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ARGUMENTS FOR AND AGAINST RETAINING EXCHANGE RATE REGIME: AN EMPIRICAL ANALYSIS FOR REPUBLIC OF MACEDONIA

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ABSTRACT

The selection and management of the exchange rate regime are an important aspect for an economy in order to preserve competitiveness, macroeconomic stability and growth. The selection of a particular exchange rate regime which is consistent with the economic interests of the country depends on various factors. Therefore , there is no single exchange rate regime which is perfect and suitable for all countries. The choice of a range of regimes depend of relative weight that arises from different factors. The appropriate exchange rate regime will be modified over time according changes in country's circumstances. Taking in view the case of Macedonia and the aspiration to be part of EU, Exchange rate regime can improve the situation of Macedonia only if the access to a large extent makes Macedonia location from which foreign investors can serve to the EU market. Also with the support of estimations, in this paper we showed that in a small and open economy such as Macedonia, using the exchange rate as an instrument could be realized the opportunity for growth of export performances, increasing aggregate demand and increasing economic growth, thus investigating the the arguments for and against retaining exchange rate regime which was the focus of this paper.In this paper we focus on Republic of Macedonia, as a small and open economy, i.e. the arguments for and against retaining exchange rate regime.(The last sentence should be deleted in my opinion its already mention in the sentence before).

Keywords: Exchange rate, Nominal effective exchange rate, VECM, Macroeconomic aggregates, Cointegration, Republic of Macedonia.

JEL Classification: F4.

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Contribution/ Originality

This study is one of very few studies which have investigated how the exchange rate regime can improve the situation of Macedonia on the road into the EU. The study contributes to the existing literature in the sense that it used VECM estimation model to estimate collected data and to analyze the causes that throw more light on how Macedonia can benefit from the type of exchange rate regime.

1. INTRODUCTION

The selection of a particular exchange rate regime which is consistent with the economic interests of the country depends on various factors. The appropriate exchange rate regime will be modified over time according to the changes in country's circumstances.

So, we examine the relationship between nominal effective exchange rate with other macroeconomic aggregates in the long run, where have included data for a small open economy - Macedonia. The other macroeconomic aggregates in the analysis are: Macedonian GDP, Real effective exchange rate, Interest rate, Purchasing power parity (PPP), Monetary aggregates as variables to money supply M2 and M4, and the index of inflation with data base beginning from 2005 (CPI), exports and imports.

The series are log to remove measurement errors and to estimate the sensitivity (elasticities) of the variable - nominal effective exchange rate - against the change of the other variables or vice versa. The analysis first applies the ordinary least squares method, but the validity of this method is challenged because of the coefficients which are produced by this method. So, we continue with modern methods such as Vector error correction model. The real effective exchange rate (REER) is one of the variables that we examine the co – integration. The concept of nominal effective exchange rate (NEER) and real effective exchange rate (REER) is extremely useful in the context of an open economy macroeconomics for measuring the competitiveness of domestic production to international markets. The nominal effective exchange rate expresses the price of the domestic currency relative to the currencies of major trading partners, while the real exchange rate represents the changes against the competition (Goswami and Sarker, 2011).Correct

$$\mathrm{NEER}_{\mathrm{j}} = \sum_{I=1}^{n} s_{ij} \left(\frac{(R_{ij})_t}{(R_{ij})_0} * 100 \right) \quad (1)$$

In the previous expression s_{ij} is part of the imports of the country j from the partner *i*, while $(R_{ij})_t$ is bilateral nominal exchange rates between country i and country j, $(R_{ij})_0$ is the base nominal exchange rate (in a base year) between countries. The expression for the real effective exchange rate is:

$$\text{REER}_j = \sum_{I=1}^{n} s_{ij} \left(\frac{\left(R_{ij} * \frac{CPI_j}{CPI_i} \right)_t}{\left(R_{ij} * \frac{CPI_j}{CPI_i} \right)_0} * 100 \right) \quad (2)$$

in the previous term REER, $\frac{CPI_j}{CPI_i}$ is the ratio of Consumer price index (CPI) in the importing country j against the exporting country i (Oskooee, 2001). Oskooee (2001) First, we make a review of the literature in this area, and than follow the section with regressions.

