ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية
2017

working paper series

DETERMINANTS AND MACROECONOMIC IMPACT OF PARALLEL MARKET FOR FOREIGN EXCHANGE IN SUDAN

Ebaidalla Mahjoub Ebaidalla

Working Paper No. 1155

DETERMINANTS AND MACROECONOMIC IMPACT OF PARALLEL MARKET FOR FOREIGN EXCHANGE IN SUDAN

Ebaidalla Mahjoub Ebaidalla

Working Paper 1155

November 2017

Send correspondence to:
Ebaidalla Mahjoub Ebaidalla
University of Khartoum
ebaidallamahjoub@yahoo.com

First published in 2017 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Abstract

This paper attempts to identify the factors that influencing the parallel exchange rate premium in Sudan during the period 1979–2014. In addition, the impact of parallel exchange rate premium on economic performance is examined; focusing on three key macroeconomic indicators namely, economic growth, inflation and exports. The empirical results show that parallel exchange rate premium is significantly affected by policy variables such as, real exchange rate, trade openness and money supply. The results also reveal that GDP growth, expected rate of devaluation, and foreign aid are the most significant factors affecting parallel exchange premium. Moreover, the results demonstrate that parallel premium has a detrimental impact on both economic growth and export performance. Expectedly, the results show a positive association between premium and inflation rate. These outcomes are still hold under robustness checks, indicating that parallel exchange rate premium has negative consequences on macroeconomic performance in Sudan. Accordingly, the paper concludes with some policy implications that aim to narrow the spread between the black and official exchange rate as an important way out to contain inflationary pressures, improve export competitiveness, and boost economic growth.

JEL Classification: C3, F3, F4

Keywords: ARDL, parallel exchange rate premium, macroeconomic performance, Sudan

ملخص

تحاول هذه الورقة التعرف على العوامل المؤثرة على علاوة سعر الصرف الموازي في السودان خلال الفترة 1979-2014. وبالإضافة إلى ذلك، يجري بحث أثر علاوة سعر الصرف الموازية على الأداء الاقتصادي؛ مع التركيز على ثلاثة مؤشرات رئيسية للاقتصاد الكلي وهي النمو الاقتصادي والتضخم والصادرات. وتبين النتائج التجريبية أن علاوة سعر الصرف الموازية تتأثر تأثرا كبيرا بمتغيرات السياسة مثل سعر الصرف الحقيقي والانفتاح التجاري وعرض النقود. وتكشف النتائج أيضا أن نمو الناتج المحلي الإجمالي، والمعدل المتوقع لانخفاض قيمة العملة، والمساعدات الخارجية هي أهم العوامل التي تؤثر على أقساط الصرف الموازية. وعلاوة على ذلك، تبين النتائج أن العلاوة الموازية لها تأثير ضار على النمو الاقتصادي وأداء الصادرات. ومن المتوقع أن تظهر النتائج ارتباطا إيجابيا بين معدل التأمين ومعدل التضخم. ولا تزال هذه النتائج تحت رقابة المتانة، مما يشير إلى أن علاوة سعر الصرف الموازية لها عواقب سلبية على أداء الاقتصاد الكلي في السودان. وبناء على ذلك، تخلص الورقة إلى بعض الآثار السياسية التي تهدف إلى تضييق الفارق بين سعر الصرف الأسود والرسمي كوسيلة هامة للخروج من الضغوط التضخمية، وتحسين القدرة التنافسية للصادرات، وتعزيز النمو الاقتصادي.

1. Introduction

It is well known that government restrictions on free trading of foreign exchange lead to the emergence of parallel or black market for foreign exchange, which has been considered as one of popular phenomena in developing countries. It is also acknowledged that parallel exchange rate has a negative impact on macroeconomic performance, since parallel premium indicates a market distortion, hence reduces trade and growth (Kiguel and O'Connel, 1995). In addition, the spread between black and official exchange rate may enforce the speculative activities in foreign currencies and illegal trade, and result in capital flight and deviation of remittances flows from the formal channels (Kiguel and O'Connel, 1995 and Elbadawi, 1994).

In Sudan, the spread between parallel and official exchange rate is a remarkable phenomenon over the last four decades. The premium between the two rates has emerged since the late of 1970s when the government had started the devaluation of domestic currency with the support of World Bank and IMF' stabilization programs. Since then, the state has adopted several policy measures to control the black market for foreign exchange; including, unification of exchange rate and trade liberalization policies. Despite these interventions the parallel market premium remained high during the last forty years. Moreover, in the past few years the gap between parallel and official exchange rate has widened sharply, particularly after the secession of South Sudan and loss of most oil resources[1]. For instance, at the end of 2016, the parallel exchange reached a rate of 18.5SDG/US$ compared to an official rate of 6.5SDG/US$. Accordingly, during the periods of large parallel market premiums, Sudan economy experienced a dismal economic performance, as manifested in low economic growth, high inflation rate and trade deficit. Furthermore, the parallel market premium diverts the flow of migrants' remittance from formal channels to black market, hence forbids the country an important exchange source, which are supposed to compensate a considerable portion of loss in oil revenues. In the spirit of such context, this paper aims to investigate the determinants and impact of parallel exchange rate premium on macroeconomic performance in Sudan.

The contribution of this study is to fill a gap in literature on the determinants and impact of parallel exchange rate premium on Sudanese economy, since there is a dearth in empirical studies on this issue. Besides, the existing empirical studies on parallel exchange rate in Sudan (e.g. Elbadawi, 1992 and 1994) used dataset that dated back to 1980s and 1990s; thus, updating information on this issue may reveal new dimensions on the phenomenon. Moreover, this paper is timely and relevant as Sudan has witnessed many economic transformations in the last decades owing to the exploitation of oil and secession of South Sudan, as well as changing macroeconomic landscape; therefore, understanding the determinants and impact of parallel market for foreign exchange could reveal the importance of some variables that may be subject to the control of policy makers, hence contributing in guiding appropriate exchange policies that foster exports' competitiveness, and attract foreign finance such as, foreign direct investment and migrants' remittances.

The paper is organized as follows: section one is an introduction, while section two reviews the exchange rate policies in Sudan. Section three outlines the empirical literature on the determinants and impact of parallel exchange rate. While section four discusses the data and research methodology, section five presents the empirical results. Finally, Section six ends with a conclusion and policy recommendations.

2. Exchange Rate Policy in Sudan: An overview

Throughout the last five decades, a number of exchange rate policies have been adopted in Sudan; including fixed, floating and dual exchange rate regimes (Ebaialla, 2016). For example, during the period 1956-1978, the exchange rate has been pegged at a fixed rate of

[1] After the secession of South Sudan in July 2011, the country has lost about 75% of oil revenues.

approximately one Sudanese pound to 2.85 US dollar. In September 1979 the monetary authority shifted from the fixed exchange rate regime to floating system, with the support of International Monetary Fund and World Bank's structural adjustment programs (Ebaidalla, 2014). Accordingly, the local currency underwent a significant devaluation to the rate of about three pounds per US dollar. The main goal of this policy was to reduce the external imbalances through encouraging exports, and attracting remittances of Sudanese nationals working abroad.

During the 1980s, exchange rate in Sudan has experienced a sequence of devaluations. It is worth mentioning that over 1980s the country has witnessed many factors that affecting economic performance, such as, drought and famines in 1984-1985 and the eruption of the second civil war in 1983 (Ebaidalla, 2014). The country, therefore, suffered from a severe lack of foreign reserves and relied mainly on foreign aid in financing development projects. Thus, the exchange rate has devalued sharply during 1980s, reaching an official rate of one dollar to 8 pounds in 1989, while the black market exchange rate set at more than LS20/US$ in the same year (Central Bank of Sudan, 2009).

At the onset of 1990s, Sudan economy witnessed several transformations, notably the transition from the state control policies that characterized the period of 1970s and 1980s to free market polices (Ebaidalla, 2014). In such period, the exchange rate has received great attentions from policy makers, as it was believed to be a core factor affecting the economic instability. Thus, the government launched the economic recovery program in early 1990, which prohibited the black market for exchange and considered it as an illegal practice and strict punishments have been adopted to obstruct illegitimate exchange transactions. Therefore, all foreign exchange transactions were confined to the licensed commercial banks. However, despite these policies, the exchange rate reported higher rate in the early 1990s compared to the 1980s. Subsequently, in 1992 the government unified the exchange rate market. Nevertheless, due to the drastic depreciation of local currency and sustainable increase in inflation rate, the floating system was abandoned by the end of 1993 and replaced by the dual exchange system. After that, the exchange rate experienced continuous devaluations, as the official rate reached LS300/$ and LS430/$ in 1994 and 1995, respectively (Central Bank of Sudan, 2009).

By the second half of the 1990s, exchange rate has been stabilized owing to the flow of FDI and the commercial exploitation of oil in 1999 (Ebaidalla, 2016). That is, the exportation of oil generated a huge amount of foreign reserves to the country, which was the largest source of foreign exchange during 2000s, accounted for around 85% of the total exports (Ebaidalla, 2014). Thus, the exchange rate saw substantial stability with a limit rate of LS 2650-2600 per US dollar during 2000-2003. As a result, during such period the Central Bank of Sudan adopted the managed floating exchange regime (Ebaidalla, 2016).

