The validity of bank lending channel in Zimbabwe

Munyanyi, Musharavati Ephraim

Istanbul Medeniyet University, Turkey

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The validity of bank lending channel in Zimbabwe (1970-2014)

Musharavati Ephraim Munyanyi
Department of Economics, Istanbul Medeniyet University,
Istanbul, TURKEY
E-mail: ephraimmunyanyi@gmail.com,
Phone: (+90) 534 703 64 89

Abstract

This paper seeks examine the validity of the bank lending channel in Zimbabwe. It estimates the relative impact of this channel on key economic variables such as, economic growth and inflation by covering the period from 1970 to 2014. For this purpose, Vector Autoregression (VAR) approach is employed. Impulse Response Functions are also generated to confirm the response of a shock in bank lending upon itself and other variables (economic growth and inflation). The result findings indicate that bank lending channel does not have a significant role in monetary transmission mechanism of Zimbabwe. The results imply that the bank lending channel should be improved through for example, tightening creditworthiness standards, revamping accounting standards and bank credit assessment capabilities, as well as setting up an effective judicial system to improve banks' ability to enforce on collateral.

Key Words: Economic Growth, Bank Lending, VAR

1. Introduction

It has always been an imperative phenomenon in the economics arena to try to comprehend the channels that transmit monetary shocks to real economic activity. Based on monetary economics literature, there are a number of monetary transmission mechanisms through which monetary policy effect changes to the real economy and these include the following; the interest rate channel, the exchange rate channel, the equity price channel and the credit channel (Juks, 2004, p.3). Since the past few decades, the credit channel transmission mechanism has drawn much attention and many scholars have pondered around the subject to empirically examine its effectiveness in various economies. The credit channel encompasses the bank lending and the balance sheet channel. The bank lending channel is limited to bank lending behavior, while the balance sheet channel links firm investment decisions with bank lending behavior, and captures all credit market interactions (Hussain, 2009). As the main target of this research, the study will concentrate more on the bank lending channel.

According to Mbat (2006), bank lending refers to short, medium or long-term loans and advances granted to organizations and individuals to meet their temporary or long-term deficit operations. This lending can either be to the public sector or private sector. In this transmission mechanism channel, monetary policy works by affecting bank assets (loans) as well as banks' liabilities (deposits), for instance, an expansionary monetary policy that increases bank reserves and bank deposits increases the quantity of bank loans available. That is, where many borrowers do not have other sources of funding and are dependent on bank loans to support their operations, this increase in bank loans will drive investment and consumer spending up, leading ultimately to an increase in aggregate output (Gambacorta, 2005, p. 49).

Since bank loans are a major source of external finance for most firms and individuals, economic activity therefore tends to be very sensitive to shocks on bank lending behavior. That is, if banks are not able to offer loans to the deficit economic units, the business sector will face stagnant growth and vice versa is also true (Honohan, 1997). This is so, because when bank lending levels are low, firms will not be able to acquire enough loans to finance their investments. Investment in the economy will fall considerably causing some negative knock on effects on the economy such as increasing unemployment, reducing consumer spending and ultimately causing a decline in the level of economic growth.

In light of this, it can be inferred that bank lending plays an important role in influencing levels of consumer spending, investment and economic growth. Many scholars have conducted research on this area and have agreed that there is relationship between bank lending and economic growth but they differ on the direction of causality between the two variables.

The purpose of this study is to empirically test the effect of bank lending on Zimbabwe`s economic growth. In Zimbabwe, economic growth is one of the main macroeconomic goals of the government and, the monetary policy is strongly believed to be in full support of this main objective. Like in many countries, in Zimbabwe, bank lending is considered a very crucial and effective tool in stimulating the economy. To date, a lot of policies have been implemented so as to increase the magnitude of bank lending. For example, this year (2016), the Reserve Bank of Zimbabwe reduced the banks' lending rate to an average of 15% per annum and established a lot of credit schemes to increase the citizens' access to bank credit (Reserve Bank of Zimbabwe, 2016). The government argues that in doing so, economic growth will be stimulated and poverty reduced. However, before validating such claimed statements, such policies need to be critically analyzed before implementation so as to avoid negative after-effects. To simplify the process, the significance of bank lending in effecting changes in economic growth will need to be tested first, and this explains the purpose as well as the vitality of this study. Thus, the study will aid Zimbabwean policy makers in their decision making process as far as these bank lending related policies are concerned.