2. LITERATURE REVIEW

This section presents several studies that use the variable nominal effective exchange rate. Also, here is provided an overview of methods used by these studies (Table 1).

Table-1. Review of methods used in studies which analyze nominal effective exchange rate.

Studies	Title	Methods
Baxter and Stockman (1989).	Business Cycles and the Exchange Rate Regime: Some International Evidence	Correlation analysis
Bollerslev (1990)	Modeling the coherence in short run nominal exchange rates: A multivariate generalized ARCH model	SUR, ARCH andGARCH model
Flood and Rose (1995)	Fixing exchange rates :A virtual quest for fundamentals	Ordinary least squares method
Oskooee (2001)	Nominal and real effective exchange rates of middle eastern countries and their trade performance	Dickey-Fuller Unit Root Tests, Engle-Grangercointegration testand Johansen cointegration test
Lai and Lowinger (2002)	Nominal effective exchange rate and trade balance adjustments in South east Asia countries. Nominal effective exchange rate and trade balance adjustment in South Asia countries	VECM
Tenreyro (2007)	On the trade impact of nominal exchange rate volatility	Poisson pseudo maximum likelihood model
Harbinger Albert (2005)	Nominal Exchange Rate Neutrality: The Case of Australia	VAR model

3. METHODOLOGY

The presence of bilateral causal relationship between two variables, makes more complex building of models. Regressions by the method of ordinary least squares produce statistically high and significant parameters, but the presence of autocorrelation raises the question whether MNC models robast. This applies when the variables are co-integrated. Once we find evidences of cointegration between the variables, we specify appropriate vector model to correct the deviation of equilibrium (error) or VECM (Vector error correction model), which is applied in the examination of models containing more than one endogenous variable.

Engle and Granger provided a solid theoretical fundamental for estimation and modeling co-integrated non-stationary time series in their research (Robert and Clive, 1987). Some authors suggest that the coefficients of Engle and Granger, the long estimated parameters by the method of least squares are consistent and highly efficient (have a small standard deviation) (Stock, 1987). Correct This formally is proven in VECM models estimations that are given below. Another authors introduce systematic approach, and the main advantage of the Johansen method of maximum likelihood (ML), is that it allows to determine the number of co-integration (long-term) relationships between variables (Johansen and Juselius, 1990). Correct Akaike information criterion (AIC) has a feature to estimating the optimal order of lagging. A new asymptotic efficient estimator was proposed, which is known as Saikkonen-Lutkhepohl cointegration method, and the idea behind it is removing the asymptotic inefficiency of the estimated coefficients by the method of ordinary least squares (Saikkonen, 1991). Correct

4. EMPIRICAL RESEARCH

4.1. Vector Correction Models of Deviations from Equilibrium (VECM)

The optimal number of lags for the endogenous variables in the VECM model is determined by Hannan-Quinn information criterion. Other criteria are less reliable, or as Akaike information criterion which reestimate the number of lags. The optimal number of lags in the endogenous variables (in the models) are also annotated in the tables below. Rank of cointegration: results of the tests for cointegration of nominal effective exchange rate and other variables. On the basis of the Johansen test and Saikonen-Lutkepol for all variables we got a result that these variables are cointegrated with the nominal effective exchange rate so we continue with models that contain one cointegration relation.

Cointegration between $\mathrm{logneer}$ and loggdp Saikonen and Lutkepol test has showed that in the case when a constant is included in the relationship of co-integration, the cointegration rank is 1(Saikkonen and Lütkhepohl, 1999) Correct. Whereas in the case of Johansen test $rc(\Pi)=1$ applies when we included constant and trend, the p-value is 0.0001 or possibility to make a Type 1 error if we reject the null hypothesis that $rc(\Pi)=0$ is very low.