During the period 2008-2010, exchange rate saw many fluctuations due to the drop-in oil prices as a result of the global financial crisis of 2008-2009. The decline in the inflow of foreign currency that followed led to another split in exchange markets into official and black. Moreover, in the aftermath of the secession of South Sudan in 2011, Sudan has suffered from many economic challenges owing to the sudden loss of oil revenues. As a result, the exchange rate depreciated rapidly, leading to increase in the black market premium. In response to such situation, the authorities adopted a number of exchange rate devaluation measures in recent years, which result in high parallel exchange rate premium.

In general, the exchange rate in Sudan has experienced a series of devaluation since 1979, which in turn lead to widening the gap between official and parallel exchange rate. Figure 1 in Annex (I) shows the evolution of parallel exchange rate premium during the period 1979-2014. The Figure indicates that the parallel premium has emerged obviously by the early of 1990. After the free market policies of 1992 and up to the mid of 1990s, the parallel premium increased dramatically. However, during the period of oil exploitation (1997-2007), parallel

premium decreased, reflecting the shrinking of the gap between parallel and official exchange rate due to huge supply of foreign currency from oil exportation. After the separation of South Sudan, parallel exchange rate premium has seen a considerable increase owing to the loss of oil revenues and instability of economic situations.

3. Literature Review

Throughout the last few decades, the issue of parallel exchange markets has raised a considerable policy attention in developed and developing countries. This is because a huge gap between parallel and official exchange rate lead to devastating impact on macroeconomic performance in terms of high inflation rate, low economic growth, unattractive investment environment and dismal exports performance. In this section we review some empirical studies on the determinants of parallel markets for foreign currency and its impact on the macroeconomic indicators.

3.1 Determinants of parallel market for foreign exchange rate

Given the negative link between parallel market premium for foreign exchange and economic prosperity, the issue of parallel market exchange has received a sizable attention from policymakers and researchers, over the last four decades. In the theory, parallel markets for foreign exchange rate have been explained and analyzed via common three approaches namely, real trade models, portfolio balance models and monetary approach.

The real trade models attribute the emergence of parallel exchange rate to the exchange rate restrictions and heavy government interventions in trade. For example, controlling exchange rate to prevent the depletion of foreign exchange reserves may results in excess demand for foreign currency, which in turn creates black market for foreign currency (Nowak, 1984). In addition, government intervention in trade by tariffs and quotas stimulates smuggling and emergence of parallel market for foreign exchange become inevitable. Thus, according to such approach, parallel market premium is generated due to disequilibrium in exchange rate market i.e. mismatch between demand and supply of foreign currency. Notably, the supply of foreign currency in the parallel foreign exchange market comes from five sources: smuggling of exports, under-invoicing of exports, over-invoicing of imports, foreign tourists, remittances of nationals working abroad, and diversion of foreign currency from official to the parallel market through corruption. On the other hand, the demand for foreign exchange is usually derived from the motives of current account transactions, currency substitution and capital flight. Nevertheless, the real trade models have been criticized because they concentrate solely on the parallel market itself and neglect its interaction with other macroeconomic variables (Agenor, 1992).

Second, the portfolio-balance approach was developed by De Macedo (1987) and Dornbusch et al. (1983). This approach emphasizes the role of foreign currency as an asset in portfolio composition. Thus, loss of confidence in domestic currency due inflation, taxes and low real interest rate stimulate the demand for foreign currency, as a hedge and store of value and as a mean of acquiring and hoarding imports (Agenor, 1992). Therefore, changing the portfolio composition between foreign and domestic currencies determine the size of parallel market for foreign exchange rate. Many studies confirmed the role of portfolio in emergence of a parallel market premium (e.g. Degefe, 1994 and Aron and Elbadawi, 1992).

Finally, the monetary approach emphasizes the role of high money growth on emergence of parallel market for foreign exchange. That is, the excess money supply leads to inflation and high demand for foreign currency in parallel market (Blejer 1978). Excess money supply creates excess demand for goods and services which creates inflationary pressures and hence, depreciate the exchange rate. Thus, an expected future depreciation (appreciation) in parallel rates reduces (increases) the demand for domestic currency and creates excess supply (demand) and causes parallel market rates to further depreciate (appreciate) (Siddiki, 2000). According

to the monetary approach also an increase in interest rates stimulates excess money supply and hence increases inflationary pressures and parallel market premium.

Empirically, several studies have been conducted to investigate the determinants of parallel exchange rate. For example, Degefa (2001) investigated the determinants of parallel foreign exchange market and its effect on macroeconomic performance in Ethiopia. His results show that real money balances, real effective exchange rate and inflow of aid have positive effect on parallel market premium in the long-run. On the other hand, the terms of trade negatively affect the premium only in the short run. He also found that inflation is Granger-cause the parallel exchange rate premium.

Aron and Elbadawi (1992) investigated the determinants of parallel premium for exchange rate in Zambia using a portfolio model of parallel market exchange rate. Adopting annual data over the period 1970-1987, they found that the interest parity differential and the change in the stock of real domestic money are the most significant factors affecting positively the parallel exchange rate premium. Their results also show that the term of trade and foreign aid grants have negative and significant effect on exchange rate premium.

In the same vein, Elbadawi (1992) studied the determinants of parallel exchange rate in Sudan, using a portfolio approach. He attributed the emergence of black market premium to mis-invoicing and smuggling of exports and imports, and diversion of remittances of expatriates to the black market for foreign exchange. He also found that real exchange depreciation has a significant negative effect on the premium in both short and long run. Finally, the author pointed out that trade liberalization policy exerts negative and significant impact on the parallel market premium. Moreover, Nkurunziza (2002) examined the factors that affecting parallel exchange rate premium in Burundi using annual time series data for the period 1970-1988. Adopting cointegration and error correction model, his results show that expected rate of devaluation, economic growth and trade policy are the most significant factors influencing parallel exchange rate premium.

Siddiki (2000) investigated the determinants of parallel market premium in India over the period 1965-1994. His results reveal that the parallel market for foreign exchange is influenced significantly by the official exchange rate, trade liberalization, foreign reserves and interest rate. In addition, he found that the application of flexible Breton Woods exchange policies of 1973 has negative and significant impact on parallel market. Moreover, his results show that real per capita income, money supply and political instability do not have any significant effect on parallel exchange rate premium.

3.2 Impact of the parallel exchange rate on macroeconomic performance

Despite the huge body of literature on the causes of parallel market for exchange rate, the impact of parallel premium has gained a little attention. The influential study of Kiguel and O'Connel (1995) analyzed the parallel exchange systems in eight developing countries: Argentina, Ghana, Mexico, Sudan, Tanzania, Turkey, Venezuela and Zambia. They found that high premium was tolerated for a long time in most of these countries, with damaging effects on economic performance. In most countries also, they found evidence that exchange controls generated large parallel premiums which exert a detrimental effect on exports performance and economic growth rate.

Munoz (2008) studied the effect of parallel exchange rate market on Zimbabwe's export performance during the period 1984:Q1-2004:Q4. He found that a more depreciated parallel exchange rate provides an incentive to smuggling rather than export through official markets. His study also argued that exports can increase the profits by under-invoicing and later on selling the currency corresponding to the under-invoiced amount in the black market; thereby

obtaining a greater amount of local money for the same transaction. Degefa (2001) found similar results for the case of Ethiopia.

In the same vein, Pinto (1988) analyzed the relationship between black market exchange rate, real exchange rate and inflation in Sub Saharan Africa. He found that parallel market exchange rate premium is an implicit tax on exports, creating conflict between the fiscal goal of financing rates with a limited menu of tax and the allocative goal of simulating exports. He affirmed that the attempts to unify official and black market exchange rates, by officially floating the domestic currency in Sierra Leone and Zambia, led to large increases in inflation, associated with an acceleration of the rate of currency depreciation relative to that historically observed in the black market.

For the case of Sudan, Elbadawi (1994) is the first who examined the behavior of parallel market premium and its impact on economic performance. His results show that an increasing in parallel premium exerts negative impact on official exports and tax revenue from foreign trade, as well as a positive effect on capital flight. He argued that a rising premium and expanding black market for foreign exchange could have serious fiscal and commercial impact by squeezing the tax base in foreign trade transactions and by expanding the opportunities for large scale rent seeking activities. Elbadawi (1994) also pointed out that a high premium also aggravates the debt problem and foreign exchange constraint through its effects on capital flight. Finally, he found that exchange rate premium has a negative impact on the remittances sent by expatriates Sudanese working abroad. Moreover, Ebaidalla and Abdalla (2014) investigated the role of macroeconomic environment on the flow of migrants' remittances into Sudan. They found that the parallel market premium is the most significant factor that negatively affecting the flow of migrants' remittances.

Overall, the above discussion has revealed that the literature on determinants and impacts of parallel market for foreign exchange on macroeconomic indicators is widespread and diversified. However, there is a dearth of empirical studies on the issue of parallel markets for foreign currency in Arab countries in general and Sudan in particular. Therefore, this study would contribute to the empirical literature on this issue, aiming at providing some policy implications to contain the parallel exchange rate in Sudan.