Most of the research on bank lending channel has been confined to developed countries. Studies from these developed countries include those by (Jiang et al., 2005), (Sun, 2004), and (Sheng and Wu, 2008) among others. Not much research has been done on this area in Zimbabwe either. However, rather than providing a brief overview of recent studies on this area, this study is different from those previously conducted studies in the following ways: This study focuses on a developing country, Zimbabwe, which makes it different from all previous studies which concentrated on the developed economies. As far as the study is concerned, it is one of the first studies in the literature to examine the effect of bank lending on the Zimbabwean economy. Thus, this study will add and contribute to the limited literature.

Rather than examining the effects of bank characteristics like what previous studies did, this study gives a focus on the effect of bank lending on the key economic targets, such as prices and output. Moreover, the estimation methodology of the empirical analysis (VAR model) used in this study differs from that of similar studies in the literature which used OLS (Tahir et al., 2015), providing econometrically more efficient model estimates.

This paper is organized into six sections. Following the introduction, Section 2 provides the empirical literature review. Section 3 gives a brief overview of the bank lending system in Zimbabwe. Section 4 presents the methodology and describes the data set. The results are discussed in Section 5 and finally, Section 6 concludes the study.

2. Literature Review

To effectively examine the relationship between bank lending and economic growth, Mohd and Osman (1997) grouped the relationship into supply-following and demand following hypotheses. Those who support the demand-following hypothesis argue that economic growth is a causal factor for bank lending and not the other way around. In their research they argue that as the economy expands and continues to grow, it causes an increase in the demand for financial services thereby stimulating banks to provide more credit (Muhsin and Eric, 2000). On the contrary, those who advocate for supply-following hypothesis strongly believe that bank lending is a vital catalyst for economic growth and development. They argue that efficient allocation of those borrowed bank loans by entrepreneurs will ultimately lead to economic growth (McKinnon, 1973; Fry, 1988; and Greenwood and Jovanic, 1990).

Mamman and Hashim (2014) examined the impact of bank lending on economic growth in Nigeria for the period 1987 to 2012. Using secondary data and multiple-regression model, the study found out that bank lending is statistically significant in explaining changes in economic growth. From the results, bank lending accounts for about 83% variation in economic growth in Nigeria for the period under study. In the same country but different period, Nnamdi (2015) also did research with an objective to evaluate the bank credits allocated to both the private and public sectors. Employing an error correction model, and running causality and cointegration tests, the results show a positive long-run significant relationship between bank lending and economic growth. Thus, confirming the findings of Mamman and Hashim (2014).

Using secondary data ranging from 1973 to 2013, Tahir et al., (2015) ran an OLS model to find the causality between bank lending and economic growth in Pakistan. Other variables like interest rate, inflation rate, investment and consumption were invoked into the model. Based on the findings, it shows that bank lending has an unexpected negative effect on economic growth in Pakistan. According to the study, this negative effect may have been due to hostile regulation policies which were imposed on the financial sector during the period.

Timsina (2014) studied the effect of bank lending channel (commercial bank credit to the private sector) on the economy of Nepal between 1975 and 2013. Applying the Johansen cointegration approach and Error Correction Model, the results reveal a positive long-run effect of bank lending channel on the economic growth of Nepal. 1% growth in real private sector credit leads to a 0.4% point increase in economic growth in the long run, implying that policy makers should focus on drafting ideal long-run policies to increase the level of economic growth in the economy. In the short-run however, a feedback effect running from economic growth to private sector credit is observed.

Using a fixed-effects panel model and collecting panel data from 25 transition countries between the year 1993 and 2000, Koivu (2002) surveyed to see if the efficiency of banking sectors can accelerate economic growth. To measure the efficiency of banking sectors, the margin between lending and deposit interest rates was used and bank lending to the private sector was used to represent the level of financial sector development. The results show that the interest rate margin is significantly and negatively related to economic growth. However, bank lending was found to be statistically insignificant in explaining changes in economic growth. Among the reasons cited for this insignificancy is the issue of banking crises and budget constraints that were obtaining during that period.

Vaithilingam et al., (2003) investigated the nature of the relationship between bank lending and economic growth in the Malaysian economy using quarterly data between the year 1968 and 1998. A VAR model was run and variables like real GDP, inflation, interest rate, government consumption, and bank lending were incorporated into the model. The results show a direct causal effect of bank lending on economic growth and an indirect effect running from economic growth to bank lending as well.

