UDC 339.743.053(497.7)"1992/2009"

NOMINAL EFFECTIVE EXCHANGE RATE NEUTRALITY: THE CASE OF MACEDONIA

Dushko Josheski, Msc
Teaching assistant
dusko.josevski@ugd.edu.mk

Darko Lazarov, Msc
Teaching assistant
darko.lazarov@ugd.edu.mk

Abstract

This paper uses quarterly data on Macedonian nominal effective exchange rate for the time period 1992 to 2009 along with six other variables to investigate the nominal effective exchange rate neutrality. SVAR and Impulse response functions had been used to prove the hypothesis. Empirical evidence in this paper supports the nominal exchange rate neutrality in the case of Macedonia.

Keywords: *NEER, SVAR, Impulse response functions*

1. Introduction

Currently, the exchange rate regime in the Republic of Macedonia is what is refered to as a "managed float." The exchange rate of the denar is established on the basis of supply and demand of foreign exchange markets. The denar exchange rate against the euro serves as a fundamental of the Republic of Macedonia monetary policy. Money supply and interest rates are dictated by the exchange rate target. This paper uses Structural Vector Autoregression method to find empirical evidence for the nominal exchange rate neutrality concept for the case of macedonia. In particular, it examines whether Macedonian real GDP is neutral to changes in the nominal exchange rate as predicted by the macroeconomic theory.

Baxter and Stockman (1988), found little evidence of systematic differences in the behavior of other macroeconomic aggregates or international trade flows under alternative exchange rate systems. This is contra-

dictory to the claims that existed before this paper was published.[1] This is known as **Baxter-Stockman** neutrality of exchange rate regime puzzle. In this paper we will test the neutrality of the nominal effective exchange rate. Germany is our biggest trade partner so in the SVAR model we test influence of German Real GDP relative to Macedonian Real GDP.

This paper is divided as follows, Part 2 Theoretical and empirical literature on neutrality, here we set the theoretical foundations and empirical findings in this literature, in Part 3 we give data definitions and their sources, in Part 4 we set the SVAR model, in Part 5 we are interpreting the results from our models and in Part 6 we make conclusions.

2. Theoretical and empirical literature on neutrality

Neutrality is a condition in which one variable does not change as a result of changes in another variable (Geweke,1986). Geweke comments on structural and stochastic neutrality. First neutrality is when one variable has no effect on other variables in the model, while the second neutrality is when the change in the mean of the exogenous variable does not have impact of the value of a mean of an endogenous variable. Fisher and Seater (1993), define long run super neutrality. Let say nominal effective exchange rate is long run super neutral if

$$LRD_{y,\Delta neer} = \mu$$

Where LRD is long run derivative y is some real variable(let say Real GDP), is some change in nominal effective exchange rate μ should be equal to one if y is the nominal exchange rate and $\mu=0$ when y is real variable. Fisher and Seater (1993),claim that super neutrality applies to those variables that $LRD_{y,\Delta neer}=o$, so long run neutrality is necessary but not sufficient condition for super neutrality. Since the paper by Lucas (1972), money neutrality became one of the central issues in macroeconomics (Lucas tried to resolve Gurley paradox).[2] Nowadays, economists use VAR (Vector Auto Regressions) and SVAR (Structural Vector Autoregressions) techniques generally found some evidence of neutrality (Cogley 1993). In this study, the neutrality is refered to a situation, in which real GDP in Macedonia is neutral with regards to changes in the nominal exchange rate. Caporrale and Pittis (1995), they used the exchange rate neutrality to refer to the effect of the nominal exchange rate determination regime. As Papel (1992), points out the literature on nominal exchange rate neutrality is dominated by examinations of the neutrality of the exchange rate determination regime.

3. Data source and definitions

In this paper we use quarterly data derived from Econstats™,[3] and from the OECD data base,[4] and State statistical office of Macedonia[5] in the Table 1 these variables are summarized

1) Large class of theoretical models before implied that the nominal exchange rate system has important effects on a number of macroeconomic quantities, but Baxter and Stockman proved opposite.

