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in Sudan: An Economy-wide General
Equilibrium Assessment**

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The Controversy of Exchange Rate Devaluation in Sudan: An Economy-wide General Equilibrium Assessment

Khalid H. A. Siddig¹

Abstract

The international Monetary Fund (IMF) has been working with Sudan since 1997 to implement macroeconomic reforms including a managed float of the exchange rate (EXR). The IMF sees the EXR flexibility as key to safeguard and rebuild foreign exchange reserves and essential to meet the international reserve target in Sudan. However, the authorities in Sudan are concerned that greater exchange rate flexibility could contribute to inflationary pressures. In addition, a review of literature focusing on the exchange rate policies in Sudan reflects huge ambiguity about its outcome. This calls for additional empirical investigations that provide economy wide assessments of the various possible scenarios that could be adopted in the Sudanese context. Accordingly, the current paper applies an economy-wide impact assessment tool to investigate the possible effects of devaluating the overvalued (according to the IMF, 2009) Sudanese pound. Namely, it uses a Computable General Equilibrium (CGE) model together with its detailed database of Sudan to simulate the Sudanese pound to depreciate according to three different scenarios by 5%, 10%, and 15%. Results of the paper recommend that the additional flexibility in the Sudanese EXR regime suggested by the IMF should be carefully considered if that would lead the value of the Sudanese currency to be devalued. This imply that the authorities in Sudan should closely monitor and control the EXR to avoid its depreciation in the short run, while encouraging both public and private investments to help creating additional jobs that increases domestic income and reduces the negative consequences of inflation.

Key words: devaluation, Sudan, CGE analysis.

JEL classification: A1, C6, C8, D1D5, D6E6, F1H3.

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1. Introduction

Exchange rate (EXR) is an important economic variable that influences the national economy and the regulations of international trade as it converts foreign prices of exports and imports into the domestic currency of the particular country. These prices determine which goods are traded and where they are shipped or sourced. Being able to convert one currency into another at the prevailing exchange rate is crucial to international business and decision-making. The difference in relative prices determines the flow of products and the patterns of trade. Currency devaluation and appreciation are used as tools to correct external imbalances of countries, and mostly they are short term in nature, as their effects occur during the first several months after the exchange rate change (Thirwall, 1992).

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 (Alkhalifa et al. 2009). The fixed EXR approach is applied during the period between 1956 and 1971, where two subsystems were followed. The subsystems are (1) the Currency Board that manages the EXR policy during the first four years until 1960 and (2) the credible fixed EXR approach that is followed between 1960 and 1971. Afterwards, the incredible fixed EXR approach was followed during the period between 1972 and 1996, which in turn has three different subsystems including (1) the period of 'Fixed-like' EXR system, which is applied between 1972 and 1978, (2) the period of moderate frequencies reductions in the EXR, that is followed between 1979 and 1991, and (3) the period of rapid frequencies reductions in the EXR, which is followed between 1992 and 1996. Finally, the 'Managed float' EXR regime is applied afterwards from 1997 and on (Alkhalifa et al. 2009).

From 1997 to date, Sudan has been working with the International Monetary Fund (IMF) to implement macroeconomic reforms, including a managed float of the exchange rate (IMF, 2010). The IMF (2010), argue that exchange rate flexibility is key to safeguard and rebuild foreign exchange reserves and essential to meet the

international reserve target, particularly after the terms of trade shock associated with 2009 lower oil prices has depreciated the equilibrium real exchange rate. There is a trade-off between greater exchange rate flexibility and the need for additional fiscal tightening, with the risk that the latter could result in expenditure arrears. While the authorities in Sudan recognizing this trade-off, and prefer pursuing a flexible exchange rate policy, they are concerned that greater exchange rate flexibility could contribute to inflationary pressures. At this point, the IMF mission in Sudan acknowledges the pass-through effect of changes in the exchange rate on overall prices, but argues that low international prices for food combined with tight monetary and fiscal policies should help ease inflationary pressures at this juncture (IMF, 2009).

There is a strong relationship between the real effective exchange rate (REER) and real oil prices in Sudan since the start of oil production, reflecting the large share of oil in total exports and total revenues, as well as the strong correlation between government spending and oil revenue. These are all considered critical factors in determining the equilibrium real exchange. Based on an IMF study, the sharp drop in oil prices has made the REER overvalued starting in the fourth quarter of 2008. While the exact amount of the overvaluation is subject to a large degree of uncertainty, and is therefore difficult to quantify (IMF, *op cit.*).

The IMF mission in Sudan is insisting that without greater exchange rate flexibility and a prudent fiscal policy stance, it would be difficult to rebuild reserves from the current low levels. They ran a simple regression of the size of over-valuation of the exchange rate on a change in net international reserves, and found that it demonstrates a clear negative relationship, suggesting that the Central Bank of Sudan (CBoS) has lost a significant amount of reserves owing to the overvaluation of the currency (IMF, *op cit.*). The IMF also assumes that, without greater EXR flexibility, there will be a need for further greater fiscal restraint, which could lead to the accumulation of domestic arrears. Moreover, they suggest that the sustained exchange rate intervention and the introduction of exchange restrictions will not address the underlying problem of excess demand for foreign exchange, and should be avoided. At

the same time, the declining trend in world food prices and the slower growth in domestic demand should help reduce the inflation concerns associated with greater exchange rate flexibility.

