# CURRENCY DEVALUATION AND INFLATION DYNAMIC IN SUDAN (Jan.1993 - Sep.2014)

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## ABSTRACT

The paper examines the response on inflation to changes in nominal exchange rate in Sudan over two different exchange regimes (fixed and managed floating regime) by focusing on the currency devaluation in 2012 and 2013. It uses the interaction term as a technique to analyze the structural breaks dates on the given time series (inflation and nominal exchange rate), this includes the interaction between exchange rate and a binary variable represents a structural breaks. The paper figures-out that the devaluation is infeasible for Sudan where there is a shortage of foreign currencies. This result is in line with other empirical evidences (Asian crisis, 1997), which point out that devaluation under such circumstances is infeasible.

**KEYWORDS:**   Devaluation; exchange rate; inflation, Structural Break, Sudan

## 2.INTRODUCTION

Exchange rate has been at the center of macroeconomic policy debates in the developing markets. In many countries, the exchange rate is used as a way of driving inflation down to one-digit. This makes some policy makers searching on it from different perspectives such as the exchange rate pass-through to the domestic prices and the effectiveness of the exchange rate as a shock absorber; others have also debated about the misalignment of the exchange rate. Other developing countries however, use it as a way of taxing the export sector. Empirically, exchange rate has recently been less important in the macroeconomic policy analysis because of the currency crashes of the late 1990s and early 2000s. In response to this crashes, some countries shifted to the inflation targeting as a tool of analyzing the macroeconomic policy. But this does not imply that exchange rate is overlooked as it is extremely crucial.

The paper attempts to analyze the trend behavior of both inflation rate and nominal exchange rate in Sudan during two separated periods. The first period during (Jan. 1993-Dec1997) when the fixed exchange regime had been adopted, and the second period during (Jan.2010-Sep.2014) when the managed floating regime has been followed. Basically, these two periods are picked because of the substantial change in the economics situations over the last two decades, economics recession in 1990s dominated with high levels of inflation rates (Hyperinflation), which hit the peak of 164% in August 1996 followed by relative stabilization in the Sudanese pound against US$. However, because of the availability of the foreign currencies in late 1990s, inflation rate declined to the range of one-digit, exchange rate appreciated and remained stable at 2.5 Pound/US$ and remained as it is until 2012. Additionally, the budget deficit converted to

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the surplus due to oil production which was the main source of revenue for the government budget. Unfortunately, the situation got worth after the separation, which made the Macroeconomic indicators to be declined again.

The paper also examines the relationship between exchange rate and inflation rate throughout the technique of the structural break at a known date in different exchange rate regimes (Fixed and Managed Floating Regimes). During the second period of the study, the effect of the devaluation on the inflation rate is examined (2012 by 63% and 2013 by29%) on the inflation dynamic. Moreover, different scenarios are proposed in terms of the devaluation such as the effectiveness of the devaluation when the fixed regime is followed from one side, and also when the managed floating regime is followed from the other side.

The structural breaks dates of the two study periods are identified (May 1996 & July 2011). May 1996 represents the structural break date of the oil production, which is followed by the comprehensive economic reforming program jointly implemented by the Sudanese government (SG) and the International Monetary Fund (IMF), while July 2011 was the date of the separation between Sudan and South Sudan followed by a significant deterioration in the economic conditions in Sudan. Actually, the identification of the breaks dates enables us to use the interaction terms as an econometrics technique to evaluate the effect of the devaluation on the inflation dynamic in Sudan. Thus, a binary variable for a break date is being generated and it is given the value of Zero before the break date and the Value of one after the break date.

The issue of which exchange rate regime should the CBOS follow is not the aim of the paper rather than it is examining the impact of the currency devaluation on inflation at two different exchange rate regimes (Fixed and Managed Floating). It is also (the paper) examining how devaluation efficient is when there is an availability in the foreign currencies and when there is a shortage as well.

## 3.THE METHODOLOGY

The paper follows the interaction terms as an econometrics approach to examine the impact of the devaluation on inflation rate in Sudan. Exchange rate effectiveness is examined throughout structural breaks at two known dates (June1996 and July2011). This implies that exchange rate and inflation are regressed over two periods of study. The first period is being identified from (Jan.1993-Dec.1997), while the second period is picked to be between (Jan2010-Sep.2014). The reason behind is that the two periods witnessed structural breaks, in other words (positive and negative shocks). In 1996, the oil production made a positive difference in the Sudanese economy and July 2011 was a transitional date for the economic situation in Sudan (reduction in oil production).

