Effectiveness of Monetary Policy Transmission Mechanisms on Macroeconomic Objectives

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Abstract

Using a dynamic panel VARDL model with pooled mean group data estimate, this study investigated the impact of monetary policy transmission channels on macroeconomic objectives in selected East African nations. Using annual data from 1992 to 2017, we investigated the dynamic effects of the exchange rate, real interest rate, domestic credit, and wide money supply on the rate of economic growth, the consumer price index (CPI), and the balance of payments. The variables and their connections to the dependent variables were investigated using three models: the panel unit root test, the Pedroni co-integration test, and the pooled mean group estimation. According to the empirical data, the real interest rate, the broad money supply, and the exchange rate all have positive long-term effects on the rate of economic growth in a model of economic growth. The real interest rate and exchange rate have a long-term negative impact on the CPI, whereas domestic credit and the overall money supply have a long-term positive impact. The balance of payments is benefited both immediately and over the long term by exchange rates and domestic credit. Therefore, in order to achieve effective economic growth and a balance of payments for a stable consumer price index, we advise the government to concentrate on these three factors: the price of commodities, the money supply, and the channels of currency devaluation.

Keywords: Macroeconomic objectives, monetary policy transmission mechanism, panel

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Introduction

Macroeconomic policies play a fundamental role in providing and maintaining a sustainable and acceptable economic environment, which makes it possible for an economy to achieve faster, more stable, and sustainable growth. They are important for influencing the direction of economic activity in both developed and developing countries. Through various monetary transmission channels, monetary authorities can use monetary policy to either expand or contract activities in the real economy depending on the desired macro-economic objectives (i.e., economic growth, price stability, exchange rate stability, the balance of payments (BOP) equilibrium, employment, the neutrality of money, equal income distribution, and credit control (Ekpo and Effiong, 2017).

Similarly, Van Hai and Trang (2015) described that monetary policy is considered an important instrument to influence the economy in order to achieve some targets, like price stability. Compared to other macroeconomic policies, the impact of monetary policy appears to be greater on the economy in general and on financial markets in particular. Its effect (through some variables, such as money supply, credit, interest rates, and the exchange rate) is especially evident in the short term. In the monetary authority of a country, the central bank controls the money supply by setting exchange rates and interest rates for the purpose of promoting economic growth and stability, which is the fundamental objective of macroeconomic policy for all countries, both developed and developing ones (Holtrop, 1963; Usman, 2015). Therefore, the achievement is through a monetary policy transmission mechanism.

Different scholars (see Mishkin, 1995; Muric, 2010; Zgambo & Chileshe, 2014; Van Hai & Trang, 2015; ÖZCAN, 2016) have described that the transmission mechanisms of monetary policy include the interest rate channel, the exchange rate channel, asset price effects, and the credit channel. On the other hand, Havi and Enu (2014) and Akhtar (2008) described that macroeconomic objectives are sustained economic growth, price stability, low unemployment, equilibrium in the balance of payments, and sustainable development. And these objectives are achieved by monetary transmission mechanisms (i.e., a change in interest rates, a change in the money supply, and a change in the exchange rate).

There are several studies on the effectiveness of monetary policy on macroeconomic objectives in developed and developing countries, including Ethiopia (including Isedu, 2013; Fiador, 2016; Usman, 2017; Jayaraman & Choong, 2009; Chepkemoi, 2014; Chaitipa et al., 2015). For instance, Fiador (2016) examined the effectiveness of monetary policy and economic performance in three Anglophone West African countries (Gambia, Ghana, and Nigeria) using the bounds testing approach to co-integration and the Autoregressive Distributed Lags (ARDL) between 1975 and 2011. The findings show significant differences in the interest rate pass-through of the three countries studied. The study also assesses the impact of monetary policy on foreign exchange market pressure by focusing on some selected countries in SSA with the Generalized Method of Moments (GMM) model. The study found a negative and significant relationship between monetary policy and exchange market pressure.

Moreover, a study by Usman (2017) examined the growth effects of fiscal and monetary policies in the case of Pakistan by using Johansson and Juselius (1990) approach of co-integration in a VECM setting from 1972 to 2015. The study concluded that monetary policy has a negative response to economic growth in the short run, but in the long run, monetary policy has a positive impact on economic growth. From some monetary policy transmission mechanisms, the findings of the study indicate that money supply has a significant and positive impact on economic growth in the long run but has a negative impact in the short run. Similarly, the exchange rate has a positive impact on economic growth in the long run but negative responses in the short run.

This study differs from the other studies with different characteristics of the monetary transmission mechanism (MTM) in developed countries by focusing on prices (interest rate, exchange rate, and other asset prices) rather than quantities (money, credit, base money, bonds, foreign assets, etc.). In addition, the studies in developing countries focused on quantities (money, credit, base money, bonds, foreign assets, etc.) rather than prices (interest rate, exchange rate, and other asset prices) (Davoodi et al., 2013). This study aims to see the effect of the exchange rate, real interest rate, money supply, and domestic credit on stable economic growth, the consumer price index, and the balance of payments in selected East African countries.

Literature Review

Theoretical Review

In the classical monetary transmission mechanism, a change in the money supply does not affect real variables like output, employment, and income. Money is neutral in its effects on the economy because it serves only as a medium of exchange. This analysis is based on a direct and mechanical relationship between money and prices, i.e., if the quantity of money is raised, the price level will also rise in the same proportion. They believed that, when the monetary authority increases the money supply, liquidity rises along with the people who increase the demand for goods and services. This, in turn, raises the price level. The rise in price level reduces the real wage, which provides an incentive for employers to expand employment and output toward full employment.

