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Manufacturing Sector Development in Sub-Saharan Africa: Does Monetary Policy Matter?

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This study investigated the effect of monetary policy on the manufacturing sector value added in 24 sub-Saharan African (SSA) countries. The study is motivated by the persistent state of underdevelopment of the manufacturing sector in the region and the palpable dearth of empirical evidence on the sector's response to monetary policy actions as suggested by theory. The study employed panel data from 1995 to 2020 and the framework of the panel ARDL model which is estimated using three dynamic panel estimators – Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effect (DFE). Findings from the study showed that the monetary variables are time sensitive and heterogeneous in their effects depending on the long or short-run. We document that while interest rate and the exchange rate had statistically significant negative impacts on manufacturing value added in the long-run only credit to the private sector had no real impact on manufacturing value added in the short and long-run. The implication is that policymakers have to conduct monetary policy in such a manner that mitigates the persistent rise in interest and the depreciation of the domestic currency exchange rates to boost manufacturing value added in the region.

Keywords: Manufacturing value added, monetary policy, panel ARDL, pooled mean group, dynamic fixed effect, SSA

JEL: E52, N97, O14

For a very long time, there has been a strong macroeconomic debate regarding the effect of monetary policy actions taken by the monetary authorities of different countries on the performance of their real economies. At first, right from the time of the classical economic theorists, there has been an emphasis, through the quantity theory of money that output growth is not sensitive to monetary policy (Pandey and Shettigar, 2017). However, with the failure of this theory to justify the great depression of the 1930s, its stand only lasted till 1936 when Keynes (1936) put forward his novel work entitled "The general theory of employment, interest, and money". In what is now widely considered as the Keynesian perspective on the efficacy of monetary policy, Keynesians contend that efforts aimed at expanding the money supply will indirectly stimulate output through a decline in interest rates, assuming there is no liquidity trap. The monetarists yet opine that monetary policy tools can be used to stimulate the economy to full employment level of output at least in the short-run. However, in the long-

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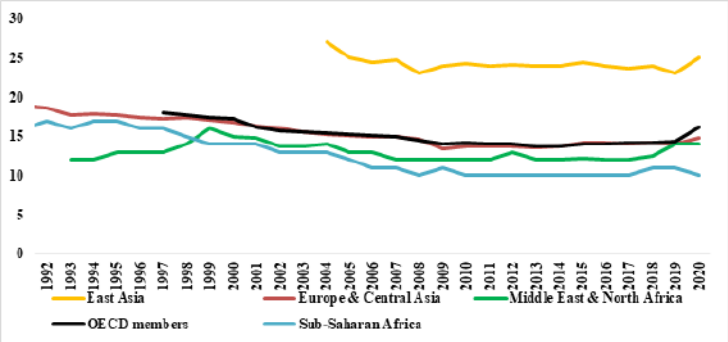
run, beyond the levels of full employment level of output, further expansions in the money supply tend to impact negatively on the price level. Irandoust (2019) explains that during periods of slowing economic growth, central banks frequently engage in monetary policy ease, especially by lowering target interest rates to boost investments and economic activity. On the other side, when inflation appears to be having a significant impact on the economy, monetary policy is tightened by raising the target interest rate, which slows both economic growth and inflationary pressure. Notwithstanding, the perceived influence of monetary policy actions on investment and production, it is still subject to failure in situations of financial crises, underdeveloped financial systems, primitive monetary systems, lack of independence of the central bank, rational expectations, etc. (Junankar, 2019). Based on this evidence it is critical that central banks pay much closer attention to the success of their monetary policy measures in terms of price stability and optimal economic growth (Irandoust, 2019).

Manufacturing is often seen as a key economic activity that is highly sensitive to the monetary policy actions of the Central Bank (Otero, 2017; Quintero, 2015). This is because production and investments which are core aspects of manufacturing activities are largely driven by monetary indicators such as the inflation rate, interest rate, exchange rate, credits, and money supply. Being one of the key sectors of the economy, the manufacturing sector has been fundamental to the growth and development processes of many regions of the world (Adesina., 2021; Appleyard *et al.*, 2019; Egwaikhide, 1997; Junankar, 2019; Nwokoma, 2016). For instance, the rapid structural transformation of the emerging economies of East Asia could not have been achieved without the contributions of their vibrant manufacturing sectors (Anyanwu, 2017; Junankar, 2019). Sadly, Sub-Saharan Africa's (SSA) manufacturing sector has not developed over time as shown in Figure 1 where it is observed that its value-addition in comparison to other regions is the lowest since 1998.

As of 2020, available statistics from the World Bank suggest that SSA manufacturing share of total output was a mere 10.28% compared to 25.95% and 14.19% for East Asia and Europe, respectively. Again, manufacturing contributes only a small portion of the merchandise export of SSA countries. As of 2020, manufacturing export for SSA was 23.6% compared to 78.4% and 85.9% for Europe and East Asia,

respectively. The manufacturing industry in SSA faces several difficulties, including a shortage of credit that is affordable, a lack of investment in infrastructure and human capacity, growing demand for imported manufactures, as well as an unfavorable business climate (African Development Bank [AFDB], 2017).