The analysis is carried out using monthly time series data from Sudan examined over the two periods (Jan.1993-Dec.1997) & (Jan.2010 Sep.2014) these data was mainly compiled from the Central Bank of Sudan (CBOS). Frankly, there was no difficulty to identify the break date since there was a substantial shift in macroeconomics indications after the mentioned-date above.

More importantly, the paper raises two perimitive questions as follow:

1- Does inflation dynamic in Sudan have a stochastic trend?
2- Was it necessarily for the CBOS to devaluate the overvalued of the Pound?

The question whether inflation has a stochastic trend is tested by using the unite root technique by identifying the null and alternative hypothesis.

$H_0$: *inflation has a stochastic trend VS. $H_1$: inflation rate is stationary* ..................... See table [1]

The second question is examined by using the interaction terms to explain the effect of exchange rate before and after the break as it is mentioned above. Actually, I focused on the devaluation that happened twice during the second period (Jan2010-Sep.2014) because it was an actual, whereas the other scenarios were just simulations.

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \delta_1 ex_{t-1} + \gamma_0 D_t(\tau) + \gamma_1 [D_t(\tau) * \pi_{t-1}] + \gamma_2 [D_t(\tau) * ex_{t-1}] + u_i \ldots\ldots\ldots (1)$$

If $D_t(\tau) = 0$ the model takes the following position

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \delta_1 ex_{t-1} \ldots\ldots\ldots\ldots (2)$$

However, after the structural break, $D_t(\tau) = 1$ the estimated model is

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \delta_1 ex_{t-1} + \gamma_0 D_t(\tau) + \gamma_1 [D_t(\tau) * \pi_{t-1}] + \gamma_2 [D_t(\tau) * ex_{t-1}] + u_i \ldots\ldots (3)$$

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \delta_1 ex_{t-1} + \gamma_0 + \gamma_1[\pi_{t-1}] + \gamma_2[ex_{t-1}] + u_i \dots\dots\dots\dots\dots\dots\dots\dots \text{ (4)}$$

$$\pi_t = (\beta_0 + \gamma_0) + (\beta_1 + \gamma_1)\pi_{t-1} - (\delta_1 + \gamma_2)ex_{t-1} \dots\dots \text{ (5)}$$

So the coefficient of the binary variable is increment to the effect of inflation when the $D_t(\tau) = 1$. Based on the regression results, the estimated coefficient of this model after including the interaction term between exchange rate and the binary variable is going to be as it is stated on equation (3).

## 4.LITERATURE VIEWS

Much has been written about the relation between inflation and exchange rate, some addresses the effectiveness of the exchange rate as a shock absorber while others examine the pass-through of the exchange rate to the domestic prices in countries where inflation targeting is adopted.

Hafer, (1989) points out that when the dollar depreciates relative to other currencies, the dollar prices of foreign goods increase relative to domestically produced goods, other things equal, making imports more expensive. Since imports make up part of the basket of goods purchased by consumers, measures of inflation based on that basket also will rise. (Hafer, 1989)

Yuriy & Olena, study the effect of the devaluation on the Ukrainian Economy, they find that devaluating the currency by 20% causes inflation rate in increase by 5-10% higher than the devaluation, which is claimed to be traditional for Ukraine (Yuriy & Olena). Similarly, (Michael,2006) comes up with the same outcome, which indicates that the sharp 25% exchange rate depreciation (devaluation) on the Thai currency of 1997 to 1998 led to an additional cumulated inflation of 13% over the period. (Michael Goujon, 2006). Furthermore, Kahn concludes that changes in the value of the dollar cause changes in inflation-or that changes in inflation cause changes in dollar. Yet, this conclusion is unjustified because other factors have influenced both inflation and the dollar during this period. (Kahn, 1989). Unlike other scholars, (Ilter,2012) indicates that Inflation and devaluation do not run in parallel because any loss or gain due to inflation will have been recognized in the income statement even devaluation is lagging behind the inflation or it is just the opposite. (Ilter, July 2012). Stock and Watson examine the effectiveness of the devaluation on the CPI; they find that a %10 appreciation of the Australian dollar is estimated to lower the level of overall consumer prices by around %1 over a period of around three years. (Stock & Watson, 2012)

Many authors point out that inflation targeting requires some degree of exchange rate flexibility such as (Sebastian Edwards, 2010) who examines the effectiveness of the nominal exchange rate as a shock absorber in inflation targeting regimes. He also analyzes (Sebastian Edwards, 2010) whether the adoption of inflation targeting has had an impact on exchange rate volatility. This issue is related to the extent of the pass-through from the exchange rate to the domestic prices. Similarly, (Siok Kun Sek, 2012) conducts empirical investigation on the relationship between exchange rate and inflation targeting regime they observe that the volatility in exchange rate has increased dramatically and is very volatile in Asian compared to the developed economies.

