Inflation, External Market Performance and Government Policy: An Empirical Investigation Using VAR-VECM Approach in the Context of Ethiopia

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Abstract

This study aims at determining the effectiveness of demand management policies in stabilizing the macroeconomic environment of Ethiopian economy. Inflation and Balance of Payments are used as the two indicators of stability. The researcher made use of Co-integrated VAR approach and estimates inflation and balance of payments equations. All together the researcher used data for the period 1976-2011. The findings of the study imply the existence of two-way relationship between inflation and balance of payments. Excess balance of payment surplus leads to inflationary pressures in the economy while inflation booming deteriorates the country's external balance.

Ethiopia is pursuing a public sector led development strategy that focuses on promoting growth through high public investment facilitated partly by low nominal interest rates. The strategy calls for government directed economic policy, with a dominant role for public enterprises in infrastructure development. Within this development strategy, the authorities adopted both medium and long-term visions. Its medium term vision is to achieve the Millennium Development Goals (MDGs). This should be achieved at the end of the implementation of the five-year plan, named as the Growth and Transformation Plan (GTP) (IMF, 2012). The planning period for the GTP spans the period 2010/11-2014/15. Its long-term vision, on the other hand, is to build on the achievements of the GTP and become a middle-income country in the coming ten years. Among its strategic pillars is an emphasis on agriculture, promotion of industrialization, and investment in infrastructure (MOFED, 2010/11). The strategy has contributed to lifting economic growth; In 2010/11 real GDP growth was 11.4 percent moderately higher than the 10 percent growth a year earlier. The overall economic performance, measured by growth in real GDP, between 2003/04-2010/11, registered an average annual growth rate of 11.4% (NBE, 2010/11). This robust and broad based economic growth places Ethiopia among the top performing African and other developing Asian countries. In the fiscal year 2010/11, agriculture grew by 9.0 percent due to improved productivity, good weather conditions, and conducive policy environment. The industry sector has also expanded by 15.0 percent, owing to investment in electricity & water as well as construction sector. Service sector growth, however, slightly declined to 12.5 percent from 13.0 percent a year ago (NBE, 2010/11).

The main development objective of Ethiopia is to eradicate poverty in a relatively short period of time. This would be achieved by implementing broad based development policies that would not only enhance economic growth but would also adhere to the principles of an equitable distribution of the benefits from such growth. Robust growth in the recent past and pro-poor focus of the government budget has resulted in significant poverty reduction: estimates indicate that the

poverty head count declined from 38.7 percent in 2004/05 to 29.6 percent in 2010/11 (IMF, 2012). Despite these achievements, the Ethiopian economy has been facing serious macroeconomic imbalances. Inflation rose above 40 percent in August 2011 from 10 percent in November 2010 and resulted in highly negative real interest rate and an overvalued real exchange rate (IMF, 2012). Moreover, according to annual report of MOFED (2010/11) during the years spanning between 2003/04 and 2008/09 the rate of inflation recorded an average annual rate of 15%; reaching its highest of 36.4% for 2008/09. The inflation experienced in the country was largely driven by food inflation. Federal government budget execution and monetary policy were tightened later in 2011 and this resulted in declining inflation, though still elevated. However, other risks and vulnerabilities related to the financing model of the large public investment projects are now emerging (IMF, 2012).

The Recent Macroeconomic Environment

According to reports by different institutions, the Ethiopian economy registers remarkable double-digit growth for the last eight years. The real GDP growth has remained above 10 percent since 2003/04 when the Ethiopian economy recovered from a severe drought in 2002/03 (IMF, 2012). In 2010/11 the growth rate reached 11.4% according to reports by the government and IMF (2012) lowers the rate to 7.5%. This was one of the highest growth rates registered by Sub-Saharan countries. The average growth rate for these economies was only 5.2%.