In Ethiopia, Murty et al., (2012) used cointegration approach to examine the ways through which bank credit to the private sector affects long-run growth. Using secondary data between 1971 and 2011, and other control variables like human capital, domestic capital, inflation, government spending, and openness to trade, the results show a positive and statistically significant equilibrium relationship between bank credit and economic growth.

In view of the above findings, it is imperative to also examine this relationship in Zimbabwe. The next section gives an overview of Zimbabwe bank lending system.

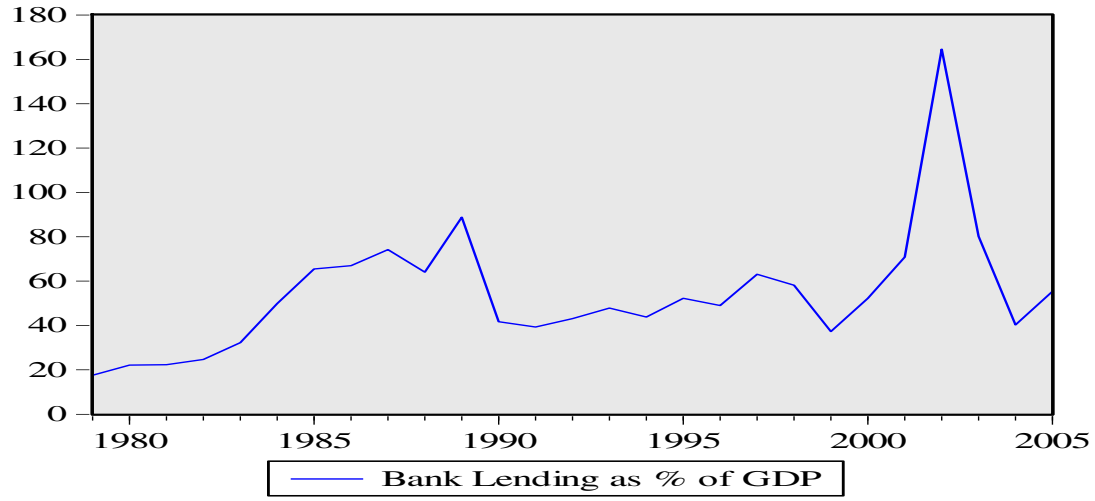
3. Bank Lending in Zimbabwe

Zimbabwe has five major agencies which regulate and supervise the financial system. There is the Ministry of Finance, the Reserve Bank, the Securities Exchange Commission, the Deposit Protection Board, and the Insurance and Pensions Commission. The Ministry of Finance is the overall supervisor of the Zimbabwean financial system; it oversees the whole system and delegates authority to the other four agencies. The Reserve Bank of Zimbabwe (RBZ) is responsible for the regulation and supervision of banks. The banking sector involves 14 operating commercial banks, 4 building societies, and 168 microfinance institutions (Reserve Bank of Zimbabwe, 2016).

Bank loans have been one of the major sources of finance for a very long time in Zimbabwe. Other institutions like microfinance institutions and building societies only contribute a significantly small amount of credit. Due to the fact that the legal and institutional structure for enforcement of debts contracts in Zimbabwe is very weak, bank loans are based on collateral security.

Shown below, is a trend of aggregate bank lending (expressed as a percentage of GDP) in the Zimbabwean economy between the years 1979 and 2005.

Bank Lending from the year 1979 to 2005



Source: Author's compilation based on figures from World Bank (2016), World Development Indicators

From the above figure, a fair level of lending can be seen throughout the period hitting peaks in 1989 and 2002. This increase in the provision of credit by the banks may have been influenced by the favorable domestic and external conditions, including the lifting of economic sanctions, stimulation of overall demand in the economy, and the opening up of external markets (IMF, 1998). As highlighted on the above diagram, major declines in the level of bank lending were witnessed in 1999 and 2004. This may be attributed to droughts and bank crises that reigned during those years (World Bank, 2008). Overall, it can be clearly seen that the level of bank lending in the economy was fairly on an incremental path although fluctuating. The next section presents the methodology.

4. Methodology

Model: Vector Autoregression (VAR)

In line with similar studies of Hussain (2009) and others on the effectiveness of monetary policy transmission mechanism channels, the study also uses Vector Autoregression Approach (VAR) to estimate the model. This model is very effective in analyzing the effectiveness of monetary policy transmission mechanism channels in economies with a recent history of macroeconomic instability and with short data series like Zimbabwe. Furthermore, this model takes into account the simultaneity between monetary policy and macroeconomic variables.