To link the current IMF approach in tackling the monetary policies with its historical counterparts, Hassan (2006) quoted the IMF, where they were arguing that "over the past ten years a number of domestic and external economic developments affecting budgetary operations, credit expansion, and cost price relationships have resulted in structural disequilibrium in the Sudanese economy. Thus, in addition to taking steps to eliminate the causes of imbalances it became necessary to take corrective action through depreciation of the Sudanese pound." The IMF saw devaluation of the Sudanese pound as an important means of putting the economy back on the rails. That was based on that by making exports cheaper in the world market and imports dearer in the domestic market, devaluation will lead to an improvement in the balance of payments. The impact of devaluation on exports comes through its effect on export competitiveness. In particular, as the price of domestic currency in terms of foreign currency falls, exports become more competitive in the world market. Furthermore, by raising the domestic prices of imported goods relative to the price of domestically produced goods, devaluation shifts the demand from imported goods to domestically produced goods. This is what is referred to as the expenditure switching effect of devaluation. On the other hand, by lowering the foreign prices of exports, devaluation restores the economy competitiveness in the international market for exports. Thus, by curtailing domestic demand for imports and increasing foreign demand for exports, devaluation is said to help the economy overcome the problem of external imbalance (Hassan, *op cit.*).

A number of other studies were undertaken to tackle issues related EXR policies in Sudan with particular focus on the devaluation of the Sudanese pound and its impacts on the competitiveness of Sudanese exports. Nashashibi (1980) calculated the foreign exchange earned in the case of exports or saved in the case of import substitutes per unit of domestic resources employed in the production of exports or import

substitutes for a range of tradable goods. According to his approach the appropriate the exchange rate is the one that goes down the scale far enough to ensure the profitability of traditional exports, as well as to encourage new export activities.

Hussain and Thirwall (1984) examined the profitability of long and medium staple cotton, groundnuts, sesame, and gum Arabic. Their results reveal that the elasticity of export supply may be very low because of structural rigidities and factor immobility, while the elasticity of import prices and domestic prices may be very high, so that profitability of exporting remains largely unchanged. Thirwall (1992) added that, when the price elasticity of demand for exports is large but not infinite and real wages are sticky downwards, devaluation might be a second-best policy compared to structural intervention to raise foreign exchange earnings per unit of domestic inputs.

Mahran (1987) is stressing the failure of devaluation in providing the impetus for dramatic improvements in exports, and its likely undesirable inflationary effects. He argued that devaluation increases domestic prices (of goods and services) and production costs. He further argue that the inflationary impact of devaluation is even more pronounced under conditions of shortages in supply and the existence of black markets for goods and services. Under such circumstance, instead of promoting exports, devaluation may actually retard them. Eldaw (1992) examined the effect of devaluation on the competitiveness of cotton, groundnuts, wheat, and sorghum crops that are cultivated in Gezira scheme during the period (1981-1991). His results reveal that devaluation seems to have had serious negative impact on the competitiveness of these crops. Applying the Marshal-Lerner (1946) approach, Sayed (1996) observed that devaluation leads to a deterioration in the balance of payments, attributing these results to the rigidities that characterize the Sudanese economy.

Mohammed (2004) investigated the effect of devaluation of the Sudanese pound on the competitiveness of medium staple cotton grown in Gezira scheme for the period (1989-2000). His results suggest that depreciation of the exchange rate under liberalization policies seems to have had negative effect on competitiveness of this crop over the period under study. According to him, this may be attributed to a

number of factors including the increase in the cost of imported and domestic inputs used in the production of this crop, because of liberalization policies.

Hassan (2006) calculated the marginal propensity to absorb to address the issue of devaluation policies in Sudan as a tool to maintaining the balance of payments. She applied Ordinary least square (OLS) method to annual data covering the period (1982 - 2005). To calculate the marginal propensity to absorb (MPA) she used real consumption, real investment, and real government expenditure. Then she estimated the elasticity of absorption, and used it to calculate the marginal propensity to absorb. Her empirical results provide strong evidences that the MPA is very high in Sudan during the period under study (0.988). This may be attributed to the increases in the total expenditure on final goods and services both by household and government sectors. This suggests that devaluation of the Sudanese pound has probably been ineffective as far as the balance of payments is concerned. The policy implications in this regard are that government has incentives to fiddle with absorption by changing the volume of the government expenditure and limiting the absorption of the economy through taxes.

During the past ten years, there has been considerable debate about the appreciation of the Sudanese pound and its currency regime. Exchange rate of the Sudanese pound against US dollars has appreciated to about 21% in 2006/07, raising many concerns about the competitiveness of the Sudanese agricultural exports. In analyzing the economic policy, the performance of agriculture in Sudan must be borne in mind, because agriculture is important to the Sudanese economy as it contributed about 38% of GDP, about of 67% of employment, and 8% of exports in the year 2007. This is beside the dependency of many industries in the country on the agricultural raw materials (CBoS, 2007).

This literature survey on the EXR policies in Sudan show how controversial and ambiguous is the outcome of adopting specific EXR policy in Sudan. However, it also shows the need for empirical studies that provide the economy wide assessments of the impact of various possible scenarios that can be adopted. Therefore, this paper

applies an economy-wide impact assessment tool to investigate the possible effects of devaluating the overvalued (according to the IMF, 2009) Sudanese pound on the different components of the economy. Namely, it uses a Computable General Equilibrium (CGE) model together with its detailed database of Sudan. Accordingly, the following section of this paper provides the rationale of applying CGE approach as well as a detailed description of the model and the database. Afterward, the setup of the simulation scenarios and their introduction in the CGE modeling framework will be described in the third section. Section four shows the results and elaborates on the discussion, while the paper winds up by some concluding remarks.