Abdalla argues that it is clear that when exchange rate depreciates inflation shoots level, i.e. we expect a positive relationship between inflation and the exchange rate. Yet, he finds that foreign inflation is not correlated with inflation, and he asks for an empirical evidence to be conducted in order to prove such a statement (Abdalla, 2010)

(Minoru Yasuda) examines the relation between inflation, the exchange rate and currency substitution in Russia for the period including the recent economic crisis. Following a descriptive analysis, a simple vector autoregressive model (VAR) with four variables is estimated. The results suggest that the depreciation (appreciation) of the ruble lead to an increase (decrease) in currency substitution. On the other hand, there is no evidence that inflation Granger caused currency substitution in the post-crisis period. Consequently, Yol indicates that Flexible exchange rate regime is strongly believed to be independent source of inflation. Flexible exchange rate systems have a tendency of causing dynamic instability in which the exchange rate constitutes an independent source of inflation (Yol, 2010).

## 5.EXCHANGE RATE AND INFLATION IN SUDAN (a Historical Prospective).

The dispute among policy makers about the derivation of the inflation rate has been the center of the macroeconomic analysis in Sudan over the last two decades especially during the hyperinflation era in 1990s. Monetary policy makers criticized fiscal policy makers that it is derived by fiscal factors (TALHA, 2014) whereas fiscal

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policy makers argue that hyperinflation was attributed to the substantial increase in the money supply in early 1990s. Recently, however, it is approved that exchange rate is one of the most important determinants of the inflation and it is the only explanatory variable.

In this section, I will discuss the behavior of the inflation rate and exchange rate in Sudan during 1990-2014, taking into account all the factors that these two variables influenced with such as economics reforming programs, structural changes, and most importantly, the positive and negative shocks on the economy.

Since the early 1990s, Sudan had been experiencing incessant and swilling rate of hyperinflation until 1996. Some policymakers and economists have realized that this level of hyperinflation has an inordinatesteam, and that either it is merely not susceptive to be treated by monetary or fiscal policy, unless the government carries out a comprehensive reforming program and more importantly an alternative source of finance instead of money printing. Predominantly, it is assumed that unlike exchange rate, hyperinflation responds tardily to the shocks in the economy weather they are positive or negative. In the sense that people shape their expectation by looking at past rates of inflation as well as the government's policies.

This section depicts number of changes occurred during the period of hyperinflation in Sudan by putting more emphasis on the exact timing point of stopping hyperinflation in Sudan. Likewise, the goal is to figure out what is behind ending hyperinflation in Sudan and what fetched it under control in late 1990s see figure [1]. I shall expound evidences on Sudan associated with the period of hyperinflation.

## Figure 1: Inflation Rate in Sudan during Jan.1990-Sep.2014
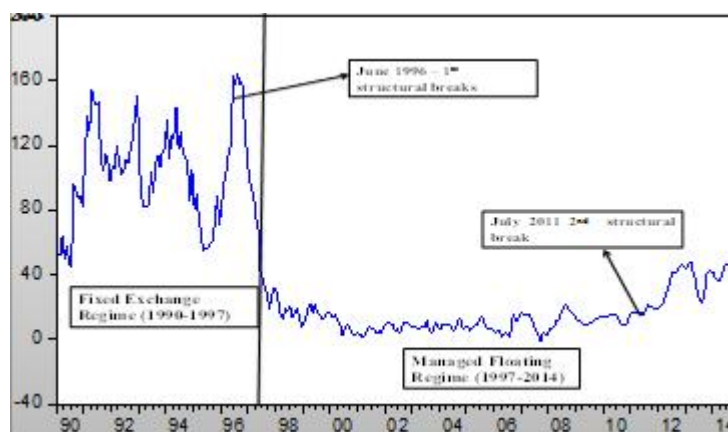


The episode of the Sudan Hyperinflation was attributed to the enormous budget deficit, which used to be financed through printing money. It is also referred to some extend to the high level of public debt created by the government. On the other hand, because of the independence of the Central Bank of Sudan (CBOS), the government had the upper hand on the economy and used to push the Central Bank to use printing press and borrow from the Banking system to finance the deficit. The deficit was because of the civil war in south Sudan where 75% of government expenditure used to be oriented to.