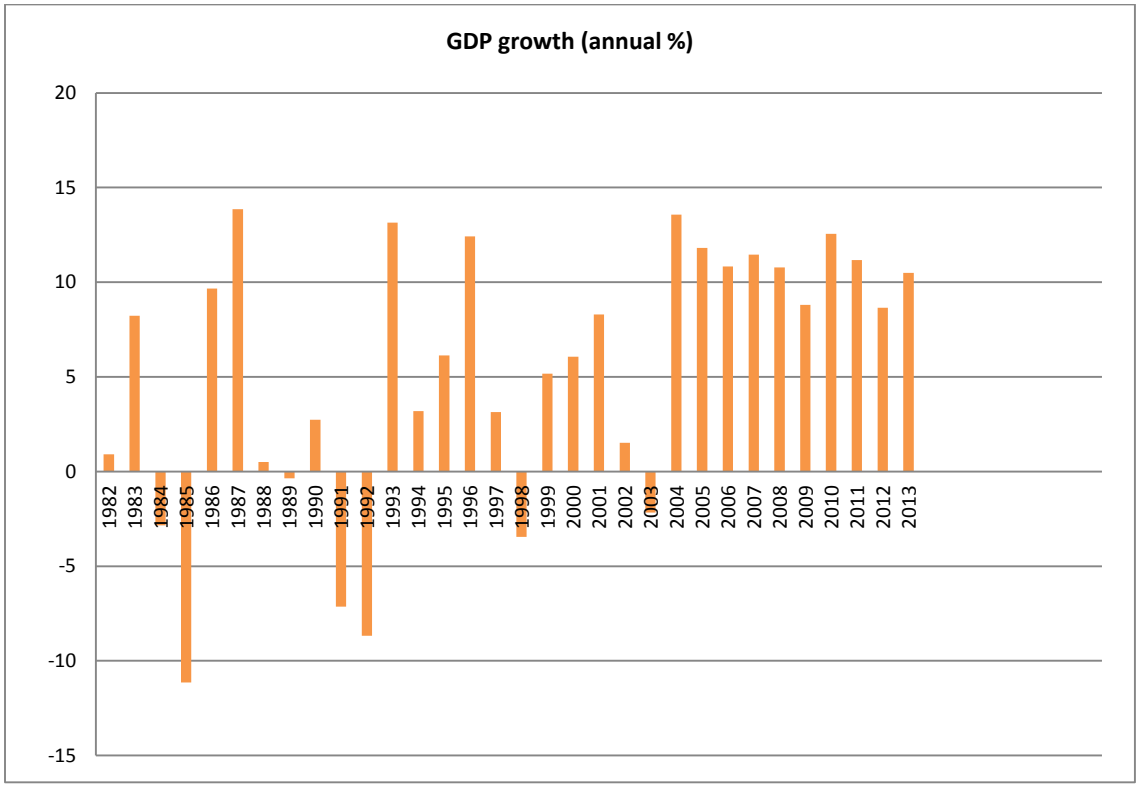

Figure1. Annual Ethiopian GDP growth. Constructed based on data obtained from World Bank

In terms of the structure of the economy, the contribution of agriculture to overall GDP was 47% in 2003/04. The share declined gradually and reached 41.1% in 2010/11. The share of industry showed no significant change, accounting on average for 13.3% of the total value added over the last eight years. On the other hand, during this period, the service sector became the dominant in the economy with its share increasing from 39.7% in 2003/04 to 46.6% in 2010/11 (MOFED, 2010/11).

Despite this reported significant increase in output, the country experienced general inflationary pressures. Annual average general inflation at the close of the fiscal year 2010/11 was 18.1%, measured by a 12-month moving average, about 15.3% higher than the preceding year. During the years 2003/04 and 2004/05, the general rates of inflation were 7.3% and 6.1%, respectively, and rose to 10.6% in 2005/06 (MOFED, 2009/10). For the years 2006/07, 2007/08 and 2008/09, the general annual inflation rates were 15.8%, 25.3% and 36.4%, respectively. These were largely driven by the trend of the food price component, which showed 21% annual average growth during 2003/04–2008/09 (MOFED, 2009/10).

Another important dimension of macroeconomic environment is Balance of Payment condition. According to a report by IMF (2012), Ethiopia had been accumulating foreign exchange reserves since 2008 when the country faced world commodity price surge and ever flowing fund support. But the trend reversed in 2011 as a result of foreign exchange reserve sales to control domestic liquidity. Reports suggest due attention to be given to the sustainability of the foreign exchange reserve sales as a key monetary policy instrument as foreign exchange reserves (FX) in months of imports have declined. These reports advise the authorities to begin gradually building FX coverage to about 3 months of imports mainly through some flexibility in the exchange rate, which will improve the current account balance. Foreign exchange reserves decreased from a peak at about US$3.5 billion in September 2011 to about US$2.3 billion (1.8 months of prospective imports) in April 2012. The current level is well below the commonly used rule of thumb of 3 months of import cover, potentially putting external stability at risk (IMF, 2012).

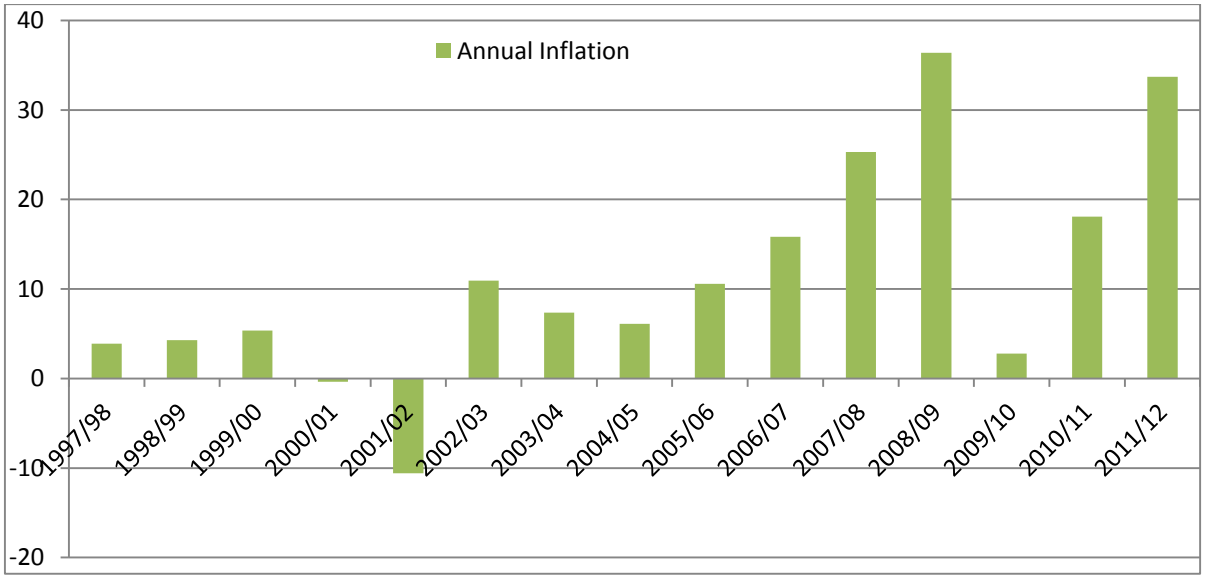

Figure 2. Annual Inflation. Constructed based on data obtained from National Bank of Ethiopia

The Ethiopian economy is exposed to various exogenous shocks, such as volatilities in the terms of trade, export demand, and aid inflows, suggesting a need for an adequate level of foreign exchange reserve to smooth adjustment. These problems are fueled by the export structure, which is dominated by agricultural goods whose international prices fluctuate greatly and whose outputs are affected by periodic significant droughts. Coffee, oilseeds and chat account for 54.26% of total export earning on average from 2008/09 to 2010/11 (NBE, 2010/11). Together with the risks of oil price increment, these bottlenecks adversely influence the country's current account.