Source: Authors' presentation

Figure 1. Trends of Manufacturing Value Added (Output) Share of GDP

The motivation to investigate the impact of monetary policy on manufacturing development in SSA derives from the theoretical links between the monetary sector and the productive sector. This nexus suggests, even though tentatively, that monetary policy cannot be absolved of responsibility for the manufacturing sector's poor performance in the region. The study becomes even more germane considering the relatively underdeveloped domestic economic structures in the region. Whereas the focus of the majority of theoretical discussions on the transmission of monetary policy to output has been the developed and emerging economies (Bellocchi *et al.*, 2021; Irandoust, 2019; Kilinc and Tunc, 2019; Liu *et al.*, 2022; Murgia, 2019; Nguyen, 2020; Sheikh *et al.*, 2021), the impact of these short-term stabilizing measures on the long-term economic growth and development of the Less Developed Countries (LDCs) and worse still for their industrial sectors is not well supported by empirical data. For SSA, very few studies specifically address the nexus between monetary policy and manufacturing performance at an extensive cross-country or regional level. Most of the related studies have been largely country-specific (Adedokun, *et al.*, 2018; Onakoya, 2018; Ozigbu, 2018). This study represents a modest effort to close this noticeable gap.

This study investigates the effect of monetary policy on the manufacturing performance of SSA measured by manufacturing value added. It addresses the pertinent research question of whether the manufacturing sector's performance in SSA is significantly influenced by monetary policy. Against, the prevalence of country specific studies, we contribute to the existing literature by extending the study to 24 SSA countries under a dynamic heterogeneous panel framework. Furthermore, the study contributes to on-going debate by establishing empirically that monetary policy has not significantly enhanced manufacturing sector development in SSA through credits to the private sector. What is evident is the sensitivity of value addition to the exchange rate depreciation and lending interest rate, which has been addressed through policy suggestions. We document that comparatively, the exchange rate exerts the strongest effect on manufacturing value added followed by the lending interest rate while credits has the weakest impact. On theoretical grounds, our findings contribute to the literature by lending credence to the predictions of the Keynesian IS-LM model while refuting that of its extended version.

This study has some practical significance for the monetary authorities and manufacturers in the region. It highlights the dangers of the persistent rise in lending interest rates and depreciation of domestic currency exchange rates to the growth of the manufacturing sector in SSA and makes policy recommendations rooted in empirical findings to support the drive to double manufacturing output in line with the 2030 Sustainable Development Goal (SDG) no. 9. The findings of the study will no doubt stimulate future research on the subject matter amongst academia. Following this introductory section are the literature review, methodology, results, discussion, conclusion, implications, limitations and future directions.

LITERATURE REVIEW

Theoretical Underpinnings

-IS-LM Model

The IS-LM model is a Keynesian macroeconomic model developed by Hicks (1937) based on Keynes's (1936) "General Theory of Money, Income and Employment". The model provides the theoretical underpinnings of

this study. The IS-LM theoretical framework, which stands for investment-savings and liquidity preference-money supply shows how the goods market or the real sector, that is IS interacts with the loanable funds or money market which is the LM. In other words, the IS-LM framework as mostly depicted in a graph examines the relationship between output and interest rate. The IS curve unveils the set of interest rates and output in which the goods market is at equilibrium, the LM shows the rates of interest and output levels in which the money market is at equilibrium. The model assumes that equilibrium in the goods and money market is necessary for macroeconomic stability. Assuming less than full employment equilibrium and fixed prices, the IS-LM model demonstrates how the interplay between the money and goods markets impacts both interest rates and output. In this model, the money market determines the interest rate, which then influences the amount of output in the goods market through its influence on investment spending. The transmission mechanism is such that an expansionary monetary policy by the Central Bank first results in a decrease in interest rate in the money market which then reduces the cost of capital and because investment is sensitive to interest rate and a part of aggregate demand, investment spending increases and aggregate demand also increases thereby stimulating a rise in output. On the flip side, a contractionary money supply produces the opposite effect by increasing the cost of capital, reducing interest-sensitive investment and the volume of output.

The choice of the IS-LM model is based on several factors. First, is its appeal to reality, especially, in describing less-than-full employment equilibrium output and providing the framework not only for analyzing fluctuations in economic activity but also for understanding the adjustments that must take place in terms of stabilization policies (monetary and fiscal) for the restoration of full employment equilibrium. The model provides answers to critical questions on what economies operating under less than full employment equilibrium output should do or what should be the policy prescriptions. The long-run conditions of full employment that have been the starting point of the neo-classical is a negation of the real conditions of underdeveloped regions like SSA. Thus, notwithstanding its theoretical slippages and criticisms, the IS-LM model remains relevant to the macroeconomic conditions of SSA where pervasive unemployment, low

capacity utilization, and production levels in the industrial sector hold sway. The second is the model's recognition of the interest rate as a key channel through which monetary policy may be transmitted to the productive sector or real economy. The interest rate typically influences the investment decisions of manufacturers and is considered relevant to the conditions of SSA where financially constrained firms tend to rely more on bank borrowing to finance investments in the face of limited access to the capital market. The third is its flexibility in accommodating the ongoing debates about the self-equilibrating features of contemporary neo-capitalist economic theory and the effectiveness of the International Monetary Fund (IMF)-led short-term economic stabilization interventions.