In Keynesian structural models, the channels of monetary policy that affect the total product are presented by defining the behaviors of firms and consumers in most sectors of the economy. In structural models, the transmission process of monetary policy is toward total expenditures from the monetary supply. The transmission mechanism in the Keynesian theory is indirect, via the interest rate. The higher the interest rate, the lower the demand for money. This negative relationship between the interest rate and the demand for money provides a link between changes in the money supply and the aggregate variables of the economy. Therefore, in the Keynesian transmission mechanism, changes in the money supply affect aggregate expenditure, output, employment, and income indirectly through changes in the interest rate. That is, an increase in money supply leads to a decrease in interest rates; a decrease in interest rates leads to an increase in investment and income; and also, an increase in income leads to an increase in output and causes full employment. The direct effects of variations in the interest rate on the real economy by means of investment are described in the Keynesian approach, in the frame of IS-LM analysis (ÖZCAN, 2016).

In a monetarist view, demand (expenditure), price, interest rate, and financial and non-financial assets that include money, securities, durable and semi-durable goods, and services are affected by a change in the transmission mechanism, i.e., the money supply. An increase in money supply leads to an increase in cash balance, which forces people to spend on financial and non-financial

assets like shares, bonds, and goods and services and will affect interest rates; an increase in interest rates will discourage investment and reduce output and employment.

The neo-Keynesian monetary transmission mechanism is based on the portfolio adjustment process by considering three effects: the wealth effect, substitution effects, and credit availability effects. Under the wealth effect, the increase in the money supply leads to an increase in output, employment, and income in the economy. While, under the substitution effect, the central bank engages in open market purchases of securities and the holders of those securities sell them to the central bank because they get high prices for them (i.e., they hold more money than they desire). Finally, the effects on credit availability relate to the transmission mechanism following the effects of changes in the interest rate on banks and financial institutions.

The financial market price view stresses the effect on the price of return on financial assets due to changes in monetary policy by including bond prices, interest rates, and exchange rates, and also considers different versions of the financial market view depending on the degree of openness of the economy being studied (Taylor, 2000). As Hildebrand (2006) described, the central bank intervenes in the financial market to achieve macroeconomic objectives such as full employment, maximum sustainable growth, a stable interest rate, or a stable exchange rate. Therefore, monetary policy and financial markets are intrinsically linked in different ways by considering expectations (i.e., directly or indirectly). The direct expectation is about the future evolution of the monetary policy instrument, and the indirect expectation is about the expected effect of monetary policy on the real economy. Similarly, Petursson (2001) described that the first stage of the transmission mechanism is a financial system in which monetary policy actions are primarily manifested by changes in short- and long-term interest rates, asset prices, liquidity, and exchange rates of the domestic currency. According to this study, a change in the central bank's policy rate also changes interbank and Treasury bill rates, asset prices (i.e., equity and housing prices), and the volume of liquidity funds in the economy. The study by Kigabo, Munyankindi, and Amahoro (2008) in Rwanda shows that the effectiveness of monetary transmission mechanisms varies across countries depending on the extent of financial intermediation, the structure of the financial system, and structural economic conditions. The variables that affect conditions in the non-financial sector are lending rates, deposit rates, exchange rates, and asset prices.

Empirical Review

There are many empirical studies conducted on the effectiveness of the monetary policy transmission mechanism on macroeconomic objectives. Given different macroeconomic objectives, this study focuses only on the three important objectives of economic growth, consumer price index, and balance of payments.

Transmission Mechanism and Economic Growth

Monetary policy concentrated on creating a stable macroeconomic environment to support sustainable economic growth (Zgambo & Chileshe, 2014). The two linkages in the transmission mechanism are the increase in real balance, which generates portfolio disequilibrium, and the change in the interest rate, which affects aggregate demand and the level of output in the economy (Begg et al., 1997). According to Usman (2017), monetary policy has a negative response to economic growth in the short run and a positive impact in the long run on economic growth. From some monetary policy transmission mechanisms, the findings of the study indicate that money supply has a significant and positive impact on economic growth in the long run but has a negative impact in the short run.

Sen and Kaya (2015) also carried out an analysis of the relative effectiveness of monetary and fiscal policies on growth and showed that both monetary and fiscal policies are effective in stimulating growth. However, the relative effectiveness of monetary policy is much stronger than that of fiscal policy. Money supply and interest rates have a long-run positive and significant impact on economic growth, while the exchange rate has a negative and significant impact. However, in the short run, there is a significant negative impact of money supply and exchange rate on economic growth, but interest rate has no impact in the short run (Galadima and Ngada, 2017). Similarly, the studies by Chepkemoi (2014) and Chaitipa et al. (2015) conclude that the money supply has a positive impact on economic growth.

Transmission Mechanism and Consumer Price Index

Isedu (2013) defined that the theory of demand for money demonstrates the effect of money supply on the consumer price index (CPI) and partially domestic output. In addition, monetarists view that money supply is an important factor affecting consumers' price level and domestic output in

the short run and price level in the long run. An increase in domestic output is also affected by monetary policy. The monetary policy promotes price stability to increase the welfare of the public (i.e., price stability is an overriding objective of monetary policy).

Transmission Mechanism and Balance of Payment

The balance of payments is a summary statement for recording all transactions of residents of a nation with residents of all other nations to inform the government of its international position and to help formulate monetary, fiscal, and trade policies. The international transaction has two parts, i.e., a credit transaction with a positive sign and a debit transaction with a negative sign. For example, exports of goods and services or capital inflows are entered as a credit while imports of goods and services or capital outflows are entered as debt in the nation's balance of payments (Salvatore, 2012).

According to Keran (1967), exports depend on external factors, while imports depend on the level of growth in domestic income, i.e., an increase in income will lead to an increase in imports, and a decrease in income will lead to a decrease in imports. On the other hand, net capital movements are influenced by both foreign and domestic factors. Isedu (2013) defines that as a monetary authority function, the balance of payment flow is one of the mechanisms by which actual money balances are adjusted to their desired levels, i.e., if the monetary authorities do not generate money through expansionary policy, the disequilibrium of the balance of payment is automatically adjusted. Therefore, excess money demand can be controlled by the sale of domestic goods and services, and excess money supply can be reduced by purchasing foreign goods and services.