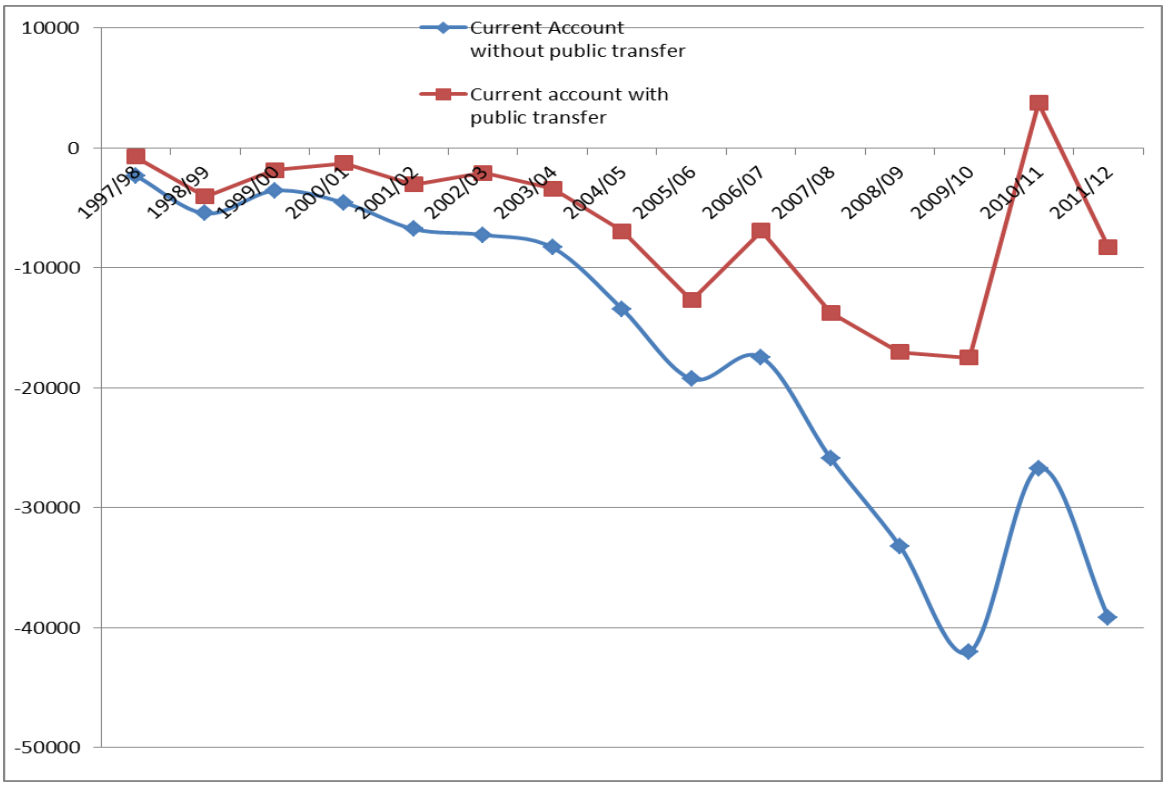

Figure 3. Country's current account. Constructed based on data obtained from National Bank of Ethiopia

In the year 2007/08 the country had a huge trade imbalance (imports of $7.21 billion compared to exports of $1.56), and a current-account deficit of 4% of GDP. In 2010/11 the current account balance (including public transfers) registered USD 377.4 million in surplus against USD 174 million deficits in the preceding fiscal year. The main reason behind this improvement is higher income from public and private transfers. From 2008/09 to 2010/11 public and private transfers grew by 22% and 17% respectively. The external current account deficit (before official transfers) has deteriorated from 5.2 percent of GDP in 2010/11 to 10.1 percent of GDP in 2011/12 (NBE, 2010/11). The improvement of current account balance in 2010/11 is reversed due to a strong growth of imports in 2011/12. Despite a continued robust performance in the export of goods and remittances in previous periods, strong consumer goods imports and the deteriorating service balance in the first half of 2011/12, moved the current account into a deficit. This is in contrast to the surplus recorded in 2010/11. Although capital account transactions are limited in

Ethiopia, in 2010/11, the surplus in capital account reached USD 2.5 billion compared to USD 2 billion surpluses in the preceding fiscal year. This was attributed to strong growth in official long term loan disbursements (33 percent) and estimated foreign direct investment inflows (30 percent). In addition, aid inflows have also been large (about 5–7 percent of GDP) in the last few years (NBE, 2010/11).

Model Specification

The empirical framework of this study is focused on modeling inflation and balance of payments all together and evaluating the impact of government policies. In order to do so this study employs VAR model. The rationale for using VAR model is that it can be hypothesized that the variables studied in this research tends to affect each other intertemporally. In other words, the possible existence of inter-temporal two way interaction amongst inflation and balance of payments provides strong ground to use VAR model. Thus, each variable will have an equation explaining its evolution based on its own lags and the lags of the other model variables. This inter-temporal two way interaction is partly supported by scrutinizing the time series of the two variables. As can be seen from the graph below, from 1997/98 to 2011/12 when the BOP keeps deteriorating the inflation rate in contrary keeps rising. When the inflation rate reached its peak in 2008/09, the next year in 2009/10 the BOP account recorded the worst deficit of the last decade. Moreover, in 2009/10 the inflation rate was the lowest of the past eight years whereas in the next fiscal year 2010/11 Ethiopian BOP account registered its first surplus of the past fifteen years. These empirical evidences support the hypothesis of possible existence of lagged value effect of inflation on BOP and vice versa.

