

Money, Inflation and Output: Understanding the cornerstones of a monetary union in East Africa Community

Dr. Scholastica Achieng Odhiambo, PhD (Economics)

Lecturer of Economics, Department of Economics,
Maseno University, Kenya

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Abstract

The advent of the East Africa Monetary Union in the East Africa Community region is bound to bring about significant change in monetary policy management in terms of money growth strategies, inflation and output growth overtime. The monetary policy will depend mainly on the objective of the umbrella regional monetary authority credibility in terms of managing inflation-output trade-off as result of monetary policy. The objectives of study are measuring the determinants of inflation, measuring output-inflation trade-off, monetary policy reaction function and money demand in EAC. The study used panel data for the period 1990-2010 covering 5 countries of the EAC. Static and dynamic panel data estimation methods were employed, namely: fixed effect model, Arellano-Bond dynamic panel model and systemic dynamic panel model by Arellano-Bover Model/Blundell-Bond. The result indicate that foreign price increases inflation while growth in GDP and M2 reduces inflation. The previous year inflation also contributed to subsequent year inflation. There exist output-inflation tradeoff and expected inflation tend to affect the existing inflation in EAC. Evidently, current inflation also had a positive influence on funds rates in the monetary policy reaction function. For money demand, previous year real money balance increase money demand in the current period while, fund rates had a marginal influence. In conclusion money, inflation and output interaction are pertinent to future stability of EAMU in the region.

Keywords: Inflation, monetary union, economics

1. Back ground

Economic integration in terms of trade, capital markets and more so money markets is global trend which has grown significantly in a recent past. The drive has been fuelled by increase need for global competitiveness and

new economic growth strategies. East Africa Community (EAC) countries (Kenya, Uganda, Tanzania, Rwanda and Burundi) have not been left behind. The Article 5 of the EAC Treaty states that the partner States shall undertake to establish among themselves a Custom Union , a Common market , a Monetary Union and ultimately a Political Federation (ECB, 2010). The formation of EAC in 1999 has progressed to implementation of various agreements which includes East Africa Custom Union (2005) and East Africa Common Markets (2010). The East Africa Monetary Union (EAMU) is the next level of agreement which is to be implemented by the member countries. Article 82 of the EAC Treaty called for cooperation in monetary and financial matters and maintenance of currencies convertibility as a benchmark for the establishment of a Monetary Union (ECB, 2010). EAMU is the final pathway to the formation of Political Federation of the East African States (EAC Online, 2012).

Economists have set prerequisite for a monetary union to be viable. These include: a) a sufficient degree of convergence¹⁶ of the EAC economies proposing to form the monetary union; b) sufficient economic and financial integration to capacitate benefits of lower transaction costs and exchange rate risk from the advent of a monetary union. For EAMU to become a viable and sound functioning organization it has to take the following into consideration at the starting point: i) high degree of sustainable monetary and economic convergence and compatibility among the EAC states; ii) The economics elements to be considered are broadly synchronized economic cycles, experiencing same external shocks (for instance arising from fluctuations in world commodity prices), and have easily comparable inflation and growth rate. More so similar income levels, control of public finances, interest rates alignment and high degree of stability in nominal bilateral exchange rates (ECB, 2010).

Behaviour of money, inflation and output are significant in EAMU drive as they determine the working of the monetary policy and economic stability of the individual countries of EAC and the integrated economy (EAC). Causes of inflation, money demand behaviour and output dynamics are vital in economic policy management which can enhance future sustainability of the EAC.

Khan, et al. (2007) notes that increase inflation is mainly driven by a number of supply and demand side factors shocks. Supply shocks which include food items and oil may trigger inflation both in the long and the short run. The increasing oil prices may lead to upward movement in prices of almost all other commodities. The supply side shocks are usually very