Methodology

Model Specification

This study employs the VARDL model with the technique of pooled mean group of Pesaran and Smith (1995). The VARDL (p, q, q… q) model within a given data on time periods, $t = 1, 2 \dots T$ and groups, $i = 1, 2 \dots N$ is given as;

$$y_{it} = \sum_{j=1}^{p} \lambda_{it} \, y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \, X_{i,t-j} + \mu_i + \varepsilon_{it}$$

There are three dependent variables with three models (i.e., GDPGR, CPI, and BOP). Thus models are:

Model 1. GDP model

$$GDPGR_{it} = f(GDPGR_{i,t-j}, RIR_{i,t-j}, ER_{i,t-j}, DC_{i,t-j}, M2_{i,t-j});$$

$$GDPGR_{it} = \sum_{j=1}^{p} \beta_{it} \, GDPGR_{i,t-j} + \sum_{j=0}^{q} (\delta_{ij} \, RIR_{i,t-j} + \gamma_{ij} ER_{i,t-j} + \sigma_{ij} DC_{i,t-j} + \theta_{ij} M2_{i,t-j}) + \mu_i + \varepsilon_{it}$$

Model 2: CPI model

$$CPI_{it} = f(CPI_{it-j}, RIR_{i,t-j}, ER_{i,t-j}, DC_{i,t-j}, M2_{i,t-j});$$

$$CPI_{it} = \sum_{j=1}^{p} \beta_{it} \, CPI_{i,t-j} + \sum_{j=0}^{q} (\delta_{ij} \, RIR_{i,t-j} + \gamma_{ij} ER_{i,t-j} + \sigma_{ij} DC_{i,t-j} + \theta_{ij} M2_{i,t-j}) + \mu_i + \varepsilon_{it}$$

Model 3: BOP model

$$BOP_{it} = f(BOP_{it-j}, RIR_{i,t-j}, ER_{i,t-j}, DC_{i,t-j}, M2_{i,t-j});$$

$$BOP_{it} = \sum_{j=1}^{p} \beta_{it} \, BOP_{i,t-j} + \sum_{j=0}^{q} (\delta_{ij} \, RIR_{i,t-j} + \gamma_{ij} ER_{i,t-j} + \sigma_{ij} DC_{i,t-j} + \theta_{ij} M2_{i,t-j}) + \mu_i + \varepsilon_{it}$$

Whereas GDPGR = Growth domestic product growth rate

            CPI = Consumer price index   *ER= Exchange rate*

            BOP =Balance of payment   *DC= Domestic credit*

            RIR= Real interest Rate   *M_2= Broad money supply*

Source of Data

The data sources for the variables (i.e., real interest rate, exchange rate, money supply (broad money supply), and domestic credit) and three macroeconomic objective variables (i.e., economic

growth rate, consumer price index, and balance of payment study) are from the world development indicator. The data set stretches from the year 1992 to 2017 for selected east African countries (i.e., Ethiopia, Kenya, Tanzania, Uganda, Burundi, Rwanda, Madagascar, Zambia, and Seychelles).

Method of Analysis

Many studies on the effectiveness of monetary policy transmission mechanisms on macroeconomic objectives, especially stable economic growth, the consumer price index, and the balance of payments, were analyzed using dynamic approaches of panel data by employing a vector autoregressive distributed lag (VARDL) model with a technique called pooled mean grouping (PMG). Panel data is a statistical tool to perform a model using a number of individuals across a defined period. There are two types of panel data, i.e., static panel and dynamic panel.

Given this, we employed the dynamic panel methodology to estimate our model because it addresses the heterogeneity of individuals and uses several instrumental variables to deal with the endogeneity of the variables that are known as lag variables. In the model, two conditions are required (i.e., a number of observations n and a period of time t). To have adequate degrees of freedom and to avoid over-identification, it is advisable to use a large number of individuals in a short time. This is used more frequently in studies at the firm level because databases usually have a large number of observations in a short period of time. However, for countries, regions, sectors, etc., the database is frequently small for a long time, and some serious difficulties arise, i.e., the proliferation of instruments (existence of a higher level of instruments) and serial autocorrelation of errors. The proliferation of instruments will cause over-identification in the model because of the generation of instrumental variables in differences and levels (Labra & Torrecilla, 2018).

For dynamic panel data with a long period of time and a small number of observations, two procedures are commonly used. The first one is called the Mean Group (MG) estimator, which can estimate separate equations for each group and examine the distribution of the estimated coefficients across groups. According to Pesaran and Smith (1999), this estimator provides consistent estimates of the parameters' averages. It also provides efficient long-run estimators for a large sample size. It allows the parameters to be freely independent across groups and does not consider potential homogeneity between groups. The second one is called the Pooled Mean Group

(PMG) estimator, which considers intercepts, short-run coefficients, and error variances to differ freely across groups but constrains the long-run coefficient to be the same. That means PMG is an intermediate estimator that allows the short-term parameters to differ between groups while imposing equality of the long-term coefficients between countries. One advantage of the PMG is that it can allow the short-run dynamic specification to differ from country to country while constraining the long-run coefficients to be the same (Pesaran, Shin, & Smith, 1999).

Therefore, PMG estimations are more relevant for this analysis to detect the long- and short-run association between financial development and economic growth and investigate the possibly heterogeneous dynamic issue across countries by using the appropriate methods of vector autoregressive distributed lag (VARDL) in dynamic panel models. For the validity, consistency, and efficiency of this methodology, the assumptions of the pooled mean group, i.e., the existence of a long-run relationship among variables (a negative coefficient of error correction), the serial uncorrelated error-correction model, and the explanatory variables that can be treated as exogenous, are important. These conditions are fulfilled by including the VARDL lags for the dependent and independent variables in the error correction form (Rafindadi & Yusof, 2013; Lee & Wang, 2015). The maximum lag length of the study is VARDL (4, 3, 3, 3, 3). However, the study uses the base model between the above different variables as VARDL (1, 1, 1, 1, 1) by using the natural logarithm function for smoothing the coefficients of the regression and to simplify the model equation:

