Impact of Domestic Credit Shock on Output and Price in Ethiopia

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ABSTRACT

Using the Structural Vector Autoregression (SVAR) method, this paper analyses the impact of domestic credit shock on Ethiopian economy for the period 1998 to 2013 using quarterly data. Totally six variables are included in this SVAR model, four from domestic economy and two from external economy. A number of restrictions were imposed on the contemporaneous relationship of variables to identify the unique dynamic response of inflation and output to the credit innovations. The impulse response shows that positive credit shock affect CPI positively for long period of time (about five year)and affect real GDP negatively at the beginning (output puzzle) and then positively after third quarter. Whereas, variance decomposition found that the own innovation of domestic variables, except domestic credit, has the highest proportion both in short-term and long-term forecast error. Innovations of CPI take the highest proportion in explaining forecast error of domestic credit relative to other endogenous variables. Based on the finding of the study it can be suggested that taking into account the relative impact of credit shock on output and price monetary policy can stimulate output and stabilize price through instruments that affect credit of banking system.

***Key words**: Ethiopia, Structural VAR, Domestic Credit, Output and Price*
***JEL Classifications**: C58, C87, E30, E50*

1.Background

There are plenty of theoretical and empiricalliteratures advocatingthe role ofmonetary policy in stimulating effect on real output and employmentunder condition of less than full employment level, at least in the short run. Nevertheless, the mainstream classical economists argue that money is neutral or does not affect the real output but only affect the nominal variables.However,other schools of thought such as Keynesian and neoclassical, after then has reachesconsensus on the stimulating effect of monetary policy on output in the short run (Brian Snowdon and Howard R. Vane, 2005).

However, economists less agree on the transmission mechanism of monetary policy (B. Bernanke, 1988). The conventional classification of monetary transmission channels in crude term divided in to four channels. Namely, interest rate channel, exchange rate channel, expectation channel and credit channel (Mishkin 1995). Following B. Bernanke and M. Grether (1995) credit channel of monetary transmission mechanisms is divided into balance sheet channel and bank lending channel.They ignore credit channel as self-standing monetary transmission mechanism rather treat as a channel that amplify and propagate the interest rate channel.

According to Bernake and Grether, Bank lending channel focuses on the possible effect of monetary policy on the lending ability and decision of commercial banks (Depositary Corporations). Whereas, balance sheet channel of monetary policy transmission mechanism examines the effects of monetary policy measures on the cash flow and income statement of borrowers.

Domestic credit by banking system is the main counter part of money on the balance sheet of banks, so the same relationship expected to holds between credit and output as that of money and output. Bank lending is the main source

of external financing for small firms generally and specifically for developing countries. Financial sector of less developed country is characterized by regulated interest rate, no or limited stock market, underdeveloped secondary market and financial asset holding of household are limited, among others. As a result, central banksfrequently rely on direct type instruments of monetary policy. Direct type here to mean policy measure taken by central banks through directly controlling monetary aggregates development directly. Direct intervention includes credit ceiling, selling and buying of bonds/certificates by central banks and direct intervention into foreign market. These make the role of credit as a monetary policy variable most important in developing country.

Banks' lending is the major component of domestic credit supply in developing countries generally and in Ethiopia particularly. Commercial banks major source of fundsfor extending loans comes from deposit they mobilized from government and non-government (i.e. public enterprises, cooperatives, private and sometimes foreign deposit) sectors. On the other hand, the amounts of saving depend on the opportunity cost of saving and income of the agents, among other determinants. By implication credit supply or loanable fund is determined by the output of the economy. In addition, the amounts of credit extended to the economy alter the level of investment, which ultimately affects the output level and hence the price level.

Despite the fact that Ethiopian economy witness high economic growth recently (MoFED annual report, 2012) still it is characterized by low per capita income, under developed financial sector and capital constraint economy. The role of domestic credit in supplementing this growth is not trivial. As IMF article IV report for the year 2012 acknowledged the recent growth of Ethiopian economythey give credit to the significance contribution of public sector to achieved growth by saying public enterprises lead growth. When we look at the share of public enterprise from total creditthe bulk of credit is extended to public enterprises, whichstrength the argument of contribution of credit to economic growth of the country. Moreover, like many developing countries Ethiopian economy is also credit constraint economy this is mainly due to underdeveloped financial sector of the country, among other reasons. According to World Bank ranking of ease of doing business in terms of getting credit Ethiopia ranked 105th in 2013 out of 189 countries, supporting the argument that credit availability is challenging in the country for private sector. This is not only because of low supply of credit but also due to credit rationing activity of financial institution which raises as a result of asymmetric information on the side of lender about their borrowers behavior.In addition to determining output level in the economy, credit also affects the price level. The immediate impact of increase in credit leads to high level of demand. Demand created due to surge in credit leads to high price level. This effect is significant especially if the credit goes to projects that have long gestation.

National Bank of Ethiopia (NBE) is the institution that has mandate to stabilizing price, exchange rate and financial sector of the country, as can be understood from mission of the bank, to do so NBE takes different policy measure at different time. During 2008/09 and 2011/12, inflation rate was high in the country; annual inflation rate was 55.2 percent and 38.0 percent during the aforementioned years respectively as measured by consumer price index. During this time, among the major policy measures taken by NBE credit ceiling in March 2009 that last for 2 years and zero direct advance to government in 2011/12 fiscal year to curb the then inflation rate is worth mentioning.This implies the considerable importance of credit in altering inflation rate and its significance as policy variable.