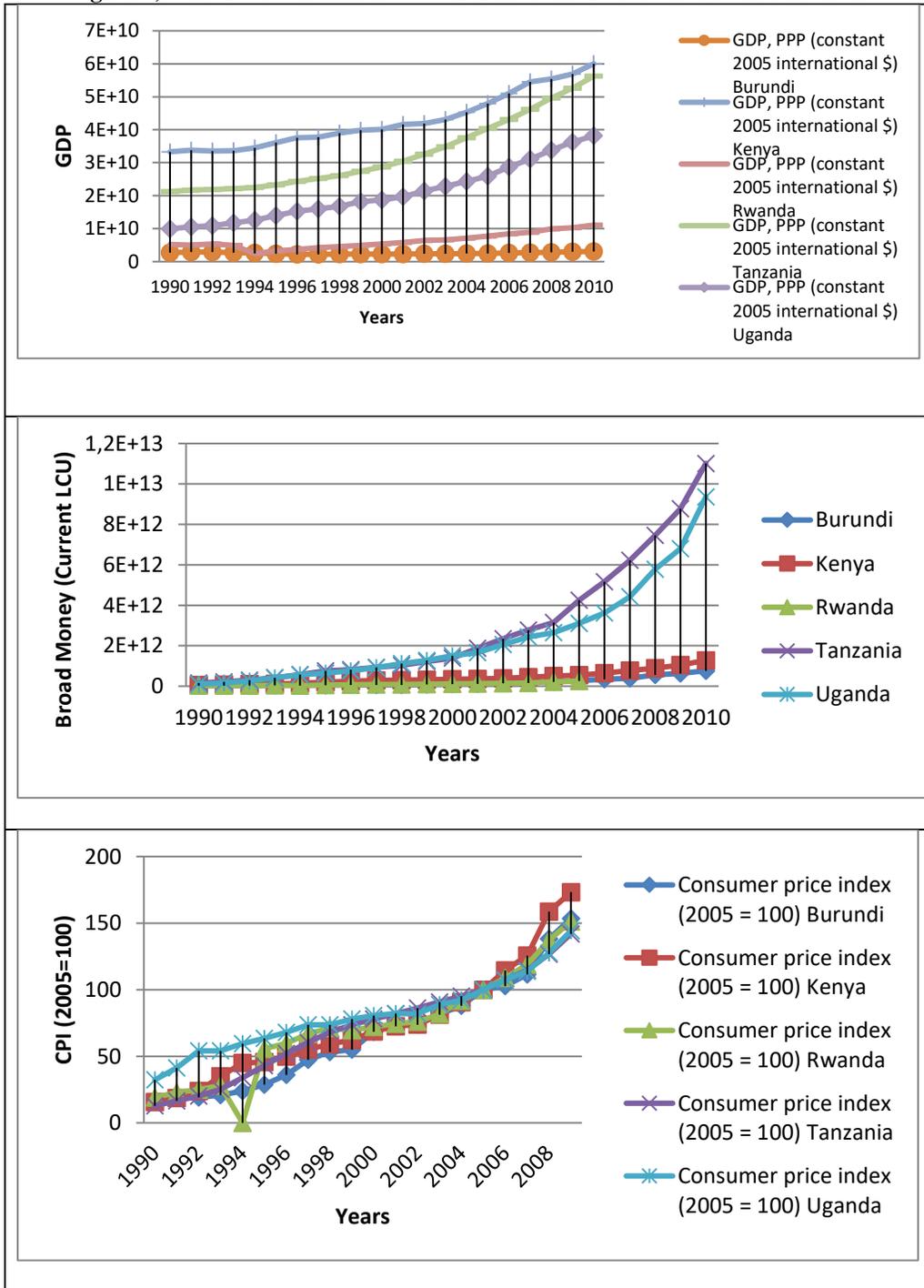
¹⁶ This to provide compensation for the loss of national discretion in monetary and exchange rate policy, which is a vital feature of monetary union.

volatile and can result into large fluctuations in food and oil prices. The resultant effect on inflation can be huge and may not be mitigated through demand side management, including monetary policy. Demand sides shocks are considered in times of conflicts and combination of expansionary monetary and fiscal policies. Upward trends Remittances from abroad and private consumption may drive prices up the in any given economy. These two may outpace domestic production hence creating a positive output gap, which in turn may lead to increase in prices.