2) John Gurley wrote the following parody of Friedman's monetary views: "Money is a veil, but when the veil flutters real output sputters." He meant, in theory, the money supply should only determine the number of zeros on price tags; it should not have real economic effects. In practice, however, wild swings in the money supply can produce wild swings in real output

3) http://www.econstats.com/ifs/NorGSc_Mac2_M.htm

4) Data on the German real GDP are gathered from OECD data base

5) Data on Macedonian Real GDP are collected from this source

Table 1 **Summary statistics**

Variable	description	Obs	Mean	Std.Deviation	Min	Max
realgdpmacedonia	Macedonian real GDP (quarterly data)[6]	24	12.5	7.071068	1	24
neermacedonia	Nominal effective exchange rate of Macedonia (quarterly data)	71	33.19718	20.33197	1	68
inflation	PPI index (quarterly data)	55	87.34418	15.43846	30.69	104.4
ir	Lending interest rate (quarterly data)	63	27.05957	48.68202	9.6	380.7
M1 macedonia	Monetary aggregate M1 (quarterly data)	27	14	7.937254	1	27
M2 macedonia	Monetary aggregate M2 (quarterly data)	27	14	7.937254	1	27
germany GDP	German Real GDP	71	95.25592	7.039186	83.46	108.2

All series will be transformed into logs for analysis except for interest rates and inflation.

This study uses quarterly data over the period from 1992 to 2009 encompassing 72 observations utmost (on some variables observations are missing).The use of 18 year horizon is short to international studies. Now, we will briefly explain the variables. The price of one currency in terms of another is called exchange rate. Here we use as a proxy for the exchange rate nominal effective exchange rate (NEER) variable, which adjusts all the individual bilateral rates for their share of total trade. This variable covers period from 1992quarter 1 to 2009quarter3. The relationship between nominal effective exchange rate and Real GDP is in the focus of our research. Gross Domestic Product data are calculated according to the new National Classification of Economic Activities NACE Rev.2.Money supply is included to capture the impact on other variables in the model, M1 the includes physical money such as coins and currency, it also includes demand deposits which are checking accounts, and all cash and assets that can quickly be converted in to currency. M2 is a category within the money supply that includes M1 in addition to all time-related deposits, savings deposits, and non-institutional money-market funds.These tvo variables cover period from 2003quarter 1 to 2009quarter3.Inflation as Producers price index is in the data set. Interest rate is another important variable in the macroeconometrics models, in our data it is the lending rate it covers period from 1994quarter 1 to 2009quarter 3.

4. Structural Vector Auto Regression (SVAR)

Since Sims(1980) VAR approach is very popular in the macroeconomic literature. In VAR modes all of the variables are considered endogenous and can impact other variables in the model. VAR representations are given in their structural or reduced form (Stock and Watson 2001)

$$Y_t = C(L)Y_t + \varepsilon_t$$

6) All these are quarterly data i.e. realgdpmacedonia (2004q1,2009q4), neermacedonia(1992q1,2009q3),inflation(1993q1,2006q3),ir(1994q1,2009q3),M1macedonia(2003q1,2009q3),M2macedonia(2003q1,2009q3),germanyGDP(1992q1,2009q3)

Where C represents the lagged values of the variable and other variables in the model, Yt is the vector of the variables in the model. SVAR model imposes restrictions on the VAR model. These restrictions that have the effects of assuming no causal relationship either contemporanesly or through lags are used as assistance in the identification of the model (Stock and Watson 2001).German Real GDP it is used in the model since Germany is our biggest trade partner. German GDP it is assumed it is not affected by Macedonian events; That is due to the fact that Macedonian economy is small size relative to the German economy.