In 1996, hyperinflation stopped and started to fall constantly until reached two digits in one year, this was mainly attributed to the pre-implemented policies followed by the government (monetary and fiscal policies). But the main factor contributed significantly to ending hyperinflation was the oil production at early 1996, as all the pre-implemented policies followed the announcement of oil production (TALHA, 2014)

The government announced economic liberalization policy in 1992; the main goal of this policy is to stimulate the economy after the huge budget deficit in early 1990s. In order to achieve this goal, the government adopted concert steps to end hyperinflation after it reached more than 100% between 1994 and mid-1996. By January 5th 1995, the government liberalized the Sudanese currency and decided to peg its currency in anticipation that such a policy might stop hyperinflation. In 1996, the Sudanese government announced oil production; this announcement is followed by an announcement from the Chinese government about constructing a pipeline to export Sudanese oil to abroad. (TALHA, 2014)

By June 10th 1996, the CBOS has formally pegged the Sudanese pound against U.S. dollar. But the currency peg did not continue for long time as the Central Bank decided to adopt the managed floating regime in mid-1997 instead in a consideration of huge capital inflow from oil exports. At the same year mid-1997, CBOS became an independent central bank which means that the

government had no influence on its policies as what was used to happening during the hyperinflation period (early and mid-1990s). (TALHA, 2014) This advantage comes simultaneously with oil production. Also the government carried out taxation reform to shrink the budget deficit, which was gradually started to eliminating from 1997. Asresult to the taxation reform, the government

introduced VAT on 15th April 1997. By Dec 1999, VAT was approved and become official tax in June 2000. By 1st September 1999, the first shipment of oil was to be exported to China. Basically, by this date Sudan's macro-economy has become heavily dependent on oil product as the main source of revenue.

**Figure 2: Nominal Exchange Rate during Jan.1990 - Sep.2014**
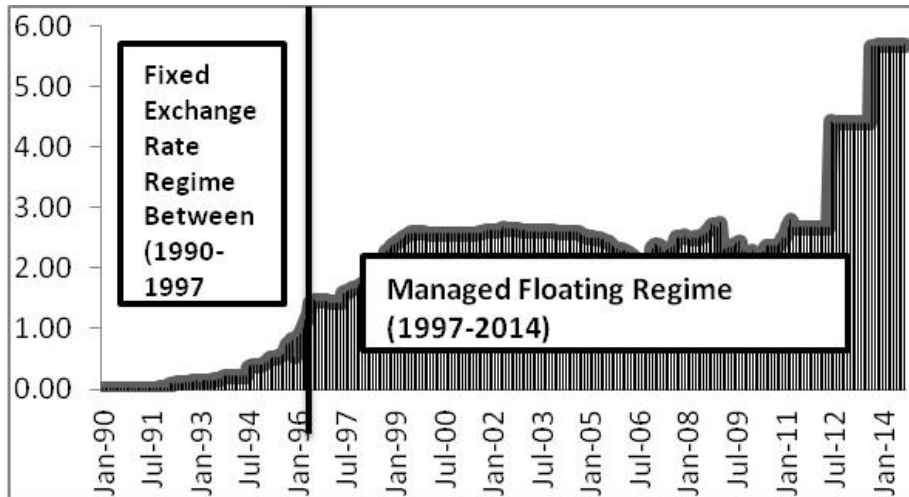


Exchange rate policies in Sudan followed different systems throughout the history. It applied the fixed exchange rate arrangements, intermediate EXR arrangements, until it reached the current managed float arrangements (Al-Khalifa et al. 2009). As I am examining the period between (1990-2014), I am considering two exchange regimes (Fixed and Managed Floating) The fixed EXR approach is applied during 1990-mid1997)

while the managed floating regime is adopted from 1997 until now. The CBOS has devalued the overvalued pound twice in 2012 and 2013 by 63% and 29% respectively in order to increase the competitiveness of the Sudanese exports. But this devaluation is completely undesirable as yet. This because the negative impact is solely extended to the prices levels and causes inflationary pressures.