Inflation-output trade off characterized the discretion of policymaker on regard to monetary policy reaction. In response to money supply requirement in an economy and output fluctuations the policy maker may practice inflation targeting. This mitigates the runaway inflation tendency has result of monetary policy outcomes. Central bank monetary policy is benchmarked on the following key variables: the central bank inflation target; the central bank preferences; the slope of the Phillips curve, the interest sensitivity of aggregate demand (i.e. the slope of the IS curve), the equilibrium level of output and stabilizing interest rate (Carlin and Soskice, 2005). Money demand is highly influenced by real income, interest rates (both long term on substitutable non-money financial assets and short-run on the money) and the inflation rate (Valdkhani, 2008; Ericsson, 1998; Beyer, 1998, Coenen and Vega, 2001; Felmingham and Zhang, 2001). Demand for money can also influenced by exchange rate in addition to real income and interest rates (Mundell, 1963).

The economic fundamentals in the EAC have shown positive growth within the last decade. According to World Bank (2011) the GDP (constant 2000 US\$) for the EAC in 2010 was US\$ 56.1 billion, an increase from US\$ 31.5 billion in 2000. More so exports value for the region have grown significantly US\$ 4.98 billion in 2000 to US\$ 19.6 billion in 2010. On the other hand the import value has also increased significantly from US \$ 7.795 billion in 2000 to US \$36.864 billion in 2010. World Bank (2011) reports that broad money in the EAC region experience positive growth from 3011.26 million (Current, LCU) in 2000 to 22, 421.9 million (Current, LCU) in 2010. Subsequently, money growth has also expanded from 1760.14 million (Current, LCU) in 2000 to 13,510.5 million (Current, LCU) in 2010. The average Consumer Price Index (CPI, 2005=100) for EAC was 160 in 2010 compared to 74 in 2000. The average inflation rate ranged from 1.5 to 17.6 between the periods 2000 to 2010; this variation is due to inflation changes in constituent countries.

Figure 1) Economic Indicators in EAC Countries for the Period 1990 to 2010.



Source of data: World Bank (2011).

Figure 1) shows the trend for various economic indicators in EAC countries. The figure shows output (GDP), broad money (M2) and inflation (CPI) shows upward trend overtime. This generally indicates real GDP has been growing across the EAC countries. The consumer price index also indicates that the general price level has also been rising considerable. The trends are inevitably showing that if EAMU is to be launched the three economic fundamentals have to be taken into consideration strongly.

The varying economic environment for the EAC countries needs to be taken into consideration for the EAMU to be viable. The economic fundamentals which have guided different monetary regimes in individual countries needs harmonization in for the drive to be successful in the long run. The differences in money growth episodes, high inflationary tendencies and varying GDP realization needs to be taken into consideration by the policy makers. Thorough examination of the central bank independence and their credibility in terms of output-inflation trade off and dealing with central bank lending rate as reaction to inflation and output-gap and money growth need to be well articulated before the advent of EAMU.

The study aims to answer the following questions; a) What are the determinants of inflation in EAC countries?; b) Is there output-inflation trade-off in EAC countries?; c) How does the monetary policy instrument (central bank rate) react to inflation, output and money growth?; d) What are the determinants of money demand in EAC countries? The objectives of the study are to: a) analyze the determinants of inflation in EAC; b) derive the output-inflation trade off; c) to evaluate the reaction function for monetary policy; d) estimate the money demand function. The study is organized as follows; Section 2 examines the theoretical and empirical framework. Section 3, presents the methodology of the study and the data analysis and results.

2. Literature Review

In wide literature on inflation there has been debate about its effects on economic outcomes. The question which has been asked overtime is whether inflation is bad for the economy. The answer has been not always as a reasonable level of inflation of about 3 to 6% can have positive effects on the economy (Khan et al, 2007; Khan, 2005; Hussain, 2005). High inflation can be retrogressive to gains of growth as its welfare effect on the poor is detrimental (Easterly and Fischer, 2001).

Keynes believed that inflation was caused by increase in aggregate demand or decrease in aggregate supply. Hence inflation caused by increased aggregate demand was defined as demand-pull inflation; and the decrease in aggregate supply called cost-push inflation (Khan et al., 2007). In the 1950s A.W. Phillips developed a Phillips curve to account for falling in money

wages. Lipsey (1960), Samuelson and Solow (1960) later modified the Philips curve. They introduced the trade-off notion between inflation and unemployment. Barro (1995) also considered the tradeoff between inflation and growth.