The argument of inter-temporal interaction can also be supported theoretically using quantity theory of money (Steiner, 2009). From the quantity theory of money

$M_s*V = P*Y$……. (1)

where, M is money supply, v is velocity of money, P is price level, Y is output.

In log form (1) can be written as, $m + v = p + y$, rearranging

$P = m_s + v - y$……. (2)

But From base money definition of money supply: $M_s = m \cdot B$, where B is base money and m is money multiplier. B= NDA + NFA where NDA is Net Domestic Asset and NFA is Net Foreign Asset held by the central bank. Incorporating this information, M_s can be written as

$M_s = m \cdot (NDA + NFA)$…….(3), taking differential of (3) gives as

dMs = dm + dnda + dnfa…….(4), taking deferential of (2), assuming constant velocity and making use of (4), we get

dP = dm + dnda+ dnfa – dy …… (5)

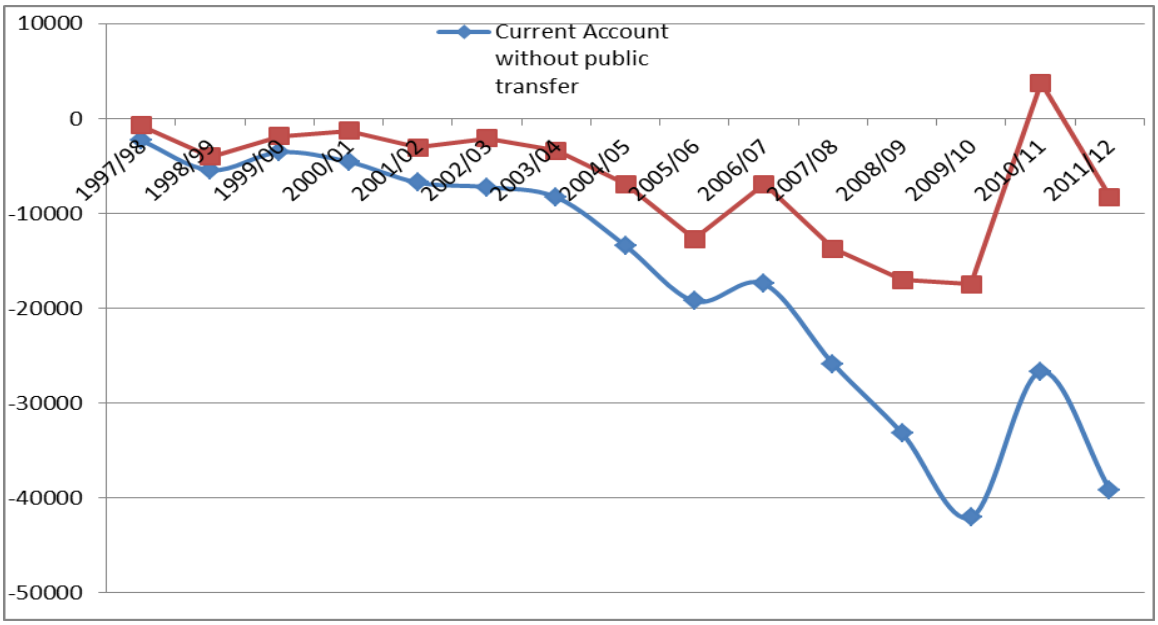

Figure 4. Account without public transfer

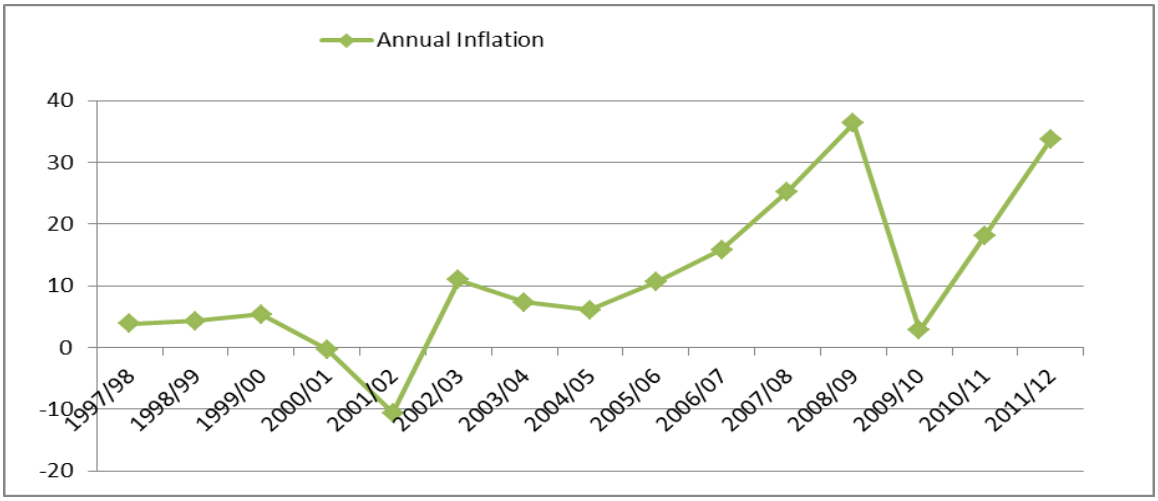

Figure 5. Annual inflation

Equation (5) highlights the links between changes in international reserves and the price level (Steiner, 2009). If the central bank does not sterilize, the increase in international reserves directly translates into an increase of the price level Even if it's sterilized, since a sterilization operation expands the stock of domestic debt, policymakers might be tempted to reduce the nominal value of the debt through surprise inflation.