To summarize, credit in the economy is affected by the prevailing economic growth in addition to government policy, since increase in economic growth is accompanied by high saving rate (that increases the availability of loanable fund). On the other hand, the rise in credit stimulates the economic growth by increasing the investment level. In addition, increase in credit lead to high demand that leads to inflationary pressures. Similarly, expected inflation can determine the credit demand through its effect on real interest rate.

2. Statement of the Problem

Monetary policy of Ethiopian is designed,similar to other countries, to achieve stable price and exchange rate, and leads to developed financial sector and hence foster the economic growth of the country. NBE as a responsible institution to design monetary policy of the country set reserve money as operational target and broad money as intermediate target based on the assumption that demand for money is stable. For this reason, the change in broad money accommodates movement of reserve money, which varies due to domestic credit and net foreign asset of NBE. Therefore, to make the growth rate of reserve money within the target NBE uses T-bills, reserve requirement, credit ceiling, determining credit to government, forex market intervention etc as monetary policy tools.

The role of credit as monetary policy tools especially to combat inflation is high in Ethiopia,through affecting credit supplies directly or indirectly by central bank. Different literatures find out that the effect of credit shock on output and price in credit constraint countries, like Ethiopia, issignificant relative to credit abundant economy (see McCallum (1991), Galbraith (1996) and Balke (2000)). This is due to differ in extent of information asymmetries. This imperfection of credit market affect also the way monetary policy transmitted to aggregate demand (Christina D. Romer and David H. Romer, 1996).

The share of credit to government and public enterprise from total domestic credit is significant in Ethiopia. In addition, government owned financial intermediaries extend considerable amount of credit into the economy. Then the high importance of credit as monetary policy variable and dominance of government and public enterprise in borrowing from banking system raise the need to identifying the effects of credit shock on output and price so that it supportthe design of sound policy making process.

Moreover, despite enormous literature on the effect of money on output and price in Ethiopian case there are only limited work done on the effect of domestic credit shock on output and price. The existing literature also conducted either on the impact of credit on output (Murty, Sailaj, Wondaferahu, 2012 et al) or on the impact of credit on price separately. Therefore, this particular work tries to narrow the literature gaps.

3.Monetary policy framework

Central bank of a country is responsible to design monetary policies depending on the existing issues and future countries development strategy. Therefore, they set policies and use different tools to achieve their goals. Central bank's target different variables at different levels, the variables they target may differ from country to country but in crude term, there are three targets at different level. Employment creation, economic growth, stable prices are the final target (goal) of most central banks. Instead of targeting goal variables directly, they have intermediate targets that link operational targets and final goals of monetary policy, intermediate targets include monetary aggregates, exchange rate or interest rate. The other target which closely monitored by central banks and central banks have more control is called operational targets, includes reserve money or short-term interest rate. Monetary policy makers employ different tools to achieve their targets, which includes open market operation, discount windows and reserve requirement. By using these tools, they affect operational target variables then intermediate targets.Finally, the change in final target alters the goal variables. (Mishkin, 2004)

The monetary transmission mechanism describes how policy-induced changes in the nominal money stock impact real variables, such as aggregate output and employment (The Palgrave Dictionary of Economics). Similarly, Taylor (1995) defines monetary transmission mechanism as a process through which monetary policy decisions are transmitted into changes in income and inflation. Monetary transmission operates through the effects that monetary policy has on interest rates, exchange rates, credit and expectation generally.

The idea behind credit channel of monetary transmission mechanism is, central bank's policy alter the decision of commercial banks regarding supply of loan. This idea comes in contrast to the view, where there is no reference to loan supply shocks (see Bernanke and Gertler, 1995). As A.Markidou and E.Nikolaidou (2006) put it the major shortcoming of the view is the considerable difficulty in the identification of a quantitatively meaningful effect on aggregate spending and investment that the theory indicates it should influence. The credit channel has emerged to fill the gap.

4.Empirical literature review

There are only limited empirical literature conducted on monetary transmission mechanism of Ethiopia let alone the methodology they employ (irrespective of whether SVAR methodology is used or not), especially published research papers. Therefore, in this section we try to look at the existing research papers conducted on Ethiopian case with focuses on the impact of credit and money shocks on output and price, or related area and paper conducted on other countries case,particularly East Africa, using similar methodology with ours.

However, worldwide the relationship between monetary aggregates on one hand and output and inflation on the other hand is one of the most studied areas in monetary economics. The early works by Friedman and Schwartz (1963) conclude that changes in money aggregates leads changes in income in the U.S. Moreover, Romer and Romer (1989), unlike other research papers which employ statistical tools to examine the effect of money expansion on real output

they employ narrative approach which focuses on evidence derived from theory. Similarly, for Australia, Sheppard (1973), Davis and Lewis (1977) and Boehm (1983) all found that monetary aggregates' leading real activity but using statistical tools. In addition, Sims (1972) using VAR methodology found out that money led income in granger causality test for U.S.

During early period,money dominates the literature examining monetary transmission mechanism. However, B.Bernanke and A. Blinder (1988) on their research paper "credit, money and aggregate demand" they try to modify the conventional monetary transmission mechanism that give high role for liability side of banks' balance sheet so as to permit balanced treatment and giving equal emphasis for asset side of banks' balance sheet including loan, bond.

Recently, Leon Berkelmnas (2006) using SVAR approach including seven variables, two foreign and five domestic variables, try to examine the impact of credit and monetary policy shock on output and price in case of Australia. Almost all variables included in this study is integrated of order one. VAR model is employed at level following Sim (1989) and Doan (1990) recommendation, though the variables have unit root. The study found out that the response of credit and price to monetary policy shock is relatively slow and even slower than that of output. On the other hand, in response to macroeconomic consequence of credit shock output, exchange rate and price are moderately affected but it would be higher in absence of monetary policy response.