Scheibe and Vines (2005) suggested that there was a positive relationship between inflation and output gap, exchange rate and inflation expectations. Friedman (1968, 1970, 1971) introduced monetarism and Schwartz (1973) empirically tested the model of quantity theory of money. The model assumes that past money supply in an economy to output ratio is the main determinant of current inflation. This derives a statement that inflation has always been a monetary issue.

Structuralist model advocated by Sunkel (1958), Stretten (1962), Olivera (1964), Baumol (1967) and Maynard and van Rijkeghem (1976) emphasizes supply side factors such as food prices, administered prices, wages and import prices as determinants of inflation. Structuralist model suggests that inflation in the long run can be described by the differential rates in productivity growth, wages and elasticity of income and prices between the industrial and service sectors (Khan et al., 2007).

Most literature as from 1990s on inflation have applied demand side and supply side factors as well as policy variables and adaptive expectations. The main determinants of inflation have been identified as monetary shocks, inflation expectations, nominal exchange rate, price of imports, exogenous supply shocks and fiscal policy shocks (Naqvi et al., 1994; Hasan et al., 1995; Bokil and Schimmelpfennig, 2005; Callen and Dangkoo, 1999; Leigh and Rossi, 2002; Chauvet, 2000; IMF, 2001; Sun, 2004; Simone, 2000; and Bailliu et al., 2003).

Barro-Gordon (1983) notes that in a discretionary regime the monetary authority or central bank can print more money and create more inflation beyond people's expectations. The unexpected inflation may lead to an expansion of economic activity and reductions in the real value of the government's nominal liabilities. Clarida, et al. (1999) comments that credible commitment by policy maker to fight inflation in the future can result into improvement in the current output-inflation trade-off that a central bank faces. Specifically, it can lower the effective cost in terms of current output loss that is required to lower current inflation. Optimal monetary policy relies upon the degree of persistence in both inflation and output. The degree of inflation persistence is of importance since this factor governs the output/inflation trade-off that the policy- maker faces (ibid.).

Inflation-output trade-off relates the inflation rate to the output gap and expected inflation. It is largely synonymous traditional expectations-augmented Phillips curve (Blanchard 1997). The major difference with the standard Phillips curve is that expected future Inflation enters additively, as

opposed to expected current inflation. With standard Phillips curve there is no inertia which is arbitrary or lagged dependence in inflation. In this case inflation is dependent entirely on current and expected future economic conditions. However, there is a vital difference an important from the classic problem as the target variables depend not only on the current policy but also on expectations about future policy: The output gap depends on the future path of the interest rate and, in turn, inflation depends on the current and expected future behavior of the output gap (Clarida et al., 1999). Kydland and Prescott (1977) originally emphasized, in this kind of environment, credibility of future policy intentions becomes a critical issue.

Sutherland (2010) observed that monetary policy reaction functions can be used to provide insights into the factors influencing monetary policy, such as whether inflation targets dominate or other factors such as output and asset price stabilization also influence policy. Monetary policy benchmarks policy rates on expected developments in inflation and, in some cases, output. More so monetary authorities with only an explicit inflation target may attempt to respond to output volatility or at least aim to meet their medium-term inflation target without creating excessive volatility in output. Monetary policy reaction functions are widely studied using variation of Taylor-type rules (Taylor, 1993). The monetary policy reaction is characterized by measuring short run interest against inflation rate and output gap (Sutherland, 2010).

Sutherland (2010) adds that monetary policy is usually effective only with a lag; policymakers make their decisions based on evaluations of future rather than contemporaneous conditions. For instance, policymakers typically look through surges in commodity prices when they expect these relative price movements to be temporary. This not only suggests that the Taylor rule is forward-looking, but that in some cases the measure of inflation may be stripped of large relative price changes. The monetary policy reaction function variables can modeled into forward looking as inflation and output are now expressed as expected values. This forward-looking monetary policy reaction function is a more realistic characterization of policymaking.

Demand for money is macroeconomic phenomena that have resulted into development of literature in both developed and developing world .Developed economies are interested in the behaviour of money demand as disequilibrium (difference between the real money stock and long-term equilibrium money stock) is likely to affect the efficacy of interest rate policy in the long run through its effects on output gap and / or inflation ((Valadhkani, 2008). In developing countries importance of demand for money is mainly because of real money gap (residuals arising from the money demand function) which assist in forecast future dynamics in the

output gap and/or inflation (Laidler, 1999, Gerlach and Svensson, 2004, and Siklos and Barton, 2001).