2. The Model and Data

A CGE model of Sudan is constructed and used for this study. It is an open-economy single-country model that treats the rest of the world as one region. The model allows for two-way trade, assuming that imports and domestic demand as well as exports and domestic supply, respectively, are imperfect substitutes. Producers maximize profits subject to Leontief production functions, and households maximize utility with respect to interlinked Linear Expenditure Systems (LES). The model is static in nature solving for a new equilibrium within a single period, given a specified policy change, which is in general, a reasonable approach to be used for the objectives of this paper, provided the lack of data that allow for using a dynamic model.

The paper focuses on the analysis of how the economy will adjust and the nature of the new equilibrium of the economy under the EXR changes shocks according to macroeconomic constraints and assumptions. The macroeconomic closure rules of the model and the specification of its factor markets are crucial to describe this convergence process properly and to determine the short, medium, or long-term character of the model. Thus, within a certain period, under some given conditions and some applied policies, the shocked economy adjusts to achieve a new state of equilibrium. Generally, this study's approach to CGE modeling follows the type of Dervis *et al.* (1982), and particularly based on the model developed at IFPRI and documented in Lofgren *et al.* (2002).

To implement the intended simulations, a modified closure of the model is used. For the government balance of the model, the closure assume that the government saving is flexible, while tax rates which represent a major component of the government revenue are fixed.

Total government revenue (YG) is defined as shown in the flowing equation as the sum of revenues from taxes, factors, and transfers from the rest of the world. Taxes include income tax ($TINS_i \cdot YI_i$), taxes on factors of production ($tf_f \cdot YF_f$), VAT ($tva_a \cdot PVA_a \cdot QVA_a$), taxes on production ($ta_a \cdot PA_a \cdot QA_a$), import tariffs ($tmc_c \cdot pwm_c \cdot QM_c$), export taxes ($te_c \cdot pwe_c \cdot QE_c$), sales taxes ($tq_c \cdot PQ_c \cdot QQ_c$), and transfers from the rest of the world ($trnsfr_{gov\ row}$).

$YG =$

$$\begin{aligned} & \sum_{i \in INSDNG} TINS_i \cdot YI_i + \\ & \sum_{f \in F} tf_f \cdot YF_f + \\ & \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a + \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in CM} tmc_c \cdot pwm_c \cdot QM_c \cdot EXR + \\ & \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR + \\ & \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{c \in C} YIF_{gov\ f} + trnsfr_{gov\ row} \cdot EXR \end{aligned}$$

On the other hand, the following equation defines the government consumption demand for commodity (c) as (QG_c), which is the base-year quantity of government demand (qg_c) multiplied by an adjustment factor ($GADJ$) that is exogenous and, hence, the quantity of government consumption is fixed.

$$QG_c = \overline{GADJ} \cdot \overline{qg_c}$$

For the external balance, which is expressed in foreign currency, the real exchange rate (indexed to the model numéraire) is fixed while foreign savings (the current account deficit) and the trade balance are flexible. Under such a situation, a depreciation of the real exchange rate should simultaneously reduce spending on imports (a fall in import quantities at fixed world prices) and increase earnings from exports (an increase in export quantities at fixed world prices).

This could be described as: (*Import expenditure + transfers to the rest of the world = exports revenue + transfers from the rest of the world + foreign savings*), where foreign savings will adjust to assure the equilibrium. The balance of payments equation that is expressed in foreign currency requires total payments for imports and the transfers from production factors to the rest of the world to equal total receipts from exports plus foreign savings (*FSAV*) and transfers from the rest of the world, as shown in the following equation:

$$\sum_{c \in CM} p_{wm_c} \cdot QM_c + \sum_{f \in F} trnsfr_{row f} = \sum_{c \in CE} p_{we_c} \cdot QE_c + \sum_{i \in INSD} trnsfr_{i row} + FSAV$$

Where: p_{wm_c} is the world imports price of the commodity (c), QM_c is the imported quantity of commodity (c), $trnsfr_{row f}$ are the transfers to the rest of the world, $p_{we_c} \cdot QE_c$ are the world export price and quantity of commodity (c), $trnsfr_{i row}$ are the transfers from the rest of the world, and $FSAV$ is the foreign savings.

Finally, for the saving-investment balance, the model assumes an investment-driven environment, in which the value of base savings adjusts with same percentage points as investment (Siddig, 2009). At the end, the model should close by that total savings and total investment are equal. As defined in the following equation, total savings is the sum of savings from domestic nongovernment institutions (YI), the government ($GSAV$), and the rest of the world ($FSAV$), with the last item converted into domestic currency using the exchange rate. Total investment is the sum of the values of fixed investment and stock changes ($qdst_c$).

$$\sum_{i \in INSDNG} MPS_i \cdot (1 - TINS_i) \cdot YI_i + GSAV + EXR \cdot \overline{FSAV} = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$

CGE models are known to be very demanding in terms of data, because they basically rely on the Social Accounting Matrix (SAM). The SAM is a consistent data framework that captures the information contained in the national income and product accounts and the Input-output Table (IOT), as well as the monetary flows between institutions

within the economy under consideration (Pyatt & Round, 1985). Moreover, the SAM is a self-controlled accounting framework, because total receipts must equal total payments for each account contained within its square matrix. It follows the principle of double entry bookkeeping, presenting expenditures in the column and receipts in the row accounts; that is, each entry represents a monetary flow from a column to a row (Pyatt & Round, *op cit.*).

