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The macroeconomic implication of exchange rate regimes

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The Macroeconomic Implication of Exchange Rate Regimes

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Abstract

This study investigates the relation between macroeconomic variables such as real GDP growth, inflation, unemployment rate, trade deficit and the exchange regimes. The idea is to explore whether the macroeconomic indicators give better result when are under the influence of fixed or fluctuating exchange rates. In order to obtain relevant results, we took 5 countries with fixed and 5 countries with floating exchange rates.

 The paper also concerns the Macedonian exchange rate regimes. Here the focus is put on two periods. The first one is from 1993- 1995 when the country had fluctuating exchange rate. The second period is from 1995 till now -2011, when Macedonia has been implementing a regime of fixed "pegged" exchange rate.

Key words: exchange rate, macroeconomic variables

Sample of countries that have accepted the fixed exchange rate in the period between 2000- 2011

In our analysis, 5 Central Eastern European countries (CEE) are involved: Bulgaria, Estonia, Bosnia, Lithuania and Latvia. For each of these countries we used data for the period between 2000 until 2011. Because in the statistics for a normal sample (sample that follows a normal distribution $(0, \sigma^2)$ is considered that one of at least 30 observations or more, we merged the data, so now we have 60 observations for a total of 5 variables.

Variables that are subject of our interest are following: ER (fixed exchange rate), UNEM (unemployment as a percentage of the total active population), RGDP (real GDP growth in percentage value), INF (inflation expressed as a percentage of price increased), TRDEF (trade deficit also expressed in percentage).

Descriptive statistics of sample

The following table provides descriptive statistics of our sample 1. The sample contains 60 observations.

Variables	Max	Min	Mean	Stand. Deviations	Skewness	Kurtosis	Coef of variations
Exchange Rate	15.64	0.559	4.7383	5.5705	1.4032	0.11989	1.1757
Unem	31.8	4.3	14.6863	8.1767	0.88425	-0.26097	0.55676
RGDP	13.9	-18	4.76	5.5346	-2.0303	5.4611	1.1627
Inf	15.3	-1.2	4.525	3.3674	0.9297	0.93983	0.79187
TRDEF	5	-53	-14.4637	13.4865	-1.3902	0.79187	0.93244

Sample of 60 observations

In the group of 5 countries with fixed exchange rates (Bulgaria, Estonia, Bosnia, Lithuania, Latvia), the average unemployment rate is 14.68%, the average real GDP per capita is 4.76, the average inflation is single-digit of 4,53%, the average trade deficit in the selected group of countries is negative -14.46%.

From kurtosis'data, the variable- unemployment has the lowest kurtosis, and the highest one has the variable- real GDP growth per capita of 5.4611. The other variables have positive kurtosis which means that the distribution has "fat tail ″ right. Examples of this type of distribution are :Student t-distribution, exponential, poisonove. The asymmetry is positive which means deviations from the mean value 0, are positive i.e. $\sigma > 0$.

Correlation matrix

Correlation matrix is a single matrix of correlation coefficients. The fixed exchange rate of the matrix can be seen to be correlated with the real GDP growth, the ratio is 0.20257, which indicates a weak positive correlation. The fixed exchange rate shows a weak negative correlation with inflation (-0.032561), and the fixed exchange rate positively but weakly is associated with the trade deficit (0.36528). From the other results, the unemployment rate and the real GDP per capita are negatively correlated (0.19475). While the fixed exchange rate with the rate of unemployment is also negatively correlated (-0.25928). The trade deficit has positive correlation with the inflation (0.026845).

Table of correlation matrix [1]

	ER	UNEM	RGDP	INF	TRDEF
ER	1.0000	-.25928	.20257	-.032561	.36528
UNEM	-.25928	1.0000	-.19475	-.44101	-.69025
RGDP	.20257	-.19475	1.0000	-.045774	-.080679
INF	-.032561	-.44101	-.045774	1.0000	.026845
TRDEF	.36528	-.69025	-.080679	.026845	1.0000

[1] See Appendix 2 correlation matrix, extract from Mycroft 4.0

Graphic tables (scatters diagrams)

The sign before the coefficient of each variable can be examined graphically. On the following chart are crossed the variables of the fixed exchange rate and the real GDP growth per capita. From the graph we can see that most of the observations are on the right side, and only seven of 60 observations are on the left side, with a negative sign in the second quadrant. In conclusion there is a positive association between fixed exchange rate and the real GDP growth.