The determinants of money demand includes real income, a long-run interest rate on substitutable non-money financial assets, a short run rate of interest on money itself and the inflation rate (Ericsson, 1998, Beyer, 1998, Coenen and Vega, 2001; Felmingham and Zhang, 2001). Exchange has been suggested as a determinant of money demand in literature (Mundell, 1963; Ewing and Payne, 1999). Some studies have used process of financial asset substitution, exchange rate and a foreign interest rate in the analysis of the demand for money (Bahmani-Oskoe and Rhee, 1994;Traa, 1991; Chowdhury, 1995).

3. Methodology

This section presents the methodology used in the study, econometric models, definition of variables and the data analysis and Results.

3.1 Relating Inflation, M2 and Output Inflation in EAC

The model for estimation is adapted from Akbari and Rankaduwa (2005). The econometric model for determining the general price level in EAC is developed and estimated to account for the significance of domestic and foreign variables affecting inflation in EAC.

The model is presented as follows:

$$P_{it} = f(P_{it}^m, MS_{it}, Y_{it}) \dots \dots \dots (3.1)$$

$$P_{it}^m = ER_{it} * PF_{it} \dots \dots \dots (3.2)$$

$$P_{it} = f(ER_{it} * PF_{it}, MS_{it}, Y_{it}) \dots \dots \dots (3.3)$$

This model relates the general price level, P_{it} , to the domestic price level of imports, domestic money supply, MS_{it} , and domestic output level, Y_{it} . The import price is measured by the product of foreign exchange rate, ER_{it} and foreign price level, PF_{it} . The subscripts i and t refers to country and time period.

The model can be transformed in a log linear model as follows:

$$\ln P_{it} = \alpha_0 + \alpha_1 \ln ER_{it} * PF_{it} + \alpha_2 \ln MS_{it} + \alpha_3 \ln Y_{it} + u_{it} \dots \dots \dots (3.4)$$

The EAC economies are relatively small open economies which operates below full employment and do rely heavily on imports for facilitating their domestic demands for both intermediate and capital goods and more so other consumer goods. Therefore imported inflation is an important factor to be considered overtime. The changes in domestic prices of imports due to changes in exchange rate and world market prices (foreign prices) can be expected to influence the domestic price level significantly. The model in equation (2.2) restricts the coefficients of the exchange rate and foreign price variables to be equal in sign and magnitude. Therefore the

model is modified to include the exchange rate and foreign price level variables separately so that their effects can be values separately.

The resulting model is presented as follows:

$$\ln P_{it} = \beta_0 + \beta_1 \ln ER_{it} + \beta_2 PF_{it} + \beta_3 \ln MS_{it} + \beta_4 \ln Y_t + u_{it} \dots \dots \dots (3.5)$$

Where $\beta_1, \beta_2, \beta_3 > 0$ and $\beta_4 < 0$

The preceding model assumes that the price level adjusts instantaneously to its equilibrium level (P_{it}^*) in the current period in response to changes in the explanatory variables (i.e., $P_{it} = P_{it}^*$). However in typical developing country it is reasonable to assume that prices do not adjust instantaneously (Akbari and Rankaduwa,2005). Under this assumption that prices do not fully adjust in the current period, the following partial adjustment mechanism is introduced into the model.

$$\ln P_t - \ln P_{t-1} = w[\ln P_t^* - \ln P_{t-1}] \dots \dots \dots (3.6)$$

Where $0 \leq w \leq 1$

Substitution equation (2.6) in equation (2.5) yields the following partial adjustment (or disequilibrium) formulation of the model.

$$\ln P_{it} = \gamma_0 + \gamma_1 \ln ER_{it} + \gamma_2 PF_{it} + \gamma_3 \ln MS_{it} + \gamma_4 \ln Y_t + \gamma_5 \ln P_{t-1} + u_{it} \dots \dots \dots (3.7)$$

Where, $\gamma_0 = w \alpha_0, \gamma_1 = w \alpha_1, \gamma_2 = w \alpha_2, \gamma_3 = w \alpha_3, \gamma_4 = w \alpha_4$, and $\gamma_5 = 1 - w$