Based on the IS-LM model, a relationship is assumed to hold among the trio of real money supply, interest rates, and the output of the goods sector which in this case can be said to be the manufacturing or industrial sector. Thus, the IS-LM model can be used to show the effect of monetary policies on the manufacturing sector (Mankiw, 2017; Mishkin, 2022). This study is, however, geared towards a modification of the theoretical conclusion of the model by considering additional monetary indicators. For a more robust examination of the effect of monetary policy on the manufacturing sector performance of the SSA, we consider three monetary policy indicators viz: interest rate, exchange rate, and credit to the private sector. These variables have been selected because they are major channels through which monetary policy tends to influence the performance of the real sector. The addition of the exchange rate variable introduces the external sector dynamics into the model thereby, allowing the determination of the effect of monetary policy on manufacturing sector performance in the context of the open economy or the extended IS-LM model (see Fleming, 1962; Mundell, 1963). Given the conduct of monetary policy under the flexible exchange rate regime by more countries in recent times, the exchange rate channel has become increasingly important. All things being equal, following a monetary expansion, the depreciation of the domestic currency should stimulate output through its trade effects on net exports. Domestic credit to the private sector remains critical to manufacturing processes in SSA as many financially constrained firms depend on it to support working capital requirements and finance long-

term investments. Bernanke and Blinder (1988) and Gertler and Gilchrist (1993), for instance, argue in favor of the existence of the credit channel by making known that the supply of bank credit is just as important as the interest rate in the monetary policy transmission process hence, the need to investigate the impacts of credit availability on the performance of the manufacturing sector (see AFDB, 2017; Getachew, 2019; Junankar 2019; Modugu and Dempere, 2022).

Empirical Review

A robust strand of literature exists on the relationship between monetary policy and manufacturing sector performance for developed and developing countries. However, not much is known about this nexus for SSA which is the focus of this investigation. In this region of our interest, three strands of findings were observed; the monetary policy does not matter for manufacturing sector performance, monetary policy matters, and third is that it does not matter so much.

Kutu and Ngalawa (2016) examined the response of industrial sector output to monetary policy shocks in South Africa. The researchers provide evidence that shows that industrial output growth is not directly affected by exchange rate and interest rate shocks. Sudden changes in the money supply, however, had a positive and significant impact on industrial output growth. In a related study, Adebayo and Harold (2016) adopted the technique of an eight variable Structural Vector Auto Regression (SVAR) model to investigate the effect of monetary policy shocks on industrial output in South Africa using monthly data for the period January 1994 to December 2012 and uncovered that money supply shocks have a positive and significant effect on industrial output growth from about the eight-month.

In yet another study on the South African manufacturing sector, Lesame (2019) revealed that manufacturing firms responded differently to monetary policy changes based on their size. Findings from the study made known that the impact of interest rate changes weighed more heavily on the growth performance of smaller firms. The smaller firms were typically financially constrained with very restricted access to the capital market. The policy implication is that if monetary policy is to yield the desired result of stimulating growth, the balance

sheet health status of small-scale manufacturing firms in the country cannot be ignored by monetary policymakers in decision-making and implementation.

Mlambo (2020) analyzed the effect of variations in some monetary indicators on the manufacturing output in South Africa, Namibia, Lesotho, Eswatini, and Botswana using the Fully Modified Ordinary Least Square (FMOLS) and Pool Mean Group (PMG) models. The study which was based on panel data covered the period from 1996 to 2016. In the study, manufacturing GDP was the dependent variable while exchange rate, interest rate, inflation, import, exports, and foreign direct investments were the explanatory variables. Findings show that manufacturing output had a heterogeneous response to the monetary indicators. While the exchange rate has a negative and statistically significant effect on manufacturing sector output, the reverse is the case with the inflation rate which has a statistically positive effect on manufacturing output. The interest rate on the other hand had a positive but statistically insignificant effect on manufacturing output.

Buabeng *et al*. (2019) employing the Auto Regressive Distributed Lag (ARDL) estimation technique analyzed the effect of monetary policy indicators on manufacturing firms' performance in Ghana from 1990 to 2018 and discovered that the monetary policy rate and the exchange rate had negative and significant effects on manufacturing sector output.

Isola (2016) estimated multiple regression models using the Ordinary Least Square (OLS) technique to examine deindustrialization in Ghana and Nigeria in light of the IMF/World Bank-led monetary policy reforms embarked upon by the two countries from the mid-eighties. The study covered the period from 1990 to 2010. In the estimated models, the share of manufacturing sector employment and output were taken as the dependent variable while interest rate, net export, net foreign investment, real GDP, and exchange rate were independent variables. The monetary policy indicators included in the model i.e., exchange and interest rates were used to test the argument that market reforms in Sub-Saharan Africa have led to increases in the output of the region's manufacturing sector. Based on findings from the study, the researcher documented that the interest and exchange rate liberalization embarked upon has negatively impacted the manufacturing sector in Nigeria while the reverse is the case for Ghana.

Simon-Oke and Aribisala (2010) assessed the nexus between exchange rate deregulation and industrial performance in Nigeria. The results of the study indicate that the exchange rate is a significant determinant of industrial productivity in Nigeria. The study further reveals that interest rate and a period and two periods of lags of industrial productivity influence industrial productivity in Nigeria. The findings of Omotayo and Olusegun (2021) are similar to that of Simon-Oke and Aribisala (2010) but contrary to the findings of Ojeyinka (2019). Omotayo and Olusegun (2011) find that exchange rate and government expenditure have a positive and significant effect on manufacturing productivity in the long-run. However, the findings of Isibor *et al*. (2018) and Tams-Alasia *et al*. (2018) contradict those of other studies that the exchange rate is positive and significant in influencing industrial performance. For instance, Isibor *et al*. (2018) uncovered that the exchange rate has a positive effect on manufacturing and agricultural output. However, its effect on manufacturing output was not significant. Tams-Alasia *et al*. (2018) found that the exchange rate has a positive but insignificant long-run effect on manufacturing industry output.