In order for the SAM to be constructed, an IOT is required. Unfortunately, it is always difficult to find recent IOTs as they are normally developed each several years due to the amount of data and efforts required. This problem is particularly apparent in a developing country like Sudan, where the advanced tools and experts for data collection, monitoring, and manipulation are always scarce. In the case of Sudan, the only IOT that was developed by the statistical authorities was produced in 1961 (Siddig, 2009). Nonetheless, the CGE model of this study is benefiting from the most recent IOT and SAM of Sudan for the year 2004; those are developed and documented in Siddig (2009a)².

The 2004's SAM and IOT are based on data collected from official sources in Sudan. Namely the Central Bureau of Statistics, the Central Bank of Sudan, Ministry of Finance and National Economy, and the Ministry of Agriculture and Forestry in addition to several relevant administrations such as custom administration and tax administration.

The Sudanese IOT and SAM provide data on 33 sectors, including 10 agricultural sectors, 10 industrial sectors, and 13 service sectors. Each activity in the SAM is assumed to produce only one single commodity, i.e. there are 33 commodities as well. Production factors are disaggregated to Labour, land, and capital, while households are grouped based on income to three groups; namely high, middle, and low. The government account is divided into four subaccounts including current government

² The author is providing the detailed Sudanese SAM of the year 2004 in the Appendix to be publicly available as a base for further investigations in the context of Sudan. For detailed documentation of the SAM, see Siddig (2009).

accounts, tariffs, direct taxes, and indirect taxes (excluding tariffs). In addition, the SAM also includes accounts for saving-and-investment, enterprises and separates one account for the rest of the world. The detailed Sudanese SAM of this study is presented in Appendix 1 of this paper.

3. Simulations Setup

As shown in the previous section of this paper, the literature on the EXR policies in Sudan is both diverse and contradictory. However, the enormous amount of studies on it especially during the last decade reflects its importance and the need for further investigations. This provides the rationale for its selection as the main theme to be addressed in this paper. In addition, this paper distinguishes itself from the previous studies focusing on the EXR policies in Sudan by that it tackles the issues that occupy major IMF recent concerns with respect to Sudan. Moreover, it employs different methodological approach that captures the economy-wide impact assessments, which is the CGE modeling approach.

To account for wide range of policy debate with respect to EXR devaluation in Sudan, this paper considers wide range of simulation scenarios. It simulates the Sudanese currency to be devaluated by 5% in the first scenario, by 10% in the second and by 15% in the third. Despite the consecutive appreciations of the Sudanese pound during the last ten years, this paper focuses on the devaluation to provide evidences on whether or not the IMF calls on relaxing the control on the currency, which might allow its devaluation will be good for the economy.

4. Results Discussion

Usually it is easier to keep currencies of the particular economy undervalued than to keep them overvalued as this help in avoiding deficits in the balance of payments and only keep the own currency supplied to the foreign exchange market. However, governments always avoid devaluating their national currency because it is not a

politically popular step reflecting a sign of a weakening economy and a loss of international stature (Waud *et al.* 1989).

In theory, devaluation of the real EXR makes tradable goods expensive in the domestic market and hence it improves the current account balance. Moreover, it could also reduce the domestic absorption as a response to the increased prices of domestic goods, specially, if income does not increase, e.g. in the presence of unemployment (Waud *et al. op cit.*).

Table (1) shows the changes in selected macroeconomic indicators as a response to the three devaluation scenarios of this paper. The base values of the selected indicators are shown in the second column of all the result tables. Exchange rates and price indices are set at 100 in the baseline. Units for non-base columns are percentage changes from the baseline for items not computed as GDP shares, while they are deviation from the baseline for items computed as GDP shares.

Table 1: Effects of devaluation on macroeconomic indicators

Macro-indicators	Base value	% changes from the base*		
		5%	10%	15%
Real absorption (LCU at base price)	6549.7	-1.8	-3.6	-5.3
GDP at market price	6206.9	-0.1	-0.3	-0.6
Real household consumption	4655.1	-2.5	-5.0	-7.5
Total real exports	969.5	6.1	12.1	18.2
Total real imports	1312.3	-3.9	-7.4	-10.5
PPP real exchange rate	100	5.1	10.1	15.1
Export price index	100	0.0	-0.1	-0.1
Domestic (non-tradable) price index	100	-0.1	4.1	6.3
Investment (% of nominal GDP)	20.2	0.3	-3.2	-5.0
Private savings (% of nominal GDP)	17.7	2.0	0.2	0.3
Trade deficit (% of nominal GDP)	7.4	-1.6	0.0	-0.1

* Except for items computed as GDP shares.

Results show that exchange rate devaluation would reduce absorption, private consumption, total imports, and GDP, while improving exports. This deterioration in

the level of absorption led by household consumption conforms to the findings of Mahran (1987), where he was arguing that the devaluation of the EXR in Sudan leads to huge inflationary pressures.