In contrary to developed economies empirical finding for African case shows that monetary transmission mechanism are full of puzzle, even though some empirical finding witness the puzzles are also there for developed countries. H. Davoodi, S.Dixit and G. Pinter (2013) examined the MTM in the east African community, where reserve money and policy rate are two frequently used instrument of monetary policy. They find that MTM in the region is weak when using standard statistical inference but somewhat strong when using non-standard inference method. Based on their review of empirical literature they conclude that MTM is strong in Kenya relative to other countries in the region, though only for prices, while it is generally week in the rest of east African community. Cheng (2006) applied both recursive and non-recursive structural vector autoregression (SVAR) to monthly data in Kenya for 1997–2005 and found some evidence for the presence of the traditional transmission channels. For example,Cheng (2006) using monthly data for Kenya find out that the existence of both price and output puzzle in the short term. In general, contractionary monetary policies (short-term interest rate) have significant impact on price and less impact on output. In contrary, Maturu, Maana, and Kisinguh (2010) applied the same methodology as Cheng (2006) to study MTM in Kenya using quarterly data and M3 as monetary policy instrument. They find that an exogenous shock to M3, an expansionary monetary policy, has no effect on real output, but leads to rising prices for almost 18 months, which is also statistically significant.

Similarly, Mugume (2011) examine monetary transmission mechanism, applying structural VAR models to quarterly data for 1999–2009, and found all channels of monetary transmission to be ineffective. In particular, the interest rate channel remains weak, even though there is some evidence for a transmission of Treasury bill rate changes to lending interest rates.

A.Yohannes and R.Gottschalk (2010) in there paper entitled "Macro-econometric Model of Ethiopia" consider private sector credit (which includes term loans and banks overdraft loan) as a function of private investment, export and import of goods, and lending interest rate. Therefore, they employ the error correction model to examine the long run and short run dynamics of private sector credit and they find out that in the long run international trade explain credit better than domestic investment activity and lending interest rate. Finally, they conclude that interest rate is not a real problem for private sector credit.

Similarly, K. Murty, K. Sailaja and W.Demissie (2011) examined the long run impact of bank credit on economic growth in Ethiopian case using multivariate Johansen cointegration approach the study covers the period from 1971/72-2010/11. Specifically, the study is focused on the impactof bank credit to private sector in affecting long run economic growth. Variables included in this study are; GDP per worker, per capita capital stock, bank credit to private sector, deposit liability of banks to GDP ratio, openness to trade measured as sum of import and export as a share of nominal GDP. The result obtained from this study shows that there is positive and statistically significant long run relationship between bank credit and economic growth in Ethiopia. In addition, deposit liability also affects long run economic growth through banks service of resource mobilization.

5.Data and Methodology

(a) Data

Four endogenous domestic variables and two foreign variables are included in our study. The domestic variables included to represent domestic economy, namely, domestic credit, gross domestic product, consumer price index, and lending interest rate. On the other hand, foreign variables are included to capture the impact of external economic shock on domestic economy. Foreign variables included are world crude oil price and world food price index. The series used for our model is on quarterly basis.

Data source for foreign variables is World Bank databasewhereas; domestic variables data are obtained from National Bank of Ethiopia, Ministry of Finance and Economic Development (MoFED), Ethiopia Revenue and Custom Authority (ERCA) and Ethiopian Investment Agency (EIA). Moreover, attempts are made by researcher to make the data tailored to the study.

(b) Model Specification

After Sims (1980) influential paper VAR methodology become popular in time series econometrics. VAR model is mostly used for forecasting and to know the dynamic response of variables to different shocks. However, Cooley and Leroy (1985) criticized VAR methodology by it's a theoretical identification system which lead to the development of SVAR models by economists like Sim(1986), Bernanke (1986), Blanchard and Qua *et al* (1989), they used VAR methodology by basing the identification on theory. Currently SVAR methodology is widely used in time series econometrics particularly in identifying monetary transmission mechanisms.

It is not possible to estimate SVAR equation directly by following conventional estimation methodology due to the correlation between error terms and endogenous variables so first we estimate reduced form VAR model by OLS method. Besides, SVAR is over parameterized so, we must place enough restriction to recover structural parameters and get unique impulse.

Finally, to interpret our result we used two VAR tools; impulse responses function and forecast error variance decomposition and the result are analyzed. Impulse response function tells us the response of one or all variable in the system to exogenous shocks whereas, forecast error variance decomposition determine the contribution of each variables in explaining the h period a head forecast error of variables.

Our model is assumed to have the following structural form;

$$Ay_t = \alpha_0 + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} + cz_t + B\varepsilon_t \qquad (1)$$

Where, A is 6 X 6 instantaneous parameters and normalized to have unit elements on the main diagonal. y_t = (world crude oil price, world food price, real GDP, real lending interest rate, real domestic credit and CPI) is 6 X 1 vector of all endogenous variables. $y_{t-p}$is 6 X 1 vector of lag of our endogenous variable and p is lag order of auto regressive process included in our VAR model, in our case two lags are included based on lag length criterion discussed above. z_t contain all deterministic terms, in our case three seasonal dummies and time trend are included; $\varepsilon_t$is 6 X 1 innovation term of our structural model and assumed to be distribute as $\varepsilon_t \sim (0, I_n)$; α_0 are constant term, B is 6 X 6 diagonal matrix and, all β's and C are coefficients of respective variables.