$$
\begin{aligned}
lnGDPGR_{it} = {}& \beta_i lnGDPGR_{it-1} + \delta_{1i} lnRIR_{it} + \delta_{2i} lnRIR_{it-1} + \gamma_{1i} lnER_{it} \\
& + \gamma_{2i} lnER_{it-1} + \sigma_{1i} lnDC_{it} + \sigma_{2i} lnDC_{it-1} + \theta_{1i} lnM2_{it} + \theta_{2i} lnM2_{it-1} \\
& + \mu_i + \varepsilon_{it}
\end{aligned}
$$

$$
\begin{aligned}
lnCPI_{it} = {}& \beta_i lnCPI_{it-1} + \delta_{1i} lnRIR_{it} + \delta_{2i} lnRIR_{it-1} + \gamma_{1i} lnER_{it} + \gamma_{2i} lnER_{it-1} \\
& + \sigma_{1i} lnDC_{it} + \sigma_{2i} lnDC_{it-1} + \theta_{1i} lnM2_{it} + \theta_{2i} lnM2_{it-1} + \mu_i + \varepsilon_{it}
\end{aligned}
$$

$$
\begin{aligned}
lnBOP_{it} = {}& \beta_i lnBOP_{it-1} + \delta_{1i} lnRIR_{it} + \delta_{2i} lnRIR_{it-1} + \gamma_{1i} lnER_{it} + \gamma_{2i} lnER_{it-1} \\
& + \sigma_{1i} lnDC_{it} + \sigma_{2i} lnDC_{it-1} + \theta_{1i} lnM2_{it} + \theta_{2i} lnM2_{it-1} + \mu_i + \varepsilon_{it}
\end{aligned}
$$

The short-run model or error correction equations between variables are as follows:

$$
\begin{aligned}
\Delta lnGDPGR_{it} = {}& \emptyset(lnGDPGR_{it-1} - \partial_{1i} lnRIR_{it} - \tau_{1i} lnER_{it} - \alpha_{1i} lnDC_{it} - \omega_{1i} lnM2_{it}) \\
& - \delta_{1i} \Delta lnRIR_{it} - \gamma_{1i} \Delta lnER_{it} - \sigma_{1i} \Delta lnDC_{it} - \theta_{1i} \Delta lnM2_{it} + \varepsilon_{it}
\end{aligned}
$$

$$\Delta lnCPI_{it} = \emptyset(lnCPI_{it-1} - \partial_{1i}lnRIR_{it} - \tau_{1i}lnER_{it} - \alpha_{1i}lnDC_{it} - \omega_{1i}lnM2_{it}) - \delta_{1i}\Delta lnRIR_{it}$$
$$- \gamma_{1i}\Delta lnER_{it} - \sigma_{1i}\Delta lnDC_{it} - \theta_{1i}\Delta lnM2_{it} + \varepsilon_{it}$$

$$\Delta lnBOP_{it} = \emptyset(lnBOP_{it-1} - \partial_{1i}lnRIR_{it} - \tau_{1i}lnER_{it} - \alpha_{1i}lnDC_{it} - \omega_{1i}lnM2_{it}) - \delta_{1i}\Delta lnRIR_{it}$$
$$- \gamma_{1i}\Delta lnER_{it} - \sigma_{1i}\Delta lnDC_{it} - \theta_{1i}\Delta lnM2_{it} + \varepsilon_{it}$$

Results and Discussion

Overview of Monetary Policy Transmission Mechanism

In this section, we focused on an overview of central bank monetary policy and trends in the monetary transmission mechanism of selected east African countries. There are different channels that affect different variables and different markets by determining the most effective set of policy instruments that central banks face in making their decisions to achieve the goals of macroeconomic management (i.e., sustainable growth, full employment, price stability, and a healthy balance of payments).

As described under the NBE's Monetary Policy Framework (2009), the monetary policy strategy of the central bank of Ethiopia depends on a number of factors that are unique and contextual to the country. The degree of openness of the economy, i.e., the dominant role of the external sector with three main targets (i.e., the ultimate or final target, the intermediate target, and the operating target), is more important. The principal objective of the final targets of monetary policy of the National Bank of Ethiopia is to maintain price and exchange rate stability and support the sustainable economic growth of Ethiopia by considering exchange rate stability as the principal policy objective for monetary policy to affect both foreign reserve position and domestic money supply.

Kenya's central bank's (CBK) monetary policy is designed to support growth in the production of goods and services to achieve and maintain a low and stable rate of inflation. Therefore, the Central Bank of Kenya (CBK) has the responsibility of formulating and implementing monetary policy for achieving and maintaining price stability (Annual Report of the CBK, 2016/17). The reason is that monetary policy is quicker at resolving economic shocks by addressing multiple monetary targets, i.e., price stability, promotion of growth, achieving full employment, smoothing the

business cycle, preventing financial crises, stabilizing long-term interest rates, and the real exchange rate.

The National Bank of Rwanda (BNR) is an independent central bank with the missions of ensuring and maintaining price stability, achieving and maintaining exchange stability, enhancing and maintaining a stable and competitive financial system without any exclusion, and supporting the government's general economic policies (BNR Law 55/2007, Article 5). Understanding monetary policy transmission mechanisms is critical for the BNR in order to design, manage, and implement its monetary policy. Therefore, the National Bank of Rwanda is operating its monetary policy under a monetary targeting regime by using the broad monetary aggregate (M3) as an intermediate target and reserve money as an operating target to achieve the objective of price stability (Nkikabahizi, 2013).

The Bank of Zambia maintains macroeconomic stability and continues to implement prudent monetary policies to support and promote economic growth with low and stable inflation and a lower interest rate to encourage households and businesses to borrow for investment purposes (Monetary Policy Statement of Zambia, 2016). Banks study the monetary policy transmission mechanism from time to time to update the available evidence. The evidence from different studies suggests that the money, interest rate, exchange rate, and credit channels were operational during varied study periods with various strengths (Kamaan & Nyamongo, 2014).