4. Methodology and Data

To achieve the research objectives, the analysis proceeds via two steps: first, we identify the determinants of parallel market exchange rate premium in the short and long run, and then assess its impact on three main macroeconomic indicators namely, economic growth, inflation and export performance. Therefore, this section will be organized in two sub-sections: the first section specifies the models of parallel market exchange rate and its impact on macroeconomic indicators, while the second one discusses the estimation methodology and data.

4.1 Models specification

Based on the literature discussed in the previous section, we observe that there are many economic variables that influence the emergence of the black market for foreign exchange. Despite several models that have been used to analyze the parallel exchange rate premium, this study will follow the Kiguel and O'Connel (1994) and the Elbadawi (1992) portfolio-balance model, although with some modifications. This approach will be chosen for its relevance, especially for the case of Sudan and because of the availability of reliable data. That is, the most important factors influencing portfolio composition such as, inflation and exchange rate devaluation have been considered as the main reasons behind the black market exchange rate in Sudan (Elbadawi, 1992). Thus, the estimable econometric equation of parallel market premium could be expressed as follows:

$$PREM_t = \beta_0 + \beta_1 RER_t + \beta_2 GDP_t + \beta_3 DEV_t + \beta_4 MS_t + \beta_5 IR + \beta_6 TOT_t + \beta_7 AID + \beta_8 DUM99 + \beta_9 DUM92 + \varepsilon_t \quad \ldots \quad (1)$$

The model implies that the parallel market premium (PREM) is explained by real exchange rate (RER), real GDP per capita, expected rate of devaluation (DEV), international reserves (IR), money supply (MS), terms of trade (TOT), aid (AID) and two dummy variables (DUM99) and (DUM92). The first dummy variable captures the oil exploitation, takes value of one for the period (1999-2014) and zero otherwise, while the second one reflects unification of exchange rate during the period (1992-1993). All the variables expressed in logarithm form, except GDP growth.

According to theoretical and empirical evidence, the coefficient of real official exchange rate is expected to be negative, since depreciation of real exchange rate reduces the parallel market premium. The sign of expected devaluation is expected to be positive, as an increase in currency devaluation rate raises exchange rate premium. The impact of money supply would also be positive, since monetary expansion increases the inflation rate, which in turns results in high parallel premium of foreign exchange. The impact of terms of trade and international reserves are expected to be negative. The coefficient of aid is expected to be negative, this is because a flow of foreign aid increases the supply of foreign currency hence reduces parallel premium. The sign of the first dummy variable is expected to be negative, since during the period of oil exploitation exchange rate has witnessed a sound stability. Finally, the effect of second dummy variable would be negative, as unification of exchange rate during 1992-1993 is expected to reduce the parallel premium.

After identifying the factors that influencing parallel premium for foreign exchange, the next step is to investigate the impact of the parallel market premium on macroeconomic performance, focusing on three key macroeconomic indicators, namely, real GDP growth, inflation rate and exports performance. These variables are assumed to reflect the macroeconomic performance. Each macroeconomic variable under investigation will be considered as a dependent variable to be explained by parallel market premium beside other relevant control variables that supported by theoretical and empirical literature.

First, we examine the impact of parallel market premium on real output growth. Following previous studies on economic growth' determinants (e.g. Rodrik, 2008 and Barro and Lee 1994), the estimable model could be expressed as follow:

$$GDP_t = \beta X_t + \delta PREM_t + \varepsilon_t \quad (2)$$

Where GDP is the real GDP per capita growth, X is the vector of control variables, PREM is the parallel market premium, and ε_t is the error term. The control variables include inflation rate, trade openness, domestic investment and government expenditure. The model also involves two dummy variables, one to capture the announcement of full floating exchange rate in 1992-1993 and the other one to indicate the adoption of managed floating exchange rate after oil exploitation in 1999[2]. The first dummy variable takes the value of one for the period (1992-1993) and zero otherwise; while the second dummy takes the value of one during the period 1999-2011.

According to the theoretical and empirical literature, inflation rate may have negative or positive impact on economic growth. The trade openness also has mixed effect on growth, depending on trade policy. The domestic investment is considered as an important factor that stimulating growth; hence its impact is expected to be positive. The government spending is

[2] During the period under investigation (1979-2014), the exchange rate policy in Sudan has experienced several transformations. Thus, we use dummy variables to capture these structural breaks. In 1979 the country the system of dual exchange; in 1992 the government adopted full floating regime and during 1999-2011 the managed exchange rate system has been followed oil exploitation.

assumed to have positive impact on economic growth. Finally, the impact of parallel market premium would be negative as indicated by previous studies.

Second, with respect to the impact of parallel premium on inflation, the analysis will follow Aron and Elbadawi (1992) model. Therefore, the estimable current account equation is specified as follows:

$$INF_t = \beta X_t + \delta PREM_t + \varepsilon_t \quad (3)$$

Where INF is the inflation rate; X is a vector of control variables which include factors such as, real GDP per capita, government expenditure, trade openness, money supply; PREM is the parallel premium and ε_t is the error term. We also use two structural break dummies to reflect the adoption of dual exchange rate system during 1979-1984 and the second one to capture the announcement of full floating exchange rate in 1992-1993.

According to the economic theory, GDP per capita is expected to have positive impact on inflation, as an increase in the level of income raises the aggregate demand, which in turn increases the general price level. The impact of money supply and government expenditure are expected to be positive on inflation. The effect of trade openness is ambiguous, as an increase in trade openness may discourages or encourages the price level, depending on export sector' performance. The parallel market premium would be either negative or positive since there is disagreement in literature regarding the impact of premium on inflation.

Finally, regarding the effect of parallel market premium on exports performance, we estimate the following equation:

$$EXP_t = \beta X_t + \delta PREM_t + \varepsilon_t \quad (4)$$

Where EXP_t is the total export, measured by the ratio of total exports to GDP, X is the vector of control variables, PREM is the parallel market premium and ε_t is the stochastic error term. In literature, the most important factors affecting export performance are GDP per capita, terms of trade, domestic investment, level of human capital and foreign direct investment. The control variables also include one dummy variable to capture the impact of oil on export performance, taking the value of 1 for the period of oil exportation (i.e., 1999-2011) and zero otherwise.

The GDP per capita is supposed to be positive, since an increase in home income stimulates the export supply capacity. The sign of terms of trade, domestic investment, human capital and foreign direct investment are expected to be positive. The coefficient of oil-dummy variable would be positive, as Sudanese exports have increased sharply after oil exploitation. Finally, the parallel market premium is expected to be has negative effect on export performance.

4.2 Estimation methodology and data

To examine the determinants of parallel market premium for foreign exchange and its impact on macroeconomic performance, the study uses the bound testing or Autoregressive Distributed Lag (ARDL) model to cointegration developed by Pesaran and Pesaran (1979). This technique has many advantages over the traditional approaches of cointegration such as, Engle and Granger (1987), Johanson and Juselius (1990) and Phillips and Hansen (1990). First, the bound testing (ARDL) technique is more appropriate for small sample studies. Second, the bound testing procedure is simple compared to other multivariate cointegration techniques such as, Johansen and Juselius; thus, it allows cointegration relationship to be estimated by OLS once the lag order of the model is identified. Third, unlike Johansen- Juselius approach, the bounds testing (ARDL) technique does not require a pre-testing of the variables used in the analysis for unit roots. Therefore, its applicable irrespective of whether the underlying regressors are purely *I(0)*, purely *I(1)*, or a mixture of both. Fourth, ARDL approach also is suitable for the data that characterized by structural breaks. Finally, the traditional cointegration

technique may also suffer from the problems of endogeneity while ARDL method can distinguish dependent and explanatory variables.

ARDL method yields consistent and robust results because it allows describing the existence of an equilibrium-relationship in terms of long-run 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 bound testing (ARDL) technique for cointegration. Following Pesaran and Pesaran (1997), Pesaran and Shin (1999) and Pesaran and Smith (2001), the unrestricted error-correction version of ARDL framework for equations 1 through 4 can be written as follows:

$$\Delta y_t = \alpha + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_i \Delta X_{t-i} + \lambda_1 Y_{\,t-1} + \lambda_2 X_{\,t-1} + \varepsilon_t \qquad (5)$$

Where y is the dependent variable and X is the vector of explanatory variables. The first part in equation (5) with the summation signs represents the error correction dynamics while the second part (with λs) corresponds 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 using bound cointegration test. Precisely, the null hypothesis of having no integration or long run relationship among variables in the system, $H_0: \lambda_1 = \lambda_2 = 0$, is tested against the alternative hypothesis $H_1: \lambda_1 \neq \lambda_2 \neq 0$ by judging from the F-statistics. Since the distribution of this F-statistics is non-standard regardless of whether the variables in the system are stationary or non-stationary, we use the critical values of the F-statistics provided in Pesaran et al. (2001). Pesaran et al. (2001) tabulates two sets of critical values, the first assumes all variables are *I(1)* and the second one assumes that they are all *I(0)*. According to Pesaran and Pesaran (1997) if the calculated F-statistics is higher than the appropriate upper bound of 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 would be 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 *ARDL* approach to cointegration and the use of OLS[3]. The long run coefficients are derived from the estimation of the second part of equation (5) 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 *ARDL* specification is chosen using Akaike Information Criteria (*AIC*).