This study exposes how this policy instrument (bank lending) affects economic indicators such as output and prices. The VAR model expressed in a trivariate system is specified below:

$$\begin{bmatrix} RGDP_t \\ INFL_t \\ BL_t \end{bmatrix} = A(L) \begin{bmatrix} RGDP_{t-1} \\ INFL_{t-1} \\ BL_{t-1} \end{bmatrix} + \begin{bmatrix} \mu_{RGDPt} \\ \mu_{INFLt} \\ \mu_{BLt} \end{bmatrix}$$

Where $RGDP_t$ represents economic growth measured by Real Gross Domestic Product, $INFL_t$ represents the prices or inflation measured by GDP deflator, and BL_t is the policy instrument used, that is, bank lending measured by aggregate bank lending. $A\ (L)$ is a 3×3 matrix polynomial in the lag operator L and u_{it} is a time t serially independent innovation to the ith variable. These innovations can either be independently distributed shocks to $RGDP_t$, $INFL_t$ or to policy instrument BL_t.

Stationarity Test

The series is tested for stationarity using the Augmented Dickey Fuller test. Non stationary series are made stationary by differencing. The study will test the following hypothesis:

H_0: The time series is non-stationary (there is unit root)

H_1: The time series is stationary

Determination of Lags

The study uses Akaike Information Criterion (AIC) to determine the lag length of the VAR model. The model with the smallest AIC value is chosen.

Cointegration Test

If the series are all non-stationary, cointegration test is run to ensure that the VAR is stable. Johansen cointegration test is employed instead of other approaches since it can detect more than one cointegrating relationship. However, if the model is composed of both stationary and non-stationary series, ARDL model is applied since it can incorporate such series in same estimation.

Vector Error Correction Models (VECM)

Vector Error Correction Model (VECM) is applied if cointegration has been detected among the series, if not; the analysis is restricted on VAR only.

Impulse Responses

Another exercise conducted is the impulse response functions. These describe the response of endogenous macroeconomic variables such as output and prices, at the time of the shock and over subsequent points in time.

Data Sources

Time series data on all the variables is collected from the World Bank Statistics. All variables are at their end period rates and are all in yearly frequencies. The data set stretches from the year 1970 to 2014, giving a total of 45 observations. E-views 9 is employed to estimate the model. The next section presents and interprets the results.

5. Results

This section presents the estimated results and their remarkable interpretation

Stationarity Results

Augmented Dickey-Fuller Unit Root Test

Variable	ADF Statistic	Critical Values	P-value	Order of Integration
Economic Growth **[RGDP]**	-4.550239***	1% -3.588509 5% -2.929734 10% -2.603064	0.0007	I(0)
Inflation **[INFL]**	-5.605149***	1% -3.588509 5% -2.929734 10% -2.603064	0.0000	I(0)
Bank Lending **[BL]**	-3.224429**	1% -3.711457 5% -2.981038 10% -2.629906	0.0299	I(0)

Source: Eviews 9

From the results above, it is shown that all variables are stationary at all levels of significance except for bank lending variable (BL) which is stationary at 5% and 10%. This stationarity is confirmed by the ADF statistic values that are greater than critical values (in absolute terms) and the p-values which are less than 0.05. That is, based on the above results, we reject the null hypothesis (H_0), which states that the time series is non-stationary, and conclude that the variables are all stationary.

VAR Stability Condition Check

Root	Modulus
-0.895939	0.895939
0.518509 - 0.717860i	0.885536
0.518509 + 0.717860i	0.885536
-0.612764 - 0.634974i	0.882423
-0.612764 + 0.634974i	0.882423
-0.100102 - 0.873761i	0.879476
-0.100102 + 0.873761i	0.879476
0.780147 - 0.259860i	0.822287
0.780147 + 0.259860i	0.822287
0.186127 - 0.618732i	0.646121
0.186127 + 0.618732i	0.646121
-0.015942	0.015942

Source: Eviews 9

Since all roots are less than 1, it means there is also no root that lies outside the unit circle; therefore, VAR satisfies the stability condition.