Scatter plot of the fixed exchange rate on the real GDP growth
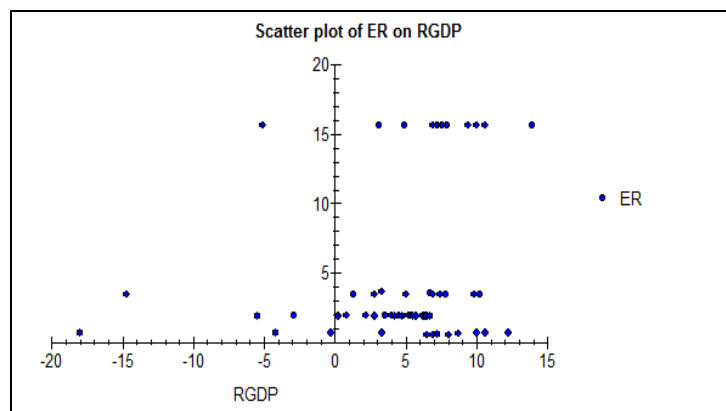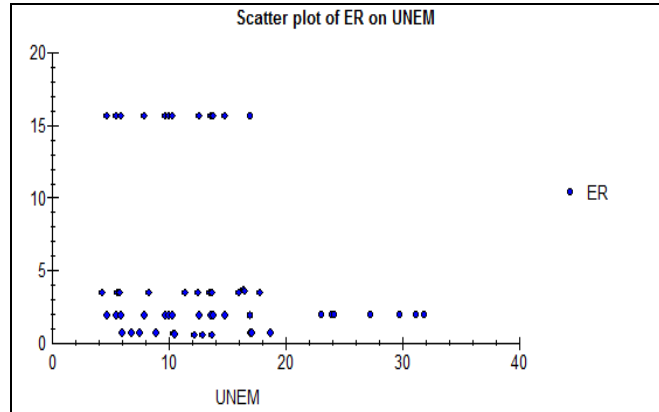

The graphic table of the inflation and the fixed exchange rate shows also a positive relationship between the inflation and the fixed exchange rate.

**Scatter plot of the fixed exchange rate on the inflation.**
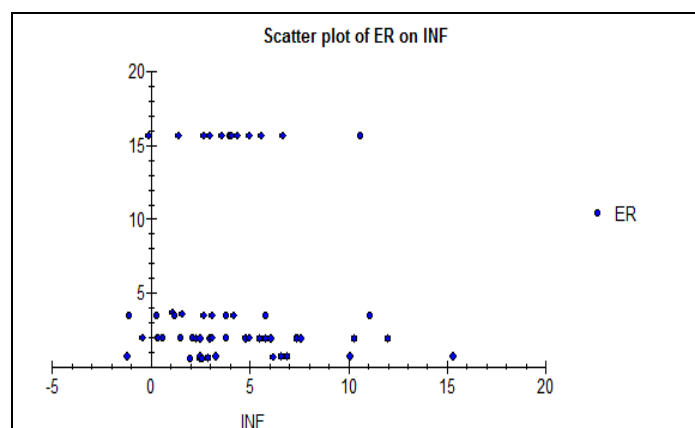
The fixed exchange rate is also positively correlated with the unemployment, and therefore, they move in same direction.

Scatter plot of the fixed exchange rate on the unemployment rate.

The graphic table of the fixed exchange rate and the trade deficit shows negative relationship between these two variables, hence, they move in opposite direction.