The study of Ezeaku *et al*. (2018) examined the monetary policy transmission and the industrial sector growth in Nigeria. The result from this study shows that exchange rate, interest rate, and private sector credit hurt real output growth both in the short- and long-run. It was further shown that the degrees of the established effect was higher in the long-run than in the short run. Adedokun *et al*. (2019) also discovered that a period lag of bank credit had an inverse relationship with manufacturing firm output.

Yabu and Kimolo (2020) employed the GARCH model and the Panel Auto Regressive Distributed Lag Models to examine the response of manufacturing exports to exchange rate volatility in the East African countries of Tanzania, Uganda, and Kenya using quarterly data covering the year 2002 to 2018. The study was carried out against the background of the adoption of the IMF/World bank-led monetary and fiscal policy reforms of the early 1990s. They documented a negative short-run effect of exchange rate volatility on export performance implying that the monetary authorities in the region must put in place appropriate stabilization policies to smooth out the volatilities in the exchange rate to achieve positive export performance.

Getachew (2019) examined the link between bank export credit and export earnings in Ethiopia from 2007

to 2017 by employing panel data and the fixed effect model. The inflation rate and the real GDP were adopted as control variables. In the period under review, the results show that export credit had a positive and significant effect on export earnings. The implication is that Ethiopian export earnings can be enhanced significantly by increasing the volume of bank credit directed at local industries to facilitate growth.

Akinlo (2005) inquired into the macro-economic determinants of total factor productivity (TFP) in 34 SSA countries for the period 1980 – 2002 using pooled annual panel data and stepwise regression analysis. The study documented that lending rate and inflation have negative and significant effects on productivity in SSA whereas credit to the private sector, bank liquid liabilities and foreign direct investment (FDI) have significant positive effects on TFP. The findings of the study have some implications for macroeconomic management in SSA. Thus, if SSA desires to see a rise in productivity, the monetary and fiscal policy must be such that will engender sound performance of the region's macroeconomic fundamentals.

In Uganda, Abuka *et al*. (2019) adopted the OLS regression technique and documented the weakness of monetary policy transmission to the real sector through the bank credit channel. The ineffectiveness of the credit channel is attributed to constraints imposed by shallow financial markets. They provide evidence that highlights that the effectiveness with which monetary policy stimuli are transmitted to the real sector depends crucially on banking sector conditions in terms of banks' balance sheets, capital adequacy liquidity, etc. An interesting insight from this finding is that when the banking sector fundamentals are weak, the bank credit channel will also be weak implying that the Central Bank must take steps to strengthen the banking institutions for effective transmission of monetary policy to output and employment.

Due to the conflicting and different perspectives on how monetary policy affects the manufacturing or industrial sectors of SSA nations like South Africa, Nigeria, Ghana, etc., a conclusion on the possible influence of monetary policy cannot be drawn. Consequently, this study will test the following null hypothesis:

H_{01}: Monetary policy does not have any significant effect on manufacturing value added (output) in Sub-Saharan Africa.

METHODOLOGY

Sample and Procedure

The sample for the study comprises 24 SSA countries. The countries include Angola, Botswana, Burundi, Cameroon, Central African Republic, Congo Republic, Cote D'Ivoire, Gabon, Gambia, Ghana, Kenya, Madagascar, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South – Africa, Tanzania, Uganda, and Zambia. The countries have the largest manufacturing sector development potentials in SSA with huge capacity under-utilization. The ultimate list of the 24 SSA countries was also informed by the availability of data. The study employed annual data for the period 1995 to 2000. Data on manufacturing value added (% of GDP) as a proxy for manufacturing sector performance, lending interest rate (%), the official exchange rate (exr) in LCU/US$, domestic credit to the private sector (cps, % of GDP), labor force as a proxy for labor (lab), gross capital formation (% of GDP as proxy for capital, cap), and trade (% of GDP) as proxy for trade openness were sourced from the World Development Indicators WDI database (World Bank, 2021). The definitions of the variables and their proxies are provided in Table 1 (see Appendix-I). The variables are all in ratio or percentages except for *lab* and *exr* which are the logarithmic values of the series.

Model Specification

Adapting the IS – LM theoretical framework and the empirical studies of Saibu and Nwosa (2011), Fasanya *et al*. (2013), and Adedokun *et al*. (2018), the functional empirical model to examine the effect of monetary policy on manufacturing output in SSA is specified below.

$$mva = f(int, exr, cps, cap, lab, top) \quad (1)$$

Expressing equation (1) in econometric form yields:

$$mva_{it} + \delta_0 + \delta_1 int_{it} + \delta_2 exr_{it} + \delta_3 cps_{it} + \delta_4 cap_{it} + \delta_5 lab_{it} + \delta_5 top_{it} + u_{it} \quad (2)$$

Where *mva* is the dependent variable; *int, exr, cps* are independent variables and monetary variables of

interest and *cap, lab* and *top* are the control variables.