The findings of Mahran (1987) have further warned that the devaluation would also increase the trade deficit, however the current results shows an increasing total exports and declining total imports. This is particularly obvious when the EXR is simulated to depreciate by 5%, where the trade deficit as a percentage of the nominal GDP will deviate from the baseline share by 2% less. Deteriorations in the consumption expenditure of households and total absorption are mainly due to the increase in the domestic price of goods particularly when the EXR is simulated to depreciate by 10% and 15%.

The impact of the EXR devaluation by 10% on the domestic output, domestic sales, and domestic demand price of goods is shown in Table (2). For simplicity, Table (2), is prepared to show the results of 10% devaluation as a medium size shock on the EXR compared to the two other shocks simulated in this paper. In general, devaluation will benefits the producers who tend to send their output abroad as exports, while hurting the ones who rely only on the domestic consumers as a destination for their output. Under the small country assumption, devaluation of the Sudanese currency would increase the returns to Sudanese exporters on the local currency basis, while causing no effect on the world price of exported goods. On average, devaluation would increase the domestic agricultural output by 2% and the industrial output by 3%, while service output would decline by 0.5%. More specifically, the domestic output of cotton, oilseeds, and forest products (includes Arabic Gum) increases by 13%, 11%, and 8%, respectively due to the respective increases in their domestic demand prices by 5%, 2%, and 2.4%, while the domestic output of cereals, sugar, and fishery decreases by 3% each. The deteriorations in the output of some staple goods such as cereals and other crops reflect the negative consequences of devaluation on the share of domestic output on the domestic food supply, which may have negative implications on the domestic food security.

Table 2: Effects of 10% devaluation on domestic production and demand

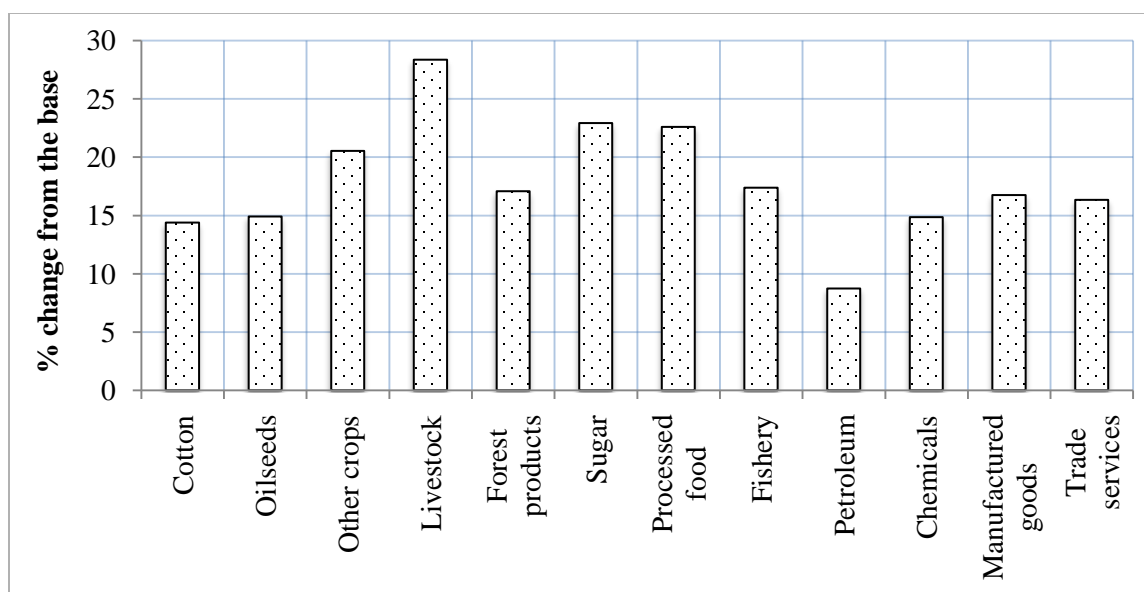
Commodities	Domestic output		Domestic sales		Demand price (%)
	base	% change	base	% change	
<i>Agriculture (average)</i>	376.9	2.4	349.1	-0.7	0.9
Wheat	42.0	1.6	42.0	1.6	3.1
Cereals	183.6	-3.2	182.8	-3.3	-1.7
Cotton	106.7	13.1	14.2	4.8	5.3
Oilseeds	93.1	10.6	25.1	-1.6	1.8
Other crops	765.6	-1.6	741	-2.4	-1.0
Livestock	1547.5	-0.5	1467.1	-2.2	-4.0
Milk	11.8	1.6	11.8	1.6	5.8
Forest products	19.6	7.8	11.8	1.4	2.4
Sugar	197.5	-2.9	194.9	-3.3	-2.4
Fishery	801.1	-2.7	799.9	-3.1	0.0
<i>Industry (average)</i>	166.6	2.8	97.4	1.5	3.2
Food industries	54.4	-1.1	49.3	-2.8	-2.0
Other mining	65.1	-0.8	64.0	-1.1	0.8
Petrol	924.1	6.5	264.5	0.9	6.0
Textile	82.7	0.9	82.6	0.9	3.0
Wood	14.7	3.5	14.1	3.0	3.9
Paper	35.7	2.7	35.4	2.6	4.5
Chemicals	286.4	2.0	281.7	1.8	3.6
Metal	90.7	6.4	76.0	4.0	3.0
Machinery	71.2	3.8	70.8	3.8	6.1
Other Manufactures	40.7	4.0	35.6	2.1	2.9
<i>Service (average)</i>	307.0	-0.5	307	-0.5	1.4
Electricity	271.0	-0.9	271	-0.9	1.1
Water	63.7	-3.6	63.7	-3.6	0.6
Construction	653.1	0.2	653.1	0.2	2.5
Trade	643.2	1.3	642.8	1.3	2.7
Water transports	39.8	1.4	39.8	1.4	3.1
Air transports	41.1	0.5	41.1	0.5	2.3
Communication	75.6	-0.4	75.6	-0.4	0.1
Business services	252.3	0.1	252.3	0.1	1.3
Other services	474.8	-3.5	474.8	-3.5	0.0
Public services	697.2	-0.9	697.2	-0.9	1.2