Our reduced form VAR is assumed to be like this:

$$y_t = A^{-1}\alpha_0 + A^{-1}\beta_1 y_{t-1} + \ldots + A^{-1}\beta_p y_{t-p} + A^{-1}CZ_t + A^{-1}B\varepsilon_t$$

In compatible form, the reduced form of VAR can be written as:

$$y_t = \phi_0 + \phi_1 y_{t-1} + \ldots + \phi_p y_{t-p} + \varphi Z_t + e_t \quad (2)$$

Defining $A^{-1}\alpha_0 = \phi_0$, $A^{-1}\beta_1 = \phi_1$, $A^{-1}\beta_p = \phi_p$, φ=A^{-1}C and $A^{-1}B\varepsilon_t = e_t$. Where, e_t is 6 x 1 observable error terms of our reduced form VAR model $e_t \sim (0, \sum_e)$. $\sum_e$ is variance covariance matrix of reduced form model residual and assumed to be symmetric matrix.

Prior to estimating equation (2) we check whether inclusions of dummies improve our model or not. To check it we conduct LR test with null hypothesis of no seasonal dummy and we calculate the LR statistics manually, the statistics have the following form;

$$LR_{stat} = (T-n)[\ln|\sum_r| - \ln|\sum_{unr}|] \sim x^2(q)$$

Where, T is the number of observation (62 after adjustment); n is number of equation multiplied by lags in each equation plus deterministic terms and constant (17 in our case); $|\sum_r|$ and $|\sum_{unr}|$ are determinants of residual covariance of restricted and unrestricted model respectively. The LR statistics have chi-square distribution with q degrees of freedom; q is number of equation multiplied by number of dummies (i.e. 18). The computed LR statistics is equal to 47.6 (LR_{stat}=47.60) wich is compared with chi-square critical value of 5% significance level of equal to 28.87 (x^2(18) at 5% equal to 28.87). The statistics value is greater than critical value so, we reject the null and proceed with model including dummies.

Therefore our reduced form VAR model include six endogenous variables with two lags for each endogenous variable, constant, time trend and three seasonal dummy are estimated using OLS.

6.Econometric Analysis

(a)Stationarity Test

Stationarity property of time series data should be checked prior to any estimation, so in this study we used augmented dickey fuller test (ADF) and Philips Perron test (PP) to check for existence of unit root in our series. We used lag length suggested by Schwarz information criteria in regression for unit root test. In addition the issue of detrended or trended data in regression for unit root test we rely on graphical inspection and significance of trend and constant term in unit root test regression. Then the following hypothesis is tested;

H_0 : unit root present

H_1 : no unit root

The results of these tests are depicted in the table below;

Table 1: ADF and PP test Results at level*

Variables	ADF test		PP test	
	With trend	Without trend	With trend	Without trend
Lnwop	-4.021 (0.013)	-1.351 (0.600)	-3.088 (0.118)	-0.975 (0.757)
Lnwfp	-3.587 (0.039)	-0.305 (0.918)	-2.708 (0.237)	-0.335 (0.913)
Lnrgdp	-2.527 (0.315)	0.507 (0.986)	-6.618 (0.000)	-1.403 (0.575)
Rir	-7.457 (0.000)	-6.844 (0.000)	-7.444 (0.000)	-6.844 (0.000)
Lnrdc	-2.524 (0.316)	-1.639 (0.457)	-2.524 (0.316)	-1.657 (0.448)
Lncpi	-1.464 (0.832)	1.805 (0.998)	-1.472 (0.829)	1.759 (0.999)

Source: own computation using Eviewsresult, numbers in parenthesis are p-value of the test

The above table shows as that ADF test (at 5 percent of significance level) find that Lnwop, Lnwfp and Rir are trend stationary at level (only Rir is stationary both with and without trend). In contrary to ADF test, PP test at the same

significance level found out that only Lnrgdp (trend stationary) and Rir is stationary. The rest of variables are found to be non-stationary. Therefore, the next step is to check for amounts of differencing needed to convert it into stationary series. The table below depicts the ADF and PP test statistics and its P-values at first difference of variables that are found to be non-stationary at level;

Table 2: ADF and PP test Results at first difference*

Variables	ADF test		PP test	
	With trend	**Without trend**	**With trend**	**Without trend**
Lnwop	-6.370 (0.000)	-6.416 (0.000)	-5.471 (0.000)	-5.543 (0.000)
lnwfp	-6.096 (0.000)	-6.036 (0.000)	-5.322 (0.000)	-5.266 (0.000)
lnrgdp	-12.791 (0.000)	-12.758 (0.000)	-22.047 (0.000)	-20.882 (0.000)
lnrdc	-8.688 (0.000)	-8.721 (0.000)	-8.711 (0.000)	-8.725 (0.000)
lncpi	-7.695 (0.000)	-7.139 (0.000)	-7.694 (0.000)	-7.134 (0.000)

Source: own computation using Eviewsresult,numbers in parenthesis are p-value of the test

As depicted in the above table the rest variables become stationary both by ADF and PP test after first differencing, so they are integrated of order one, I(1).

(b)Lag Length Selection and Diagnostic Tests

We used standard lag length selection criterion to choose for number of lag included in our model. Therefore, information criteria, likelihood based test and Wald lag exclusion test are used. The information criterions are Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ), whereas the likelihood based tests includes, final prediction error test (FP) and sequential modified likelihood ration test (LR) are used. Using lag length favored by each criterion, we undertake residual diagnostic test so that it enables us to choose the best model.