For the purpose of further investigation and robustness check of the impact of parallel market for exchange rate on macroeconomic variables, the study employs forecast error Variance Decomposition (*VDCs*) 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 (i.e. macroeconomic variable) that are due to their own shocks and the shocks of the other variables. On other hand, impulse response functions examine the effect of a one standard deviation shock to the orthogonalized residuals of equation on current and future values of the endogenous variables. The impulse responses measure the responsiveness of the dependent variables in the *VAR* to shocks to each of the variables.

The study utilizes annual time series data covering the period 1979-2014. This period is selected because since 1979 the exchange rate has seen many policy interventions. In addition, by the end of 1970s, the country has started to suffer from unfavorable economic situations. Moreover, this period ensures the availability of data on the variables under investigation. The

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

data will be gathered from different national and international sources. The national sources include the Central Bank of Sudan and the Central Bureau of Statistics, while the international sources include the World Bank' Development Indicators and the International Monetary Fund' Financial Statistics.

5. Empirical Results and Discussion

This section will be devoted to present and discuss the results of empirical analysis. Prior to investigate the effect of parallel market exchange rate and its impact on macroeconomic performance, the analysis proceeds via testing the properties of time series using unit root and cointegration tests. First, the order of integration of all variables will be identified, using Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests. Even though, ARDL approach does not necessitate a unit root test, but in the case of variables that integrated of order two (i.e, I(2)) the computed F-statistics provided by Pesaran et al. (2001) will be not valid, because the bounds test is designed on the assumption that the variables are I(0) or I(1). Therefore, we implemented the unit root test in the ARDL context to ensure that none of the variables are integrated of order more than I(1). The order of integration for each variable is tested using the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests[4]. The results of the unit root test for each variable with and without trend are reported in Table 1 in Annex (II).

The results of unit root test indicate that most of the variables are non-stationary at level, except real exchange rate, real per capita GDP, money supply which are integrated of order I(0). When taking the variables in the first difference, the results show that all variables are I(1), by both Augmented Dickey-Fuller and Philips-Perron test. Therefore, we can conclude that the series are mixture of I(1) and I(0). This result represents a suitable rationale for using ARDL approach; since the conventional test of Johanson and Juselius (1990) requires that all variables must have the same order of integration.

After implementing the stationarity tests to ensure the order of integration of the variables, the next step in ARDL approach is to test for the existence of a long-run causal relationship between the variables using the bounds test approach developed by Peasran et al. (2001). The result of cointegration test for the four models understudy with the assumption of unrestricted constant and no trend is reported in table 2 in Annex (II). Since the test is sensitive to the lag length we determined the lag length according to Akaike Information Criterion (AIC).

The result of bound tests in table 2 shows that the calculated F-statistics for all the four models are statistically significant (i.e. higher than the upper bound) at least at 5% level of significance. This indicates that the null hypothesis of no cointegration between the variables is rejected in four models. In other words, there is a long relationship between the parallel exchange rate, economic growth, inflation and exports on one hand and their major determinants on the other hand.

Having the existence of a cointegration relationship between the variables in our models, the next step is to examine the determinants of parallel exchange rate and its impact on macroeconomic variables using ARDL approach for cointegration.

5.1 Determinants of parallel market exchange rate premium

To identify the factors that affecting parallel market for exchange rate we estimate equation (1) using ARDL method. First, the results of long-run ARDL model using the specification of (2, 2, 1, 2, 2, 2, 2, 1), selected based on AIC, are reported in Table 1.

The results of the long-run estimation indicate that most of the estimated coefficients carry their expected signs except aid and international reserve. The results also reveal that the black

[4] 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.

market exchange rate premium in the long-run is influenced negatively by real exchange rate, GDP per capita, trade openness. On the other hand, money supply, expected rate of devaluation and flow of foreign aid are positively affecting the parallel market premium.

The coefficient of real exchange rate is negative and statistically significant as expected. This indicates that depreciating real exchange rate discourages parallel market premium. This result confirms the study of Elbadawi (1992) who found that real exchange depreciation has a significant negative effect on the premium in both short and long run, in Sudan. This also can be explained by the fact that depreciation of national currency increases aggregate exports and reduce imports volume, hence mitigates the gap between official and parallel exchange rate market. The effect of GDP per capita is found to be negative and statistically significant, confirming the existing literature. This implies that an improvement in the per capita income discourages black market premium in the long run. This result also supports the fact that during the period of positive economic growth Sudan economy has experienced a very low black market premium. Moreover, these finding is consistent with most empirical studies on the determinants of parallel exchange rate (e.g. Nkurunziza, 2002 and Aron and Elbadawi, 1992 and Yiheyis, 1998).

The results of long-run also reveal that money supply has a positive impact on black market premium, implying that increasing supply of money stimulates the black premium. This can be explained by the fact that monetary expansion may raise inflation which increases parallel exchange rate. In addition, the coefficient of trade openness is found to be negative and statistically significant as expected. This suggests that trade openness reduces black market premium through improvement in exports performance.

In line with previous empirical studies, the coefficient of expected rate of devaluation is positive and significant in the long run. The effect of aid flow is found to be positive and significant. This suggests that increasing aid flow raises exchange rate premium. Unexpectedly, the effect of international reserve is found to be has no significant effect on exchange rate premium in the long-run. The coefficient of dummy variables unification is found to be insignificant, indicating that unification of exchange rate alone is not an effective strategy to reduce parallel market premium in the long-run.

Regarding the short run analysis of the determinants of parallel exchange rate premium, table 2 shows the results of error correction model using ARDL framework. The results show that the short-run model has a good explanatory power with the adjusted R square = 0.92. The model also indicates that there is no serial correlation problem as indicated by the Durbin-Watson (*DW*) statistics which is close to 2.

The results in table 2 reveal that most of explanatory variables are statistically significant and consistent with the theory. Like the results of long-run model, the analysis of short-run indicates that parallel exchange rate premium inversely affected by real exchange rate, real GDP per capita, trade openness, foreign aid, and terms of trade. On the other hand, money supply and international reserves are found to be have positive effect on parallel exchange rate premium in short-run. Thus, the ECM findings fit well with the results of the long-run analysis.

Specifically, the results of short-run analysis point out that the coefficient of real exchange rate is negative and statistically significant, confirming the analysis of long-run model. This implies that deprecating exchange rate enlarges the gap between official and parallel exchange rate. Surprisingly, the coefficient of lagged dependent variable is found to be not significant, suggesting that premium in previous year does not affect exchange rate premium in the current year. Expectedly, the coefficient of devaluation of exchange rate is positive and significant in the short-run, contradicting the results of long-run model. This implies that devaluating local currency may reduce the parallel exchange rate premium in the short-run, but in the long-run

do not. The results also indicate that real per pita GDP exerts negative and significant impact on exchange rate premium. Interestingly, the effect of dummy variable of unification is found to be negative and significant in the short-run, indicating that unification of parallel and official exchange rate has negative impact on parallel market premium in the short run.

Moreover, the results indicate that the error correction term (ECT) is negative and statistically significant, confirming the existence of long-run equilibrium relationship between parallel exchange rate premium and its explanatory variables. The sign of ECT (-0.68) indicates that the parallel market premium has a relatively high speed of adjustment to the long-run equilibrium. In other words, approximately 64% of long-run disequilibria from the previous year's shock converge back to the equilibrium in the current year.

Overall, the above results indicate that macroeconomic environment in terms of high per capita GDP, stable real exchange rate, low inflation rate have positive impact on reducing parallel exchange rate premium in both short and long run. Therefore, adopting effective macroeconomic policies that improve economic performance may contribute to narrow the spread between parallel and official exchange rate.

5.2 Parallel market exchange rate premium and economic growth

The impact of parallel market exchange rate premium on economic growth is investigated through the estimation of equation (2) using ARDL approach. First the results of long run coefficients of economic growth equation are presented in Table 3.

The results of long-run analysis indicate that most of the variables bear their expected signs and confirm the theory. The impact of domestic investment, government expenditure and education are found to be positive and statistically significant on economic growth in the long-run. The coefficient of inflation is negative but not significant. The coefficient of money supply is negative and significant as expected. Interestingly, the results show that exchange rate premium is positive but not significant, implies that parallel exchange rate premium has no important impact on economic growth in the long-run.

In accordance with the effect of parallel market premium on economic growth in the short-run, table (4) reports the estimation results of growth equation using ARDL model. The results of error correction model indicate that most of the variables are consistent with the theory and statistically significant. The results also show that GDP growth is positively influenced by money supply, domestic investment, trade openness and education as expected. Expectedly, the effect of inflation is found to be negative and significant, contradicting the results of long-run analysis.