On the other hand, Inflationary pressures influence balance of payment status of a nation. Following traditional Keynesian macro approach, we can write the BOP equation as:

B=X-M+K …….. (6) Where X is export, M is import and K is capital account balance. We can write the export and import equation as:

$X = b + aY + \beta P/p_f$ …….. (7) Where, y-income, P/p_f – relative price of local goods, and $a>0$, $\beta<0$

$M= c + mY$…….. (8) where $m>0$

Then substituting (7) and (8) into (6) we get;

$B = aY+ \beta P/p_f-m Y -(c-b)$…… (9)

Equation (9) implies that an increase in the inflation rate negatively influence[1] the competitiveness of the domestic economy in a way that import becomes cheaper and high while the quantity of export decreases, which lead to balance of payment deterioration. Such interdependence between the two main variables provides a fertile ground for using VAR model to study their relationship and the impact of policy.

The Model

The VAR model is a multivariate time series specification developed as a generalization of the univariate autoregressive (AR) model. Considering p-lags of Yt , the basic VAR(p) model can be specified as follows

$Y_t = A_1 Y_{t-1} + \ldots + A_p Y_{t-p} + C' D + u_t$ …… (10)

Where

$Y_t = (Y_{1t}, Y_{2t}, \ldots Yk_t)'$ - K x 1 vector of vaiables

D_t = Vector of constant

u_t = white noise, with $E(U_t) = 0$, $E(u_t u_t') = \Sigma$, $E(u_t u'_{t-k}) = 0$

A, C = are parameter matrices of suitable dimension

In order to choose the set of variables modeled in this study, besides inflation and balance of payment, the study made use of structural, monetary and elasticity as well as absorption theories of inflation and balance of payments respectively. Based on the above framework and theories the following variables are chosen; inflation, balance of payments, budget deficit, domestic credit, exchange rate, import price, and GDP.

Given this set of variables, the VAR model employed in this study is specified as follows; in this setting the model is in line with those studied by Korsu (2001), Tafere (2008) and Geda and Tafere (2011)

$Z_t = \alpha + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + \beta_3 Z_{t-3} + \ldots + \beta_p Z_{t-p} + U_t$ …… (11)
Where Zt is 7 x 1 vector of variables, u_t is a k-dimensional unobservable zero mean white noise process with positive definite var-covariance matrix, $E(u_t u_t^{'}) = \Sigma_u$

[1] Since $\beta<0$

Analytical Approach and Estimation

The study uses data from African Development index of the World Bank and International Financial Index of International monetary Fund (IMF) from 1976 to 2011. First, the variables are tested for stationarity and based on the result, co-integration test is undertaken. Then, long run and short run relationships are revealed. Formal testing for stationarity and the order of integration of each variable are undertaken using ADF and Phillips-Peron tests. The result of Phillips-Peron test is presented below whereas that of ADF test is presented in the Appendix.

Table 1

Philips-Peron test of Stationarity Result

Variable	With Constant		With Constant and Trend	
	At Level	First Difference	At Level	First Difference
Bd	-2.934	-8.209*	-2.835	-8.268*
LNDc	-0.197	-5.696*	-2.784	-5.607*
LnExr	0.275	-5.448*	-2.140	-5.550*
Forex	0.029	-7.005*	-2.389	-7.310*
LNGdp	3.602	-4.580*	0.361	-5.495*
Imp	-0.443	-7.369*	-2.330	-7.923*
Inf	-2.621	-6.890*	-2.466	-7.447*

Note. Null: series have unit roots. *Significant at 1% level

The results from the Philips-Peron test presented in table 1 demonstrate that all variables are non-stationary in levels. However stationarity was achieved after differencing implying that all the variables included in the model are integrated of order 1 or I(1). This finding triggers the search for a long-run relationship amongst the variables which is done using the cointegration technique. Test for co-integration (the Johansen Test) is often highly sensitive to the number of lags included for the endogenous variables in the estimation of VAR. This stresses the importance of testing for the optimal lag length. The optimal lag order is determined with the Final Prediction Error (FPE), the Akaike Information Criterion, the Hannan-Quinin Information Criterion and the Schwartz Information Criteria (SIC). The result is presented in the Appendix and can be seen that all the FPE, AIC and HQIC suggest an optimal lag of three at 1% level of significance. Based on the lag order selected, the presence and the number of co-integrating relationships are evaluated with the trace and maximum Eigen value tests. The results are presented below and both the trace and the maximal Eigen value tests imply the presence of three co-integrating relationships at 1% level of significance.

Table 2

Cointegration Rank Test

Test	Null Hypothesis	Alternative Hypothesis	Cointegration Test Result	Critical Value
Trace Statistic	H0: r≤0	H1: r>0	265.0990*	133.57
	H0: r≤1	H1: r>1	147.6212*	103.18
	H0: r≤2	H1: r>2	91.8832*	76.07
	H0: r≤3	H1: r>3	47.3182	54.46
	H0: r≤4	H1: r>4	16.8496	35.65
Maximal Eigen Value	H0: r=0	H1: r=1	117.4778*	51.57
	H0: r=1	H1: r=2	55.7380*	45.10
	H0: r=2	H1: r=3	44.5650*	38.77
	H0: r=3	H1: r=4	30.4685	32.24
	H0: r=4	H1: r=5	9.8009	20.97

Note. *Denotes rejection of the null hypothesis at 1 percent level of significance.