Macedonian Interest rates are assumed to be influenced by the world economy, similar as Macedonian inflation. Macedonian money supply is related to the inflation, interest rates. Macedonian Real GDP is influenced by the all of the variables.

***Table 2* Contemporaneous Relationships among Variables**

DEPENDENT VARIABLES	INDEPENDENT VARIABLES					
	germanyGDP	inflation	ir	M1 or M2 macedonia	neermacedonia	realgdpmacedonia
germanyGDP						
inflation	*					
ir	*	*				
M1 or M2 macedonia	*	*	*			
neermacedonia	*	*	*	*		
realgdpmacedonia	*	*	*	*	*	

5. Interpretation of the results

When conducting VAR analysis standard procedure is to perform unit root test, to verify the stability of the system. There a number of different types of test each of them with different null hypothesis. For example Dickey-Fuller test and Philips Perron test (Phillips and Perron 1988),starts with the null hypothesis of unit root while KPSS test (Kwiatkowski at. el. 1992) tests stationarity rather than its absence. In this paper all three tests are conducted and are reported in the Table 3.

As it is common in this literature the tests gives mixed results regarding stationarity. Hence, some judgment about the nature of the series and transformation required to make it stationary is required in the estimation. The summary for the conclusions and the method of transformation are given in the Table 4.

***Table 3* Summary of Unit Root test results**

Variable	Augmented D-F test (test statistic vs crtitical value at 95% confidence level)	Philips-Perron test (test statistic vs crtitical value at 95% confidence level)	KPSS	Conclusion
realgdpmacedonia	trend stationary (-6.461> -3.600)	trend stationary (-27.642 >-17.900	Trend stationary	Trend stationary
neermacedonia	trend stationary (-6.257>-3.480)	trend stationary (-43.174>-20.160)	I(1)	trend stationary
inflation	trend stationary (-8.265>-3.496)	I(1) (-25.584>-19.854	I(1)	I(1)
ir	trend stationary (32.048>-3.488)	trend stationary (-46.743 > -20.016)	I(1) or I(2)	trend stationary
M1macedonia	I(1) (-7.213 > -3.600)	I(1) (-34.196 > -17.900)	I(1) or I(2)	I(1)
M2macedonia	I(1) (-5.266>-3.600)	I(1) (-27.891 > -17.900)	Stationary	I(1)
germanyGDP	I(1) (-5.971>-3.481)	I(1) (-47.673 >-20.142)	I(1,2)	I(1)

Monetary aggregates are trend stationary Macedonian Real GDP is also trend stationary, same as nominal effective exchange rate other variables are I(1) variables.

***Table 4* Summary of conclusions regarding stationarity and transformation**

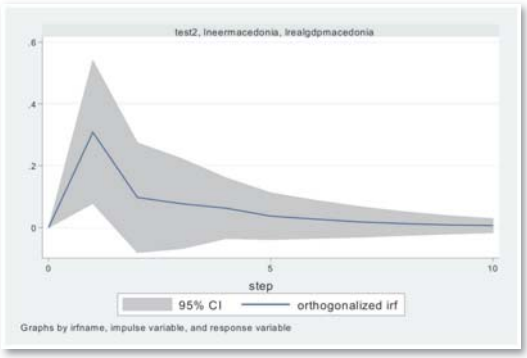
Variable	Test statistic	Transformation required
realgdpmacedonia	trend stationary	detrending
neermacedonia	trend stationary	detrending
inflation	I(1)	First difference
ir	trend stationary	detrending
M1macedonia	I(1)	First difference
M2macedonia	I(1)	First difference
germanyGDP	I(1)	First difference

Impulse Response functions

For the sake of brevity, we report only the responses of Macedonian real GDP to a shock in the nominal exchange rate.