**Figure 3: Changes in the Nominal Exchange Rate during Jan.1990-Dec.2014**
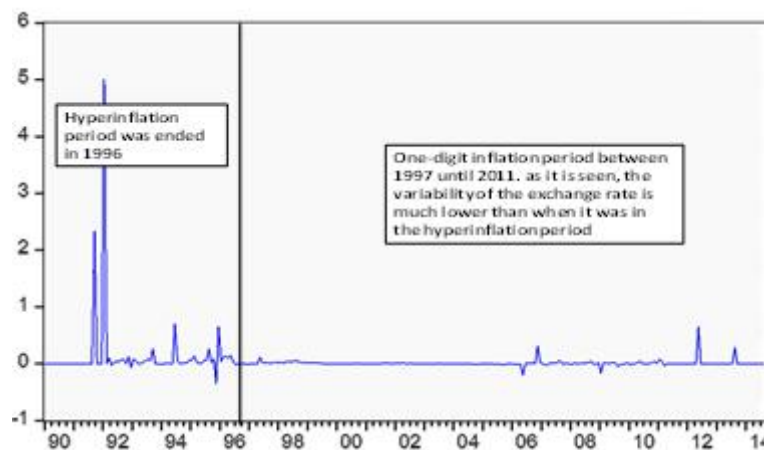


Sudan has been implementing a comprehensive economics reforming program since 1997 in cooperation with the International Monetary Fund (IMF), who advised the Sudanese government to shift from the fixed regime that was used to be using during the first half of the 1990s

to the managed floating regime. The IMF was eager to assist Sudan to meet the international reserve target. Yet, the Sudanese government were concerned that the greater exchange rate movements the more like for the inflationary pressures to be taken place.

## 6. Does Inflation in Sudan have A Stochastic Trend?

The inflation dynamic in Sudan has encountered a couple of changes from hyperinflation at early and mid 1990s to a stable period of one-digit during 1998-2010 in spite of some minor fluctuations as a maximum of 13% per month. Inflation rate has brought back to the age of the 1990s immediately after the separation of Sudan in July 2011 because of the shortage in the cash inflow. My goal in this section is to test whether Sudan's inflation has a stochastic trend. With this regard, the hypothesis tests are set to find an accurate answer for the above question.

### Table 1: Unite Roots for Inflation and Exchange Rate

|  | 1% | 5% | 10% |
|---|---|---|---|
| $\pi$ | -3.453234 | -2.87151 | -2.572154 |
| ex | -3.453567 | -2.871656 | -2.572233 |
| ex-volatility | -3.452596 | -2.871229 | -2.572004 |

$H_0$: *Inflation has a stochastic trend*
$H_1$: *Inflation is stationary*

$H_0$ That inflation has a stochastic trend is tested against the $H_1$ that it is stationary by performing the ADF test for a unit autoregressive root. See table [1] In other words, the ADF t-statistics is testing the hypothesis that the coefficient on $\pi_{t-1}$ = 0, this is t= -2.69 and its critical value is -2.87 at the 5% significance level.

The inflation rate is found to be stationary at the first difference so as stated on the equation (6)

$$\Delta \pi_t = -0.27 - 1.20\pi_{t-1} + 0.25\Delta\pi_{t-1} + 0.37\Delta\pi_{t-2} \ldots \ldots + 0.36\Delta\pi_{t-11} \ldots \ldots \ldots \ldots (6)$$

Because the ADF statistic of -2.69 is less negative than -2.86, the test does not reject the $H_0$ at the 5% significance level. So based on the regression in the equation (5), we therefore cannot reject the $H_0$ that inflation has a unit autoregressive root at 5% significance level, that is that inflation contains a stochastic trend , against the alternative that it is stationary .

In practice, failure to reject the $H_0$ does not necessarily mean that the $H_0$ is true or has a unit root; it simply means that you have insufficient evidence to conclude that it is false. Even-though, failure to reject the $H_0$ of a unit root does not mean that the series has a unit root. It still can be reasonable to use differences of the series rather than its level. (Stock & Watson, 2012)

The ADF regression in equation (1) includes number of lags of $\Delta inf_t$ when the number of lags is estimated using the AIC where $0 \leq P \leq 5$. The AIC estimator of the lag length is however, three when three lags are used (that is when $\Delta\pi_{t-1}, \Delta\pi_{t-2}, \Delta\pi_{t-3}, \Delta\pi_{t-4}$) are included as regressors, the ADF statistic is -2.72 which is less negative than -2.86. thus when the number of lags in the ADF is chosen by AIC, the hypothesis that inflation contains a stochastic trend is not rejected at 5% significance level. This is applied on the exchange rate as well. (Stock & Watson, 2012)

## 7. A STRUCTURAL BREAK OF INFLATION AND EXCHANGE RATE IN SUDAN

There is a variety of reasons for breaks to be occurred in the economy such as changes in economic policies, changes in structures of the economy, or an intervention that changes a specific industry. If that happened, the regression model might give us a misleading basis for inference and forecasting and then inaccurate results.

In order to avoid the misleading that is generated by the regression due to the breaks occur in the economy, I am going to check for a break from the perspective of hypothesis testing using F-statistics.

