Exchange Rate and Inflation Rate a Casuality Analysis: Case of Albania

Msc. Brunilda Lufi
Lecturer at Faculty of Natural Science,
University of Shkodra Albania
Email:brunalufi@yahoo.com

Prof. As. Dr. Valentina Sinaj
Lecturer at Faculty of Natural Science
University of Tirana
AlbaniaEmail sinajv@yahoo.com

Abstract **This reseach studies the empirical relationship between the exchange and inflation rate in Albania during the period 2002-2014. The test of unitary roots can be used for the study of stationary series taken in this study. By using Granger test of causal, it is revealed the casual relationship between the exchange rate and inflation rate. For the selection of lag of Model VAR two dimensional are used the selection criteria of models like AIC,SBQ,HQ. The criteria JarqueBera is used to show that the ramins of model VAR have a normal distribution whereas the tes LM for the reveal of serial correlation.**

Keywords: Exchange rate, Inflation, Granger Casuality, VAR, modeling.

I. Introduction

The exchange rate (ER) is considered as one of the most important economic concepts, the study of which it is being paid a great attention from the economists, since after the failure of Bretton Woods's system. Inflation is a general increase of the prices in a given economy and happens only when the majority of the prices increase in a certain scale, in all geographical distribution, of a given economy. Inflation is one of the main problems of macroeconomy where low inflation is one of the four main aims of this politics. Inflation (high) is considered as a "serious illness of macroeconomics".

The aim of this study is to find out the relation of these two economics indicator, echange rate and inflation rate. By Granger casuality we will

study the relationship of casuality, according to which we construct the Models VAR and test the hypothesis for the reveal of their relationship. In case of our study, it results that the exchange rate is a stationary series of the first order I (1), whereas inflation is a stationary series I (0).

II. Literature review

Inflation usually is seen in two broad forms, monetarists and structuralist. Monetarists claim that the empirical study of monetary history shows that inflation has always been a monetary phenomena. Makochekamwa (2007) in Zymbabwe has used a CGE analysis (Computable General Equilibrium) with annual data to prove the relationship between inflation and exchange rate by using the date for year 1975-2006. He empirically has found out that for variables that have to do with inflation and exchange rate the causual relationship according to Granger is two sided. M.O. Odedokun (1995) has analyzed the annual data for 35 places since 1971 until 1990. The findings suggest that the monetary increase, amortization rate of national currency has positive effects in inflation, whereas the expansion of food production per habitant, and also the general economics growth as served to decrease the inflation rates.

Imimole.B & Enoma.A (2011) reviwed the impact of depreciation of exchange rate in Nigeria fpr the period 1986-2008, by using the cointegration procedure. The research found out that the depreciation of exchange rate, currency offers and the bruto domestic production are the main indication of inflation in Nigeria, and that the devaluation of "Naira" is positive, and has an imporarant and long term effect in Inflation, in Nigeri, this means that the depreciation of exchange rate can bring an increase on inflation rate in Nigeria.

Ndungu (1993) valuated the model VAR of money offers price level in family, and index of exchange rate, index of foreing prices and interests rate. In an effort to explain the movement of inflation in Kenya, he noticed that the inflation rate and exchange rate explain each-other.

The study made according to Kamas (1995) in Colombia, noticed that the exchange rate has not played any important role in explanation of inflation variations and that inflation should mainly be inertial in relation with the exchange rate.

According to Madesha.W, Chidoko and Zivanomoyo (2013) inflation and exchange rate tested through generalizedDicter Fuller's test, found that series are I(1). After testing and confirmation that series are I(1), Madesha, Chidoko and Zivanomoyo considered the presence and not cointegration between variables. In the studied case it is being defined that long term inflation (LINF) and long term exchange rate (LEXCH), are variables that have a two sided, long term relationship.

III. Empirical analysis

1 The Data

Variables taken in the study are the inflation rate and exchange rate Albanian Leke Euro. The data are taken for period 2002-2014 with monthly frequencies from the Albanian Bank and Trading.

2. Study of Stationary

Variables that are in time series in general are variables that have a define trend toward those that are not stationary and those should be converted in such by using the differentiation rule. One time series is stationary if the mathematical expectation, variance and covariance are constant (do not depend on time t. In this analytical way we can write:

$E(Y_t) = \mu$
$Var(Yt) = \sigma^2$
$cov(Y_{t+k}, Y_t) = \gamma_k$

In one useful was for the order definition of differentiation and usage of criteria for the existence of unitary existence for the series in study. The differentiation order will be defined by the number of unitary roots.

We will use the DF by assuming that the remainings were uncorrelated between them. If it happens something like this we will use the test Dickey-Fuller generalized ADF(p), which is an asymptotic test to show the existence of unitary roots.