The output of some industrial sectors also witness improvements as the domestically manufactured goods should provide substitutes for the deteriorating demand for imports domestically. The latter as well is due to the increases in the domestic prices of imports due to high value of foreign currency against the devalued local currency.

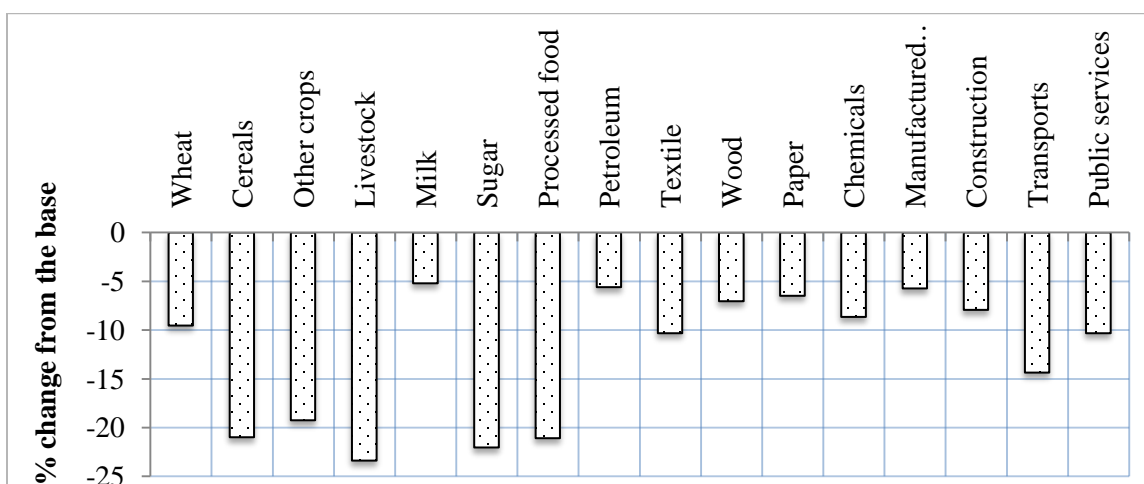
The domestic price of all industrial goods witnesses apparent increases especially petroleum and machinery increasing by 6% each. Petroleum is of particular importance in the Sudanese economy since its exploitation in 1999, because in addition to its major share in the total value of the Sudanese exports it fuels a major part of the domestic production in the Sudanese agricultural, industrial, and service sectors.

In order to investigate the detailed impact of EXR devaluation on the Sudanese foreign trade, Figures (1 and 2) further elaborate on the sources of changes in the total values of exports and imports reported previously in Table (1). The changes in the domestic production of exportable goods, and the deterioration of the output of the domestically oriented sectors shown in Table (2), could be also linked to Figures (1 and 2) to see the reallocation of the domestic resources across the different sectors in the Sudanese economy due to the respective changes in the value of the local currency against its foreign counterpart.

Changes in the EXR alter the domestic prices of foreign goods to domestic buyers and the returns to exported goods to domestic producers in local currency terms (Waud et al. 1989). Again, the results of 10% devaluation are considered for simplicity in the two following figures. Exports by sector show an average percentage increase of 9%, where all the exporting sectors increase their exports. Particularly, the exports of livestock, oilseeds, cotton, and forest products (Arabic Gum), which represent a significant share of the Sudanese agricultural exports show increases of 28%, 15%, 17%, and 14%, respectively. Moreover, exports of petroleum also show an increase of 9%, which is a huge value change, given that petroleum represent 68% and 94% of total value of the Sudanese exports in 2004 and 2008, respectively.

Figure 1: Effects of 10% devaluation on export (percentage change from the base)