Lag Determination

VAR Lag Order Selection Criteria

Lag	Akaike Information Criterion
0	23.43759
1	23.61619
2	23.90697
3	24.18951
4	22.77115*

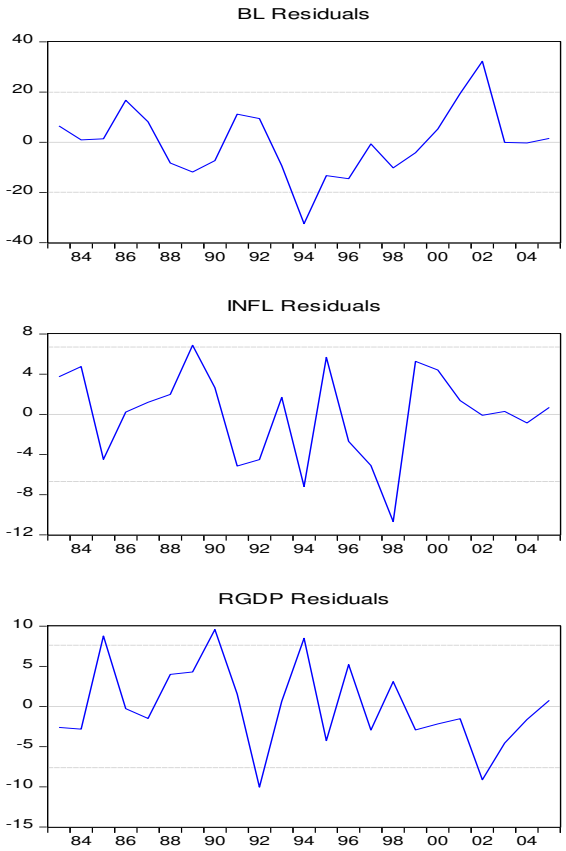
Source: E-views 9 (denotes the optimal lag length)*

Based on the Akaike Information Criterion, Lag 4 is chosen

VAR Diagnostic Tests

The following residual diagnostic tests are performed

- **Graphical Presentations of Residuals**



The plot above allows us to check whether the residuals are white noises or not, and as highlighted above, it shows that our residuals are white noises despite the larger residuals realized in certain periods. These larger residuals are as a result of the crises witnessed during the period, but are however vital since they explain something interesting about the data.

- **Normality Test**

Component	Jarque-Bera	Degrees of Freedom	P-value
1	0.564042	2	0.7543
2	0.866641	2	0.6484
3	0.118243	2	0.9426
Joint	1.548927	6	0.9562

Source: E-views 9

Based on the above tabled results, we do not reject the null hypothesis of normal distribution since the Jarque-Bera p-values are greater than 0.05.

- **Autocorrelation Test**

Lags	LM-Statistic	P-value
1	17.44968	0.0421
2	11.91139	0.2184
3	14.60696	0.1023
4	8.514590	0.4832

Source: E-views 9

According to the above LM-autocorrelation test results, we reject null hypothesis of no correlation because most of the p-values are greater than 0.05, especially starting from lag 2.

Impulse Response Results

According to the impulse response results, any shock on bank lending is likely to trigger an immediate negative response from economic growth and an immediate positive response on inflation rate. The results are shown on Appendix F. These results tally with the findings of Petkovski and Kjosevski (2014) and Tahir et al., (2015) who also found a negative effect of bank lending on economic growth. The results of this study demonstrate that bank lending channel does not have a significant role in monetary transmission mechanism of Zimbabwe in stimulating economic growth. This is due to various factors like the following: Firstly, the lack of collateral security by many individuals makes it complex to secure loans from banks no matter how much the banking system is willing to offer credit. Secondly, the hostile economic environment in Zimbabwe has hampered investment plans of many people. People no longer borrow from banks to invest because the environment is no longer conducive. Finally, the large stock of non-performing loans, poor institutions, inefficiency and poor governance of the overall banking system, liquidity crunches as well as the increase in the vulnerability of the banks in Zimbabwe have weakened the availing of credit.

6. Conclusion

Based on the result findings, bank lending was found to be statistically insignificant in stimulating economic growth in Zimbabwe, and this opposes the proposition of economic theory and some other previous studies. A major implication of this study is that the monetary transmission through the bank lending channel should be revamped. It could be bolstered by tightening creditworthiness standards, revamping accounting standards and bank credit assessment capabilities, as well as setting up an effective judicial system to improve banks' ability to enforce on collateral.