Scatter plot of the fixed exchange rate on the trade deficit
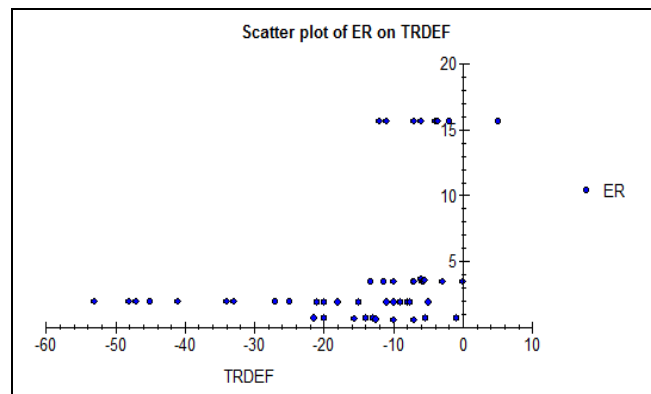
<u>**Regression analysis**</u>

After the descriptive statistics and the correlation analysis, follows the regression analysis. The simple smallest squares give the most effective estimated coefficient (Best Linear Unbiased Estimator). Here the variable of interest is the growth of real GDP per capita, thus the growth equation – the estimated simple linear model such as:

$$y = a_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + e$$

Where:

y- RGDP

x_1- ER

x_2- INF

x_3- UNEM

x_4-TRDEF

$$\hat{rgdp} = 9.6 + 0.25ER - 0.58INF - 0.52UNEM - 0.28TRDEF$$ [2]

p-value   (0.0)   (0.054)   (0.016)   (0.000)   (0.000)

$$R^2 = 0.269$$

$$F(\ 4,\ 55) =\ 5.0707[0.001]$$

	p-value	conclusion
Serial Correlation	[0.108]	We cannot reject the null hypothesis of no serial correlation at 10% level of significance
Functional Form	[0.236]	We cannot reject the null hypothesis for a good functional form at all levels of significance
Normality	[0.000]	We cannot reject the null hypothesis for normality
Heteroscedasticity	[0.053]	We cannot reject the null hypothesis of homoscedasticity at 5% level of significance

From the regression analysis it can be noted that the coefficients of all variables are statistically significant at all levels of probability ,and all of them are commonly statistical significant as F-statistics (0.001) shows. The probability to make a mistake if we reject the null hypothesis, that the variables are commonly unsignificant, is ten times less than 1%.

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[2] See Appendix 3, extract from the regression analysis in Mycroft 4.0

The signs of variables are expected from the theory, the sign of the exchange rate is positive and statistically significant, while the sign in front of the unemployment, inflation and trade deficit is negative and these variables are statistically significant. The conclusion of the regression analysis is that the exchange rate is positive and statistically significant correlated with the real GDP growth. The following graphs show the deviations from the current assessed values for the variable of interest, i.e. for the real GDP growth, as well as frequency histograms which express the normality of the distribution of frequencies.
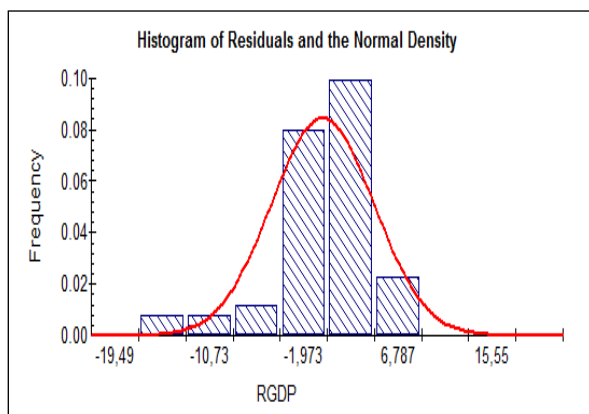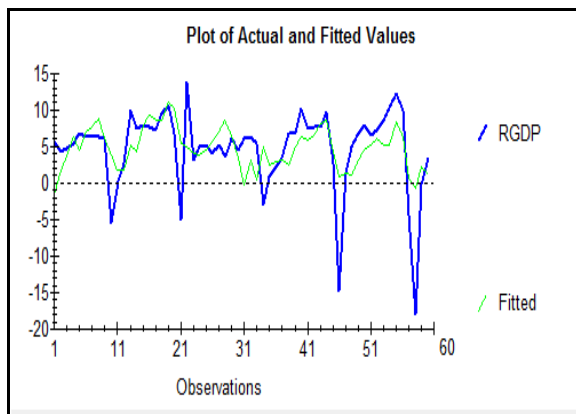
Samples of countries that have accepted the fluctuating exchange rate in the period between 2000 до 2011

This group also includes 5 countries (Croatia, Albania, Poland, Serbia and Hungary) with sample of 60 observations. On the following table, is presented a descriptive statistics of the variables in the model Mean, Standard deviation, as well as the indicators of normality and coefficient of variation.