Vector Error Correction Model (VECM)

The Johansen test of co-integration indicates the presence of three co-integrating vector. Although we find at least three co-integrating relationships, the interest in this study is to examine the impact of financial policy instruments on inflation and balance of payment. The Johansen test confirms the validity of selecting the three equations (of inflation, balance of payment and GDP) by giving more weight to them, but in this study the focus will be on inflation and balance of payment equations.

Long Run Analysis

The Inflation Equation

Table 3 presents the long run result for the inflation equation. From the long run equation it can be concluded that inflation largely depends on all the variables in the model. The result shows that the entire set of variables except budget deficit and exchange rate can explain inflation in the long run.

Table 3

Normalized cointegration equation of Inf[2]

Variable	Inf	C	Forex	LNExr	LNDc	Imp	LNGDP	BD
Coefficient	1	65.1252 [2.836]	-0.616279 [-2.402]	-1.481374 [-1.062]*	19.92753 [5.9591]	-6.68611 [-2.605]	25.59465 [6.914]	1.0412539 [1.031]*

Note. Values in parentheses are t-statistics, *means insignificant at 1% significance level

The coefficient for foreign exchange reserve indicates that accumulation of foreign exchange reserve (balance of payment improvement) brings an increment in the inflationary spiral in the long run. A unit increase in foreign reserve leads to an increase in the inflation rate by 0.62 on average. This impact of changes in foreign reserve on inflation is not ignorable since the t ratio of the coefficient is statically significant. This impact is often channeled via the impact that foreign exchange reserve has on high powered money. This finding is in line with the theoretical prediction of monetarist model which relates inflation exclusively to monetary variables.

The long run impact of domestic credit on inflation is found to be negative. Expansion of credit disbursed to the private as well as public sector brought a decline in the inflation rate in the economy. The result here suggests that a 1% increase in domestic credit in the long run lowers inflation by about 0.199 units. Though significant, it didn't confirm to the expected sign. The reason for the negative sign reflects that most of the loan might be used for improving the supply of goods and services.

Price of import and GDP all have the expected signs and the coefficients are significant. As can be seen from the table import price has a positive impact on inflation in the long run. An increase in import price by one unit leads to 6.7 units increase in the domestic inflation. This indicates the presence of international price pass through effect in the Ethiopian inflation. The coefficient of GDP is found to negative which implies that the two moves in opposite direction, for a 1% increase in real income (GDP) inflation decreases by approximately 0.26 units. This is consistent with studies by Dlamini (2008) in South Africa and Enoma (2011) in Nigeria.

The Balance of Payment Equation

Table 4 presents the long run equation estimated for balance of payment. The results show that the main significant determinants of the balance of payments in the long run are exchange rate, domestic credit, import price and GDP. Inflation, budget deficit and import price are found to have insignificant impact in the long run at 1% significance level.

[2] Interpretation of the coefficients is in a reverse sign as the table presents a normalized long run equation with all the variables on one side of the equality

Table 4

Normalized co-integration equation of Forex

Variable	Forex	C	Inf	LNExr	LNDc	Imp	LNGDP	BD
Coefficient	1	23.8972 [8.724]	1.62266 [-0.5013]*	-37.31307 [8.851]	14.51873 [6.662]	0.477024 [-1.332]*	-17.36781 [-7.727]	-0.669411 [-1.3476]*

Note. Values in parentheses are t-statistics * means insignificant at 1% significance level

The results show that the long run impact of exchange rate is found to be positive as expected. According to the coefficient estimates a 1% increase/decrease of exchange rate (devaluation/appreciation) leads to an improvement in the balance of payment through increment of foreign exchange reserve by 0.373 units. This result is consistent with that of Fekadu (2012) in Ethiopia and Rincon (2010) in Colombia.

The coefficient of GDP is positive, which is in confirmation of the theoretical expectation. The findings indicate that GDP has a positive effect on the balance of payments. A 1% increase in GDP causes balance of payment to improve by 0.17 units. The implication is that, a country's income plays a significant role for its foreign reserve. The positive impact of GDP is a sign of export expansion. Increase in export makes the trade balance and balance of payments positive. This empirical result confirms the findings of Eita and Gaomab's study in Namibia (2012), Rincon (2010) of Colombia and Korsu (2001) in Sierraleon.

Domestic credit, on the other hand, has negative impact on balance of payments, according to the findings. This result is consistent with the argument of the monetary approach to BOP provided that domestic credit expansion increases money supply in the economy. A 1% expansion/contraction of domestic credit brings a decrease/increase of foreign reserve by 0.145 units and thus worsens the balance of payments. This result is consistent with a study by Adamu and Itsede (2008) in which it was found that domestic credit affects balance of payment negatively.

Short Run Analysis

Table 5 presents the short run result from VECM. Equation 1 in table 5 shows the dInf equation which contains the short run impact of domestic credit, exchange rate, foreign exchange reserve, GDP and budget deficit on inflation. The coefficients of the one period lagged difference in the table can be interpreted as the short run parameters representing the short run impact of the respective variables. The result shows that foreign exchange reserve, domestic credit import price and GDP have significant impact on inflation in the short run. Budget deficit is also found to be significant. As the coefficient of $dInf_{t-1}$ indicates, in the short run, inflation in the current period is quite sensitive to what it was in the previous period. A one unit increase in the inflation rate in the current period leads to a further increase of 0.1873 in the next period on average.