Figure 1:

Impulse Response Functions-Impact on Real GDP to a shock to the effective exchange rate



Findings from our models clearly support nominal exchange rate neutrality fo Macedonia. As expected, some responses are found in the short-run, but they dissipate quite quickly and revert back to the base line level implying no impact on the long run equilibrium real GDP.From the Figure 1 one can tell that Real GDP responds to a shock in nominal effective exchange rate but only in the first five quarters and the effects afterwards dissipate slowly. Son the impact on Real GDP on a shock of the nominal effective exchange rate lasts 1 year in three months(5 quarters).

SVAR reuslts are presented in the following tables .As it can be seen from the table 1, 1% change in the nominal effective exchange rate for Macedonia affects Macedonian Real GDP by 6.4% but on a long run the effect is zero. A -matrix shows negative impact of -0.12 (12%) but on a long run the effect is zero.

***Table 5* SVAR of Nominal effective exchange rate as impuse function and Real GDP as reposnse**

	lrealgdpmacedonia	lneermacedonia
lrealgdpmacedonia	-0.0465	0
lneermacedonia	0.0640474	0.2288

$$A = \begin{pmatrix} 1 & 0 \\ -0.12691 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 0.504 & 0 \\ 0 & 0.228 \end{pmatrix}$$

Macedonian and German GDP

On a short run 1% growth in German GDP influences the growth of Macedonian GDP by 0.2% .A-matrix shows that this impact is negative on short run but on a long run the effect is zero.

$$A = \begin{pmatrix} 1 & 0 \\ -0.00482 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 0.449 & 0 \\ 0 & 0.005 \end{pmatrix}$$

	lrealgdpmacedonia	lgermangdp
lrealgdpmacedonia	0.4492	0
lgermangdp	0.0021	0.005

6. Conclusion

Nominal exchange rate neutrality is the situation where variations in the nominal exchange rate have no impact upon real GDP. It is generally defined for the long-run allowing some short-run variations during the period of adjustment. Empirical results presented in this paper support the nominal exchange rate neutrality for the case of Macedonia.

Refferences

1. Phillips, P.C.B. and Perron, P. 1988, 'Testing for a Unit Root in Time Series Regression', Biometrika, vol 75, no 2, pp335-346
2. Sims, C.A. 1980, 'Macroeconomics and Reality', Econometrics, vol 48, no 1, 1-48
3. Stock, J.H. and Watson, M.W. 2001, 'Vector Autoregression', Journal of Economic Perspectives, vol 15, no 4, pp101-115
4. Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. 1992, 'Testing the null hypothesis of stationarity against the alternative of a unit root', Journal of Econometrics, vol 54, no1-3,pp159-178
5. Stock, J.H. and Watson, M.W. 2001, 'Vector Autoregression', Journal of Economic Perspectives, vol 15, no 4, pp101-115
6. Caporale, GM. and Pittis, N. (1995), Nominal exchange rate regimes and the stochastic behavior of real variables, Journal of International Money and Finance 14 (3) : 395- 415
7. Papell, D.H. (1992), 'Can equilibrium models explain nominal exchange rate non-neutrality?
8. HarbingerC, Albert Wijeweera, Nominal Exchange Rate Neutrality: The Case of Australia, University of New England, Armidale, NSW 2351
9. Baxter, M. & Stockman, A.C., (1989)"Business Cycles and the Exchange-Rate Regime" Journal of Monetary Economics, Vol. 23, No. 3, pp. 377-400, (May 1989).
10. Fisher, M.E. and J.J. Seater (1993), "Long Run Neutrality and Superneutrality in an ARIMA Framework," American Economic Review 83: 402-415.
11. Lucas, Robert (1972). "Expectations and the Neutrality of Money". Journal of Economic Theory 4 (2): 103–124.
12. Geweke, John F, 1986. "The Superneutrality of Money in the United States: An Interpretation of the Evidence," Econometrica, Econometric Society, vol. 54(1), pages 1-21, January
13. Cogley, T. 1993, 'Empirical Evidence on nominal wage and price flexibility', Quarterly Journal of Economics, vol CVIII, Issue 1, pp475-491