## Table 2: Regression Results of the Model at Two Different Regimes

| | Managed Floating Exchange Regime (Jan. 2010 – Sep.2014) | Fixed Exchange Regime (Jan. 1993 – Dec. 1997) |
|---|---|---|
| $\pi_{t-1}$ | 0.05763 (0.0000) | 0.009883 (0.0000) |
| $ex_{t-1}$ | 0.182883 (0.3195) | 0.095878 (0.2731) |
| $\pi_{t-1} * D_t(\tau)$ | -0.033549 (0.0128) | 0.002873 (0.0183) |
| $ex_{t-1} * D_t(\tau)$ | -0.127418 (0.4907) | -0.437632 (0.0000) |
| R-squared | 0.942192 | 0.900188 |
| Adjusted R-squared | 0.936411 | 0.892795 |
| S.E. of regression | 0.126163 | 0.157722 |
| Sum squared resid | 0.795855 | 1.343308 |
| Log likelihood | 39.64275 | 27.86349 |
| F-statistic | 162.9861 | 121.7545 |
| Prob(F-statistic) | 0.00000 | 0.00000 |
| Mean dependent var | 3.23493 | 4.448286 |
| S.D. dependent var | 0.500312 | 0.481707 |
| Akaike info criterion | -1.20153 | -0.77503 |
| Schwarz criterion | -0.98453 | -0.59897 |
| Hannan-Quinn criter. | -1.1174 | -0.70631 |
| Durbin-Watson stat | 0.98872 | 2.210538 |

*Dependent Variable LOG(INF) – Method: Least Squares – Date 11/11/14 – 06:46 – Sample (adjusted): 1993M011997M12 and 2010M01 – 2014M09 included observation 56 after adjustments.*

There are two break dates are identified during the two periods of study June 1996 & July 2011. See page [2] each of which has a significant impact on the economic structure in Sudan. June 1996, has turned the economic condition to better life whereas, July 2011 has negatively affected the economy. Since the second break up to date, the economic situation has been declining, inflation rate has been increasing substantially, exchange rate has been depreciating (changes), budget deficit has been registering very high levels as a percentage of the GDP, and in general, the economic situations have been getting worse and worse.

*Argument-1: It is found that the responsiveness of inflation to the nominal exchange rate in the managed floating regime has been much higher than in the fixed regime.*

The exchange rate was essentially constant except the single devaluation in 2012 and 2013 in which the official value of the Sudanese pound relative to the dollar was decreased. In contrast, exchange rate has fluctuated over Avery wide range.

## 8. TESTING FOR A BREAK IN THE TIME SERIES OF THE INFLATION AND EXCHANGE RATES

I assume that there is a break in the population regression function in June1996 and July 2011. Since dates of the hypothized breaks are identified (June1996 and July 2011), the null hypothesis of no break can be tested using a binary variable interaction regression models.

$H_0$: there is no break  vs.  $H_1$: there is a break

$D_t(\tau) = 0$ (before the break)   and   $D_t(\tau) = 1$ (after the break)

$D_t(\tau)$ Be a binary variable that equals 0 before the break date and 1 after the break date. So,  $D_t(\tau) = 0$ if $t \leq \tau$ and $D_t(\tau) = 1$ if $t > \tau$. Then the regression including the binary break indicator and all interaction terms is

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \delta_1 ex_{t-1} + \gamma_0 D_t(\tau) + \gamma_1 [D_t(\tau) * \pi_{t-1}] + \gamma_2 [D_t(\tau) * ex_{t-1}] + u_i \dots (7)$$

Where   $ex_{t-1}$ is a single lag of the exchange rate, $\pi_{t-1}$ is a single lag of the inflation rate, $D_t(\tau)$ is a binary variable and Let $\tau$ refers to the hypothised break dates

If there is no break , then the population regression function is the same over both parts of the sample so the terms involving the break binary variable $D_t(\tau)$ do not enter the equation .that is under the null hypothesis of no break $\gamma_0 = \gamma_1 = \gamma_2 = 0$. In contrast, under the alternative hypothesis that there is a break , then the population regression function is different before and after the break date $\tau$.in which case at least one of the $\gamma's$ is non zero. Then the hypothesis of the break can be tested using F-statistics that tests $H_0$: $\gamma_0 = \gamma_1 = \gamma_2 = 0$ vs. $H_1$: at least one of the $\gamma's$ is non zero.