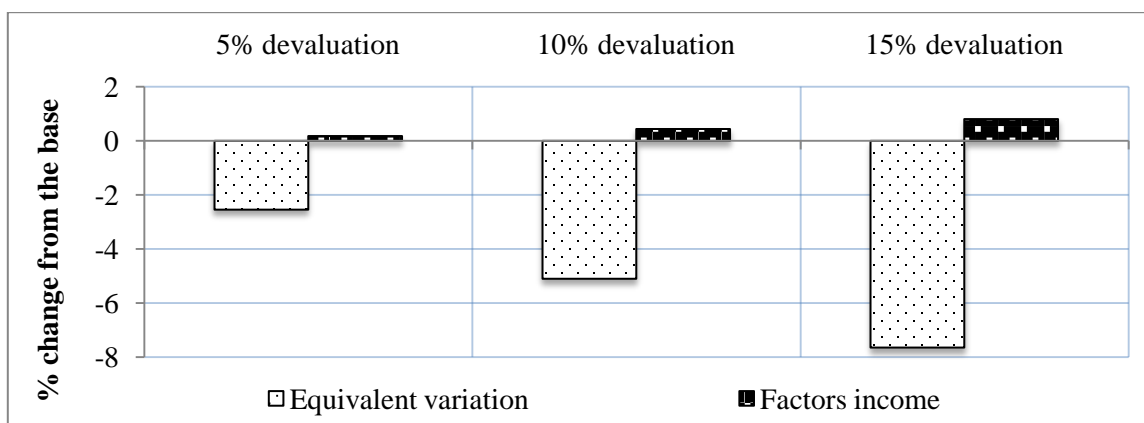
On the side of imports, the average percentage change in the imports value by sectors is 6% deterioration. Similar to exports but in the reverse; imports by all commodities decrease due to 10% devaluation of the EXR. Particularly, reductions in the imports of goods with huge shares in the total value of the Sudanese imports does appears. For instance, manufactured goods (-6%), textile (-10%), other crops (-20%), and wheat (-10%) are important due to their larger share in the Sudanese total imports value of the baseline.

Figure 2: Effects of 10% devaluation on imports (percentage change from the base)

On the other hand, the comparatively large percentage increase in the imports of sugar have no significant impact on the overall trade balance due to its smaller share in the total Sudanese imports value, which is 0.2%.

Equivalent variation (EV) is a measure of how much more money a consumer would pay before a shock would take place to avert the impact of the shock. In the context of this paper the EV represent the percentage change from the base consumption values of households due to changes in the EXR, which is the welfare measure that is captured by the CGE model of the study. Results on the impact of devaluation on the welfare levels of the Sudanese people as depicted by Figure (3) seem to be unfavorable. Despite the slight increase in factors income by 0.2%, 0.4%, and 0.8% due to 5%, 10%, and 15% devaluation, respectively, the increase in the inflation seem to be faster. This is reflected by that, the percentage increases in factors income are quite small compared to the increases in the domestic prices.

Figure 3: Effects of devaluation on people's welfare (percentage change from the base)



Thus, with the increase in domestic prices of many commodities by greater amounts than the increase in factors income; the household demand for consumption for all income groups (high, middle, and low) decreases with an average of 3%, 5%, and 8% due to three devaluation scenarios, respectively. Accordingly, devaluation may have negative impacts on food security especially in the context of access to food, because domestic prices of important food staples (wheat and milk) increase as a result.

5. Concluding Remarks

Exchange rate devaluation is one of the most important but controversial trade policies recommended by the IMF for most of the developing countries in Africa under its well-known Structural Adjustment Programs (SAP). In the case of Sudan SAP was implemented in the late seventies and early eighties, where it has got a lot of debate on its effectiveness particularly for the case of Sudan. Several studies have tackled the devaluation as a policy for maintaining the Sudanese balance of payment, which were mainly during the late seventies, eighties, and early nineties. The majority of those studies discourage its implementation due to the undesirable negative effects particularly with respect to domestic prices and inflation rates.

Since 1997, the IMF is recommending Sudan to implement a managed float EXR regime, where they see the EXR flexibility as key to safeguard and rebuild foreign exchange reserves. The authorities in Sudan on the other hand are concerned about the inflationary pressures that might be caused by the additional flexibility of the EXR (IMF, 2009).

A review of literature focusing on the EXR policies in Sudan reflects huge ambiguity about its outcome. This call for additional empirical investigations that provide economy wide assessments of the various possible scenarios that could be adopted in the Sudanese context. Those are the rationale that the current paper applies an economy-wide impact assessment tool to investigate the possible effects of devaluating the overvalued (according to the IMF, 2009) Sudanese pound. Namely, it uses a CGE model together with its detailed database of Sudan to simulate the Sudanese pound to depreciate according to three different scenarios by 5%, 10%, and 15%.

The paper reports the impact of devaluation on several economic indicators considering the domestic commodity markets, factors market, and institutions. Responses of specific economic variables such as prices, households demand, welfare, and the balance of payment are used to describe the resulting equilibriums of the

economy after the three scenarios. The results reveal that the devaluation of the Sudanese pound will lead most of the domestic prices to considerably increase. This is desirable for producers whom are targeting the world market because their returns in the local devalued currency will tend to be higher. Accordingly, the export oriented sectors, which have larger share of exports on their total output show the larger increases in their output and exports.

On the other hand the final domestic demand components are shown to pay the burden as the domestic prices of both domestic and imported goods increase. In this context, two major components of the domestic demand could be distinguished. The first is the final consumption demand by households and other institutions, which can easily cope with the increasing prices if their income is increasing as well by similar trend. This is however not the case as the total income to households show very slight increases, while their purchasing power is enormously decreasing due to higher prices. The other component of the domestic demand is the intermediate use, which is negatively affected as well by the increasing prices causing several sectors to reduce their output, particularly the ones with larger share of intermediate consumption compared to primary factors.

Therefore, the conclusions to be drawn here is that devaluation in Sudan would succeed in increasing domestic prices of tradable goods and encourage producers to export. However, that affect domestic consumers negatively because the increase in prices is unaccompanied by similar increases in the households' income. This could also lead the domestic production to deteriorate at certain time point, as the intermediate use cost will also increase especially the imported goods. Therefore, devaluation would encourage producers of some sectors to increase their output and exports, while hindering consumers to enjoy the previously cheaper imported and domestic commodities, as the domestic prices increase.