The same is true when we have Orthogonal trend to the cointegration relation, and then also the rank of cointegration (between nominal effective exchange rate and gross domestic product) is a unit, $rc(\Pi)=1$. For cointegration between $\mathrm{logneer}$ and $\mathrm{loginterestrate}$, when we have constant and trend in cointegration relationship applies the rank of cointegration which should be a unit $rc(\Pi)=1$, which means that we have enough evidences to reject the null hypothesis that , this is according to Johansen test and Saikkonen Lütkhepohl.

The same result for the rank of cointegration is unit between variables $\mathrm{logneer}$ and $\mathrm{loginterestrate}$, when we have a trend in orthogonal cointegrating relationship test by Johansen and Saikkonen Lütkhepohl (Johansen, 1988). For cointegration between

$\log neer$ and $\log exports$, i.e. the nominal effective exchange rate and exports is true when the rank of cointegration is a unit only when we have constant and trend according to Johansen test for cointegration. The same is valid for the cointegration relationship $\log neer$ and $\log imports$, i.e. between nominal effective exchange rate and import the range of cointegrationis $rc(\Pi)=1$ (Johansen, 1991). The rank of co-integration between $\log neer$ and $\log ppp$ $rc(\Pi)=1$, only according the Johansen test and in all three cases, when in the cointegration relationship we have: constant, constant and trend and orthogonal trend. Only when a constant is included in the cointegration between $\log neer$ and $\log M2$ according the Johansen test $r=1$, whereas when there is constant and orthogonal trend according to Johansen test between $\log neer$ and the range of cointegration is unit $\log M4$. The same applies that $r=1$ when the cointegration between $\log neer$ and $\log reer$, nominal effective exchange rate and real effective exchange rate. While the rank of cointegration between $\log neer$ and $\log cpi$ is unit in all three cases according to Johansen test. Specifications for the rank of cointegration between nominal effective exchange rate and other variables are presented in Tables 2, 3 and 4.

Table-2. Specification of rank of cointegration between nominal effective exchange rate and other variables

Variables	Deterministic expression	Johansen Trace test			Saikkonen and Lütkhepohl		
		Lags	**LR-stat.**	**P-value**	**Lags**	**LR-stat**	**P-value**
logneer loggdp	Constant	1	3.69	0.4718	1	3.65	0.0667
	Constant and trend	1	42.76	0.0001	1	2.37	0.4571
	Orthogonal trend	2	12.24	0.1471	2	10.61	0.0359
	Constant	1	34.27	0.0002	1	9.02	0.1696
logneer loginterestrate	Constant and trend	1	14.35	0.0226	1	20.71	0.0065
	Orthogonal trend	2	28.50	0.0002	2	14.52	0.0062
	Constant	1	16.92	0.1372	1	5.33	0.5266
logneer logexports	Constant and trend	1	28.04	0.0242	1	8.99	0.4373
	Orthogonal trend	2	12.44	0.1380	2	3.08	0.6157
	Constant	2	17.55	0.1141	2	3.24	0.0852
logneer logimports	Constant and trend	2	25.72	0.0501	1	7.95	0.5526
	Orthogonal trend	2	12.41	0.1391	2	2.84	0.6557

Table-3. Specification of rank of cointegration between nominal effective exchange rate and other variables

Variables	Deterministic expression	Johansen Trace test			Saikkonen and Lütkhepohl		
		Lags	LR-stat.	P-value	Lags	LR-stat	P-value
logneer logexports	Constant	1	16.92	0.1372	1	16.92	0.1372
	Constant and trend	1	28.04	0.0242	1	28.04	0.0242
	Orthogonal trend	1	12.44	0.1380	2	12.44	0.1380
	Constant	2	24.53	0.0106	1	2.90	0.8532
logneer logppp	Constant and trend	2	32.20	0.0058	2	10.40	0.3030
	Orthogonal trend	2	20.35	0.0074	2	3.52	0.5428
	Constant	3	19.55	0.0611	3	7.87	0.2503
logneer logM2	Constant and trend	1	16.58	0.4547	1	7.39	0.6173
	Orthogonal trend	2	8.91	0.3804	2	4.12	0.4514
	Constant	3	30.18	0.0011	3	11.04	0.0807
logneer logM4	Constant and trend	1	16.45	0.4653	1	7.02	0.6608
	Orthogonal trend	2	15.20	0.0539	2	7.25	0.1454