Trends of Transmission mechanism

The data analyzed selected transmission mechanisms (exchange rate, real interest rate, domestic credit, and broad money supply) for selected east African countries (Ethiopia, Kenya, Tanzania, Uganda, Burundi, Rwanda, Madagascar, Zambia, and the Seychelles). The exchange rate channel is one of the primary transmission channels of monetary policy in open economies, especially those with flexible exchange rate regimes. Currency depreciation affects the growth of exports and gross domestic product. Therefore, in countries that are open and have flexible exchange rates, the exchange rate channel can be a powerful transmission mechanism for monetary policy. Different countries' central banks reported that the exchange rate channel is among the more important transmission mechanisms for monetary policy (Mohanty, M. S. 2014).

Figure 1

Trends of Exchange Rate with Local Currency Per USD
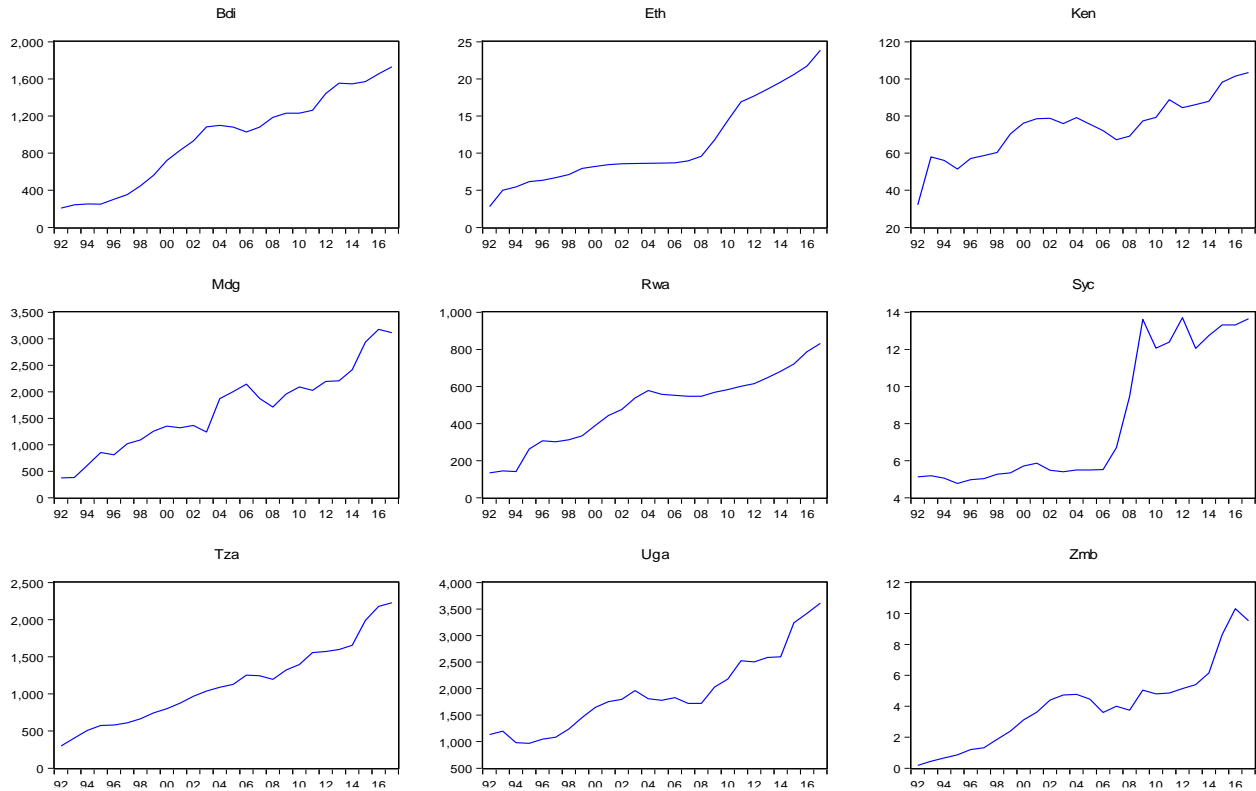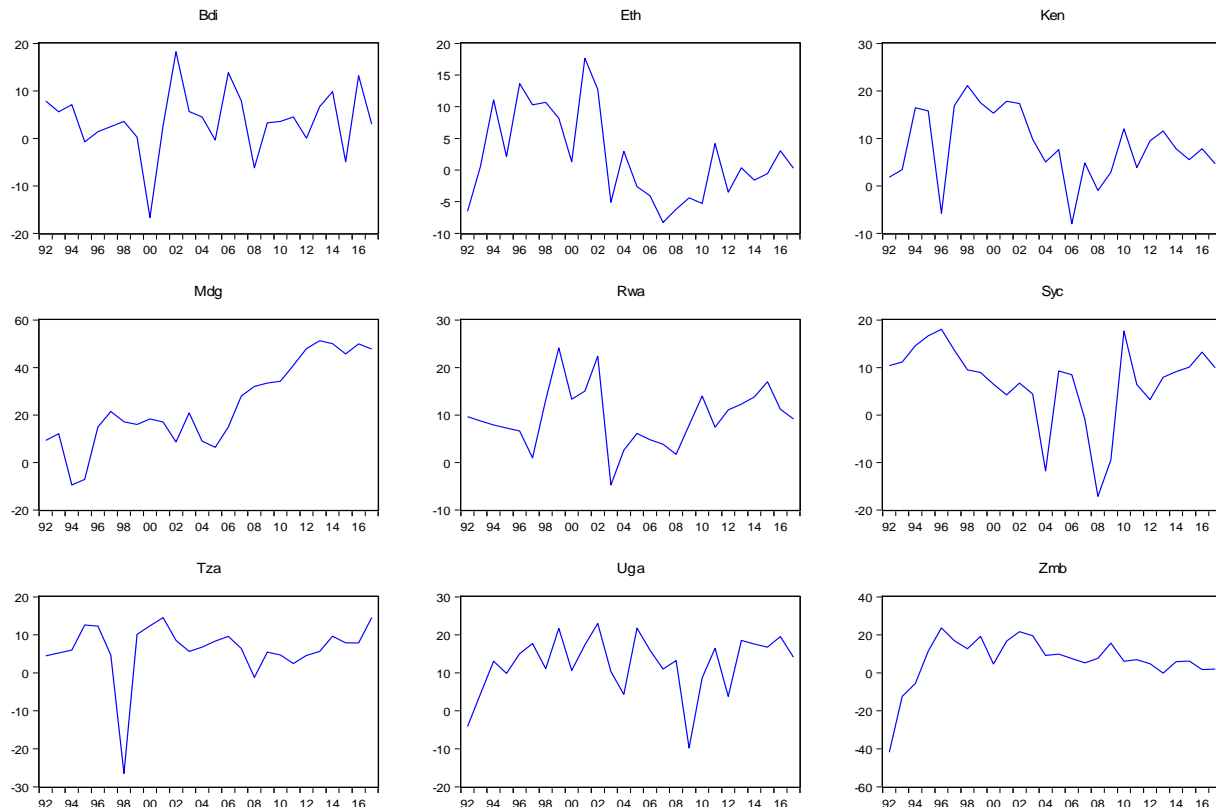

