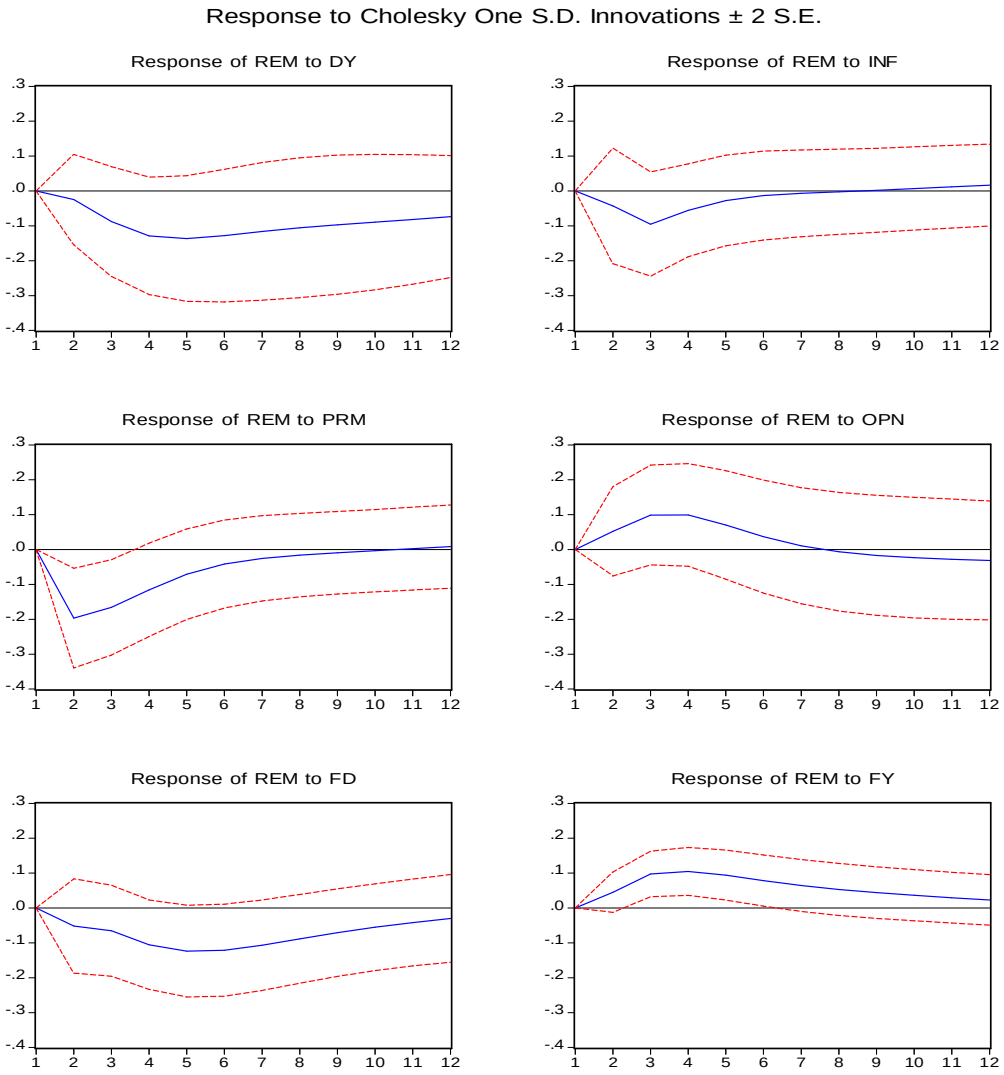


Table 1: The Result of the Unit Root Test

Variable	ADF		PP	
	Constant	Constant and trend	Constant	Constant and trend
lnREM	-2.55	-2.80	-2.37	-2.67
lnDY	-0.95	-1.36	-1.14	-1.61
lnINF	-2.67	-2.59	-2.53	-2.14
lnPREM	-2.60	-3.02	-2.50	-2.96
lnOPN	-1.31	-1.32	-1.32	-1.67
lnFD	-2.21	-2.32	-2.49	-2.62
lnFY	-2.96**	-4.36***	-3.20**	-3.28**
ΔlnREM	-6.80***	-6.70***	-7.17***	-7.03***
ΔlnDY	-3.65***	-3.59***	-5.03***	-4.96***
ΔlnINF	-8.39***	-8.69***	-8.31***	-9.12***
ΔlnPRM	-7.98***	-7.86***	-8.76***	-8.71***
ΔlnOPN	-7.68***	-8.00***	-7.17***	-8.03***
ΔlnFD	-6.89***	-6.81***	-7.02***	-7.19***
ΔlnFY	-5.73***	-4.87***	-3.28**	-3.42**

Note: ** and *** indicate significance at 5 and 1 per cent respectively. Δ: denote the first difference. Lag 3 is maximum lag length selected by Akaike Information Criterion (AIC),

Table 2: The Results of Bounds Test

Dep. Variable	*AIC* Lags	F- Statistics	Bound testing (at 99%
F (REM/ DY, INF, PRM,	3	4.04	Lower: 2.73
OPN, FD, FY)		(0.014)	Upper: 3.90

Notes: Asymptotic critical value bounds are obtained from Table CI(ii), Case II: restricted intercept and no trend for k=7 (Pesaran et al.,2001:.300).