$\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_5, \delta_6$ are coefficients of the explanatory variables and *u* is the error term.

A priori $\delta_2, \delta_3, \delta_4, \delta_5, \delta_5, \delta_6 > 0$; $\delta_1 > 0$

The lending interest and exchange rates are at the heart of the Keynesian IS-LM model and its extended version also known as the Mundell-Fleming model. Many studies on the nexus between monetary policy and real sector performance have found succour in employing the lending interest rate and exchange rate in explaining how monetary policy influences output (See Hsing, 2021; Kovachevich, 2021; Kutu and Ngalawa, 2016; Lesame, 2019; Omotayo and Olusegun, 2021; Prihatin and Aisyah, 2022). The credit to the private sector is used in studies by Modugu and Dempere (2022), Brandao-Marques (2020), Getachew (2019), Abuka *et al.* (2019), and Akinleye *et al.* (2019) to examine monetary policy transmission to the real sector. Additionally, Bernanke and Blinder (1988) and Gertler and Gilchrist (1993) have identified the availability of credit as a key monetary factor that could influence the performance of the real economy. Gross capital formation is used as the proxy for capital in several studies (Aastveit *et al.*, 2017; Durante *et al.*, 2022; Topcu *et al.*, 2020). For trade openness (see Anyanwu; 2017; Kelikume and Otonne, 2022) and for manufacturing value-added share of GDP (Mlambo, 2020; Anyanwu, 2017 and Adedokun *et al.*, 2019).

Tables 2, 3 and 4 (see Appendix-II, III, & IV) provide the descriptive statistics of the series, the correlation matrix, and the results of the slope homogeneity test. The descriptive data shows the average value of the variables, the standard deviation, and the Jarque-Bera statistic test for the normality of the distribution. In specific terms, for the mva, int, exr, and cps the recorded mean values are 9.8158, 17.4525, 486.71, and 18.6519, respectively. The variables were not normally distributed and as such further pre-estimation tests were conducted.

From the correlation matrix, we observe weak relationships amongst all the explanatory variables in the above model as none of the variables has a correlation coefficient over 0.41. A careful inspection of the correlation matrix indicates that the regressors used in the model are not only low in correlation but are also

not perfectly correlated with one another. Therefore, we can conclude that there is no multicollinearity problem in the model.

To enable us estimate the panel ARDL model using three dynamic estimators, namely the Mean Group (MG), Pooled Mean Group (PMG), and the Dynamic Fixed Effect (DFE) models, the slope of the panel model must assume heterogeneity. Using the slope homogeneity test of Pesaran and Yamagata (2008), the null hypothesis of homogeneous slope coefficients is rejected for the model at the 1% significance level. This means that the slope coefficient is heterogeneous, thus supporting the choice of the panel ARDL model.

Estimation Technique and Procedure

The Dynamic Heterogeneous Panel Auto Regressive Distributed Lag (ARDL) Model was used to examine whether monetary policy matters for manufacturing sector performance in SSA. The attractions of these models are interestingly diverse. One, the dynamic estimators can uniquely account for heterogeneity among the cross-sections (countries in the study). Two, they can suitably account for the non-stationary property of the series; hence they are also called non-stationary estimators (Salisu *et al.*, 2017). Three, the ARDL framework allows for the simultaneous estimation of both the short- and long-run estimates and can account for the effect of time lag. Four, in addition to being consistent with models with mixed integration orders, it produces an error correction mechanism through which the speed of adjustment to long-run equilibrium is assessed. Five, it can account for structural breaks in data which is quite common in developing countries. Last but not the least, its specification allows for the correction of the problem of endogeneity bias. All these merits make the employed model to be preferred above other commonly applied methods.

The unit root test is first performed to examine the time series properties of the data. The unit root test is also important because the choice of empirical techniques to a very large extent depends on its outcome. In what follows, the panel ARDL model is estimated with three different dynamic heterogeneous estimators, namely the Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effect (DFE). The most optimal among these estimators is finally determined by the Hausman test and adopted for discussion. Following

conventional empirical practice to determine the estimator with the most efficient and reliable estimates, the MG and the PMG models are first compared, under the null hypothesis that the latter is more efficient. The choice between both models is further compared with the DFE model, with the null hypothesis stating that the latter is superior.

RESULTS

The study examined the stationarity properties of the series using the Levin, Lin and Chu (LLC) and Im, Pasaran and Shin (IPS) unit root tests. The results are presented in Table 5 (see Appendix-V).

The major conclusion from both unit root tests is that the series are either integrated of order zero (0) or order one (1), i.e., none of the variables are integrated at the second order. This is consistent with the underlying condition for the application of the Autoregressive Distributed Lag (ARDL) model. The ARDL model is suitable when all the series are either stationary at level, or at the first difference, or have mixed integration orders.

How the valued added by the manufacturing sector responds to monetary policy is empirically unraveled and presented in Table 6 (see Appendix-VI).