Source: EViews Result based on data

As shown in figure 1 above, the exchange rate of Ethiopia has continuously increased from year to year at a different rate. While the exchange rate of Uganda is higher, the exchange rate of Zambia is lower than the selected East African countries in the period from 1992 to 2017. The exchange rate of Madagascar is higher than the exchange rates of the selected East African countries next to Uganda, and the exchange rate of Kenya fluctuates from year to year.

As shown in the graph below, trends in the east African real interest rate have fluctuated. This fluctuation is due to the variation of inflation from year to year because the real interest rate, which is the difference between the nominal interest rate and inflation, is almost stable, and its impact on the variation of the real interest rate is not that significant. Variation in inflation is due to the change in money supply because the main cause of inflation is money supply in the economies.

Aslam, M., and Awan,G.A. (2018) described that the money supply does not directly affect economic growth, but it indirectly affects it through inflation in the economy.

Figure 2

*Trends of Real Interest Rate*

Source: EViews Result based on data

From graph 4.3 below, the broad money supply in Kenya and Madagascar is highly oscillating compared to the others. Tanzania's broad money supply increases continuously from year to year with a minimum value, and the broad money supply for Seychelles is higher than the other selected east African countries in the period from 1992 to 2017.

Figure 3

Trends of Broad Money Supply
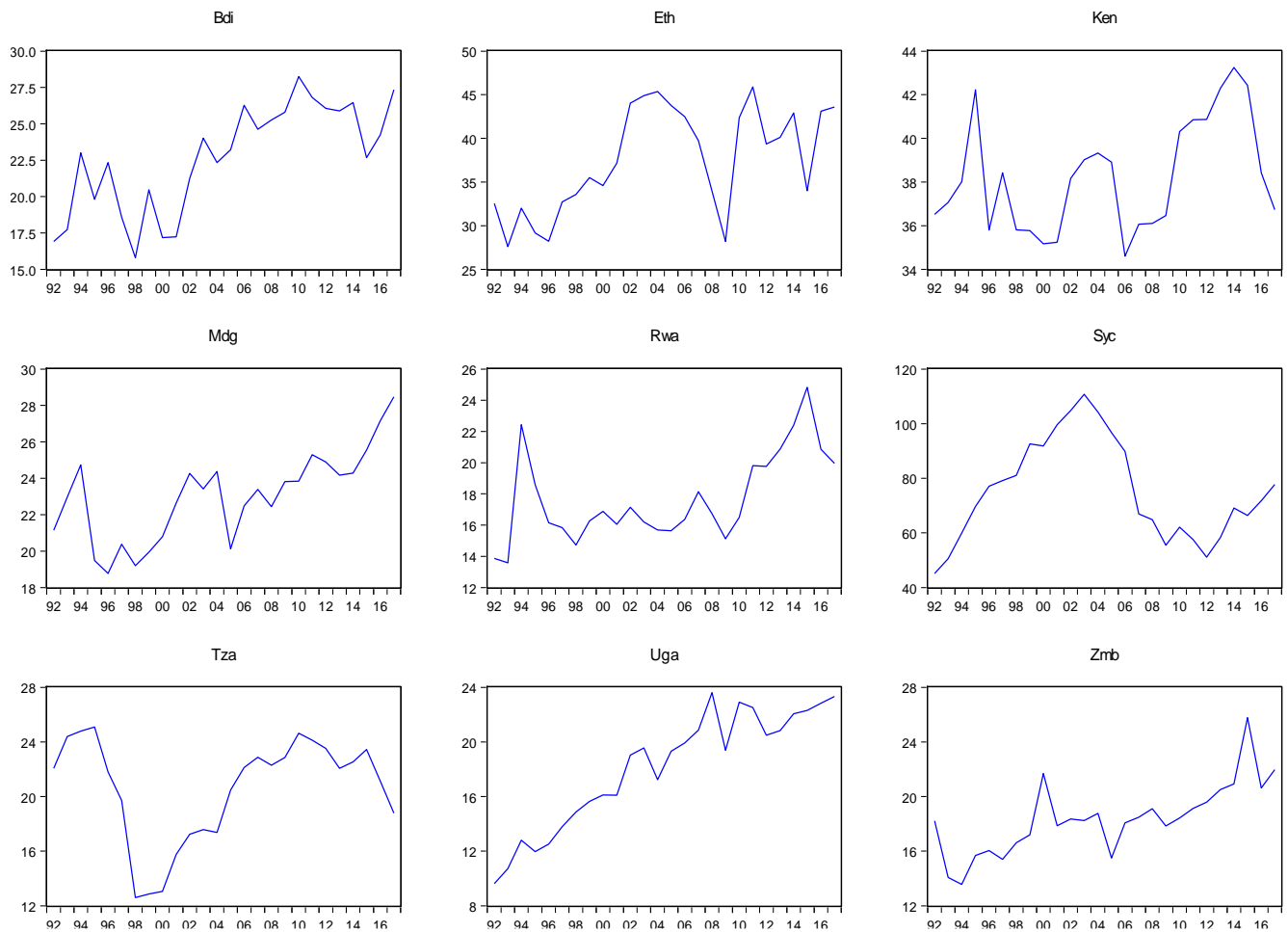
Source: EViews Result based on data

Econometric Analysis

Unit root tests

Despite the existence of multiple unit root tests, for this study, the Lm, Pesaran, and Shin (IPS) test is employed. Because IPS tests are less restrictive and more powerful, they allow for heterogeneity both in intercept and slope terms for the cross-section units and solve the serial correlation problem (Eggoh, Bangake, & Rault, 2011).