Given the sample size and frequency of our data, we select maximum lag of four and conduct the test. Therefore, SIC and HQ criterion favors lag one whereas LR and FP test choose two lags. Highest lag is selected by AIC, three lag. Using the selected different lag length we conduct thefollowing residual based specification tests; Breusch–Godfrey LM test of autocorrelation (H_0: no autocorrelation), Jarque-Bera non normality test (H_0: normality) and White heteroskedasticity test without cross term (H_0: homeskedastic). The results of the tests are summarized in the table below.

Table 3: Residual Diagnostic Test Results at Different Lag Length

Tests	Test statistics for Lag 1	Test statistics for lag 2	Test statistics for lag 3
Breusch-Godfrey LM_1 autocorrelation test	63.48(0.00)	42.67(0.21)	46.64(0.11)
Joint Jarque-Bera non normality test	86.68(0.00)	23.69(0.02)	27.45(0.01)
White Heteroskedasticity test without cross terms	1289.30(0.16)	605.63 (0.53)	886.38(0.27)

Source: own computation based on Eviews result, Number in parenthesis are p-value

As clearly shown in the above table, lag length two for our VAR model seems good since it passes autocorrelation and heteroskedasticity diagnostic test. Moreover, Wald test for lag exclusion is also reject the null hypothesis of joint insignificancy of the second lag (with p-value 0.000) and accept the null of insignificance of third lag (with p-value 0.1010). The residual of our model is non-normal at 5 percent of significance level and since non-normality of the error term makes only the inference invalid but the coefficient estimated is still consistent we do not consider it as a serious problem. Therefore, we employ lag length two in our reduced VAR model.

(c) Cointergation Test

If we have non-stationary variables of the same order and if some linear combination between them is stationary we can say the variables are cointegrated or have long run relation. Therefore, to test whether our variables are cointegrated or not we conduct Johansen multivariate cointegration test for non stationary variables to uncover the number of

cointegrating equation. Hence, we used the two likelihood ratio based tests; maximum eigenvalue test and trace test. The test result is depicted in the following table:

Table 4: Johansen Multivariate Co-integration test Results

Null hypothesis	Trace test		Maximum eigenvalue test	
	Alternative hypothesis	Trace statistics	Alternative hypothesis	Max-Eigen statistics
H_0: r=0	H_1: r≥1	89.7 (0.000)	H_1: r=1	38.0 (0.015)
H_0: r≤1	H_1: r≥2	51.7 (0.021)	H_1: r=2	20.4 (0.317)
H_0: r≤2	H_1: r≥3	31.3 (0.033)	H_1: r=3	17.5 (0.15)
H_0: r≤3	H_1: r≥4	13.8 (0.088)	H_1: r=4	12.5 (0.094)
H_0: r≤4	H_1: r≥5	1.4 (0.245)	H_1: r=4	1.4 (0.245)

Source: own Computation

The cointergation test is conducted by including intercept terms and allowing trend term in the data. As a result, trace test found out three cointegrating equation whereas, maximum eigenvalue testdiscover only one cointegrating equation. In general, we can conclude that there is cointegrating relationship between our variables.

After our reduced form VAR is estimated with appropriate lag length and checked for diagnostic test and stability of our model. We impose sufficient restriction, to identify our SVAR model. Then, variances of structural innovations and contemporaneous parameters (unrestricted instantaneous parameters) estimated by method of scoring algorithm (analytical derivatives) suggested by Amisano and Giannini (1992). Therefore, in this section structural model results are analyzed using impulse response function and forecast error variance decomposition. The result of structural parameter estimates of the matrices A and B are given by;

$$A=\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ -0.157 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0.671 \\ 1.623 & 1.154 & -0.845 & 1 & -4.936 & 93.635 \\ -0.086 & 0 & -0.009 & 0 & 1 & 0.875 \\ -0.095 & 0.214 & 0 & 0 & 0 & 1 \end{pmatrix} \quad B=\begin{pmatrix} 0.127 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.051 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.100 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.290 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.023 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.037 \end{pmatrix}$$

As discussed in the methodology part variance covariance matrix of structural model is assumed tobe identity and B matrix is diagonal matrix so, we can consider the diagonal elements of B matrix as standard deviation of residual of structural model.

The over identification test statistics with chi-square distribution is found to be $X^2(3) = 4.569$ and the p-value of the test is 0.206 so we accept the null hypothesis of valid over identification at any fair significant levels, frequently at 1 and 5 percent significance level.

7. Impulse Response Function of Structural Model

Impulse response function tells us the response of one or some variables due to exogenous shock (unexpected shock) of one of the variables in the model (H.Lutkepokl, 2005). In our case, we classify exogenous shock or innovation in to three categories. The first form of shock is external shock, which is captured by world oil price and world food price index shock. The second category of shock is monetary policy shock, captured by real credit and real lending interest rate shockand the third form of shock is domestic economy shock, which is captured by real GDP and CPI innovation. However, in interpretation ofourmodel results we emphasis on the response of GDP and CPI due to credit shock on the one hand, and external shock on the other hand. To do so, weintroduce one standard deviation shock to impulse variable and look at the response of other variables (including the variable itself) at different lag length.

To provide clear magnitude of the shock we are going to introduce it is fair to show the standard deviation of structural innovations.It is more valuable because we are going to interpret our impulse as a response to one standard deviation shock.

For the case were variance covariance matrix of structural model is identity diagonal element of B matrix is considered as standard deviation of respective variable.Therefore, we present the structural errors standard deviation in the table below for each shock from the above SVAR estimation of B matrix presented above.