Moreover, the parameter of first structural break (i.e. DUM99) suggests a significant improvement in economic growth during the period of oil exploitation (i.e. 1999-2011). In addition, the dummy variable of full floating exchange rate policy of (1992-1993) has negative and significant effect on GDP growth. This indicates that unification of exchange rate in such period distorted the economic growth via increasing imports and decreasing exports. Interestingly, the effect of parallel market premium is found to be negative and statistically significant as expected. This can be explained by the fact that exchange rate premium distorts the macroeconomic performance; hence undermine the economic growth in the short-run. This finding confirms the previous studies (e.g., Kiguel and O'Connel, 1995). This also supports the actual situation in Sudan, as during the periods of stable exchange rate, the economic growth experienced a positive trend.

Finally, the error correction term is found to be negative and statistically significant confirming the long-run findings. The value of error correction term is relatively low (0.136), implying low speed of adjustment to long-run equilibrium. This finding also implies that the long-run disequilibrium in economic growth can be corrected each year by a proportion of about 13.6%.

5.3 Parallel market exchange rate premium and inflation

To understand the effect of parallel market premium on inflation we estimate equation (3) using the ARDL model. The results of long and short run analysis are presented in table 4 and 5, respectively.

The results of long-run analysis suggest that most of the variables bear their expected signs except real GDP and international reserve. The coefficient of money supply is positive and statistically significant, confirming the theory. The impact of government expenditure and real exchange rate are found to be have positive and significant impact on inflation in the long-run. Unexpectedly, the coefficient of real GDP is negative and significant.

Interestingly, the results show that the parallel market premium has positive and significant influence on inflation rate in Sudan. This finding implies that parallel market premium exerts positive and significant effect on inflation in the long-run. The higher value of its coefficient and t-test indicates that parallel exchange rate premium is the most important factor influencing inflation in Sudan.

The results in table 6 above indicate that the model has a good explanatory power, as indicated by adjusted squared R and the significant F statistic. Similar to the results of long-run analysis, most of the variables have their expected signs, except GDP per capita. The results indicate that the lagged dependent variable, money supply have positive effects on inflation, as suggested by many previous empirical studies.

Similar to the results of long run analysis, the sing of parallel exchange rate is positive and significant as expected, indicating that parallel exchange rate premium stimulates inflation rate in the short run. This result confirms the actual situation in Sudan, since during the period of stable exchange rate (i.e., 2000-2011), the country has registered a very low inflation rate compared to the period of 1980s and early 1990s, which have been characterized by exchange rate fluctuations and high premium. This finding also supports many of the previous studies on exchange rate premium and inflation (e.g. Pinto, 1988, Degefa, 2001).

Moreover, the results reveal that the error correction term is negative and statistically significant, confirming the long relationship between inflation and its determinants. Finally, the coefficient of the first dummy (dual exchange rate system) is positive and significant, implying that the adoption of dual exchange rate has increased inflation rate in Sudan.

5.4 Parallel market exchange rate premium and exports

Finally, to investigate the effect of parallel market exchange rate premium on export performance, the estimation results of equation (4) using ARDL technique are presented in Table 7 and 8, respectively.

The results of long-run analysis in table 7 above indicate that GDP per capita, terms of trade, investment and education have positive and significant effect on exports. This implies that the home' economic environment has significant impact in stimulating exports in the long run. Unexpectedly, the coefficient of education is negative and significant in the long run. This finding could be explained by the fact that an improvement in education level pushes workers out of export sectors like agriculture, which is the leading sector in the economy. This result confirming the study of Ebaidalla (2014) which found that education has negative effect on total exports. The impact of parallel exchange rate premium on exports is found to be negative and significant, indicating that parallel market premium discourages exports performance in Sudan. This result confirms many empirical studies on parallel market premium and export performance (e.g., Kiguel and O'Connel, 1995 and Elbadawi, 1994).

The results of the error correction model in table 8 reveal that exports are positively influenced by lagged dependent variable, GDP per capita, terms of trade and domestic investment, as

expected. In addition, the dummy variable of advent of oil is found to be positive and significant, indicating that oil exploitation has had a positive impact on Sudanese exports. Contradicting the result of long-run analysis, the coefficient of education is positive and significant. Interestingly, the impact of parallel exchange rate premium is negative and significant, supporting the long-run analysis. This finding implies that exchange rate premium has a detrimental impact on export performance, supporting most previous studies such as that of Kiguel and O'Connel (1995) and Degefa (2001). Finally, the coefficient of error correction term is found to be negative and significant. The high value of error correction term (0.65) indicates a high speed of adjustment to long-run equilibrium. This finding also implies that the long-run disequilibrium in the current account can be corrected each year by a proportion of about 65%.

5.5 Analysis of variance decomposition and impulse response function

The above empirical analysis has investigated the impact of parallel exchange rate premium on macroeconomic indicators in the context of single equation model, using ARDL for cointegration model. Thus, for the purpose of further inference and robustness check for our above results; alternatively, we investigate the impact of exchange rate premium using multivariate analysis by implementing the variance decompositions and impulse response function based on unrestricted Vector Autoregression (VAR) model. To do so, the analysis proceeds with testing cointegration to examine the long relationship between the variables. The cointegration analysis allows the use of cointegrated VAR model which account for nonstationarity and endogeneity problems as it is designed for nonstationary time series, and requires no endo-exogenous division of variables (i.e., all variables used in VAR system are assumed to be endogenous). Therefore, we employ Johansen-Juselius (1990) multivariate cointegration test.

The results of Johansen-Juselius test of trace and maximum eigenvalue statistics using the assumption of linear deterministic trend in the data are presented in table (3) in Annex (II). The results of trace statistic indicate three cointegration equations, while maximum eigenvalue statistic indicates one cointegration relation between the variables under consideration. Therefore, we conclude that there is long-run relationship between the parallel exchange rate premium and the macroeconomic indicators understudy (i.e. inflation, economic growth and exports).

The empirical analysis of variance decomposition and impulse response function starting with identifying the order of the variables in VAR model, which is a big challenge facing adoption of VDC. Thus, we follow Sims (1980) by starting with the most exogenous variable in the system and ending with the most endogenous one. Therefore, we adopt the following order: parallel exchange premium, inflation, exports and economic growth. The result of forecast error variance decomposition and impulse response function are reported in Table 9 and Figure 1, respectively.

The results of variance decomposition analysis in table 9 show that the response of inflation to parallel exchange rate premium is very high, particularly in the last years. Indicating that exchange rate premium shocks or volatility explains a huge portion of the variance in inflation. Precisely, exchange rate premium represents the second largest source of shock to inflation in the first four years, while in the last years the contribution of exchange rate premium to inflation shock exceeding its own shock. This result could be explained by the fact that inflation in Sudan is more sensitive to parallel exchange premium. This also explains the high association between inflation and parallel exchange rate premium in Sudan, as in the periods of high premium the country has suffered from high inflation rate. The table also reveals that exchange rate premium represents the largest source of shock to total exports. Specifically, in the first year, the exchange rate premium has a little impact on exports fluctuations (about 8%), but after that its

contribution increased sharply to about 62% and 66% in the eighth and twelfth year, respectively. This finding confirms the previous results of the ARDL estimators, which revealed that exchange premium has the highest and significant impact on export performance. Finally, the result shows that real GDP per capita has small response to exchange rate premium compared to that of inflation and exports. However, the exchange rate premium represents the second largest source of shock to GDP per capita growth.

Second, the results of impulse response functions of each macroeconomic variable to one standard deviation in parallel exchange rate premium over a horizon of 1 to 12 years are presented in Figure 1.

The figure shows that the effect of shocks in exchange rate premium on the macroeconomic variables confirms the results of ARDL and variance decomposition analysis. The response of inflation to exchange rate premium is positive; supporting the previous analysis that exchange rate premium exerts positive effect on inflation. Confirming the results of ARDL and VDC, the response of exports and GDP per capita to exchange rate premium is negative as expected.

6. Conclusion and Policy Implications

During the past four decades, Sudan's economy has undergone high spread between parallel and official exchange rate, accompanied by extremely disappointing economic performance. Thus, this study aims at understanding the determinants of parallel market exchange rate premium and its impact on macroeconomic performance during the period 1979–2009. The analysis has focused on three key macroeconomic variables namely, economic growth, inflation and export performance.

The empirical analysis indicates that real exchange rate, GDP growth, trade openness, foreign aid and international reserve have a negative and significant effect on exchange rate premium in both short and long run. On the other hand, the effect of money supply and expected rate of devaluation are found to be positive and significant on exchange rate premium. Therefore, we can conclude that macroeconomic policy variables play a significant role in explaining changes in parallel exchange rate premium in Sudan. Interestingly, unification of parallel and official exchange rate is found to be has a negative and significant effect on premium in the short-run, but it is not significant in the long-run.

Moreover, the empirical analysis reveals that the parallel exchange rate premium has a negative and significant effect on economic growth and export performance. The results also show that there is a positive and significant association between inflation and parallel exchange rate premium. These findings imply that parallel exchange rate has a detrimental impact on economic performance in Sudan. Thus, given the long trend of high parallel exchange premium during the period under study, this finding implies that parallel premium is one of the factors that responsible for the dismal economic performance witnessed by country's economy. Furthermore, the robustness checks of variance decompositions and impulse response functions analysis supports the findings of ARDL models.