Based on the outcomes of the Hausman test, the PMG estimator provided the most optimal results. The PMG estimates were therefore focused on. It is clear from Table 6 that the impacts of the monetary policy indicators on the manufacturing value added are sensitive to time periods. There is no evidence of their significant impacts in the short-run. However, the story is different in the long-run, particularly for interest rate and exchange rate. Interest rate and exchange rate were found to significantly explain the productive performance of the manufacturing sector at the 1% significance level, whereas domestic credit to the private sector remained insignificant in impact still even at 10% level of significance. In specific terms, interest rate and exchange rate have a reducing effect on manufacturing value added. Manufacturing value added falls by 0.6211% and 0.6631% following a 1% rise in interest rate and exchange rate, respectively.

The additional regressors introduced mattered for manufacturing value added only in the long-run. In other

words, they are only found to be significant in the long-run. In this period, capital stock increased manufacturing value added by 0.0637%, whereas labor and trade openness reduced manufacturing value added by 2.7162% and 0.0699%, respectively. Apart from the significance of most of the variables in the long-run, the error correction term further confirmed their long-run relationship having fulfilled the three conditions of statistical significance, negativity, and less than one in absolute value. The error correction term also measures the adjustment speed to long-run equilibrium. Thus, having a coefficient of -0.1733, there is a speed of adjustment to long-run equilibrium of 17.33% annually.

DISCUSSION

The study has shown that the impact of the monetary indicators i.e., interest rate, exchange rate and credit to the private sector on manufacturing value added is only limited to the long-run implying that monetary policy actions do not have any immediate influence on the value addition of the manufacturing sector in the sub-Saharan African countries. In the long-run, an increase in interest rate has statistically significant negative effects on manufacturing value added which means that an increase an interest rate increases the cost of capital which then significantly decreases output through its negative impact on investment. This result is in line with the Keynesian IS-LM model *a priori* expectation which postulates an inverse relationship between interest rate and output. The result suggests that reductions in interest rate can be used to boost the manufacturing sector output while an increase in interest rate discourages growth in output by reducing investment. The finding is in tandem with Mlambo (2020) in respect of the SACU states and Onakoya (2018), Osmond (2016), Enu and Havi (2014), and Rowbotham *et al*. (2014) but contrary to Adedokun *et al*. (2019). Studies like Araujo *et al*. (2021), Buabeng *et al*. (2019), Adedokun *et al*. (2019), Judith and Chijindu (2016) show interest rate as a negative driver of manufacturing value added in developed and developing countries.

Concerning the exchange rate, the negative and statistically significant effect of the exchange rate on manufacturing value added means that as more of the local currency is given up to obtain a unit of foreign currency (depreciation of the domestic currency) the value addition of domestic manufactures reduce. This

finding is contrary to the postulation of the extended version of the IS-LM model otherwise known as the Mundell-Fleming model which predicts that following monetary expansions, the depreciation of domestic currency will enhance the competitiveness of countries export in the international market thereby increasing output. The negative effect of domestic currency depreciation on the value addition of the manufacturing sector can be attributed to the absence of linkages in the domestic economies of the region. Consequently, many SSA countries rely on the import of raw materials and intermediate goods for the production of manufactured goods. Therefore, the domestic manufactures are typically less competitive in the international market leading to a reduction in net exports and output. However, the result aligns with Mlambo (2020) and Isola (2016). The findings support that the exchange rate plays a crucial role in the competitiveness of an economy, especially if such an economy is import-dependent. The sub-Saharan African countries depend on imports for a number of resources (except agricultural commodities mostly) and intermediate goods for production. The depreciation of their domestic currencies causes production cost to rise. Demand falls in the presence of a high inflation with a rebound effect on the outputs of their manufacturing sectors. Comparing the negative and statistically significant coefficients of the interest rate 0.6211% with the exchange rate 0.6631%, it is apparent that the exchange rate exerts the greater effect.

Turning briefly to the credit to the private sector, the results have shown that the variable has no statistically significant effect in the short and long-run which is contrary to *a priori* expectations. The insignificance of the credit to the private sector is contrary to *a priori* expectations and can be attributed to low levels of financial sector development in the SSA region and many developing countries as documented by Modugu and Dampere (2022), Junankar (2019), Abuka *et al*. (2019), Todaro and Smith (2016) and Mishra *et al*. (2012). The low levels of development of the SSA financial sector, for instance, can be gleaned from the low ratios of deposit money bank assets to GDP and inadequate institutional framework to mitigate the risk of lending by financial institutions in the region. From available statistics from the World Bank (2021), credit to the private sector as a share of GDP for SSA has averaged 18.6% in the past twenty six years compared to 141.95%,

160.6 and 43.45% for the OECD and East Asia and MENA regions, respectively (WDI, 2021). Faced with this scenario, it is reasonable to expect that the transmission of monetary policy through the bank credit channel may not have the desired effect on manufacturing sector performance.

Concerning the statistically significant negative impact of labor and trade openness on manufacturing value added the labor force of most of the African countries comprise of unskilled and semi-skilled workers, rather than skilled workers that could meaningfully and positively increase the value additions of the sector. For trade openness, majority of the African countries are import-dependent, and more unfortunately, their export baskets are mainly raw materials or primary commodities.

CONCLUSION

The potency of the monetary policy actions of the central banking authorities to drive macroeconomic fundamentals has been an issue of historical debate. The lack of consensus on the subject matter has induced different theoretical and empirical views on the, particularly bringing to fore prominent schools of thoughts, led by prominent economists to explain the dynamics. Whereas some argue that monetary policies play insignificant role in driving aggregate economic outputs and other important fundamentals, or at best are just conditionally effective, others are of the strong opinion that their role cannot be jettisoned. Rooted upon this hot debate, empirical studies have consistently reviewed the nexus between various monetary policy tools and economic indicators, putting different innovations into consideration. While studies on the developed and emerging economies have mostly occupied empirical space, little is known about how monetary policies affect the performance of the manufacturing sector, especially in sub-Saharan Africa. Yet, monetary policy tools have been the most consistently employed instruments of economic regulation in these countries.