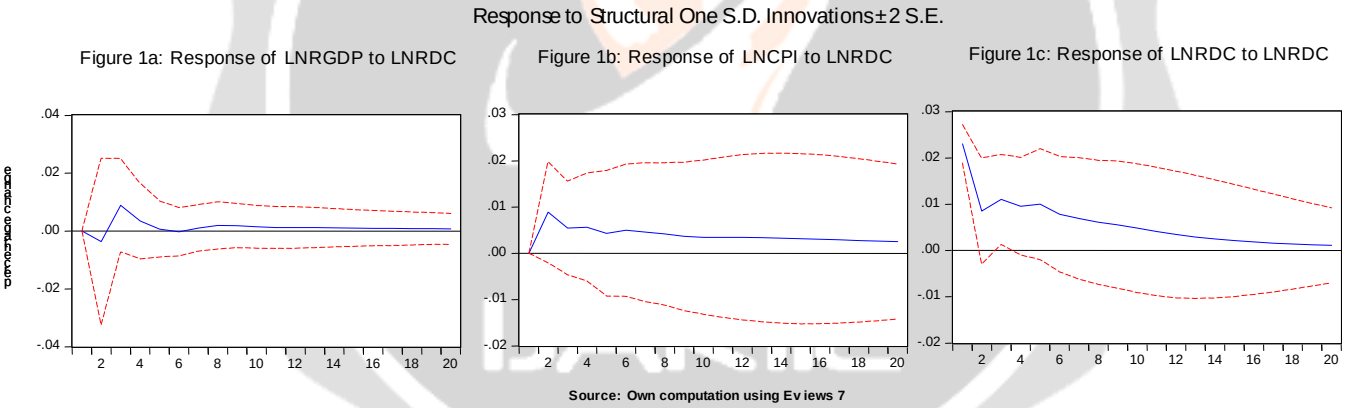
Table5: Standard Deviation of Structural Residuals

Variables	Lnwop	Lnwfp	Lnrgdp	Rir	Lnrdc	Lncpi
Standard deviation	0.13	0.05	0.10	0.29	0.02	0.04

Source: own computation

Credit Shock: From the above table the standard deviation of real credit is 0.02 so, we can interpret impulse of real credit as the impact of 2 percent (since our data is in logarithmic form) positive shock of real domestic credit or one standard deviation shock on other response variables.Similarly, the same way of interpretations holds for other variables, 4 percent for CPI shock, 10 percent for GDP shock, 0.3-percentage point for interest rate, etc.

Figure 1: Responses of Domestic Variables to Credit Shock



The above figures shows us the impulses of real domestic credit on real GDP, CPI and real domestic credit, itself, for about five years (20 quarter). Based on our restriction, credit shock does not instantaneously affect real GDP.As shown in the figure 6a, positive shock in credit (measure of expansionary monetary policy) decreases real GDP up to quarter two, and afterwards it increase real GDP until sixth quarter and then the effect is die out. Implying shock in credit does not have long run impact on real GDP but in short run it shows upward and down ward trend, decreasing until thesecond quarter and increasing after third quarter. The lowest response of real GDP to positive credit shock is at the second quarter.2 percent unexpected increase in credit lead to decrease of real GDP by 0.4 percent. On the otherhand, the positive response of real GDP is higher during third quarter, stimulating output by 0.9 percent. After third quarter,the effect is decreasing and reach zero during sixth quarter. The decrease in output at the beginning period because of positive credit shock is output puzzle because it is contrary to our expectations, and a theory.

Similarly, figure 1b shows us the response of CPI to positive credit shock. The response of CPI is in line with our expectations. Positive credit shock affects CPI positively this can be justified by the increase in credit create more demand and hence price. The impact on CPI reaches its peak point after second lags to reach 0.9 percent increase of CPI to unexpected 2 percent shock of credit. After second quarter the effect is start to decline to die out. However, as