Table of descriptive statistics of the model with floating exchange rate (FER)[3]

Sample : 1 до 60					
Variables :	FER	RGDP	INF	UNEM	TRDEF
Maximum :	280.3300	8.5000	93.3000	21.8000	6.2200
Minimum :	3.5100	−6.3000	.70000	5.7000	−26.5500
Mean :	70.3633	3.4687	8.0367	12.7752	−5.5808
Stand. Deviation :	99.3845	2.7233	15.2262	4.7271	8.2489
Skewness :	1.2291	−1.6129	4.7560	.30117	−.94913
Kurtosis − 3 :	−.18286	3.6134	22.3740	−1.1133	.032603
Coef of variations:	1.4124	.78511	1.8946	.37002	1.4781

In this group of countries, the average unemployment rate is 12.77% and this rate is lower than the average unemployment in the group of countries with fixed exchange rate.The average trade deficit is also lower (-5.58%) than the trade deficit in countries with fixed exchange rate. Additionally, the average GDP per capita is lower than the GDP real growth of countries with fixed exchange rate – 3, 47%, but the rate of inflation is higher than in countries with fixed exchange rate - 8,037%.

The sample also shows right "thick tail ", which means distribution of frequency.

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[3] See Appendix 4 descriptive statistics of the model with floating exchange rate

Correlation Matrix

Correlation Matrix of the model with floating exchange rate (FER).

	FER	RGDP	INF	UNEM	TRDEF
FER	1.0000	-.16366	.044140	-.47275	.27604
RGDP	-.16366	1.0000	.16141	.13083	-.15575
INF	.044140	.16141	1.0000	-.0060191	-.40996
UNEM	-.47275	.13083	-.0060191	1.0000	-.44793
TRDEF	.27604	-.15575	-.40996	-.44793	1.0000

The floating exchange rate is weak negatively correlated with the real GDP growth (RGDP) with a coefficient (-0.16366), unlike the group of countries with fixed exchange rate where this coefficient was positive. The rate of inflation is positive but very weakly correlated with the fluctuating exchange rate (-0.044). The fluctuating exchange rates is strongly correlated with the unemployment rate, and this sign is negative (-0.47). The fluctuating exchange rate is positively correlated with the trade deficit (0.28). Under fluctuating exchange rate, the inflation is positively correlated with real GDP per capita (0.16), which was not the case under fixed exchange rates where they were weak and negative correlated. In conditions of fluctuating exchange rates, the real GDP growth and the rate of unemployment are positively correlated (0.13), and in conditions of fixed exchange rate they were negatively correlated. The trade deficit with inflation is negative correlated (-0.41), while in terms of fixed exchange rates they were positively correlated.

Graphic Tables (Scatters diagrams)

Scatter diagrams for countries that have fluctuating exchange rate regimes.

A)Fluctuating exchange rate and the real GDP growth rate.
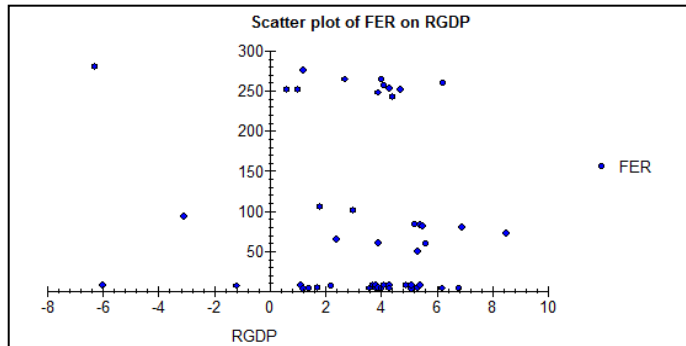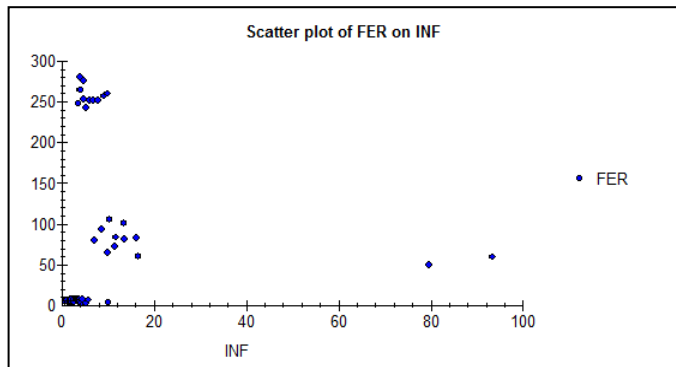
Scatter plot of FER on RGDP