Table-4. Specification of rank of the cointegration between nominal effective exchange rate and other variables

Variables	Deterministic expression	Johansen Trace test			Saikkonen and Lütkhepohl		
		Lags	LR-stat.	P-value	Lags	LR-stat	P-value
logneer logreer	Constant	3	23.46	0.0158	3	13.65	0.0284
	Constant and trend	1	17.91	0.3576	2	10.48	0.2966
	Orthogonal trend	2	13.82	0.0874	2	10.36	0.2968
	Constant	5	96.51	0.0000	5	15.07	0.0156
logneer logcpi	Constant and trend	5	104.29	0.0000	5	8.92	0.4453
	Orthogonal trend	5	91.09	0.0000	5	13.90	0.0083

4.2. Estimation of Vector ErrorCorrection Model of Deviations from Equilibrium

VECM model was already estimated by Two stage procedure (S2S) and Johansen procedure used in the first stage and Feasible generalized least squares (FGLS), in the second stage. Thereby, with the output generated by Jmulti software, the matrix of coefficients of the entry of co-integration matrix, and the parameters on short-term. Standard t tests and F tests maintain their asymptotic characteristics if they will be applied to short-term parameters in the VECM. From the model are eliminated from the coefficients which $t < 2$, t statistic is lower than two (Lütkhepohl and Krätzig, 2004; Lütkhepohl and Krätzig, 2005). Correct coefficient of normalized vectors (Loading coefficients), their t statistics could be interpreted in usual manner depending on the estimated coefficients of the co-integration.

Their significance is explained in the following table for the VECM model . Vectors of co - integration , thus we chose $\log neer_t$ for dependent variable , means that the coefficient of this variable in the cointegration relation will be normalized to 1, the procedure of maximum likelihood estimation (Table 5) .

Table-5. VECM model, the coefficients of normalized vectors, deterministic variables and the optimal number of lags of the endogenous variables

Vectors of cointegration	Interpretation of the vector of cointegration	Coefficient of normalized cointegration vectors (t-statistic) and interpretation	Influence of deterministic variables	Optimal number of lags of the endogenous variables
$\log neer_t = 0.115 \log imports_t + ec_t^{fgls}$ (-2.620)	1 % increase in imports will cause increase in nominal effective exchage rate of 0.115%	t-statistics for second equation [5.344]indicates that it enters significantly in the cointegeration.The coefficient of first equation is nonsignificant..	Seasonal factors and trend are nonsignificant in both equations	0
$\log neer_t = 0.006 \log gdp_t + ec_t^{fgls}$ (-1.393)	t-statistic which is lower than 1.65 indicates that between GDP and nominal effective exchange rate there is no cointegration	t-statistics in both equations [0.437] [0.780] indicates that both equations enter nonsignificantly in the ratio of cointegration.	Seasonal factors and trend are nonsignificant in both equations	1
$\log neer_t = -0.2 \log \mathrm{int}\ erestrate_t + ec_t^{fg}$ (3.27)	1 % increase in interest rate will cause decrease in nominal effective exchange rate of 0.2%	t- statistics in both equations [2.016] [-5.511] indicates that both equation enter significantly in the ratio of cointegration (bilateral causality).	Seasonal factors and trend are nonsignificant in both equations	1

Table-5(continue).VECM model, the coefficients of normalized vectors, deterministic variables and the optimal number of lags of the endogenous variables