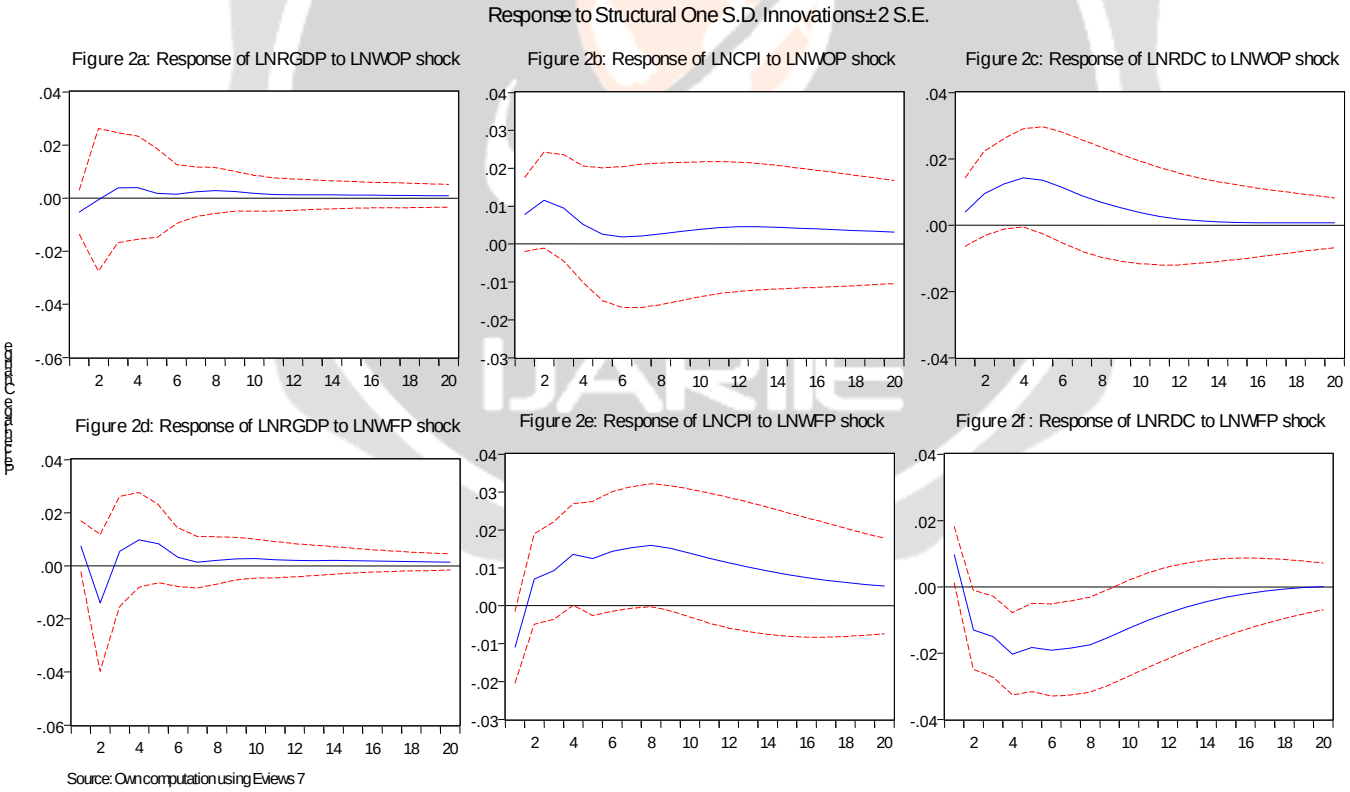
compared to response of real GDP the response of CPI takes a long time to die out even after 5 year it have 0.3 percent positive impact.

Like CPI response, the own impact of credit is also positive, and it takes a long time to die out. During the first quarter credit increase equivalently with one standard deviations of structural model residual of credit, which is equal to 0.2 percent. The own effect declines to 0.009 percent during second quarter and further decline as lag length increase to reach 0.001 after five year and then die out.

External Shock: To begin with our expectation, positive oil price shock is expected to affect credit and price positively on the one hand, and output negatively. This is due to, since the government is subsidizing oil price positive oil price raise the money needed for subsidy. To finance increased budget, because of surge in oil price,government need credit from banks since one source of financing its budget need is domestic borrowing. Moreover, the surge in world oil price is directly transmitted into domestic economy. On the other hand, positive shock in credit is expected to hamper domestic economic activity by raising the production and transportation cost.

Similarly, positive world oil price shock is expected to affect domestic price level, output and credit positively. Since, Ethiopia is commodity exporting country agricultural sector is expected to benefit from increase in world food price by stimulating agricultural output and, hence, total output. Despite the fact that agricultural output is expected to increase due to positive world food price shock domestic price is expected to increase because, the increase in world food price is expected to transfer to domestic economy through increase in price of exported commodity. In addition, increase in world food price is expected to increase domestic credit to facilitate the anticipated increase in export and output growth. The responses of each variable to two foreign variables shock are presented in figure below;

Figure 2: Responses of Domestic Variables to Foreign Variables Shock



As depicted in the above figure, except the response of credit and GDPto world food price shock almost all domestic variables response is similar to our expectations (with the exception of small decrease in CPI to both variables shock at the beginning period).

8. Forecast Error Variance Decomposition

Another means to observe the dynamic interrelationship between variables, in addition to impulse response, is to look at the forecast error variance decompositions.Which provides us information about the relative importance of each random innovation in affecting the variables in the VAR. Saying it in another words, forecast error variance decomposition describes what proportion of a shock to a specific variable is related to either its own innovations or those associated with other dependent variables at various forecast time horizons in the system. The variance decompositions for four different forecast horizons (one quarter and two quarter; and one and five years) are reported in Table below. Each column reports, for a different domestic variable, the proportion of the forecast error that is explained by structural shocks to each of the six explanatory variables, listed on the left hand side of the table (so, for a given time horizon, the entries in a given column sum to one hundred

Table6: Structural Variance Decompositions of Domestic Variables

Innovation	Forecast (quarters)	Proportion of forecast error variance for variable		
		Lnrgdp	Lnrdc	Lncpi
Lnwop	1	0.258	0.930	4.061
	2	0.245	4.125	7.432
	4	0.489	10.126	5.846
	20	0.784	10.390	3.510
Lnwfp	1	0.502	5.545	7.903
	2	2.187	10.249	6.456
	4	3.143	19.777	8.208
	20	4.017	31.302	16.494
Lnrgdp	1	93.647	0.046	0.000
	2	89.988	0.033	2.547
	4	87.653	6.875	29.617
	20	86.598	19.468	56.464
Rir	1	0.000	0.000	0.000
	2	1.207	0.796	0.983
	4	1.453	0.483	1.429
	20	1.533	0.296	1.775
Lnrdc	1	0.000	31.712	0.000
	2	0.117	23.443	3.011
	4	0.875	17.879	2.634
	20	0.991	12.769	2.317
Lncpi	1	5.593	61.767	88.035
	2	6.256	61.353	79.570
	4	6.387	44.860	52.266
	20	6.077	25.775	19.441

Source: own computation based on Eviews result

Both in short term and long term, GDP's own shocks are important for GDP forecast errors followed by CPI at the second level. Similarly, for inflation its own shocks are responsible for almost all of the short-term forecast error. Over longer horizons, shocks to GDP are increasingly important. Shocks to the domestic credit have been only a small part of GDP and CPI forecast errors, relatively it explains forecast error of CPI more than that of GDP.Over short horizons, the

forecast errors for credit are explained by shocks to CPI and credit itself unlike other domestic variables (GDP and CPI) foreign variables had relatively better explain forecast error of domestic credit. Innovations to the international variables become more important as time passes across the spectrum of domestic variables, especially for domestic credit and CPI.