The study provides new insights on the nexus between monetary policy and the output of the manufacturing sector in SSA based on the dynamic heterogeneous panel ARDL framework. The results suggest that the impact of monetary policy on the manufacturing sector value added of the sub-Saharan African countries is time sensitive and quite heterogeneous, as it varies across the monetary policy variables and depends on the

particular time horizon (i.e., the short or long-run). The study finds that the interest rate has a negative and statistically significant effect on manufacturing value added in line with the predictions of the Keynesian IS-LM model at least in the long-run. In the same period, contrary to the extended IS-LM model (Mundell-Fleming model), the exchange rate had a negative and significant impact on manufacturing value added while credit to the private sector did not have any statistically significant impact. However, all monetary variables considered did not have any real impact on manufacturing value added in the short-run. Overall, the exchange rate has the highest impact while credit has the weakest effect. Notwithstanding the relative weakness of credit in stimulating manufacturing output, the established sensitivity of the manufacturing sector's output to exchange and interest rates informs significant policy implications for the monetary authorities of the sub-Saharan African countries.

IMPLICATIONS

Against the background of the lack of consensus on the effect of monetary policy on the performance of the productive sector, and palpable dearth of evidence on the nexus for SSA, this study leaned on the theoretical foundations established by the Keynesian IS-LM model and its extended version to provide insights on the response of the manufacturing output to monetary policy in SSA. The IS-LM model predicts that monetary policy can be used to increase output through reductions in interest rate. On the other hand, the extended version of the model highlights the crucial role domestic currency depreciation plays in stimulating output by enhancing the competitiveness of exports in the international market. This study contributes to the literature by lending credence to the Keynesian IS-LM model. It follows that if SSA is to see a substantial increase in manufacturing output as envisioned by the 2030 SDG goal no. 9, then the monetary authorities in the region must ensure that interest rates are kept to the barest minimum. With this understanding, the monetary policy makers should be careful in adjusting existing interest rate, especially, when motivated to increase it. In fact, majority of the sub-Saharan African countries are still faced with low level of investment, demand, and

employment. Increasing interest rate at will would only worsen the situation rather than producing the desired results for the manufacturing sector. During the periods of economic conditions when interest rate increase is needed, a threshold level beyond which the increase should not exceed should be maintained, or at best, supporting policies should be put in place for possible checks and balances.

Exchange rate is observed to have the strongest influence on the manufacturing value addition in SSA. Being that its impact is negative on manufacturing value added and manufacturing exports, it clearly suggests that depreciation of the domestic currency is inimical to the value addition of the manufacturing sector thereby contradicting theoretical expectations of the extended IS-LM model. Thus, the monetary authorities should ensure that depreciation of domestic currencies is mitigated. One way to ascertain this is by ensuring the diversification of the domestic economy so that import-dependency is substantially reduced.

Again, against few related studies that tend to be country specific, the study contributes empirically to the debate on the link between monetary policy and manufacturing performance by extending the study to cover 24 countries in SSA over a 26 year period from 1995 to 2020.

The study also makes contributions to the literature methodologically by adopting the panel ARDL model, estimated with three dynamic heterogeneous panel estimators namely, Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effect (DFE) so that the short and long-run response of manufacturing value added to monetary policy in the region can be ascertained.

LIMITATIONS AND FUTURE DIRECTIONS

This study investigated the effects of monetary policy on the manufacturing sector's performance in SSA. In extending this study, in the future, researchers should consider a comparative analysis of the effects of monetary policy on the manufacturing performance of countries of the CFA franc and non-CFA franc zones of SSA. Considering their diversity of experience and dearth of empirical evidence in the literature on this nexus, this will help determine if there are significant differences in the impacts of monetary policy of both zones considering the exceptional longevity of the CFA franc zone monetary union of over seven decades, their

common currency and central bank and monetary policy anchored on exchange rate targeting. The study will also test the theoretical conclusions of the extended IS-LM model of monetary policy ineffectiveness under a fixed exchange rate regime that is in place for the CFA franc zone.

Additionally, since economic policies are dynamic in operation such that their effectiveness may depend on several other factors, future studies should also consider determining the threshold levels of monetary policy tools such as the lending and the exchange rates such that their levels that will not be detrimental to manufacturing development will be known. The findings will enrich the literature on the subject matter, provide a sound empirical basis for policy-making, restrain policymakers from unguarded increases in interest rates when motivated to do so, and enhance overall monetary policy effectiveness.