If γ_5 is statistically significant, the long run elasticities would be given as follows:

$$\alpha_1 = \frac{\gamma_1}{1 - \gamma_5}, \alpha_2 = \frac{\gamma_2}{1 - \gamma_5}, \alpha_3 = \frac{\gamma_3}{1 - \gamma_5}, \quad \text{and} \quad \alpha_4 = \frac{\gamma_4}{1 - \gamma_5}$$

The model given by equation (2.7) is estimated using Arellano- Bond Dynamic Panel Data Model, Fixed Effect Models and OLS. The study uses annual panel data for the period 1990-2010 for EAC countries. The domestic price level is measured by Consumer Price Index (CPI, base year 2005) . The exchange rate is measured as local currency units of the five countries per US dollars and the United States Wholesale Price Index (WPI, base year 2005) is used as a proxy for foreign price level. Broad money supply (money plus quasi money) measured in nominal terms is used as the domestic money supply variable. The GDP is used to measure domestic output level. The data has been obtained from World Development Indicators (WDI) 2011 edition.

The interrelationship between money, inflation and output are fundamental for the working and sustainability of a Monetary Union. .Econometric results for inflation are estimated using fixed effect (FE) and Arellano-Bond dynamic panel data methods. . From Table 3.1, increasing broad money M2 by 1% reduces inflation by 0.04% in FE and 0.05% in AB models respectively in EAC. Additionally, raising output (ln GDP) by 1% decreases inflation by 0.11% in both models. Interestingly results for output and inflation relation are not in tandem with apriori expectation where

when it rises inflation should be increasing. =. The previous year inflation (lnCPIL) when increased by 1% leads to arise in current inflation by 0.9% respectively across the FE and AB models. .

Table 3.1 Inflation versus M2 and Output

Dependent Variable - lnCPI								
Independent variables								
Fixed Effect Model (FE)					Arellano-Bond Dynamic Panel Data Model (AB)			
Variable	coefficient	Std. Error	t-value	p-value	coefficient	Std. Error	z-value	p-value
Ln ER	-0.0333	0.0394	-0.84	0.401	-0.0313	0.3704	-0.84	0.399
Ln FP	0.7154	0.1033	6.92	0.000	0.7330	0.0972	7.54	0.000
Ln M2	-0.0433	0.0258	-1.68	0.097	-0.0507	0.0257	-1.97	0.049
Ln GDP	-0.1065	0.0328	-3.25	0.002	-.1048	0.307	-3.42	0.001
Ln CPIL	0.8908	0.0376	23.72	0.000				
Ln CPI L1					0.8901	0.0351	25.34	0.000
Cons	0.8143	0.5298	1.54	0.128	0.8431	0.4954	1.70	0.089

3.2 Output-Inflation Trade-Off in EAC Countries

According to Akbari and Rankaduwa (2005) inflation can be reduced through many sources in the economy. These sources include favourable aggregate supply shocks such as reduction in price of imports, unfavorable aggregate demand shocks such as a decline in the income of foreign residents, increase in economic growth and deliberate macroeconomic policy actions directed at reducing aggregate demand. The authors add that when a tight monetary policy is used to curtail aggregate demand, there is a short-run adjustment period during which economic output diminishes and prices decline. Expectations of lower prices can further reduce aggregate demand thereby causing the output to move further away from its long-run (potential) level. Automatic aggregate supply increases caused by expectations of lower inflation tend to return the output towards its potential level. The loss in output during the adjustment period becomes a cost of the policy of disinflation. The output-inflation trade-off measures the cumulative loss of output as a percentage of potential output when inflation is reduced by one percent.

The output-inflation trade-off can be analysed quantitatively using the expectations augmented Phillips curve given by the following equation:

$$\Pi_{it} = \Pi^e + \theta(Y_{it} - Y_{it}^*) \dots \dots \dots (3.8)$$

Where Π_{it} , Π^e , Y_{it} and Y_{it}^* denotes current inflation, current actual output and current potential output, respectively. The output-inflation trade-off is given by $1/\theta$.

Following Andersen and Wascher (1999) equation (2.8) is modified to include lagged inflation and lagged output gap to account for nominal rigidities.