Vectors of cointegration	Interpretation of the vector of cointegration	Coefficient of normalized cointegration vectors (t-statistic) and interpretation	Influence of deterministic variables	Optimal number of lags of the endogenous variables
$\log neer_t = -0.119 \log \exp orts_t + ec_t^{fg}$ (3.56)	1 % increase in imports will cause decrease in nominal effective exchage rate of 0.119%	t-statistics of the first equation [-11.395] indicates that it enters significantly in cointegration equation, second equation is nonsignificant..	Trend enters significantly in the first equation while seasonal factors are nonsignificant	1
$\log neer_t = -0.155 \log ppp_t + ec_t^{fg}$ (2.656)	1 % increase in purchasing power parity will cause decrease in nominal effective exchange rate of 0.155%	t-statistics in both equations [-6.173] [2.652] indicates that both equations enter significantly in the ratio of cointegration (bilateral causality).	Seasonal factors and trend are nonsignificant in both equations	2
$\log neer_t = -0.341 \log reer_t + ec_t^{fg}$ (1.979)	1 % increase in real exchange rate will cause decrease in nominal effective exchange rate of 0.341%	t- statistics in both equations [-5.492] [-5.480] indicates that both equations enter significantly in the ratio of cointegration (bilateral causality).	Seasonal factors and the trend are partially significant in cointegration equations.	2
$\log neer_t = 4.089 \log cpi_t + ec_t^{fgls}$ (−3.771)	1 % increase in inflation leads to increase in nominal effective exchange rate of 4.089%	t-statistics in second equation[5.264]indicates that it enters significantly in the cointegration, the first one is not significant.	Seasonal factors and the trend are partially significant.	5

Table-5(continue).VECM model, the coefficients of normalized vectors, deterministic variables and the optimal number of lags of the endogenous variables

Vectors of cointegration	Interpretation of the vector of cointegration	Coefficient of normalized cointegration vectors (t-statistic) and interpretation	Influence of deterministic variables	Optimal number of lags of the endogenous variables
$\log neer_t = -0.064 \log m2_t + ec_t^{fgls}$ (2.511)	1 % increase in money supply M2 leads to decrease in nominal effective exchange rate of 0.064%	t-statistics in both equations [-2.030] [-1.837] indicates that both equations enter significantly in the ratio of cointegration (bilateral causality).	Seasonal factors and trend are nonsignificant in both equations	1
$\log neer_t = 0.064 \log m4_t + ec_t^{fgls}$ (−1.680)	1 % increase in money supply M2 leads to increase in nominal effective exchange rate of 0.064%	t-statistics for fisrt equation [-2.945]indicates that it enters significantly in the cointegration, the second one is not significant.	Seasonal factors and trend are nonsignificant in both equations	1

From this table of VECM model we notice that the nominal effective exchange rate is not co -integrated only with the Gross domestic product, and this goes in accordance to the Baxter-Stockman neutrality hypothesis for the nominal effective exchange rate . Baxter and Stockman, unlike previous papers, found that the nominal effective exchange rate has no effect on real macroeconomic aggregates.[1]

In table 6 is shown the diagnostic of Vector error correction model.

[1] This is considered as one of the 6 major macroeconomic puzzles, the others are: Feldstein-Horioka puzzle for the correlation of saving investments, puzzle of bias towards the domestic economy to trade, home-bias towards capita, puzzle of the real exchange rate, and the Backus-Smith puzzle which says that the correlation between consumption and real exchange rate is zero or negative.

Table-6. Diagnosis of VECM model

Tip of testing	**p-value of the model** ($\log neer_t$ $\log imports_t$)	**p-value for the model(** $\log neer_t$ $\log gdp_t$ **)**	**p- value for the model** ($\log neer_t$ $\log interestrate_t$ **e)**	**p- value for the model** ($\log neer_t$ **и** $\log exports_t$ **)**
VECM modelstatistics	0.7726 (√)	0.6933 (√)	0.2567 (√)	0.2376 (√)
LM test for autocorelation	0.5416 (√)	0.2185 (√)	0.1009 (√)	0.0200 (x)
Doornik and Hansen (1994)	0.7347(√)	0.0000 (x)	0.0000 (x)	0.1522 (√)
Lütkepohl (1991)	0.8867(√)	0.0000 (x)	0.0000 (x)	0.1577 (√)
ARCH-LM				
u1	0.6086 (√)	0.8680 (√)	0.6410 (√)	0.6251 (√)
u2	0.8772(√)	0.9999 (√)	0.2496 (√)	0.7105 (√)

Note:√ shows that there is no problems with the diagnosis; x shows that there are some problems with diagnosis