Based on the above findings, effective policies need to be adopted in order to narrow the gap between parallel and official exchange rate. Mostly, gradual unification of the parallel and the official exchange markets should be adopted. This also needs to be accompanied by appropriate trade liberalization policies that enhance exports performance. In the context of the significant role of macroeconomic policy variables in reducing premium, policy makers need to pay a considerable attention to macroeconomic policies, such as money supply and real exchange rate. Thus, tightened fiscal and monetary policies, and adequate tariff policy should be followed to maintain exchange rate at a sustainable stable level. In addition, expansionary policy that finances the budget deficits by money creation should be avoided in the short-run.

Although, unification is the most effective measure for reducing parallel premium, it should not be adopted in isolation, rather many perquisites need to be taken into account. First and foremost, diversification of the economy should be considered as a main concern within the development agenda. Since the country is abundant with potential agricultural and mineral resources, serious efforts need to be made in terms of improving productivity of these sectors, so as to promote the competitiveness of commodities and to create a conducive investment climate to attract foreign capital. In addition, consistency between unification of exchange rate and fiscal and monetary policy need to be considered as an important element for successful unification. Moreover, the partial unification that adopted recently should be accompanied by additional measures that aim to attract migrants' remittances and foreign capital. Furthermore, as aid has negative association with exchange premium, government need to construct good relations with traditional and new donors so as attract more foreign aids.

Finally, to complete the view on the parallel exchange rate premium and its impact on the economic performance of Sudan, the study suggests several avenues for future research on this issue. First, an empirical study needs to be conducted to examine the relationship between the parallel and official exchange markets, as this is very important to understand the possibility of controlling premium through official exchange rate. Second, it would be useful to identify the channels through which black market premium affect the macroeconomic indicators such as, growth and export performance. Finally, a study to investigate the impact of exchange rate premium on private capital flow like FDI and migrants' remittances would be both interesting and useful.

References

Agnor, P. (1992), "Parallel Currency Markets in Developing Countries: Theory, Evidence and Policy Implications", Essay in International Economics, No. 188, November, 1992. Princeton University, USA.

Aron, J. and Elbadawi, I. (1992) "Parallel Markets, the Foreign Exchange Auction, and Exchange Rate Unification in Zambia", Policy Research Working Papers, No.909, World Bank, Washington, D.C. USA.

Barro, R. and Lee, J. (1994), "Sources of Economic Growth", Carnegie-Rochester Conference Series on Public Policy, Vol. 40, No. 1, pp. 1-40.

Blejer, M. (1978), "Black Market Exchange Rate Expectations and the Domestic Demand for Money: Some Empirical Results", *Journal of Monetary Economics*, Vol. 4, No. 4. pp. 767-774.

Central Bank of Sudan (2009), A Documentary Study on Exchange Rate Policy in Sudan (1956-2007), Research Series, No. 14, in Arabic. http://www.cbos.gov.sd/

Degefa, D. (2001), "The parallel foreign exchange market and macroeconomic performance in Ethiopia", African Economic Research Consortium (AERC), Research Paper, No. 107, Nairobi, Kenya.

Dicky, D. and W. Fuller. 1979. "Distributions of Estimators for Autoregressive Time Series with a Unit Roots", *Journal of the American Statistical Association*. 74. No. 2: 427-431.

Dicky, D. and W. Fuller. 1981. "The Likelihood Ratio Statistics for Autoregressive Time-Series with a Unit root." *Econometrica*. 49. No 4: 1057-1072.

Dornbusch R., Dantas, D., Pechman, C., Rocha, R., and Simoes, D. (1983), "The black Market for Dollars in Brazil" *Quarterly Journal of Economics*, Vol. 98, No. 1, pp.25-40.

Ebaidalla, E. (2014) "Impact of Exchange Rate Volatility on Macroeconomic Performance in Sudan", *Journal of Development and Economic Policies*, Vol. 16. No. 1, pp. 73-105.

Ebaidalla, E. (2016), "Understanding the Sources of Exchange Rate Fluctuation in Sudan", *Eastern Africa Social Science Research Review*, 32(1), 21-40.

Ebaidalla, E., Edriess, A. (2015), "Flow of migrants' remittances into Sudan: the role of macroeconomic environment" *Middle East Development Journal*, 7(1), 70-88.

Elbadawi, I. (1992), "Macroeconomic Management and the Black Market for Foreign Exchange in Sudan", Policy Research Working Paper, No. 859. World Bank, Washington, D.C. USA.

Elbadawi, I. (1994), "The Expatriate Workers' Remittances, Parallel Foreign Exchange Market and Macroeconomic Performance in Sudan", *Journal of African Economies*, Vol. 3, No. 3, PP. 481-512.

Hansohm, D. (1985), "The Limited Success of IMF/World Bank Policies in Sudan", Sudan Economy Research Group Discussion Papers, No. 4, University of Bremen, Germany.

Hussain, N. and Thirwall, P. (1984), "The IMF supply side approach to devaluation: An assessment with Reference to the Sudan", *Oxford Bulletin of Economics and Statistics*, Vol. 46, No. 2, pp. 145-167.

Johansen, S. (1988). "Statistical Analysis of Co-integration Vector." *Journal of Economic Dynamic and Control*. 12:231-254.

Johansen, S. and K. Juselius. (1990), “Maximum Likelihood Estimation and Inference on Cointegration-With Application to the Demand for Money.” *Oxford Bulletin of Economics and Statistics*. 52. No. 2: 169-210.

Kiguel, A. and Connel, S. (1995), “Parallel Exchange rates in Developing Countries”. *The World Bank Research Observer*, Vol.10, No. 1, PP. 21-52.

Kiguel. A. and O’Connel, S. (1994), “Parallel Exchange Rates in Developing Countries: Lessons From Eight Case Studies”, Policy Research Working Papers, No. 1265. World Bank, Washington, D.C. USA.

Munoz, S. (2006), ‘Zimbabwe's Export Performance: The Impact of the Parallel Market and Governance Factors’. IMF Working Paper, No. 28. January, 3

Nkurunziza, J. D. (2002). Exchange rate policy and the parallel market for foreign currency in Burundi, African Economic Research Consortium, Research Paper No. 123.

Nowak, M. (1984), “Quantitative Controls and Unofficial Market in Foreign Exchange, A Theoretical Framework”, *IMF Staff Papers*, Vol. 31, No. 2, pp. 404-431.

Pesaran, H. and B. Pesaran. 1997. *Working with Microfit 4.0: Interactive Econometric Analysis*. Oxford, Oxford University Press.

Pesaran, H. and Y. Shin. 1999. “An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis.” Chapter 11 in *Econometrics and Economic Theory in the 20th Century*: *The Ragnar Frisch Centennial Symposium*, Strom, S. (ed), Cambridge, Cambridge University Press.

Pesaran, H., Y. Shin, and R. Smith. (2001). “Bounds Testing Approaches to the Analysis of Level Relationships.” *Journal of Applied Econometrics*. 16. No. 3: 289-326.

Phillips, P. and Hansen, B. (1990). "Statistical Inference in Instrumental Variables Regression with I(1) Process", *Review of Economic Studies*, 57, 99–125.

Phillips, P. and Perron, P. (1988), “Testing for a Unit Root in Time Series Regression”, *Biometrika*, Vol. 75, No. 2. pp. 335–346.

Pinto, B (1988), "Black Markets for Foreign Exchange, Real Exchange Rates and Inflations Overnight versus Gradual Reform in Sub-Saharan Africa", Policy Research Working Papers, No.84, World Bank. Washington, D.C, USA.

Rodrik, D. (2008), “The Real Exchange and Economic Growth” *Brookings Papers on Economic Activities*, Fall. pp. 365-412.

Siddiki, J. (2000), “Black market exchange rates in India: an empirical Analysis”, *Empirical Economics*, Vol. 25, No. 2, pp. 297-313.

Sims, C. (1980), “Macroeconomics and Reality”, *Econometrica*, Vol. 48. No. 1, pp. 1-48.

Sims, C. 1980. “Macroeconomics and Reality.” *Econometrica*. 48. No. 1:1-48.

Yiheyis, Z. (1998). "The Economic Determinants of the Parallel Currency Premium: Evidence from Select African Countries", *Journal of Economic Development*, 23(2).