The model can then be rewritten as:

$$\Pi_{it} = \Pi^e + \theta_1 \Pi_{it-1} + \theta_2 (Y_{it} - Y_{it}^*) + \theta_3 (Y_{it} - Y_{it}^*)_{it-1} \dots \dots \dots (3.9)$$

Π_{it} , measured by annual inflation rate, the $(Y_{it} - Y_{it}^*)$, output gap measured by deviating GDP from estimated GDP.

The results for output-inflation tradeoff are highlighted in Table 3.2. Arellano-Bond (AB) and Arellano-Bover/Blundell-Bond (AB-BB) dynamic panel data models are used to estimate the results. The methods takes into consideration the temporal dynamics of the output-inflation tradeoff.

Table 3.2 Output-Inflation Trade-off

Dependent Variable –Inflation(Π_{it})									
Independent variables									
Arellano-Bond Model (AB)					Arellano-Bover Model/Blundell-Bond Model (AB-BB)				
Variable	coefficient	Std. Error	z-value	p-value	Variable	coefficient	Std. Error	z-value	p-value
L. Π_{it-1}	0.3067	0.09614	3.19	0.001	L. Π_{it-1}	0.5349	0.1175	4.55	0.000
lnOutput gap	4.47e-09	5.52e-09	0.81	0.418	lnOutput gap	1.7157	0.8750	1.96	0.050
L. lnOutputgap	-7.77e-09	5.35e-09	-1.45	0.147	L.1 lnOutputgap	-0.5914	1.1475	-0.52	0.606
Cons (Π^e)	6.407	1.6745	3.83	0.000	Cons (Π^e)	-17.3611	22.1901	-0.78	0.434

The results in Table 3.2 are interpreted based on the AB-BB model which has more robust results. The lagged inflation variables, which shows inflation in the previous year is significant related to the current inflation. An increase of the previous year inflation -which is expected inflation- by 1 % would lead to rise of current inflation by about 0.54%. Output gap is significantly related to current inflation but the magnitude and the signs does not reflects theoretical basis. This implies that there is is output -inflation trade-off. At lag 1 the output-inflation trade off is insignificant.

3.3 Monetary Policy Reaction for EAC Countries

Fuhrer (1997) notes that to adequately characterize monetary policy there is need to describe the instrument of policy which refers to the central bank rate, as well as its primary targets, which do include the rate of inflation, the rate of money growth, the growth rate of output and the output gap. He adds that the transmissionary channel from the policy instrument to

the ultimate goals of the policy maker also involves the variables; inflation, money growth, output growth and the output gap.

The systematic behaviour of monetary policy can be summarized with a reaction function in which the monetary authority moves the short-term nominal rate in response to the deviations of target variables from the target. It’s vital to note that the precise form of the reaction function varies over monetary regimes. The general form of the reaction function is as follows;

$$f_t = \sum_{i=1}^m \delta_{fi} f_{t-i} + \sum_{j=0}^n \delta_{\vartheta j} \vartheta_{t-j} + \sum_{k=0}^p \delta_{yk} \bar{y}_{t-k} + \sum_{l=1}^q \delta_{ml} \Delta m_{t-l} + \epsilon_{f,t}$$

.....(3.10)

The monetary policy reaction function relates the government funds rate f_t to the lags of the funds rate, contemporaneous and lagged levels of the inflation rate ϑ_t , contemporaneous and lagged levels of the output gap \bar{y}_t and contemporaneous and lagged money growth Δm_t .

Table 3.3 Arellano-Bond Dynamic Panel Data Estimation

Dependent Variable –Central Bank Fund rate (tbrate)				
Independent variables				
Arellano-Bond Model				
Variable	coefficient	Std. Error	z-value	p-value
Tbrate L1	0.4393	0.1422	3.09	0.002
Inflation	0.6618	0.1960	3.38	0.001
Inflation L1	-0.1559	0.2218	-0.70	0.482
lnoutputgap	-0.5145	1.439204	-0.36	0.721
Lnoutputgap L1	0.1532	1.6008	0.10	0.924
lnM2	-14.9761	10.972	-1.36	0.172
lnM2 L1	11.1492	11.6687	0.96	0.339
Cons	93.5324	64.2746	1.46	0.146

Table 3.3 reports results for the reaction function. Wald Criterion shows that all the variables are jointly significant. Treasury bill rate representing the Central Bank fund rate. The tbrate in the significantly determines the current tbrate. Current inflation has significant relationship with tbrate. An increase in current inflation by about 1% will lead the tbrate to go up by about 0.6%. This implies that inflation rates are very important in determining the fund rates. The other variables which include the output gap and money growth did not have any impact on the tbrate.