Table-6(continue). Diagnosis of VECM model

Tip of testing	**p-value for the model(** $\log neer_t$ $\log imports_t$ **)**	**p-value for the model(** $\log neer_t$ $\log reer_t$ **)**	**p-value for the model(** $\log neer_t$ $\log cpi_t$ **)**	**p-value for the model(** $\log neer_t$ $\log m2_t$ **)**	**p-value for the model(** $\log neer_t$ $\log m4_t$
VECM model statistics	0.1317 (√)	0.4852 (√)	0.1048 (√)	0.8982 (√)	0.2872 (√)
LM test for autocorrelation	0.5770 (√)	0.0003 (x)	0.5313 (√)	0.1429 (√)	0.2141 (√)
Doornik and Hansen (1994)	0.0000 (x)	0.0000 (x)	0.0000 (x)	0.0000 (x)	0.0000 (x)
Lütkepohl (1991)	0.0000 (x)	0.0000 (x)	0.0000 (x)	0.0000 (x)	0.0000 (x)
ARCH-LM					
u1	0.4218 (√)	0.4203 (√)	0.0002 (x)	0.5522 (√)	0.6827 (√)
u2	0.9947 (√)	0.0013 (x)	0.7688 (√)	0.8934 (√)	0.9888 (√)

Note:√ indicates that there is no problems with the diagnosis; x indicates that there are some problems with diagnosis.

From the preceding tables for the diagnosis in models can't reject the null hypothesis that the restricted model has a better presentation from unrestricted model for correction of error. The value of this statistic in our models is respectively: for the model $\log neer_t$ and $\log imports_t$ (0.7726), for $\log neer_t$ and $\log gdp_t$ (0.4852), for $\log neer_t$ and $\log interestrate_t$ (0.2567), $\log neer_t$ and $\log exports_t$ the amounts is (0.2376), for $\log neer_t$ and $\log ppp_t$ (0.1317), for $\log neer_t$ and $\log reer_t$ (0.4852), $\log neer_t$ and $\log cpi_t$ (0.1048),

$\log neer_t$ and $\log m2_t$ (0.8982), $\log neer_t$ and $\log m4_t$ (0.2872).[2] The autocorrelation is of particular importance in the analysis of time series and it is not a problem in any of the models. The models have a problem with normality in the residuals but it is not a big problem to be reviewed the results obtained with our models.

5. CONCLUSION

From the presented estimation starting with VECM, we recognize that 1 % increase in imports will cause an increase in the nominal effective exchange rate of 0.115 % . T – statistics which is less than 1.65 indicates that between GDP and nominal effective exchange rate there is no cointegration. Further, 1 % increase in interest rates will cause a reduction of nominal effective exchange rate of 0.2 % ; 1 % increase in exports will cause a decrease in nominal effective exchange rate of 0.119 % ; 1 % increase in purchasing power parity will cause a reduction in nominal effective exchange rate of 0.155 % .When the focus is on real exchange rate, 1% increase in real exchange rate will cause reduction in nominal effective exchange rate of 0.341%. 1% increase in inflation leads to an increase in nominal effective exchange rate of 4,089%. For money supply M2, results show that 1% increase in the money supply M2 leads to reduction in the nominal effective exchange rate of 0,064%. According to results, we conclude that the cointegration relation of the nominal effective exchange rate is bilateral with following macroeconomic aggregates: interest rate, purchasing power parity, the real effective exchange rate (REER) and the monetary aggregate M2. The cointegration relation has direction from the nominal effective exchange rate to other macroeconomic aggregates only in the case of imports and inflation . In the case of monetary aggregate M4 and exports, causality moves from them to the nominal effective exchange rate. In the case of the GDP, the serie is not cointegrated with the nominal effective exchange rate .Robust tests confirmed that the model is well specified and can not reject the null hypothesis. Based on the results we can decide to favor long-term bilateral causal relationship. The series of short term are not statistically significant related to the short-term. However, researcher's conclusions about causality depends on the length of the sample, the number of explanatory variables (Lemos, 2004).

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[2] These p-values means that possibility to make Type 1 error to reject the null hypothesis that the restricted model is better than unrestricted model is high. When we have that in mind, this means that there is insufficient evidence to reject the null hypothesis.

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