Table 3: Estimated Long Run Coefficients using the ARDL Approach

ARDL (2,1,0,0,0,0,0) selected based on (AIC): Dependent variable is lnREM			
Regressor	Coefficient	T-Ratio	P-Value
lnDY	-0.816	-0.892	0.379
lnINF	-0.177*	-2.006	0.053
lnPRM	-0.862***	-3.097	0.004
lnOPN	0.264*	1.920	0.063
lnFD	-0.050	-0.305	0.762
lnFY	0.311**	2.262	0.030
constant	-10.759**	-2.328	0.026
Adjusted R square	0.67	F- statistics	9.084 [0.000]
DW-statistic	2.06		

Note: *, **, *** indicate significance at 10, 5 and 1 per cent respectively

Table 4: The Results of Estimated Short-Run Error Correction Model

ARDL (2,1,0,0,0,0,0) selected based on (AIC). Dependent variable is lnREM			
Regressor	Coefficient	T-Ratio	P-Value
$\Delta lnREM_{(-1)}$	0.282**	2.522	0.016
ΔlnDY	-0.709	-0.711	0.482
ΔlnINF	-0.137	-1.156	0.256
ΔlnPRM	-0.671**	-2.686	0.011
ΔlnOPN	0.206**	2.337	0.025
ΔlnFD	-0.039	-0.567	0.574
ΔlnFY	0.242*	1.996	0.054
ΔConstant	-8.372	-1.294	0.204
$ECT_{(-1)}$	-0.778***	-5.154	0.000
Adjusted R square	0.57	DW-statistic	2.06
F-statistics	4.473[.001]		

Note: *, **, *** indicate significance at 10, 5 and 1 per cent respectively

Table 5: Variance Decomposition Results

Variance Decomposition of REM							
Period	**REM**	**Y**	**INF**	**PRM**	**OPN**	**FD**	**FY**
1	100.00	0.00	0.000	0.00	0.00	0.00	0.00
4	62.15	5.20	2.92	16.58	4.67	3.77	4.68
8	49.42	13.06	2.31	14.46	4.46	10.40	6.86
12	46.58	16.22	2.20	13.42	4.47	11.10	6.98

Note: the VAR model estimation based on lag (2), selected using *AIC*.

Appendices

Appendix A: Descriptive Statistics

Variables	REM	DY	INF	PRM	FD	FY
Mean	4.72E+08	456.8858	35.77134	1.824127	46.54982	9.52E+10
Median	2.40E+08	411.3408	23.96305	1.644444	31.07529	8.54E+10
Maximum	3.10E+09	1352.594	132.8238	11.11111	220.1174	3.31E+11
Minimum	12300000	139.6541	1.303669	1.001167	6.616681	3.06E+09
Std. Dev.	6.08E+08	252.1420	36.92930	1.631640	51.43100	7.02E+10
Skewness	2.512179	1.766053	1.421404	4.927086	2.068974	1.484363
Kurtosis	10.34117	6.521645	3.853803	28.43134	6.314051	5.507377
Jarque-Bera	128.5976	40.42636	14.31712	1208.769	45.67152	24.53795
Probability	0.000000	0.000000	0.000778	0.000000	0.000000	0.000005
Observations	39	39	39	39	39	39

Appendix B: Description of Variables and Data Sources

Variable	Definition	Source
REM	Remittances flow, measured as ratio of remittances to GDP, in US$	Central Bank of Sudan and World Development Indicators
DY	Domestic income, measured by GDP per capita in US$	Central Bureau of Statistics, Sudan
INF	Is inflation rate, measured by the annual average of inflation rates	Central Bureau of Statistics, Sudan
PRM	Black market premium, measured as ratio of black market exchange rate to official exchange rate	Central bank of Sudan
OPN	Trade openness, defined as value of exports plus imports divided by GDP.	Central Bureau of Statistics, Sudan
FD	Financial development, proxied as ratio of bank credits to GDP	Central Bank of Sudan
FY	Foreign income, defined as weighted average of income of the five countries that hosts most of the Sudanese potential remitters. These countries are: Saudi Arabia, Qatar, Bahrain, UAE and Oman, with the weight 60%, 10%, 10%, 10% and 10% respectively. The weights are selected according to the size of Diaspora in each country[7].	World Bank's World Development Indicators

[7] - According to SSWA' statistics, most of Sudanese expatriates are working in these Gulf States.

Appendix C: The Percentage Share of Remittances in the GDP, Exports and Imports

Year	Remittances/GDP (%)	Remittances/Exports (%)	Remittances/Imports (%)
1990	0.50	18.55	8.68
1991	0.40	14.71	3.63
1992	1.76	55.82	13.89
1993	0.85	14.35	6.47
1994	0.84	20.46	9.23
1995	2.50	62.30	29.22
1996	1.66	35.71	14.72
1997	3.51	70.62	29.51
1998	6.10	71.29	39.64
1999	4.53	69.26	52.95
2000	5.18	35.47	46.90
2001	5.53	45.38	36.53
2002	6.53	50.16	45.37
2003	6.88	48.13	48.25
2004	6.47	37.14	39.12
2005	3.71	21.06	17.09
2006	3.24	20.85	16.60
2007	3.83	19.92	22.91
2008	5.54	26.57	37.68
Average	3.26	34.96	19.33

Sources: Authors' calculation based on World Bank's world development indicators and the Central Bank of Sudan (CBOS) Annual Reports- Various Issues.