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Data Set

YEAR	RGDP	BL	INFL
1970	22.56515	NA	-12.05314
1971	8.917587	NA	6.163254
1972	8.329775	NA	13.45357
1973	2.604715	NA	20.45066
1974	6.625154	NA	12.85376
1975	-1.931223	NA	11.93375
1976	0.464839	NA	-1.667908
1977	-6.860703	NA	8.509999
1978	-2.706922	NA	2.481226
1979	3.297035	17.58778	15.18073
1980	14.42068	22.16693	12.74093
1981	12.52542	22.30697	6.599081
1982	2.634297	24.67658	3.858762
1983	1.585305	32.23370	-10.50150
1984	-1.907360	49.92695	-16.59475
1985	6.944388	65.49905	-17.01666
1986	2.099029	66.95506	8.025883
1987	1.150737	74.16161	7.189361
1988	7.552375	64.10503	7.785117
1989	5.199766	88.80225	0.792933
1990	6.988553	41.72445	-0.920431
1991	5.531782	39.29270	-6.777300
1992	-9.015570	43.12052	-14.12966
1993	1.051459	47.86929	-3.791122
1994	9.235199	43.81351	-3.895672
1995	0.158026	52.28312	3.038538
1996	10.36070	48.98723	8.984383
1997	2.680594	63.05832	-2.879048
1998	2.885212	58.18620	-27.04865
1999	-0.817821	37.33052	8.006813
2000	-3.059190	52.24027	0.627900
2001	1.439615	70.83658	-0.130890
2002	-8.894023	164.5590	2.712950
2003	-16.99507	80.19562	8.801275
2004	-5.807538	40.30056	7.611525
2005	-5.711084	55.33023	5.136601
2006	-3.461495	NA	-2.017679
2007	-3.653327	NA	0.894887
2008	-17.66895	NA	1.349223
2009	5.984391	NA	74.29818
2010	11.37592	NA	3.710957
2011	11.90541	NA	3.910491
2012	10.56520	NA	2.302677
2013	4.484095	NA	4.184376
2014	3.848290	NA	1.338693

APPENDIX A: STATIONARY TEST RESULTS

(a) Economic growth: RGDP

Null Hypothesis: RGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.550239	0.0007
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 10/05/16 Time: 13:03
Sample (adjusted): 1971 2014
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	-0.569497	0.125158	-4.550239	0.0000
C	0.908691	1.013723	0.896390	0.3752

R-squared	0.330194	Mean dependent var	-0.425383
Adjusted R-squared	0.314246	S.D. dependent var	7.773071
S.E. of regression	6.436902	Akaike info criterion	6.606361
Sum squared resid	1740.216	Schwarz criterion	6.687460
Log likelihood	-143.3399	Hannan-Quinn criter.	6.636437
F-statistic	20.70468	Durbin-Watson stat	1.984746
Prob(F-statistic)	0.000045		

(b) Inflation (INFL)

Null Hypothesis: INFL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.605149	0.0000
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFL)
Method: Least Squares
Date: 10/05/16 Time: 13:10
Sample (adjusted): 1971 2014
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFL(-1)	-0.842004	0.150220	-5.605149	0.0000
C	3.254538	2.194906	1.482769	0.1456

R-squared	0.427931	Mean dependent var	0.304360
Adjusted R-squared	0.414310	S.D. dependent var	18.46922
S.E. of regression	14.13456	Akaike info criterion	8.179512
Sum squared resid	8391.004	Schwarz criterion	8.260612
Log likelihood	-177.9493	Hannan-Quinn criter.	8.209588
F-statistic	31.41770	Durbin-Watson stat	1.979219
Prob(F-statistic)	0.000001		

(c) Bank Lending (BL)

Null Hypothesis: BL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.224429	0.0299
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BL)
Method: Least Squares
Date: 10/05/16 Time: 13:13
Sample (adjusted): 1980 2005
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BL(-1)	-0.569274	0.176550	-3.224429	0.0036
C	32.37240	10.82993	2.989162	0.0064

R-squared	0.302264	Mean dependent var	1.451633
Adjusted R-squared	0.273191	S.D. dependent var	30.10083
S.E. of regression	25.66188	Akaike info criterion	9.401694
Sum squared resid	15804.78	Schwarz criterion	9.498471
Log likelihood	-120.2220	Hannan-Quinn criter.	9.429562
F-statistic	10.39695	Durbin-Watson stat	1.940433
Prob(F-statistic)	0.003620		