Table 5

Short run result from VECM

	Eq1 (dInf)	Eq2 (dForex)
C	0.320 [2.140]	0.320 [-4.626]
$dInf_{t-1}$	0.183 [2.786]	-2.176 [3.460]
$dForex_{t-1}$	1.104 [3.064]	0.819 [2.853]
$dLnExr_{t-1}$	21.851 [4.003]	1.773* [0.513]
$dLNDc_{t-1}$	-3.388 [0.251]	-3.496 [-2.212]
$dImp_{t-1}$	3.879 [3.782]	-0.635* [1.228]
$dLNGDP_{t-1}$	-99.962 [-5.288]	-12.289 [-2.986]
dBd_{t-1}	4.476 [2.560]	-0.012* [-0.531]
ECT_{t-1}	-0.249 [4.894]	-0.128 [-5.139]

*Note.** means insignificant at 1% significance level, the numbers in Parenthesis represent t-values

The coefficient of foreign exchange reserve implies the existence of a positive significant causal effect on inflation by changes in foreign exchange reserve, suggesting that excess accumulation of foreign exchange reserve could fuel inflationary pressures in the economy. The short run coefficient of GDP is found to be negative and significant. An increase in GDP of 1%, on average, leads to 0.999 point increase in the inflation rate during the period 1976-2010. The results are consistent with economic theory as a fall in output tends to slow down economic growth and trigger inflation in extreme cases. This finding for Gross Domestic Product is consistent with that of Dlamini (2008) finding in South Africa.

Domestic credit has a negative impact on inflation in the short run. Inflation reduces, on average, by 0.22 units for an expansion of domestic credit by 1%. But this impact is statistically insignificant. Inflation reduces, on average, by 0.22 units for an expansion of domestic credit by 1%. This result is consistent with the view that in the absence of a well-developed financial sector the transmission of credit expansion might take longer than what would be with well-developed financial sector. Ethiopia is deprived of well-developed financial system. Thus the effect of credit expansion may not be reflected in prices very fast. Unlike the long run case, budget deficit is important in explaining inflation in the short run. An increase in deficit by one unit leads to an

increment in the inflation rate by 4.476 units. This parallels the findings of Korsu (2001) that fiscal imbalance is disinflationary.

Exchange rate and import price are significant in explaining inflation in the short run. Import price is found to be inflationary with a unit increase in price of imported goods and services will increase domestic inflation by 3.9. Exchange rate has inflationary effect in the short run too. A percentage point change in exchange rate brought about 0.22 units change in inflation in the same direction. This findings are consistent with the results of (Tafere, 2008) Korsu (2001), Biru (2005). The coefficient of the error correction term is interpreted as speed of adjustment to long run equilibrium. The coefficient of the error correction term of the inflation equation is less than unity and negative. This guarantees that although the actual inflation mat temporarily deviate from its long run equilibrium value, it would gradually converge to its equilibrium. However, the speed of adjustment to restore long run equilibrium is quite low, which is 24.9% per year and it will take almost four years to completely recover from a single shock and restore long run equilibrium.

Equation 2 in table 5 shows the short run equation for balance of payment, dForex. Inflation here is found to have negative and significant impact on balance of payment. One unit decrease/ Increase in the inflation rate causes increase/decrease in foreign exchange reserve by about 2.2 units. The balance of payments deteriorate with domestic inflation because it may stimulate import spending, given that imports appear relatively cheaper or it may decrease export sales as exports appear more expensive abroad. Though significant, past foreign exchange reserve has got very small influence on current period reserve (about 0.819). The coefficient of exchange rate implies it has insignificant impact on the balance of payments in the short run. This result is not surprising because it takes more time for exporters and importers to adjust their transaction to the depreciation or appreciation of the exchange rate. This result is not at variant with the findings of Korsu (2001).

The coefficient of domestic credit indicates that this variable has significant but very small impact on balance of payment in the short run. 1% change in domestic credit brings a change in the balance of payment by 0.035 units. GDP is found to have significant but negative influence in the short run. As we noted before, real GDP could affect balance of payment from two sides. Increased GDP could be a sign of increased export (positive impact) or it could be a sign of faster import growth (negative impact). The negative relation between GDP and Balance of payments obtained in the short run indicates the latter effect outweighs the former.

The coefficient of the error correction term for the balance of payment equation is negative and significant, implying it is error correcting. This result ensures that foreign exchange reserve (which serve as a proxy for balance of payment) convergences to its long run equilibrium. The speed of adjustment however is slow, around 12.8% annually, as shown by the adjustment coefficient. Every year only just over 12% of the disequilibrium is adjusted.

Granger Causality Test

The Granger causality test is used to examine the existence of bidirectional causality among the given variables. According to table 6 there is bidirectional causality among inflation and foreign exchange reserve. Inflation Granger causes foreign exchange reserve changes and foreign

reserve changes Granger causes inflation. The existence of dynamic interaction among these variables confirms the appropriateness of using VAR model and the Johansen procedure. The table also implies that foreign exchange reserve Granger causes budget deficit and domestic credit whereas inflation Granger causes GDP, domestic credit and budget deficit. Import price Granger causes inflation and exchange rate. Domestic credit Granger causes GDP and inflation while exchange rate Granger causes GDP, domestic credit and import price. Budget deficit and GDP Granger causes all the variables except exchange rate and import price.