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Appendix-I

Variable	Definition	Measurement	Source
mva_t	Manufacturing value added, expressed as a percentage of GDP	Percent (%)	WDI (2021)
int_t	Lending rate.	Percent (%)	WDI (2021)
exr_t	Official exchange rate	US Dollar	WDI (2021)
cps_t	Credit to private sector, expressed as a percentage of GDP	Percent (%)	WDI (2021)
lab_t	Labor force expressed in natural logarithm	Billions	WDI (2021)
cap_t	Gross capital formation expressed as a percentage of GDP	Percent (%)	WDI (2021)
top_t	Trade openness measured as the sum of imports and export divided by GDP	Percent (%)	WDI (2021)

Source: Authors' presentation

Table 1. Definition of Variables

Appendix-II

	Mean	Max.	Min.	Std. dev.	Skewness	Kurtosis	Jarque-Bera
MVA	9.8158	23.6515	0.0000	4.8033	0.2682	2.9871	7.4852***
INT	17.4525	217.8750	0.0000	17.2342	5.6676	57.1626	79613.99***
EXR	486.7196	3787.7540	0.0000	680.6302	2.3513	9.3985	1639.46***
CPS	18.6519	106.2603	0.0000	18.5177	2.1994	7.9588	1142.419***
CAP	21.2908	79.4011	0.0000	10.3233	0.9194	6.0442	328.8521***
LAB	8277375	62259271	224696	10570604	2.7729	11.9466	2880.715***
TOP	50.5379	187.6568	12.7205	25.1564	1.1416	4.6472	206.0934***
Observations	624	624	624	624	624	624	624

Source: Authors' computation using Stata
Note: *** p-value < 0.001

Table 2. Data Statistics

Appendix-III

Variable	MVA	INT	EXR	CPS	CAP	LAB	TOP
MVA	1.0000	-0.2454	-0.0296	0.3393	0.0918	0.0601	-0.1157
INT	-0.2454	1.0000	0.0677	-0.1648	-0.1625	0.0489	0.1199
EXR	-0.0296	0.0677	1.0000	-0.2600	0.0559	0.0714	-0.3191
CPS	0.3393	-0.1648	-0.2600	1.0000	0.0274	-0.0084	0.2571
CAP	0.0918	-0.1625	0.0559	0.0274	1.0000	0.1057	0.3463
LAB	0.0601	0.0489	0.0714	-0.0084	0.1057	1.0000	-0.2562
TOP	-0.1157	0.1199	-0.3191	0.2571	0.3463	-0.2560	1.0000

Source: Authors' computation using Stata
Note: All correlations are significant at *** p-value < 0.001

Table 3. Correlation Matrix

Appendix-IV

	Model
	MVA
Δ	15.327***
	[0.000]
$\Delta\ adj$	18.494***
	[0.000]

Source: Authors' computation using Stata
Note: Represents significance at *** p-value < 0.001; Values in brackets, "[ ]", are probabilities.

Table 4. Test of homogeneity results

Appendix-V

	LLC		IPS	
	Level	**First difference**	**Level**	**First difference**
MVA	-4.7465***	----------	0.4598	-8.0449***
INT	-1.7331**	----------	-2.7194***	----------
EXR	-2.3174**	----------	-2.1004**	----------
CPS	2.5081	-3.0176***	0.8855	-6.4735***
CAP	1.9973	-10.4713***	0.8953	-10.9206***
LAB	-2.8057***	----------	-1.7503**	----------
TOP	-0.3600	-7.6397***	-1.2040	-10.8865***

Source: Authors' computation using Stata
***, **, * denote the rejection of the null hypothesis of a unit root at *** p-value < 0.001, ** p-value < 0.01, * p-value < 0.05, †p-value < 0.1

Table 5. Panel Unit Root Tests Results

Appendix-VI

	MG	PMG	DFE
Long-Run Estimates			
INT	-4.6338	-0.6211***	-2.0335**
	(5.3384)	(0.1792)	(0.9999)
EXR	1.5180	-0.6631***	-0.3062
	(2.1587)	(0.1833)	(1.1778)
CPS	-0.1707	-0.0287	-0.2514**
	(0.1379)	(0.0283)	(0.1028)
CAP	-0.1799	0.0637*	0.0941
	(0.1228)	(0.0272)	(0.0815)
LAB	-8.1621	-2.7162***	1.1531
	(13.0341)	(0.8356)	(4.0263)
TOP	-0.0806	-0.0699***	-0.0015
	(0.0818)	(0.0102)	(0.0523)
ECT	-0.6750***	-0.1733***	-0.1412***
	(0.0818)	(0.0345)	(0.0208)
Short-Run Estimates			
INT	-1.4194	-0.3131	-0.6440**
	(0.9149)	(0.9758)	(0.2893)
EXR	1.7580*	1.0650	0.1087
	(0.9534)	(0.7760)	(0.3948)
CPS	0.1751*	0.0470	0.0404
	(0.1003)	(0.0431)	(0.0256)
CAP	0.0109	0.0264	0.0103
	(0.0353)	(0.0304)	(0.0159)
LAB	-32.1773	-12.1011	-0.4703
	(24.8179)	(17.1143)	(3.6824)
TOP	-0.0463*	-0.0119	-0.0132
	(0.0243)	(0.0180)	(0.0092)
C	-67.2618	10.4608***	0.2224
	(54.0009)	(2.3455)	(8.2042)
Hausman test			
MG vs. PMG	----------	1.96	----------
		[0.9232]	
PMG vs. DFE	----------	24.11	----------
		[0.0005]	

Source: Authors' computation using Stata

***, **, * denotes the rejection of the null hypothesis of a unit root at *** p-value < 0.001, ** p-value < 0.01, * p-value < 0.05, †p-value < 0.1

Table 6. Panel ARDL Results