According to these conclusions, the additional flexibility in the Sudanese EXR regime suggested by the IMF should be carefully considered if that would lead the Sudanese currency to be devalued. This imply that the authorities in Sudan should closely

monitor and control the EXR to avoid its depreciation in the short run, while encouraging both public and private investments to help creating additional jobs that increases domestic income and reduces the negative consequences of inflation.

6. References

- Ali, A . A .G. (1985). The Sudan economy in disarray: Essays on the IMF model, (Ithaca Press, London).
- Alkhalifa M., Ali, P., Nureljalil, A., Abdelrahman, A., Norain, M. 2009. The History of Exchange rate Policies in the Sudan (1956 – 2007). Central Bank of Sudan, In Arabic.
- Central Bank of Sudan (2007). Economic and financial statistical review, October-December 2007. Accessed online at: <http://www.cbos.gov.sd/arabic/period/bulletin/q407.pdf>.
- Dervis, K., de Melo, J., and Robinson S. (1982). General equilibrium models for development policy. Cambridge University Press.
- Eldaw, O. A. (1992). Devaluation and competitiveness in Sudanese agriculture: The case of Gezira Scheme (1981 – 1991). Unpublished M.Sc. Dissertation, Department of Economics, University of Gezira, Madani, Sudan.
- Hag Elamin, N.A and Elmak, E. M. (1997). Adjustment Programmes and Agricultural Incentives in Sudan: A comparative study. AERC Research paper 63. African Economic Research Consortium, Nairobi. March 1997.
- Harris, J, R. (1989). The TIUF supply side approach to devaluation: A comment, Department of Economics, Boston University.
- Hassan, R. A. (2006). The effect of exchange rate depreciation on Sudan's balance of payments: An empirical investigation (1981- 2005). Unpublished M.Sc. Dissertation, Department of Economics, University of Gezira, Sudan.

- Hussain, M. N. and Thirwall A. P. (1984). The IMF supply side approach to devaluation: An assessment with Reference to the Sudan. Oxford Bulletin of Economics and Statistics, Vol. no. 46.
- IMF. 2009. Sudan Staff-Monitored Program for 2009–10. International Monetary Fund. Prepared by the Middle East and Central Asia Department (In consultation with other departments). July 2009, IMF Country Report No. 09/218. Approved by Juan Carlos Di Tata and Dominique Desruelle June 24, 2009. <http://www.imf.org/external/pubs/ft/scr/2009/cr09218.pdf>
- IMF. 2010. Sudan: Article IV Consultation, Staff Report; Debt Sustainability Analysis; Staff Statement; Public Information Notice on the Executive Board Discussion; Statement by the Executive Director. International Monetary Fund. Washington, D.C. June 2010. IMF Country Report No. 10/256. <http://www.imf.org/external/pubs/ft/scr/2010/cr10256.pdf>.
- Lofgren, Hans, Harris, Rebecca Lee and Robinson, Sherman, with the assistance of El-Said, Moataz and Thomas, Marcelle (2002). A Standard Computable General Equilibrium (CGE) Model in GAMS. Microcomputers in Policy Research, Vol. 5. Washington, D.C.: IFPRI.
- Mahran, H. A. (1987). Does devaluation encourage exports? Memio, Department of Economics, University of Gezira, Sudan.
- Mahran, H. A. (1995). Development Strategies in the Agricultural Sector of the Sudan: 1970-1990. Cahiers Options Méditerranéennes, vol. 4. HA Mahran - Cahiers Options Mediterraneeennes, Ciheam1995.
- Mohammed, A. B. (2004). The effect of exchange rate regimes on competitiveness of agricultural crops in Sudan: The case of medium staple cotton (1989–2000). Unpublished M. Sc. Dissertation, Department of Economics, University of Gezira, Sudan.

- Nashashibi, K. (1980). A supply framework for exchange reform in developing countries: The experience of Sudan. IMF Staff Papers, no.27. Washington, D.C.
- Osman, A. S. (2000). Economic reformation methodology in the Sudan. Sudan Coin Plant Co. Ltd, Khartoum, Sudan.
- Pyatt, G. and Round, J. I. (1985). Social Accounting Matrices: A Basis for Planning, Washington, DC: The World Bank.
- Sayed, O. A. (1996). Devaluation and the balance of payments: The experience of Sudan (1972 – 1993). Unpublished M. Sc. Dissertation, Department of Economics, University of Gezira, Sudan.
- Siddig, Khalid (2009a) GTAP Africa Data Base Documentation - Chapter 2 I-O Table: Sudan.
https://www.gtap.agecon.purdue.edu/access_member/resources/res_display.asp?RecordID=2986. Accessed 01 June 2009.
- Siddig, Khalid (2009): Macroeconomy and Agriculture in Sudan: Analysis of Trade Policies, External Shocks, and Economic Bans in a Computable General Equilibrium Approach. Farming & Rural Systems Economics. Volume 108, ISBN: 978-3-8236-1578-1, ISSN: 1616-9808. Margraf Publishers GmbH, Germany. www.margraf-publishers.eu.
- Thirwall, A. P. (1992). Growth and development with special reference to developing Economies. Macmillan Education Ltd, London, England, Fourth Edition.