Figure 1: Results of Impulse Response Function

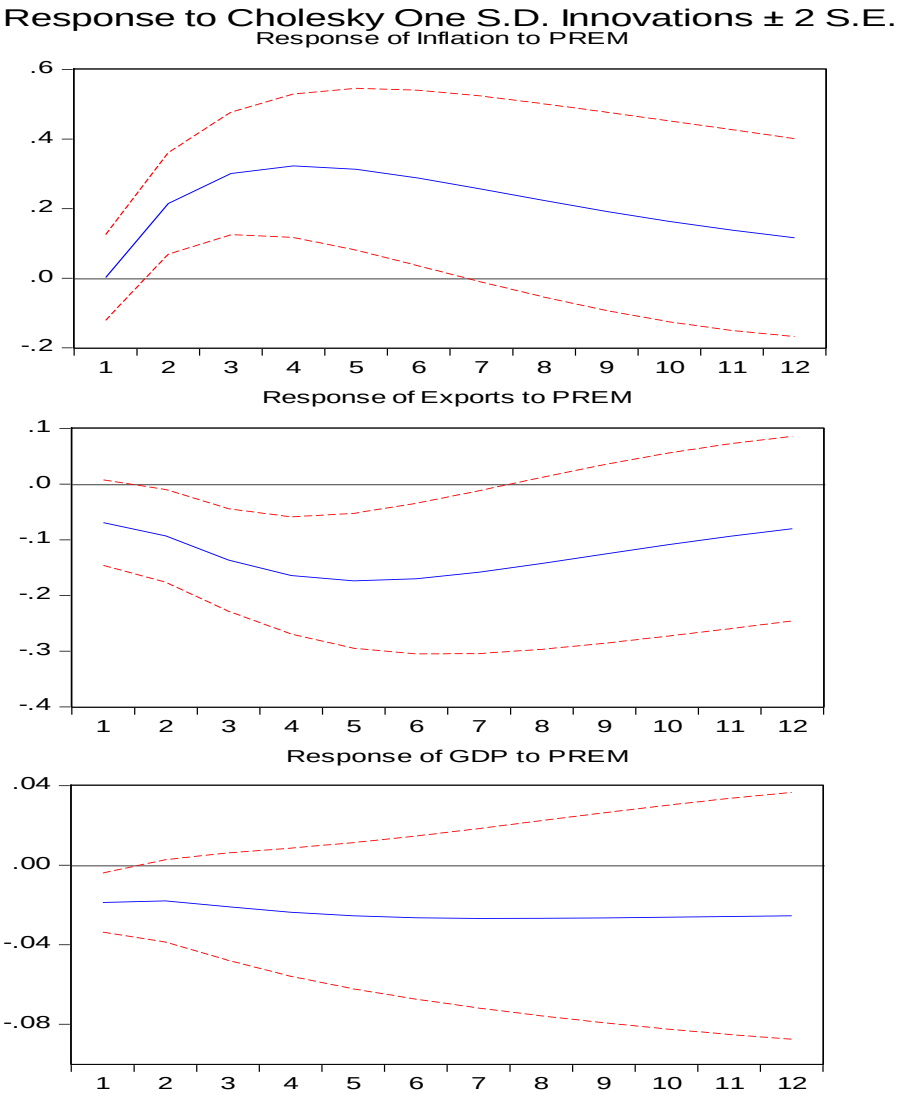


Table 1: Results of Estimated Long Run Coefficients: Parallel Exchange Rate Premium

ARDL(2,2,1,2,2,2,2,1) selected based on (AIC): Dependent variable is Parallel exchange rate premium

Variable	Coefficient	t-Statistic	Prob.
REX	-1.423***	-4.878	0.002
GDP	-0.036**	-2.647	0.033
MS	0.624*	2.137	0.070
OPN	-0.360**	-2.839	0.025
TOT	-0.872*	-2.281	0.057
DEV	0.373**	2.629	0.020
AID	0.248*	2.221	0.062
IR	0.054	0.661	0.530
DUM99	-0.038	-0.330	0.751
DUM92	1.900	1.208	0.266
Constant	3.264*	1.972	0.089

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

Table 2: Results of Error Correction Representation of ARDL

ARDL(2,2,1,2,2,2,2,1) selected based on (AIC): Dependent variable is Parallel exchange rate premium

Variable	Coefficient	t-Statistic	Prob.*
ΔPREM(-1)	-0.685	-1.353	0.218
ΔREX	-1.586***	-3.654	0.008
ΔREX(-1)	1.183	1.512	0.174
ΔREX(-2)	-1.994	-2.276	0.057
ΔGDP	-0.016**	-2.873	0.023
ΔGDP(-1)	-0.008	-0.728	0.490
ΔGDP(-2)	-0.036***	-3.257	0.014
ΔMS	1.498***	3.810	0.006
ΔMS(-1)	0.447	0.765	0.469
ΔOPN	-0.515**	-2.169	0.081
ΔOPN(-1)	0.652	1.740	0.125
ΔOPN(-2)	-0.743*	-2.357	0.051
ΔTOT	-0.701*	-2.291	0.055
ΔTOT(-1)	0.135	0.342	0.742
ΔTOT(-2)	-0.904*	-2.044	0.080
ΔDEV	-0.209*	-2.059	0.079
ΔDEV(-1)	-0.487	-1.742	0.125
ΔDEV(-2)	0.068**	2.484	0.042
ΔAID	0.277	1.584	0.157
ΔAID(-1)	-0.592*	-2.017	0.084
ΔAID(-2)	0.732**	2.837	0.025
ΔIR	0.181*	2.363	0.050
ΔIR(-1)	-0.090	-1.038	0.334
DUM92	-3.201**	-2.541	0.040
DUM99	-0.064	-0.344	0.741
ECM	-0.684**	-3.329	0.0126
C	5.499	1.625	0.148
R-squared	**0.96**	**F-statistic**	**22.780(0.000)**
Adjusted R-squared	**0.92**	**DW**	**2.19**

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

Table 3: Results of Estimated Long Run Coefficients: Economic Growth Model

ARDL(1, 1,0,0,1,1,0) selected based on (AIC): Dependent variable is real GDP per capita

Variable	Coefficient	t-Statistic	P-value
INF	-0.118	-0.593	0.560
MS	-0.159**	-2.239	0.042
INV	0.128*	1.926	0.075
GOV	0.711*	1.867	0.083
OPN	0.138	0.413	0.684
EDU	1.966***	5.691	0.000
PREM	0.105	0.533	0.600
DUM92	-0.541	-1.204	0.243
DUM99	0.084***	2.312	0.036
Constant	19.923***	13.588	0.000

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

Table 4: Results of Error Correction Representation of ARDL: Economic Growth Model

ARDL(1, 1,0,0,1,1,0) selected based on (AIC): Dependent variable is real GDP per capita

Variable	Coefficient	t-Statistic	P-value
ΔGDP(-1)	0.864***	11.170	0.000
ΔINF	-0.036***	-3.670	0.001
ΔINF(-1)	-0.043**	-1.916	0.070
ΔMS	0.059**	2.220	0.038
ΔINV	0.022*	1.981	0.062
ΔGOV	0.017	0.441	0.664
ΔGOV(-1)	0.033*	1.889	0.073
ΔOPN	0.130**	2.837	0.010
ΔOPN(-1)	0.108**	2.646	0.016
ΔEDU	0.089*	1.877	0.075
ΔPREM	-0.268**	-2.272	0.034
ΔPREM(-1)	-0.049*	-1.795	0.088
Dum92	-0.043*	-1.916	0.070
Dum99	0.864***	13.170	0.000
ECT(-1)	-0.136*	-2.075	0.051
C	2.889*	2.220	0.038
R-squared	0.83	F-statistics	46.122(000)
Adjusted R-squared	0.78	DW	2.20

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

Table 5: Results of Estimated Long Run Coefficients: Inflation Model

ARDL(0,0,1,0,1,1,1) selected based on (AIC): Dependent variable is Inflation Rate

Variable	Coefficient	t-Statistic	P-value
GDP	-0.390	-0.328	0.747
MS	0.036*	1.958	0.064
GOV	0.260*	1.847	0.080
REX	0.827***	11.615	0.000
PREM	0.523***	5.079	0.000
OPN	-0.020*	-1.871	0.076
IR	0.252*	2.184	0.041
Dum79	0.326	0.936	0.361
Dum92	-0.139	-0.253	0.803
Constant	-7.236	-1.384	0.182

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

Table 6: Results of Error Correction Representation of ARDL: Inflation Model

ARDL(1,0,1,0,1,1,1) selected based on (AIC): Dependent variable is Inflation Rate

Variable	Coefficient	t-Statistic	P-value
ΔINF (-1)	0.697***	7.153	0.000
ΔGDP	-0.118	-0.360	0.723
ΔMS	0.314***	2.883	0.009
ΔGOV	0.119	1.133	0.271
ΔGOV(-1)	0.202**	2.274	0.034
ΔREX	0.341***	3.753	0.001
ΔOPN	0.108	1.331	0.198
ΔOPN(-1)	-0.114	-1.530	0.142
ΔIR	0.002	0.082	0.935
ΔIR(-1)	0.074***	3.367	0.003
ΔPREM	0.794*	4.961	0.000
ΔPREM(-1)	0.366***	6.278	0.000
Dum79	0.099*	1.946	0.065
Dum92	-0.042	-0.237	0.815
ECM	-0.302	-3.104	0.005
Constant	-2.190	-0.994	0.332
R-squared	0.80	F-statistic	68.633(0.000)
Adjusted R-squared	0.75	DW	1.93

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

Table 7: Results of Estimated Long Run Coefficients: Export Model

ARDL(1,0,1,1,1,0,0,0) selected based on (AIC): Dependent variable is Export

Variable	Coefficient	t-Statistic	Prob.
GDP	1.441*	1.957	0.062
TOT	0.667**	2.050	0.052
INV	0.112*	1.883	0.073
EDU	1.845**	2.908	0.008
FDI	-0.052	-0.856	0.401
PREM	-0.320**	-2.242	0.035
Dum99	0.721***	3.671	0.001
C	-27.355**	-1.935	0.065