APPENDIX B: VAR STABILITY CONDITION CHECK

Roots of Characteristic Polynomial
Endogenous variables: BL INFL RGDP
Exogenous variables: C
Lag specification: 1 4
Date: 10/05/16 Time: 20:31

Root	Modulus
-0.895939	0.895939
0.518509 - 0.717860i	0.885536
0.518509 + 0.717860i	0.885536
-0.612764 - 0.634974i	0.882423
-0.612764 + 0.634974i	0.882423
-0.100102 - 0.873761i	0.879476
-0.100102 + 0.873761i	0.879476
0.780147 - 0.259860i	0.822287
0.780147 + 0.259860i	0.822287
0.186127 - 0.618732i	0.646121
0.186127 + 0.618732i	0.646121
-0.015942	0.015942

No root lies outside the unit circle.
VAR satisfies the stability condition.

APPENDIX C: LAG SELECTION

VAR Lag Order Selection Criteria
Endogenous variables: BL INFL RGDP
Exogenous variables: C
Date: 10/05/16 Time: 20:38
Sample: 1970 2014
Included observations: 23

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-266.5323	NA	3030153.	23.43759	23.58570*	23.47484
1	-259.5862	11.47615	3661105.	23.61619	24.20862	23.76519
2	-253.9302	7.869260	5142650.	23.90697	24.94373	24.16771
3	-248.1793	6.500948	7739555.	24.18951	25.67059	24.56199
4	-222.8682	22.00966*	2443681.*	22.77115*	24.69655	23.25538*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX D: VAR ESTIMATES

Vector Autoregression Estimates
Date: 10/05/16 Time: 20:53
Sample (adjusted): 1983 2005
Included observations: 23 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	BL	INFL	RGDP
BL(-1)	0.388462	0.079741	-0.096547
	(0.20151)	(0.06774)	(0.07720)
	[1.92777]	[1.17707]	[-1.25062]
BL(-2)	-0.308513	-0.002523	0.024841
	(0.22274)	(0.07488)	(0.08533)
	[-1.38510]	[-0.03369]	[0.29111]
BL(-3)	-0.202449	0.018581	-0.042777
	(0.29389)	(0.09880)	(0.11259)
	[-0.68885]	[0.18806]	[-0.37992]
BL(-4)	0.126766	0.021200	0.007224
	(0.33064)	(0.11116)	(0.12667)
	[0.38340]	[0.19072]	[0.05703]
INFL(-1)	0.442488	-0.005681	-0.021503
	(0.55808)	(0.18762)	(0.21381)
	[0.79287]	[-0.03028]	[-0.10057]
INFL(-2)	-0.175614	-0.368606	0.026096
	(0.52673)	(0.17708)	(0.20179)
	[-0.33341]	[-2.08158]	[0.12932]
INFL(-3)	0.730208	-0.073799	-0.119053
	(0.50753)	(0.17063)	(0.19444)
	[1.43874]	[-0.43252]	[-0.61229]
INFL(-4)	-1.838073	-0.082133	-0.071496
	(0.59037)	(0.19848)	(0.22618)
	[-3.11342]	[-0.41382]	[-0.31611]
RGDP(-1)	-0.070998	0.172501	0.249170
	(0.81696)	(0.27465)	(0.31299)
	[-0.08690]	[0.62807]	[0.79611]
RGDP(-2)	-1.179682	-0.471282	0.098957
	(0.89552)	(0.30106)	(0.34308)
	[-1.31732]	[-1.56539]	[0.28844]
RGDP(-3)	-0.288051	0.090862	0.107970
	(1.16340)	(0.39112)	(0.44571)
	[-0.24759]	[0.23231]	[0.24224]
RGDP(-4)	1.263040	-1.246341	-0.209895
	(1.08707)	(0.36546)	(0.41646)
	[1.16188]	[-3.41033]	[-0.50399]
C	58.32119	-4.047789	6.593762
	(27.8019)	(9.34668)	(10.6511)

	[2.09774]	[-0.43307]	[0.61907]
R-squared	0.753469	0.790391	0.389461
Adj. R-squared	0.457631	0.538861	-0.343185
Sum sq. resids	3966.743	448.3328	582.2055
S.E. equation	19.91668	6.695766	7.630239
F-statistic	2.546897	3.142329	0.531582
Log likelihood	-91.86296	-66.79106	-69.79587
Akaike AIC	9.118518	6.938353	7.199641
Schwarz SC	9.760319	7.580155	7.841442
Mean dependent	60.03530	-1.520539	0.550221
S.D. dependent	27.04391	9.860167	6.583704