B) Fluctuating exchange rate and inflation

Scatter plot of FER on INF

C) Fluctuating exchange rate and unemployment rate.

Scatter plot of FER on UNEM

D) Fluctuating exchange rate and trade deficit

Scatter plot of FER on TRDEF

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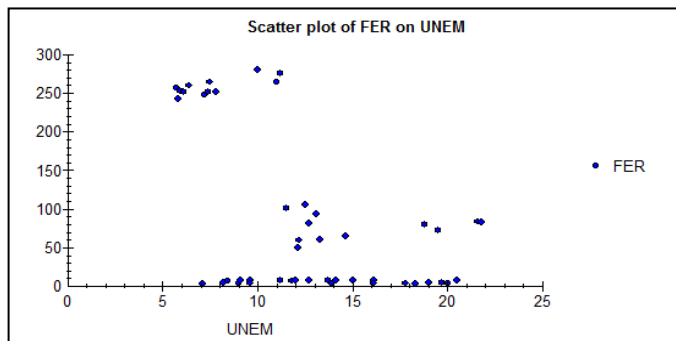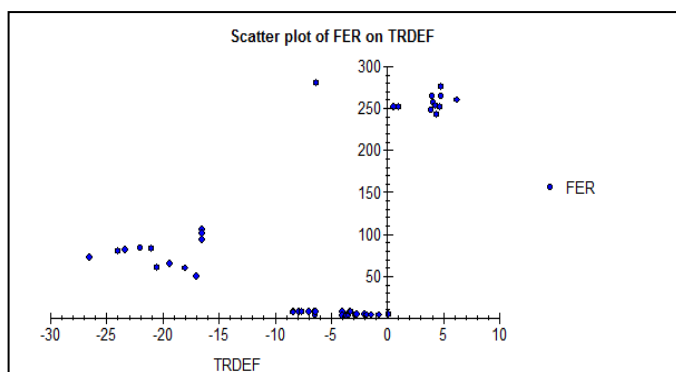
From the graphs shown above, it can be noted that there is a positive association between the fluctuating exchange rate with GDP growth per capita, inflation and unemployment, while there is a negative correlation with the trade deficit.

Regression Analysis

Here we apply the same model as for countries with fixed exchange rate.

$$y = a_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + e$$

Where:

y- RGDP
x_1- FER
x_2- INF
x_3- UNEM
x_4- TRDEF

The same equation for growth gave the following result:

$$\hat{rgdp} = 3.06 - 0.0037\,FER + 0.027\,INF + 0.031\,UNEM - 0.01\,TRDEF \text{ [4]}$$

P-value   (0.026) (0.364)   (0.299)   (0.744)   (0.856)

$$R^2 = 0.06$$

F-stat.   F(4, 55)=   0.86511[.491]

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[4] See appendix 5 regression analysis with fluctuating exchange rate

	p-value	Conclusion
Serial Correlation	[0.001]	We have enough evidence to reject the null hypothesis due to no serial correlation, but no serial correlation is not very important because we know that is a common problem in the cross-section data
Functional Form	[0.832]	We cannot reject the null hypothesis for a good functional form at all levels of significance
Normality	[0.000]	We Reject the null hypothesis of normality in the residuals
Heteroscedasticity	[0.251]	We cannot reject the null hypothesis of homoscedasticity all levels of significance

The functional form of the previous model is good, and does not suffer from heteroscedasticity. But, except the constant, the other variables are insignificant at conventional levels of significance. Also, according to the statistics of the F-model (0.491), we have insufficient evidence to reject the null hypothesis of a common power insignificance. Additionally, the explaining power of the model is about 6%.