## 9.INTERACTION BETWEEN EXCHANGE RATE AND THE BINARY

Does the effect on inflation rate of the exchange rate devaluation depend on whether the economy is encountering a break?

In order to answer this question, let's get back to the equation [1-5] and use the specification that allows for two different intercepts/different slop specifications

$$\ln(\pi) = 1.37 + 0.057\pi_{t-1} + 0.182ex_{t-1} + 1.062D_t(\tau) - 0.0335(\pi_{t-1} * D_t(\tau)) - 0.127(ex_{t-1} * D_t(\tau)) \dots (7)$$

$$\hat{\pi} = 682.2 - 0.97ex_{t-1} + 5.6D_t(\tau) - 1.28(ex_{t-1} * D_t(\tau)) \dots (8)$$

Where the binary variable $D_t(\tau) = 1$ after the break and equals 0 otherwise.

Before the break , $D_t(\tau) = 0$, the estimated regression line is $1.37 + 0.057\pi_{t-1} + 0.182ex_{t-1}$ which means 1% depreciation in the lagged exchange rate, holding other variables constant , inflation will increase by 0.182 in a logarithm. (Evident)

However, after the break $D_t(\tau) = 1$, the estimated regression line is $1.552 + 0.0235\pi_{t-1} + 0.055ex_{t-1}$. According to these estimates, decreasing exchange rate by 1 is predicted to increase inflation by 0.182 before the break when $D_t(\tau) = 0$ but by 0.055 after the break date when $D_t(\tau) = 1$. The difference between these two effects is 0.127 is the coefficient on the interaction term in the equation above.

> **Argument-2**: *depreciating the overvalued pound by 29% causes an increase in inflation rate by 15% over the period after the second structural break in September 2013.*
>
> *Fortunately, my result is in line with Michael's outcome who argues that the sharp 25% exchange rate depreciation (devaluation) on the Thai currency of 1997 to 1998 led to an additional cumulated inflation of 13% over the period. (Michael Goujon, 2006).*

### Table 3: The Effect of the Devaluation on the Inflation Rate
### In Two Different Regimes Fixed and Managed Floating Regimes

| MANAGE FLOATING REIME (JAN. 2010 – SEP.2014) | | | |
|---|---|---|---|
| Exchange Rate Scenarios In The Fixed Exchange Regime During 1990s | 1% Depreciation In Exchange Rate | The First Devaluation (63%) On 22$^{nd}$ June 2012 | The Second Devaluation (29% ) On 24$^{th}$ September 2013. |
| *** $D_t$ H $\tau$ H= 0 | 1.82 % (inflation increase) | 11.466% (inflation increase) | 5.78% (inflation increase) |
| *** $D_t$ H $\tau$ H= 1 | 0.55465% (inflation increase) | 3.4543% (inflation increase) | 15.95% (inflation increase) |
| FIXED EXCHANGE RATE REGIME (JAN. 1993 – DEC. 1997) | | | |
| Exchange Rate Scenarios In The Managed Floating Regime In 2000s | 1% Depreciation In Exchange Rate | The First Devaluation - 63% On 22$^{nd}$ June 2012 | The Second Devaluation – 29% On 24$^{th}$ September 2013. |
| *** $D_t$ H $\tau$ H= 0 | 9.5878% (inflation increase) | 12.368% (inflation increase) | 15.628 (inflation increase) |
| *** $D_t$ H $\tau$ H= 1 | 34.1754% (inflation decrease) | 21.5305% (inflation decrease) | 9.91086% (inflation decrease) |

** is an actual devaluation happened to the overvalued Sudanese pound in 2012   and 2013. *** simulations based analysis

The devaluation is claimed to be efficacious when there is a considerable cash inflow or excess of foreign currencies (oil) and ineffective when there is a massive shortage in the foreign currencies. It is found that 1% increase in exchange rate shall drive inflation down by 3.4% over the given period after the oil production. On the other hand, it is found that 1% depreciation over the fixed regime period causes a slight increase in the inflation rate by 0.9% and 1.8% over the managed floating period. ** is an actual devaluation happened to the overvalued Sudanese pound in 2012  and 2013. *** simulations based analysis

*Argument-3: I argue that devaluation is insufficient for Sudan and other countries facing a shortage of foreign currencies. This result is in line with other empirical evidences, which point out that devaluation under such circumstances is not infeasible*

The expected change in inflation rate $\Delta\pi$, associated with the change in ex, $\Delta ex$ holding other variables consistent is the difference between the value of the population regression function before and after changing the exchange rate (devaluation) , holding other variables constant .