Determinant resid covariance (dof adj.)	637265.6
Determinant resid covariance	52376.56
Log likelihood	-222.8682
Akaike information criterion	22.77115
Schwarz criterion	24.69655

APPENDIX E: VAR DIAGNOSTIC TESTS

(a) Normality Test

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 10/05/16 Time: 21:00
Sample: 1970 2014
Included observations: 23

Component	Skewness	Chi-sq	df	Prob.
1	0.083787	0.026911	1	0.8697
2	-0.410849	0.647056	1	0.4212
3	0.144118	0.079618	1	0.7778
Joint		0.753585	3	0.8605

Component	Kurtosis	Chi-sq	df	Prob.
1	3.748655	0.537131	1	0.4636
2	2.521322	0.219585	1	0.6394
3	3.200761	0.038626	1	0.8442
Joint		0.795342	3	0.8506

Component	Jarque-Bera	df	Prob.
1	0.564042	2	0.7543
2	0.866641	2	0.6484
3	0.118243	2	0.9426
Joint	1.548927	6	0.9562

(b) Autocorrelation Test

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/05/16 Time: 21:04
Sample: 1970 2014
Included observations: 23

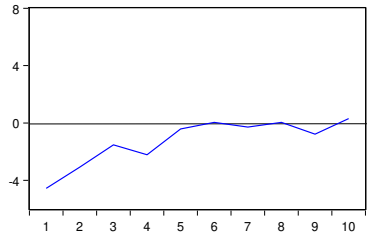
Lags	LM-Stat	Prob
1	17.44968	0.0421
2	11.91139	0.2184
3	14.60696	0.1023
4	8.514590	0.4832

Probs from chi-square with 9 df.

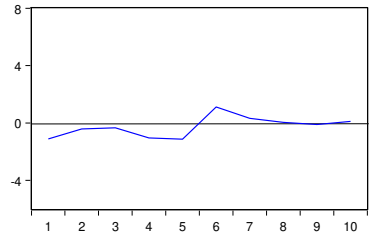
APPENDIX F: IMPULSE RESPONSE RESULTS

Response to Cholesky One S.D. Innovations

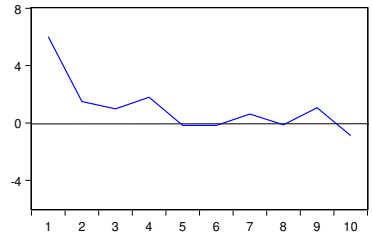
Response of RGDP to BL



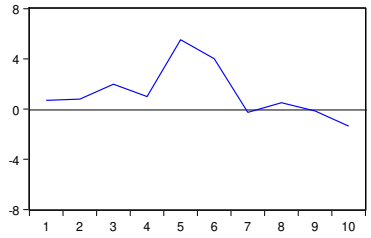
Response of RGDP to INFL



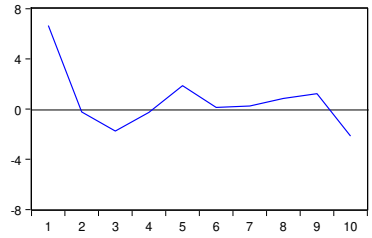
Response of RGDP to RGDP



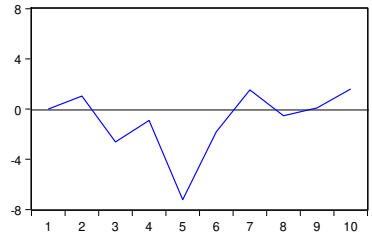
Response of INFL to BL



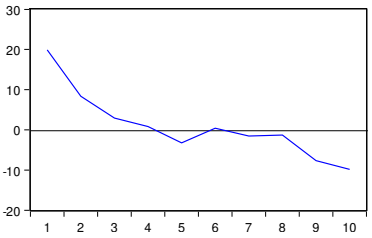
Response of INFL to INFL



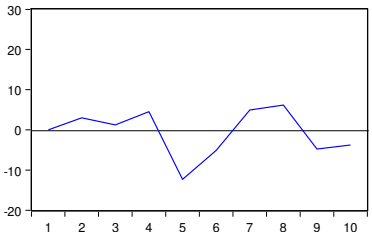
Response of INFL to RGDP



Response of BL to BL



Response of BL to INFL



Response of BL to RGDP