By referring to the model:

$$\Delta Z_t = \beta_1 + \beta_2 t + \delta Z_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta Z_{t-i} + u_t$$

Hypothesis are contructed:

$H_0 : \delta = 0$ (Equivalent with the existence of unitary roots or the series is'n stationary)

Alternative hypothesis: H_1: $\delta<0$ (time series is stationary)

If statistics values student, are bigger than the critical value, then the basic hypothesis stands.

The results of ADF test for ER series and for margin series of INF are given in the following table.

Basic hypothesis	**t-Statistic**	**Prob.***
ER has a unit root d(ER) has a unit root	-1.681547 -9.054764	0.4386 0.0000
Test critical values:	1% level	-3.4736
	5% level	-2.88043
	10% level	-2.57699

Table 2. Unit root test Authors' calculation

Basic hypothesis	**t-Statistic**	**Prob.***
INF has a unit root	-5.53961	0.000
Test critical values:	1% level	-3.473
	5% level	-2.880
	10% level	-2.5769

Table 2. Unit root test Authors' calculation

So, series ER is not stationary because the statistics value student is -1.6815 bigger than the critical values of a biased hypothesis. Whereas for the difference series of (ER) the value is -9.05 which is smaller than the critical values and consequently the basic hypothesis stands. So, series ER is a non-stationary series and one difference is enough on its return to stationary and consequently it is named integral of first order I (1).Whereas the series of inflation is one stationary series because the statistics value student is smaller than any critical value with level 1%, 5% and 10%. So series Inf can be named also a series I(0).

3. Estimated of VAR model

The VAR models are very important for the chance analysis. In general in empirical analysis of the economic data, the relationship cause-effect is very difficult to be defined. In our case we take in consideration 2 variables, the exchange rate and inflation rate and evaluate them by constructing the model VAR (p) 2-dimensional.

The simpler form of model VAR two dimensional is:

$$\begin{cases} ER_{,t} = \alpha_{11} ER_{t-1} + \alpha_{21} INF_{t-1} + \varepsilon_{1,t} \\ INF_t = \beta_{11} ER_{t-1} + \beta_{21} INF_{t-1} + \varepsilon_{2,t} \end{cases}$$

Where the remaining of model should have two dimensional normal distribution:

The evaluated model is:

INF = C(1,1)*INF(-1) + C(1,2)*ER(-1) + C(1,3)

ER = C(2,1)*INF(-1) + C(2,2)*ER(-1) + C(2,3)

VAR Model - Substituted Coefficients:
===============================

INF = 0.837*INF(-1) - 0.0027*ER(-1) + 0.78

ER = 0.113*INF(-1) + 0.9853*ER(-1) + 1.70

Solution of which lag is better for the evaluation of model which is presented as followings:

VAR Lag Order Selection Criteria
Endogenous variables: KURSI_KEMBIMIT NORMA_INFLACIONIT
Exogenous variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-735.20	NA	59.651	9.7642	9.8042	9.78050
1	-384.30	687.85	0.6028	5.1695	5.2894	5.21829
2	-369.52	28.58*	0.5226*	**5.0267***	**5.2265***	**5.1079***
3	-367.51	3.8309	0.5366	5.0531	5.3328	5.1667

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

Table3 .Testing of Model VAR for determination of lag. Authors' calculation

According to the criteria AIC, SBC and HQ lag that should be used for the performace of our study is model with lag 2,VAR (2). The appearance of equations with second lag is as following:

INF = 1.044*INF(-1) - 0.269*INF(-2) + 0.0272*ER(-1) - 0.0297*ER(-2) + 0.924

ER = - 0.146*INF(-1) + 0.309*INF(-2) + 1.255*ER(-1) - 0.275*ER(-2) + 2.22

We see if the remain of model suffer from the serial correlation. The results of the test are showed in the following table:

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Lags	LM-Stat	Prob
1	3.798263	0.4340
2	7.398806	0.1163
3	3.599539	0.4629
4	8.857046	0.0648
5	4.419498	0.3522
6	2.508517	0.6431
7	3.552690	0.4699
8	5.462698	0.2430
9	4.793579	0.3091
10	4.390732	0.3557
11	0.518808	0.9716
12	2.58568	0.6412

Table 4 . The results of LM test. Since the basic hypothesis is: it does not have serial correlation of order H in model.

In all cases we see that value q is bigger than level of importance 5%, consequently the raised hypothesis stand. So, the remainings of the model do not suffer from correlation.

We see ifremainings of VAR are white noise. We raise the hypothesis that remainings have normal distribution. For the test we use the Jarque-Bera statistics. The results of test are given in the following table:

Component	Jarque-Bera	df	Prob.
1	0.470950	2	0.7902
2	0.751991	2	0.6866
Joint	1.222941	4	0.0021

Table 5. The result of J-B test

Values of p for statistics Jarque-Bera for both equations, is bigger than level 5%, consequently the raised hypothesis that remainings have normal distribution, stands. So, remainings of VAR have normal distribution.