During the first quarter almost all, 93.6 percent forecast error of GDP comes from innovations of GDP itself, however, this figure decreases to 90.0, 87.7 and 86.6 percent during second, fourth and twentieth quarters respectively. Next to GDP, innovation of CPI had better explain the forecast error of GDP as compared to other endogenousvariables.During the first, second fourth and twentieth quarter the proportion of CPI to GDP forecast error is 5.6, 6.3, 6.3and 6.1 percent respectively, whereas, the contribution of domestic credit is insignificant. The proportion of forecast error due to credit is highest during twenty-quarter ahead forecast, which is only one percent.

Similarly, the short-term forecast error of CPI is attributed to innovations of CPI itself, which accounts for 88.0, 79.6 and 52.3 percent of the first, second and fourth quarter forecast error. Nevertheless, the share of GDP in explaining forecast error of CPI increase at long period horizon. The proportion of GDP is 2.5, 29.6 and 56.5 percent during the second, fourth and twentieth ahead forecast error. Even though, the proportion of credit is more in case of CPI than GDP still it is insignificant. It explains only 3.0, 2.6 and 2.3 percent of second, fourth and twentieth period forecast error of CPI.

Unlike GDP and CPI forecast error the own contribution of domestic credit is low. Rather CPI takes the highest share in explaining forecast error of credit. It have 61.8, 61.4, 44.9 and 25.8 percent proportion in first, second, fourth and twentieth quarter ahead forecast error. Followed by the own effect of domestic credit, which is having share of 31.7, 23.4, 17.9 and 12.8 percent in the first, second, fourth and twentieth ahead forecast respectively. In the long-term forecast error (20 period ahead forecasts) world price have 31.3 percent share, which is the highest one from foreign variables explaining the forecast error of domestic variables. This figure is 4.0 and 16.5 percent for the case of GDP and CPI respectively.

9.Conclusions and Policy Implications

Employing quarterly series, we try to examine the dynamic impact of credit shock on output and price. Even though, our interest is on impact of credit we also look at the impact of external variables shock on domestic variables, particularly on GDP, price and credit. One thing need attention in this study is that, we used quarterly series for our SVAR methodology.However, GDP is not obtained in quarterly basis so, researcher disaggregates it.Therefore, caution needed when result of this study is used for policy input.Because, there may be bias that comes due to disaggregation method.

As discussed in the main body of the paper different proxies were used for financial deepening indicator witness that, the financial sector of Ethiopia is improving overtime, even though still at infant stages. Accompanied by improved financial sector and government development strategy domestic credit shows increasing trend. In addition to augmenting economic growth, credit is important policy variables in price stabilization process. Different case of high inflation level discussed is followed by serious policy on domestic credit.

The trend of price and domestic credit gives some sign of co-movement between them; however, it is difficult to trace this kind of relationship between output and credit trend, implying credit is closely related with price than output and raise needs for econometrics model to know their relationship. So, econometric methodology, SVAR, is employed to look at the relationship between variables of our interest.Despite the fact that, some of our series have unit root we just ignore it and include the series at level not to remove the co-movement between variables by differencing.Then we impose restriction of exogeneity of foreign variables and policy variablesonly affect output and price with lag toidentify our model. After estimation,Structural Impulse responses and Variance decompositions are used to analysis the results.

The impulse response of output for credit shock during the initial period, second quarter, since we restrict the first quarter to be zero, is negative which is puzzle relative to our expectation and what theories says. However, after third quarter the responses of output became positive, reach its highest point, and begin to decrease and die out after six quarter. Unlike the response of real GDP, the response of CPI to credit shock does not have upward and downward trend. Two percent unexpected shocks in domestic credit affect CPI by 0.9 percent during the second quarter (the highest response) and the effect die out after approximately five years. On the other hand, the highest response of GDP

to 2 percent positive credit shock is 0.9 percent during third quarter and whereas the lowest response is negative 0.4 during the second quarter. The responses of GDP are dyingout too early, at the six lag, relative to CPI responses.

On the other hand, the own effect of output and price shock on forecast error are significant at the short term. In contrary, the short-term forecast error of domestic credit is attributed to CPI, implying much of the forecast error of credit is come from CPI.The proportion of forecast error of domestic variable explained by external variable is low both for short term and long-term forecast but it slightly increase in the long-term forecast error.

Therefore, the major conclusion we can draw from this study is that positive credit shock affects outputs (in net terms) and price growth positively hence, by balancing there effect monetary policy can stimulate economic growth via credit expansion.In addition credit shock also affect domestic price significantly so it can be used as policy variables and attention should be taken about the positive effect of expansionary credit policy on price. Not only policy induced credit growth we are talking about rather includes economy induced also so, bringing the informal sector that extends credit in to the formal system will increase the benefit to the economy by channeling fund to the more productive sector.

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