$$\Delta\pi = f(\text{ex} + \Delta\text{ex}, \dots) - f(\text{ex}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (9)$$

The estimator of this unknown population difference is the difference between the predicted values for these two cases .let $\hat{f}(\text{ex}, \dots)$ be the predicted value of the inflation based on the estimator $\hat{f}$ of the population regression function. Then the predicted change in inflation is $\widehat{\Delta\pi} = \hat{f}(\text{ex} + \Delta\text{ex}, \dots) - \hat{f}(\text{ex})$. This shows that the estimated effect of this reduction after the break for which $D_t(\tau) = 1$ is $-2(\widehat{\beta_1} + \widehat{\beta_3}) = 4.50$. So the standard error of this estimated effect is $SE(-2\widehat{\beta_1} - 2\widehat{\beta_3}) = 1.53$.

*Argument-4: I argue that exchange rate and inflation targeting are always associated with each other's and are both indispensable elements in the macroeconomic policy analysis that should be tested simultaneously.*

## 10.CONCLUSION AND POLICY IMPLICATIONS

Eventually, the paper comes up with a couple of results and recommendations that are discussed in this section as policy implications. My analysis provides several important policy implications for the impact of the currency devaluation on the inflation rate in Sudan during the fixed regime and managed floating regime.

The paper indicates that the inflation rate should react positively in the short-run and negatively in the long-run. Accordingly, 1% depreciation in the exchange rate leads inflation to increase by 1.7% (over the period) before the break and 2.7% (over the period) after the break when the cash flow disappeared see table [2]  A simple regression model is run to figure-out the impact of the devaluation on inflation rate on based on different scenarios. (Fixed and managed floating regimes/ before and after the structural breaks)

Based on the given scenarios, it is found that the first devaluation in 2012 had a greater negative impact on the inflation rate than the second one in 2013. On June-22nd-2012, Central bank of Sudan CBOS devaluated the overvalued Sudanese pound by 63% to boost the economy from one side, and to get the black market rate closer to the official rate throughout maximizing the availability of the foreign currencies of the exports. As a result inflation rate increased relatively by 11.3% over the period followed the devaluation, eight-month later, inflation rate declined by 4.7% in August 2013. Furthermore, to meet the devaluation requirement, CBOS adjusted money supply to increase by 11% in June; the increase in the money supply has caused the increase in inflation rate in the short run.  After awhile, in September 2013, the central bank devalued the pound by 29% this devaluation caused inflation rate to increase from 29% in September 2013 to 43% in November 2013 by1.47%. Then inflation rate declined after 3montes to 36% in March 2014 by 16% or 0.82. Fortunately, my results is in line with Michael's outcomes who argues that  the sharp 25% exchange rate depreciation (devaluation) on the Thai currency of 1997 to 1998 led to an additional cumulated inflation of 13% over the period. (Michael Goujon, 2006).

The empirical literatures found out that crawling peg is an efficient regime for countries with inflationary pressures. In mind, hyperinflation episodes in Europe (Germany – Austria – Poland est.) and Latin America (Argentina – Chile – Mexico), it is found that all the mentioned countries adopted crawling peg to end up with low levels of inflation. Similarly, in Sudan, hyperinflation was ended because the government pegged the Sudanese pound at 2.12 against the U.S. dollar in1996. The peg was announced in March 1996 and was officially adopted in August 1996 (TALHA, 2014)But the currency peg did not continue for long time as the Central Bank decided to shift to the managed floating regime in mid-1997 instead, in considerations of the expected huge capital inflow from oil exports.

It is also highly recommended for countries to adopt inflation targeting regime, which is more likely to succeed in both developed and developing countries. For instance, developing countries with high inflation rates and hyperinflations such as Sudan (46% in July 2014) should set up a reasonable level of inflation rate to be targeted in the short or the long-run even. Last year, the Sudanese government set a 13% as a target. In my opinion, this level is well-away to be achieved in the short-run and not even in the long-run unless the government follows away to minimize the shortage of the foreign currencies availability.

In terms of the developed countries, it is better for inflation targeting to be set at the range of 2% which is less costly than 6% or 7%. For example, Japan has been encountering a deflation rates over the past three decades. In order to over-come deflation, the government announced a 2% inflation targeting. Yet, economist criticized the notion of increasing consumption tax by 3%, which is a backed track to the deflation trap again.

According to the analysis, it is found that devaluating the overvalued pound in the fixed exchange rate regime is much more applicable than in the managed floating regime in the sense that a floating regime creates an independency for the domestic monetary policy buy there is always an associated risk for this independency, which might be abused with inflationary pressures.

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