4 Granger Casuality test.

In economic analysis, one problem that is displayed is the determination of cause variable and determination of effect variable. Such a problem is analyzed by Granger theory which is based over models VAR (p).The Granger test finds in empirical way relationship that exist between variables in short term periods. We are referring to the simplest case, model VAR (p) two dimensional for variables $Z_{1t}$and $Z_{2t,}$ general form of which is:

$$\begin{cases} ER_t = \sum_{i=1}^{p} \alpha_{1i} ER_{,t-i} + \sum_{i=1}^{p} \alpha_{2i} INF_{t-i} + \varepsilon_{1,t} \\ INF_t = \sum_{i=1}^{n} \beta_{1i} ER_{t-i} + \sum_{i=1}^{n} \beta_{2i} INF_{t-i} + \varepsilon_{2,t} \end{cases},$$

the residuals are white noise.

In this model, we we refer to the first equation is seen that as dependent variable is the exchange rate on it, if all coeficentsα_{2i}will be zero, so inflation variable does not affect on the variable exchange rate (in the test's language does not cause).

If we refer the second equation, it is seen that as dependent variable is Infaltion on it, if all coeficents$\beta_{1i,}$ will be zero, so the variable of the exchange rate does not affect on the inflation variable (in the test's language does not cause).

Causal can be defined from the evaluation of equations 1&2 and test of the following hypothesis:

Null hypothesis: $\sum_{i=1}^{p} \alpha_{2i} = 0$ and $\sum_{i=1}^{p} \beta_{1i} = 0$

Against the alternative hypothesis that at least one of two below amounts is differnet from zero.

If basic hypothesis swoops we will encounter with the following cases:

1. $\sum_{i=1}^{p} \beta_{1i} \neq 0$ and $\sum_{i=1}^{p} \alpha_{2i} = 0$, in this case we say that exists a causal one sided relationship and exactly Z_{1t} casuses variable Z_{2t}.

2. $\sum_{i=1}^{p} \beta_{1i} = 0$ and $\sum_{i=1}^{p} \alpha_{2i} \neq 0$, in this case we say that exists a causal one sided relationship and exactly Z_{2t} casuality variable Z_{1t}.

3. $\sum_{i=1}^{p} \beta_{1i} \neq 0$ and $\sum_{i=1}^{p} \alpha_{2i} \neq 0$, in this case we say that we have a two sided causal relationship and exactly, Z_{2t} And Z_{1t} cause each other.

The result of Granger casuality test given in the following table:

Null Hypothesis	Lag 2	Lag 3
ER does not Granger Cause INF	3.8267 (p=0.0424)	4.17 (p=0.0453)
INF does not Granger Cause ER	0.39247 (p=0.6761)	0.49 (p=0.6232)

Raised hypothesis according to Granger are tested by being based in the statistics values Fisher.

Hypothesis: ER does not Granger Cause INF swoops because the values prob are smaller than the level of importance.

Hypothesis:INF does not Granger Cause ER, stands because values of prob are in very high levels.

As a consequence, we say that between the variables the exchange rate and inflation, exists an one sided causal relationship and exactly, the change in the exchange rate are reflected with considerable changes in the inflation rate with some time delays.

4. Conclusions

By being based in the studied literature for the Albanian case, we conclude that the variable of the exchange rate is I (1) whereas the inflation rate is (0). Between them exists an one sided causal relationship. Is the exchange rate that affects in the inflation rate in the Albanian case.The two dimensional Model VAR, contructed by being based in the selection criteria of lag is a model VAR(2), furthermore in this model in not showed the problem of serial correlation and the remainings have normal distribution.

References

[1] Cakrani.E (2014), "Kursi Real iKëmbimit dhe Ndikimi I Tij në Ekonomi, Rasti I Shqipërisë"**:**http://www.doktoratura.unitir.edu.al/wp-content/uploads/2014/05/Doktoratura-Edmira-Cakrani-Fakulteti-Ekonomise-Departamenti-i-Ekonomiksit.pdf

[2] Takatoshi.IdheKiyotaka.S (2006),"Exchange rate changes and inflation in post-crisis asian economies: var analysis of the exchange rate pass-trough" .http://www.nber.org/papers/w12395

[3] Wellington.M, Clainos.ChdheJames.Z (2013), "Empirical Test of the Relationship Betëeen Exchange Rate and Inflation in Zimbabwe".

:http://www.google.al/url?sa=t&rct=j&q=&esrc=s&source=ëeb&cd=2&cad=rja&uact=8&ved=0CCkQFjAB&url=http%3A%2F%2Fëëë.iiste.org%2FJournals%2Findex.php%2FJEDS%2Farticle%2Fdoënload%2F4096%2F4124&ei=s2CFVLqfOoO7PbzAgYgF&usg=AFQjCNFBëLËVjKn2rtaffx2-o9FqlOa-cQ.

[4] http://www.tradingeconomics.com/albania/inflation-cpi

[5] http://www.bankofalbania.org/ëeb/Kursi_i_Kembimit_2014_1.php