However, although the coefficient statistically is not significant for real to be generalized, it can be taken as confirmation that the growth of real GDP is negatively correlated with the fluctuating exchange rate .This fact was previously observed in the correlation analysis.

Macedonian Fixed Exchange Rate 1996-2011

Since 1996, the exchange rate of Macedonia is tied initially to the German mark, and then to the euro (1999-2011).

Descriptive Statistics

Table with descriptive statistics for Macedonia in the period between 1996- 2011(Fixed exchange rate).

Period		:1996 – 2011				
Variables	:	ER	RGDP	INF	UNEM	TRDEF
Maximum	:	61.6200	6.1000	6.1000	37.3000	-10.0000
Minimum	:	26.4800	-4.5000	-1.9000	30.5000	-26.0000
Mean	:	55.0856	2.5875	2.4063	33.7938	-17.7181
Stand. Deviation	:	13.1154	2.7173	2.5676	2.3017	4.5072
Skewness	:	-1.6147	-1.0852	-.24105	.25195	.083455
Kurtosis - 3	:	.63478	.87025	-.99004	-1.3919	-.73511
Coef of variation	:	.23809	1.0502	1.0671	.068111	.25438

During this period, from 1996 to 2011, the real GDP per capita is averaging 2.58%, the rate of inflation is 2.41% , the unemployment rate is 33.79%, while the trade deficit is amounted to -17.71%. The indicator of kurtosis is more negative here, which means the distribution of frequencies is ″ thick left tail ″.

Correlation Analysis

On the following table is presented the correlation matrix.

	ER	RGDP	INF	UNEM	TRDEF
ER	1.0000	.11675	.22041	-.064931	-.53047
RGDP	.11675	1.0000	.16981	.56821	-.11983
INF	.22041	.16981	1.0000	-.19650	.0062146
UNEM	-.064931	.56821	-.19650	1.0000	-.057686
TRDEF	-.53047	-.11983	.0062146	-.057686	1.0000

The fixed exchange rate is positively correlated with the real GDP growth (0.117), with the inflation rate (0.22), and negatively correlated with the unemployment rate (-0.006) and the trade deficit (-0.53). Similarly, as in the group of the countries with fixed exchange rate, Macedonia also has positive correlation between the inflation and trade deficit.

Graphic Tables (scatters diagrams)

Below are presented scatter diagrams for Macedonia in terms of fixed exchange rate.

A) Fixed exchange rate and the real GDP growth.
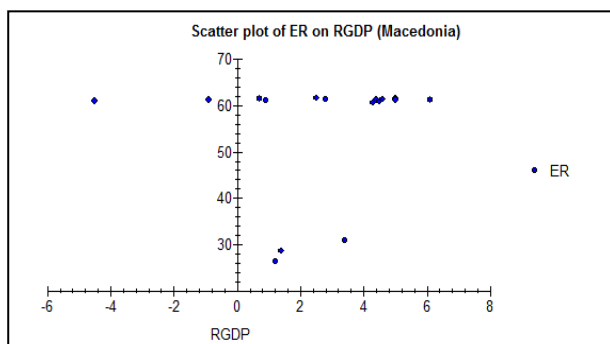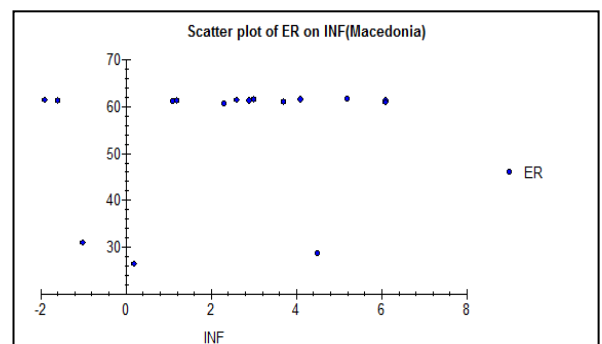
Scatter plot of ER on RGDP (Macedonia)

B) Fixed exchange rate and inflation

Scatter plot of ER on INF(Macedonia)

C) Fixed exchange rate and unemployment rate.