Table 1

Panel Unit Root Test Lm, Pesaran and Shin (IPS) with p-value in Parentheses

Variables	At A level		At First Difference	
	Intercept	Intercept &Trend	Intercept	Intercept & Trend
Ln(GDPGR)	-7.43613***	-5.66632***	-14.7742***	-13.7826***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Ln(BOP)	-0.05136	-0.52093	-6.1457***	4.16526***
	(0.4795)	(0.3012)	(0.0000)	(0.0000)
Ln(CPI)	-5.79714***	-3.62606***	-15.6378***	-14.9328***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Ln(ER)	-2.06227**	-5.17311***	9.91948***	-8.47456***
	(0.0196)	(0.0000)	(0.0000)	(0.0000)
Ln(RIR)	-15.7466***	-15.3728***	-15.4300***	-13.6889***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Ln(DC)	-1.98038**	-1.05356	-10.622***	-7.59452***
	(0.0238)	(0.146)	(0.0000)	(0.0000)
Ln(M2)	-1.67589**	-3.61808***	-12.5299***	-10.8431***
	(0.0469)	(0.0001)	(0.0000)	(0.0000)

Note: ***denotes significance at the 1% level and **denotes significance at the 5% level.
Source: *Own computation based on data*

From the table, we see that the economic growth rate, consumer price index, and real interest rate are stationary at a level with a 1% level of significance. The exchange rate, domestic credit, and broad money supply are stationary at a level with a 5 percent level of significance. The balance of payments is not stationary at a level but stationary at the first difference with a 1% level of significance. However, all variables are stationary after first differencing in both intercept and intercept plus time trend form. This shows that the null hypothesis of the unit root test is rejected.

Pooled Mean Group Estimation

The pooled mean group is considered an intermediate estimator for this paper because it involves both the pooling implied by the homogeneity restriction and averaging across groups used to obtain

means of the estimated error correction coefficients and allows us to estimate the common long-run coefficient.

Table 2

Pooled mean group result with VARDL (1, 1, 1, 1, 1) corresponding with Growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
LNER	0.042509	0.003874	10.97277	0.0000
LNRIR	0.044121	0.014997	2.941922	0.0037
LNDC	-0.043388	0.006055	-7.166076	0.0000
LNM2	0.029566	0.013174	2.244288	0.0261
Short Run Equation				
COINTEQ01	-0.876315	0.098335	-8.911559	0.0000
D(LNER)	-0.087568	0.055523	-1.577162	0.1166
D(LNRIR)	0.079298	0.036766	2.156857	0.0324
D(LNDC)	-0.132908	0.055736	-2.384583	0.0182
D(LNM2)	-0.559904	0.507761	-1.102692	0.2717
C	3.216769	0.351646	9.147748	0.0000
Mean dependent var	0.003157	S.D. dependent var		0.401850
S.E. of regression	0.196771	Akaike info criterion		-2.342311
Sum squared resid.	6.814536	Schwarz criterion		-1.485864
Log likelihood	332.0504	Hannan-Quinn criter.		-1.996992

*Note: p-values and any subsequent tests do not account for model selection.

Source: Eviews Result based on data

The result in the above table shows that all variables are statistically significant at the 1 percent and 5 percent levels of significance in the long run. Variables except domestic credit have a positive relationship with the economic growth rate in the long run. However, in the short run, only the real interest rate and domestic credit have a significant positive and negative impact, respectively. The table also shows that the error correction coefficient, or convergence coefficient, is statistically significant at the 1 percent level of significance. For the IM, Pesaran, and Shin tests, the average adjustment coefficient seems to be less than zero and greater than -0.5. Moreover, the

speed of adjustment is negative, as expected, with a magnitude of -0.876. This implies that the previous period's disequilibrium returns to its equilibrium in less than two periods. The fact that the error correction term (convergence coefficient) is statistically significant provides further evidence of the existence of a long-run relationship. One advantage of the PMG is that it can allow the short-run dynamic specification to differ from country to country.

Table 3
Pooled mean group result with VARDL (1, 1, 1, 1, 1) corresponding with lnCPI

`	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
LNER	-0.447644	0.044686	-10.01762	0.0000
LNRIR	-0.452840	0.156502	-2.893510	0.0043
LNDC	0.123941	0.063358	1.956220	0.0520
LNM2	0.942304	0.149555	6.300739	0.0000
	Short Run Equation			
COINTEQ01	-0.729127	0.092676	-7.867514	0.0000
D(LNER)	0.793483	0.583049	1.360920	0.1753
D(LNRIR)	-0.693554	0.404173	-1.715982	0.0879
D(LNDC)	-0.101743	0.269290	-0.377817	0.7060
D(LNM2)	-0.856905	0.214555	-3.993878	0.0001
C	2.520586	0.587935	4.287187	0.0000
Mean dependent var	-0.016024	S.D. dependent var		0.915400
S.E. of regression	0.656500	Akaike info criterion		0.641036
Sum squared resid	75.85465	Schwarz criterion		1.497483
Log-likelihood	-17.00119	Hannan-Quinn criteria.		0.986355

*Note: p-values and any subsequent tests do not account for model selection.

Source: EViews Result based on data

Exchange rate and real interest rate have a negative long-run relationship with the consumer price index, and they are statistically significant at the 1 percent level of significance, while domestic credit and broad money supply have a positive long-run relationship with the consumer price index and are statistically significant at the 10 percent and 1 percent levels of significance, respectively,

in the long run. The consumer price index will increase by 12.4 percent and 94.2 percent due to a one percent increase in domestic credit and a one percent increase in broad money supply, respectively. The table also shows that the error correction coefficient, or convergence coefficient, is statistically significant at the 1 percent level of significance. The estimated coefficient value is -0.73. Since the error correction term is negative and highly significant, this implies that the results support the existence of a stable long-run relationship between the variables.