Table 6

Results of Granger causality tests

Equation Excluded	Forex	LNGdp	Inf	LNDc	LnExr	Imp	Bd
Forex		2.984 (0.394)	3.6294 (0.034)	11.605 (0.009)	3.1906 (0.363)	3.7193 (0.293)	14.305 (0.003)
LNGdp	13.927 (0.003)		18.6 (0.001)	3.7799 (0.028)	6.2299 (0.101)	8.182 (0.939)	10.653 (0.014)
Inf	12.691 (0.005)	11.062 (0.001)		7.1377 (0.068)	0.81786 (0.845)	8.335 (0.415)	12.889 (0.005)
LNDc	4.7872 (0.188)	16.486 (0.001)	2.8522 (0.045)		1.6512 (0.648)	4.038 (0.304)	1.3789 (0.710)
LnExr	0.5334 (0.912)	19.9835 (0.000)	2.233 (0.525)	1388.5 (0.005)		13.547 (0.004)	11.058 (0.601)
Imp	5.2568 (0.154)	6.6238 (0.702)	0.40513 (0.039)	9.1551 (0.207)	1.4132 (0.021)		1.0466 (0.790)
Bd	14.144 (0.011)	9.7712 (0.021)	6.2853 (0.099)	15.12 (0.002)	2.2802 (0.516)	2.0282 (0.567)	

Conclusion

The empirical estimations imply that there is a tradeoff between inflation and balance of payment condition. Too much accumulation of foreign exchange reserve fuels the inflationary pressure, thus sterilization is highly recommended. Moreover, since domestic credit is found to affect inflation negatively and balance of payment positively in the short run, this sterilization ought to take in a way that increase credit extended to the domestic sector. Besides, the existence of two way relationships between inflation and balance of payments stresses that any policy interventions aimed at stabilizing the economy need to take into account the priorities of the government. This is essential in that the choice of policy instruments may bring forward tradeoff between external balance with inflationary pressures. Regarding policy instruments available to the government, exchange rate is found to have insignificant impact thus to better utilize this policy tool, diversifying the export structure would be complementary. By doing so, the country's export

demand and supply would become more responsive to changes in the exchange rate. Additionally, it is found that GDP growth effectively reduces inflation both in the short run as well as long run, and also it improves Balance of Payments in the long run. Thus, fostering the country's economic growth is essential but its orientation should be switched to export promotion as the import orientation of the country's foreign market activity makes the economy vulnerable to foreign inflation.

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Appendices

Table A1

Augmented Dickey-Fuller Stationarity test Result

Variable	With Constant		With Constant and trend	
	At Level	First Difference	At Level	First difference
Bd	-2.8816	-8.2416*	-2.7742	-8.2247*
LNDc	-0.4103	-5.6760*	-2.2479	-5.5952*
Ln Exr	0.2789	-5.4193*	-2.0528	-5.5283*
Forex	1.5987	-4.8524*	-0.8139	-5.8434*
LNGdp	2.1811	-4.6519*	-0.2285	-5.4066*
Imp	-0.9080	-5.7326*	-2.4775	-6.4685*
Inf	-2.5056	-6.3221*	-2.3936	-6.8429*
MacKinnon critical values				
1%	-3.43		-3.96	
5%	-2.86		-3.41	

Note. Null hypothesis: series have unit roots. *Significant at 1% level

Table A2

Optimal lag order Selection

Lag	LR	FPE	AIC	HQIC	SBIC
0	NA	14.7669	11.1983	11.426	11.8853
1	62.532	3.76404	9.80665	10.171	10.9059*
2	21.211	3.59737	9.7063	10.2073	11.2178
3	33.216*	2.47686*	9.23081*	9.86849*	11.1546

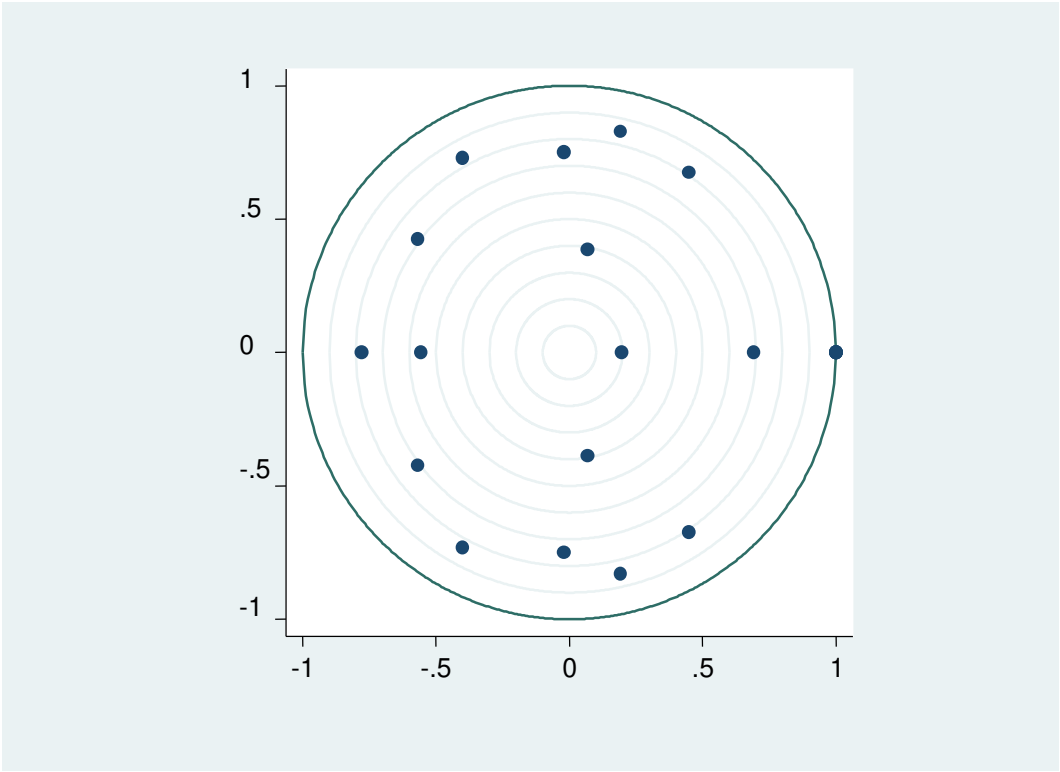

Figure A1. Inverse roots of the AR characteristic polynomial