Scatter plot of ER on UNEM(Macedonia)

D) Fixed exchange rate and trade deficit

Scatter plot of ER on TRDEF(Macedonia)
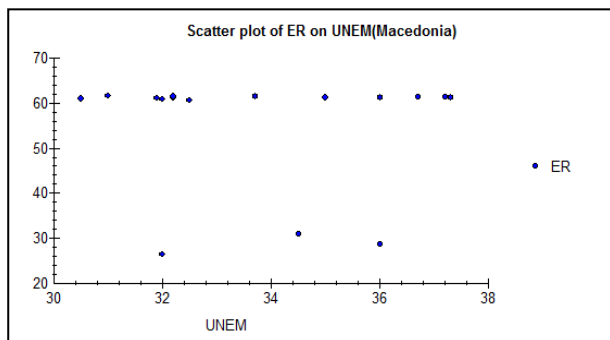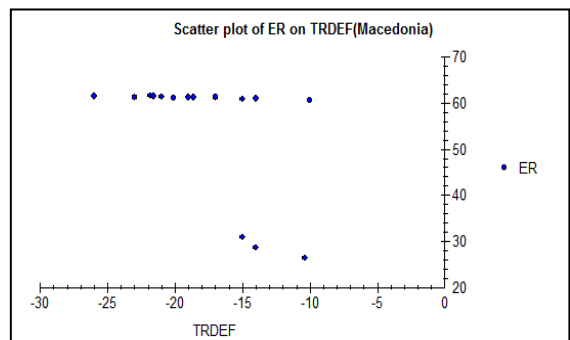
The fixed exchange rate is positive dispersed in terms of the real GDP growth, the inflation, and the unemployment rate, while is negative dispersed regarding the trade deficit.

Regression Analysis

The model is the same as the previous one, which was used for countries with fixed and fluctuating exchange rate.

The equation for growth gave the following result:

$$\hat{rgdp} = -24.35 + 0.015ER + 0.29INF + 0.737UNEM - 0.0289TRDEF \quad ^5$$

P-value   (0.032) (0.807)   (0.277)   (0.023)   (0.865)

$$R^2 = 0.42$$
$$\text{F-stat.} \quad F(\ 4,\ 11)\ =\ 1.9584[.171]$$

The diagnostic of the model is presented in the following table:

	p-value	Conclusion
Serial Correlation	[0.542]	We cannot reject the zero hypothesis of no serial correlation at all levels of significance
Functional Form	[0.070]	We can not reject the null hypothesis for a good functional form of the 7% level of significance
Normality	[0.341]	We do not have enough evidence to reject the null hypothesis of normality in the residuals
Heteroscedasticity	[0.358]	We cannot reject the null hypothesis of homoscedasticity at all levels of significance

From the previous regression, the coefficient of the fixed exchange rate is positive but statistically insignificant. The model does not suffer from heteroskedastichnost and the functional form is good, as well as normality of residuals. The explaining power of the model is about 42%. The coefficient of unemployment is positively and significantly correlated with the growth of real GDP.

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[5] See Appendix 6 regression analysis of the real GDP growth with data for Macedonia

Macedonian Fluctuating exchange rate (1993-1995)

Macedonia in the period 1993-1995, had fluctuating exchange rate regime.

Descriptive statistics

Descriptive analysis of data for Macedonia, when operated under the influence of fluctuating exchange rate:

```
Period          :1993 - 1995
 Variables      :    FER      RGDP      INF      UNEM     TRDEF
 Maximum        :  27.0000   -1.1000  229.6000  35.6000   -7.9400
 Minimum        :  14.6000   -7.5000    9.2000  27.7000  -10.2200
 Mean           :  22.7133   -3.4667   98.0667  31.1000   -9.3067
 Stand. deviation :  7.0301    3.5105  116.2298   4.0632    1.2057
 Skewness       :  -.70370   -.67561    .58351   .46089    .59309
 Kurtosis - 3   :  -1.5000   -1.5000   -1.5000  -1.5000   -1.5000
 Coef of variations:  .30951   1.0126   1.1852   .13065    .12955
```

At a time when Macedonia was adopted floating exchange rate, the average inflation rate amounted to 98. 066%, the real GDP growth is negative and amounts (-3.47), the trade deficit is -9.31%.

Correlation Analysis

A correlation analysis is presented in the following matrix.