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

Table 8: Results of Error Correction Representation of ARDL: Export Model

ARDL(1,0,1,1,0,0,0,0) selected based on (AIC): Dependent variable is Export

Variable	Coefficient	t-Statistic	P-value
ΔEXP(-1)	0.347**	2.475	0.021
ΔGDP	0.941*	1.984	0.059
ΔTOT	0.591*	1.990	0.104
ΔTOT(-1)	-1.026**	-2.493	0.020
ΔINV	0.345**	2.216	0.036
ΔINV(-1)	-0.271*	-1.728	0.097
ΔEDU	1.205**	2.524	0.019
ΔFDI	-0.034	-0.915	0.369
ΔPREM	-0.209**	-2.386	0.025
Dum99	0.471***	3.368	0.003
ECM	-0.653***	-4.658	0.000
Constant	-17.866*	-1.928	0.066
R-squared	0.939	F-statistic	37.37(0.000)
Adjusted R-squared	0.914	DW	2.51

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

Table 9: Variance Decomposition Results

Period	PREM	INF	EXP	GDP
Variance Decomposition of Inflation				
1	0.002637	99.99736	0.000000	0.000000
4	48.94973	50.87380	0.152972	0.023499
8	65.25893	34.28393	0.439367	0.017771
12	68.22686	31.17632	0.548327	0.048489
Variance Decomposition of Exports				
1	8.881687	0.130404	90.98791	0.000000
4	41.16070	18.20778	40.62394	0.007578
8	61.75352	15.91366	22.28799	0.044841
12	65.99568	14.75279	19.08581	0.165727
Variance Decomposition of GDP				
1	21.42130	19.69698	1.911567	56.97016
4	21.42130	19.69698	1.911567	56.97016
8	21.42130	19.69698	1.911567	56.97016
12	21.42130	19.69698	1.911567	56.97016

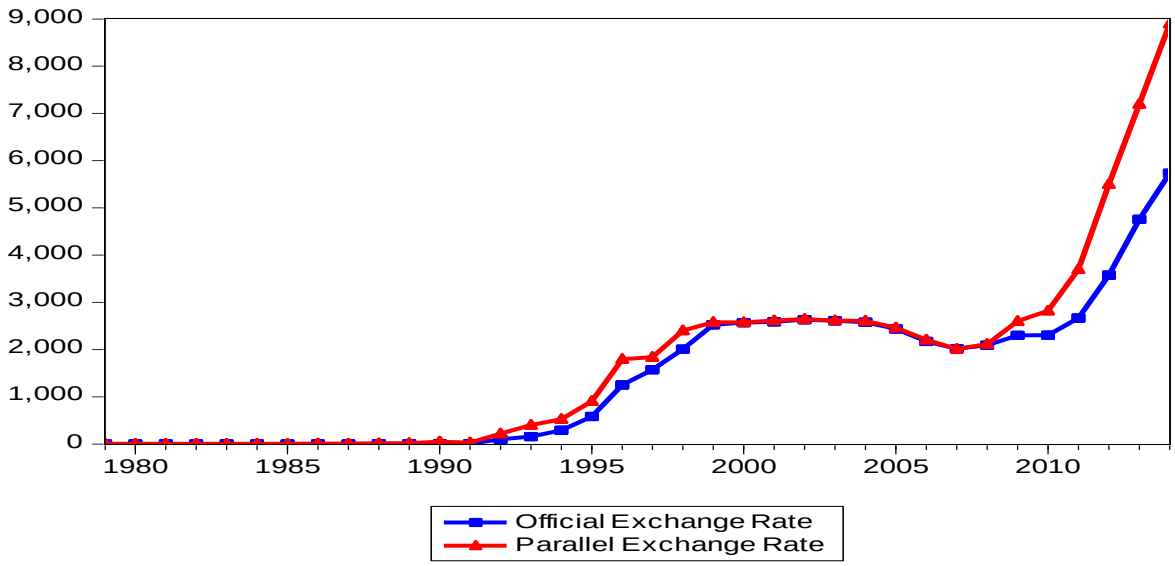
Annexes

Annex I: Definitions and Sources of Data Used in the Analysis

Variable	Definition	Source
PREM	Is the parallel exchange rate premium, measured as ratio of parallel exchange rate to official exchange rate.	Central Bank of Sudan (CBOS)
GDP	Is real GDP per capita	Central Bureau of Statistics, Sudan
REX	Real exchange rate, defined as $\frac{e_t * P_{US}}{P_t}$, where e_t is nominal exchange rate (local currency by US$), P_{US} is US wholesale price index, and P_t is local price index.	Central Bank of Sudan (CBOS)
INF	Is inflation rate, measured by the annual average of inflation rates	Central Bank of Sudan (CBOS)
MS	Money supply	Central Bank of Sudan (CBOS)
FDI	Foreign Direct Investment, measured as ratio of FDI inflow to GDP.	UNCTAD and Central Bank of Sudan (CBOS)
IR	International reserve	World Bank's World Development Indicators
OPN	Trade openness, defined as value of exports plus imports divided by GDP.	Central Bureau of Statistics, Sudan
INV	Domestic Investment, measured by fixed capital formation as share of GDP %	Central Bank of Sudan (CBOS)
GOV	General spending, is the government final consumption expenditure for purchases of goods and services, measured as share of (GDP %).	Central Bureau of Statistics, Sudan
AID	Aid flow as ratio of GDP	Central Bureau of Statistics, Sudan
DEV	Expected rate of devaluation measured as percentage change in official exchange rate.	World Bank's World Development Indicators
TOR	Terms of trade, measured as the ratio of the export unit value indexes to the import unit value indexes	World Bank's World Development Indicators
EDU	Average year of schooling, for population aged 15 and over	Barro and Lee (2010)

Note: All the variables are expressed in logarithm form, except real GDP growth which bears negative signs in some years.

Figure 1: The Official and Parallel Exchange Rate in Sudan (1979-2014)



Source: Adopted from the Central Bank of Sudan (COBS) Annual Report- Various Issues

Annex II: Empirical Results

Table 1: Unit Root Tests for the Variables used in the Analysis

Variable	ADF		PP	
	Constant	Constant+ Trend	Constant	Constant+ Trend
PREM	-1.84	-2.12	-1.85	-2.16
RER	-2.80*	-2.70	-2.80*	-2.70
GDP	2.28	-3.48*	2.84*	-1.61
INF	-1.99	-3.35*	-1.59	-1.65
MS	-2.68	-2.58	-1.45	-1.28
IR	-1.26	-2.27	-1.24	-2.42
DEV	-5.47***	-5.49***	-5.47***	-5.49***
TOT	2.40	2.14	-1.32	-2.26
AID	-1.47	-1.40	-1.62	-1.54
OPN	-2.55	-3.00**	-1.57	-1.67
INV	-2.10	-2.61	-2.00	-2.55
GOV	-4.41**	-4.42***	-1.85	-1.82
EDU	-5.28***	-3.92*	-12.22***	-5.09***
EXP	-1.42	-1.41	-1.48	-1.53
ΔPREM	-6.15***	-6.06***	-6.69***	-6.08***
ΔRER	-6.67***	-5.54***	-7.68***	-8.62***
ΔGDP	-2.53	-3.68*	-4.97***	-7.29***
ΔINF	-5.90***	-2.04	-5.96***	-5.89***
ΔMS	-1.50	-1.52	-4.38**	-4.38**
ΔINR	-6.24***	-6.14***	-6.24***	-6.14***
ΔDEV	-5.38***	-5.29***	-29.86***	-30.76***
ΔTOT	-0.92	-8.90***	-9.53***	-8.57***
ΔAID	-4.90**	-4.86***	-5.00***	-4.96**
ΔOPN	-7.42***	-0.86	-7.24***	-7.15***
ΔINV	-7.31***	-7.19***	-7.51***	-7.40***
ΔGOV	-2.88*	-2.33	5.13***	-5.07***
ΔEDU	-0.54	-3.44*	-0.46	-3.74*
ΔEXP	-6.68***	-6.61***	-6.62***	-6,56***

Notes: *,**, and ***indicate 1%, 5% and 1% level of significance, respectively.

Table 2: Results of Bound Test for Co-integration Analysis

Equation	AIC lag length	F- Statistics	Bound Testing (at 99%)		Bound Testing (at 95%)	
			Lower	Upper	Lower	Upper
Parallel exchange rate	1	4.15***	2.79	4.1	2.48	3.7
Economic growth	2	9.08***	3.15	4.43	2.45	3.61
Inflation	1	10.58****	2.96	4.26	2.32	3.5
Export	2	3.44**	3.15	4.43	2.45	3.61

Notes: **, and ***indicate 5% and 1% level of significance, respectively. The test statistics of the bounds tests are compared against the critical values reported in Pesaran et al. (2001).

Table 3: The Cointegration Results: VAR Equation

Null Hypothesis	Eigenvalue	Trace statistics	95%	Maximum Eigenvalue	95%
None	0.467222	51.26776*	40.17493	20.77846	24.15921
At most 1	0.362790	30.48930*	24.27596	14.87164	17.79730
At most 2	0.315598	15.61766*	12.32090	12.51393*	11.22480
At most 3	0.089765	3.103732	4.129906	3.103732	4.129906

Note: * indicates significance at 5% level