3.3.2 Money Demand

Fuhrer (1997) suggests that M2 appears in the reaction function hence a money demand equation is required. More so the long term real rate that drives the I-S curve depends in part on expectations of the government

funds rate, money demand behaviour will feed into expectations of the long-term real rate and have at least some effect on the output gap.

On specification of money demand, a simple error-correction model is used. In the long-run, the level of real money balances depends on real output and the opportunity cost of holding money.

$$m_t - p_t = \varphi_0 + \varphi_1 y_t + \varphi_2 f_t + \epsilon_{m,t} \dots \dots \dots (3.11)$$

Estimation of equation (3.11) is shown in appendix

The change in real money balances responds to the lagged discrepancy from the long run equation (3.11) as well as to lagged changes in real money and the funds rate.

$$\Delta(m_t - p_t) = \gamma_0 + \gamma_1 \epsilon_{m,t-1} + \gamma_2 \Delta(m_{t-1} - p_{t-1}) + \gamma_3 \Delta f_{t-1} \dots \dots \dots (3.12)$$

Table 3.4. Estimated Result for Short-Run Money Demand Function

Dependent Variable –D(Real Money Balances)				
Independent variables				
Arellano-Bover/Blundell-Bond Model				
Variable	coefficient	Std. Error	z-value	P-value
Real M2 LD	0.2083	00899	2.32	0.021
Tbrate LD	0.00082	0.00049	1.65	0.099
ECM (t-1)	0.0191	0.4109	0.46	0.642
Cons	-0.008265	0.0166	-0.50	0.619

Table 3.4 shows the results for short run money demand estimation the Wald Criterion is significant showing that the explanatory variables are jointly significant. Lagged real money balances have effect on current real money balances. It shows that 1% rise in previous years real money balances has positive effect on current money balance for each country. Although tbrate is significant it affect the real money balances marginally. The error correction term is not significant.

4.0 Conclusion

The study main objective was to determine the relationship between money, inflation and output in EAC region in the auspices of formation of East Africa Monetary Union. Inflation did react positively to the foreign price level, inflation in period t-1 for the EAC countries. Output (GDP) has negative relationship with current inflation. The money supply variable is significant but tends to reduce inflation EAC countries contrary to the theoretical benchmark. For the output-inflation trade-off, previous year inflation had an impact on the current inflation and the expected inflation has a positive significant on the current inflation too. The determination of output-inflation trade-off could not be realized because output gap had significant relationship with the current inflation.

The monetary policy reaction function, measure by the central bank fund rate (tbrate) had a positive relationship with its lagged variable. Inflation in period t-1 also had a significant relationship with central bank rate. Lagged real money balances had a positive impact on real money demand in EAC countries and also the lagged central bank rate.

Policy implication arising from the study includes; EAC countries needs to stream line their inflation rates, money supply growth and output growth so as to realize the full benefits of EAMU initiative. The behaviour of money, inflation and output in the member countries have to be fully understood by the overall monetary authorities before operationalisation of EAMU drive in the region.

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Table E1. Estimating Long-Run Money Demand Function

```

xtreg ReM2 lnrgdp tbrate, re
Random-effects GLS regression           Number of obs   =       105
Group variable: country                 Number of groups =         5

R-sq:  within = 0.5960                   Obs per group:  min =        21
        between = 0.9958                  avg =       21.0
        overall = 0.9034                  max =        21

Random effects u_i ~ Gaussian           Wald chi2(2)    =       232.90
corr(u_i, X) = 0 (assumed)              Prob > chi2     =         0.0000
    
```

ReM2	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnrgdp	1.06654	.0699519	15.25	0.000	.9294373	1.203644
tbrate	-.0008051	.0018885	-0.43	0.670	-.0045065	.0028964
_cons	-8.254369	1.589304	-5.19	0.000	-11.36935	-5.13939

```

sigma_u | .15724044
sigma_e | .27113179
rho     | .25168271 (fraction of variance due to u_i)
    
```