Table 4

Pooled mean group result with VARDL (1, 1, 1, 1, 1) corresponding with ln(BOP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
LNER	0.121474	0.035679	3.404667	0.0008
LNRIR	-0.007662	0.072301	-0.105974	0.9157
LNDC	0.344627	0.055733	6.183530	0.0000
LNM2	-0.673419	0.142781	-4.716448	0.0000
Short Run Equation				
COINTEQ01	-0.241898	0.106372	-2.274079	0.0242
D(LNER)	0.614406	0.538368	1.141238	0.2553
D(LNRIR)	-0.319899	0.329729	-0.970189	0.3333
D(LNDC)	0.970157	1.044413	0.928902	0.3542
D(LNM2)	-1.096540	1.067290	-1.027406	0.3056
C	5.487421	2.396290	2.289966	0.0232
Mean dependent var	-0.011967	S.D. dependent var		1.998035
S.E. of regression	1.572744	Akaike info criterion		-2.120596
Sum squared resid	435.3403	Schwarz criterion		-1.264149
Log-likelihood	306.1098	Hannan-Quinn criteria.		-1.775277

*Note: p-values and any subsequent tests do not account for model selection

Source: EViews Result based on data

All variables except the real interest rate are significant at the 1 percent level of significance. From the significant variables, exchange rate and domestic credit have a positive effect on the balance of payments, whereas the broad money supply has a negative effect. The negative effect of a real interest rate increase is very small; a one percent increase in the real interest rate will lead to a 0.76

percent decrease in the balance of payments. However, the effect of domestic credit and broad money supply on the balance of payments is higher, i.e., a one percent increase in domestic credit will lead to a 34.5 percent increase in the balance of payments, whereas a one percent increase in broad money supply will lead to a 67.3 percent decrease in the balance of payments.

Summary and Recommendations

This study analyzed the effectiveness of monetary policy transmission mechanisms on macroeconomic objectives in selected East African countries: Burundi, Ethiopia, Kenya, Madagascar, Rwanda, the Seychelles, Tanzania, Uganda, and Zambia, using a dynamic panel VARDL model with the pooled mean group estimation method. The empirical findings of this study show that the exchange rate, real interest rate, and broad money supply have a positive and significant long-run impact, while domestic credit has a negative and significant impact in the short-run and long-run for economic growth. In addition, exchange rate and broad money supply have no significant impact on economic growth in the short run, but the real interest rate has a positive and significant impact in the short run. Similarly, the empirical result for model two shows that exchange rate and real interest rate have a significant and negative long-run impact, whereas domestic credit and broad money supply have a significant and positive long-run impact on the consumer price index.

The short-run analysis suggests that the real interest rate, domestic credit, and broad money supply have a negative short-run impact on the consumer price index, while the exchange rate has a positive but insignificant short-run impact. For the third model, exchange rate and domestic credit have a positive but insignificant short-run and significant long-run impact on the balance of payments. However, the real interest rate and broad money supply have negative short- and long-run impacts, with the real interest rate having an insignificant impact both in the short- and long-run, meaning that even if the real interest rate increases, there would be no significant effects on the balance of payments.

When we see the short-run effect for each individual selected East African country, the exchange rate has not had a very significant impact on the economic growth rate in Burundi, Rwanda, and Tanzania. However, it has a negative and significant impact on the economic growth rate for selected East African countries, except for Ethiopia and Uganda. The real interest rate has no

significant impact on the economic growth rate in Madagascar and Rwanda but has a positive and significant impact on the economic growth rate in most selected EAC countries except Kenya and Tanzania, where it has a negative impact. In addition, domestic credit and broad money supply have a negative and significant impact on economic growth rates in most selected East African countries but have no significant impact on the economic growth rates of Rwanda and Kenya, respectively.

Similarly, the effect of these independent variables (ER, RIR, DC, and M2) on the consumer index is also not significant for most individual countries. In addition, all independent variables have no significant overall impact on the balance of payments in the short run. As individual variables, all independent variables have no significant impact on the balance of payments in Ethiopia and Kenya, but they have a statistically significant impact on the balance of payments in Burundi. The broad money supply has a positive and significant impact on the balance of payments in Madagascar and Rwanda, whereas the exchange rate has a negative and significant impact in Madagascar, Rwanda, and the Seychelles. Similarly, domestic credit has a significant and negative impact on the balance of payments in all individual countries except for Burundi, Ethiopia, and Kenya.

Macroeconomic objectives require stability, which can be ensured through monetary and fiscal coordination in order to ensure proper management of the macroeconomic dynamics of interest and exchange rates, inflation, and output. For this study, we have considered the use of monetary policy to manipulate macroeconomic objectives. For example, as part of its mandate for price stability, the government should use an effective monetary policy to reduce the rate of inflation through a contractionary monetary policy. Given the findings of this study, we suggest the government should consider the real interest rate, the exchange rate, and the broad money supply in its future plan to manipulate economic growth by encouraging the expansion of monetary policy and by discouraging a higher flow of financial credit. The monetary authority should also develop a strategy to reintroduce underground money into the economy. Focusing on the money supply is also important for controlling inflation in the short term. Because it is affected negatively by the exchange rate and real interest rate in the long run.

The monetary policy of each country is determined by its central bank. Changes in the real interest rates induce economic agents to change their investment and consumption expenditure, thereby changing economic activity. For example, in Ethiopia, to have sustainable and improved economic growth, there is a need to encourage exchange rate sustainability and expansionary monetary policy. Because the principal objective of the final targets of monetary policy of the National Bank of Ethiopia is to maintain price and exchange rate stability, it is appropriate to consider exchange rate stability as the principal policy objective for monetary policy to affect both foreign reserve positions and domestic money supply. Kenya's government encourages growth by maintaining a low and stable rate of inflation. Therefore, the Central Bank of Kenya (CBK) has the responsibility of formulating and implementing monetary policy for achieving and maintaining price stability (Annual Report of the CBK, 2016/17).

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