	FER	RGDP	INF	UNEM	TRDEF
FER	1.0000	.99122	-.97302	.70173	-.98735
RGDP	.99122	1.0000	-.99498	.78976	-.95773
INF	-.97302	-.99498	1.0000	-.84716	.92414
UNEM	.70173	.78976	-.84716	1.0000	-.57990
TRDEF	-.98735	-.95773	.92414	-.57990	1.0000

Here the fluctuating exchange rate is positively correlated with the growth of real GDP (0.9912), the rate of inflation is negatively correlated with the fluctuating exchange rate (-0.97), but is positively correlated with the unemployment rate(0.7013), while the fluctuating exchange rate is negatively correlated with the trade deficit (-0987). The rate of inflation and the trade deficit in terms of fluctuating exchange rates in Macedonia are positively correlated.

Conclusion

Taking into account the countries on which an econometric analyses were conducted, we obtained the following results:

Countries with **fixed exchange rate** are positive but weakly correlated with **GDP growth**. Their correlation is (0.20257), which means that these two units moves in same direction. The national currencies of those countries are stable (no daily fluctuations in the national currency), and therefore, as a result of the security that import-export oriented companies have, the real GDP growth has a significant positive rates. Their correlation is weak, and this means that GDP growth in a small extent depends on the exchange rate.

The *fixed exchange rate* has a weak negative correlation with the *inflation* (-0.032561), which means that these 2 units have opposite directions of movement.
Usually, countries with fixed exchange rates have a low rate of inflation because the fixed rate imposes monetary discipline in one country i.e. restricts the process of money creation. So, the governments of the countries with fixed exchange rates does not increase the money supply, on that way they prevents inflation and thus the depreciation of the currency. They have weak correlation because the inflation does not depend just on the exchange rate. For instance, in 2008 countries with fixed exchange rate reached the highest inflation rate (12% in some countries), due to the increased price of oil and food.

The rate of GDP growth in countries with fixed *exchange rate* is negative correlated (-0.080679) with the *trade deficit*. This means that if the rate of GDP growth increases, the *trade deficit* declines and vice versa.

In conditions of fixed exchange rate, the rate of *GDP* is negative correlated with the *unemployment rate*. The coefficient of their correlation is (-0, 19475), meaning that if GDP increases, the unemployment rate decreases.

After we discussed the macroeconomic implications of the fixed exchange rate, we move toward those countries that have adopted *fluctuating exchange rate*. If we see the relation between *the fluctuating exchange rate* and the *rate of GDP growth* we could see that the coefficient of their correlation is (-0.16366). This means that these 2 units moves in opposite directions i.e. when the exchange rate increases, the rate of GDP growth declines and vice versa.

It must be noted that the countries we took in our analysis are developing countries, thus most of them are imports oriented than export. In other words, when their national currency devalues, the imported costs for certain products or materials are higher, and therefore the companies are not stimulated to produce in their countries. While exporters are in a very small number so they cannot cover the costs of the import. Due to the frequent fluctuations (appreciation/depreciation of the national currencies) of this exchange rate regime, the countries with fluctuating exchange rate have more negative GDP growth than countries with fixed exchange rate. It can be seen from the descriptive analysis in which the average growth in countries with fixed exchange rate is 4.76 while in countries with floating exchange rate is 3.47%.

The *fluctuating exchange rate* is weakly and positive correlated with the *inflation*. The coefficient of correlation is (0.004). This means that these two units are moving in same direction. If one goes up. the other variable also increases. For example, if exchange rates rise or devalue the national currency, inflation goes in the same direction and that it goes forward. The average inflation of the countries (taken in the analysis) with fluctuating exchange rate is 8,037% which is higher than the inflation rate in countries with fixed rate-4, 53%.

In conditions of fluctuating exchange rates the **rate** *of GDP* and the *unemployment rate* are positively correlated (0.13) and in terms of fixed exchange rates these two items were negatively correlated. As the national currency devalues, the GDP rate goes down, thus the unemployment rate increases.

In countries with fluctuating rate, *the rate of GDP growth* is weakly negative correlated with the *trade deficit* i.e. As GDP increases, the trade deficit decreases (-0.15575). It must be noted that their correlation is stronger in countries with fixed exchange rate (-0.69025). That means that the trade deficit to a greater extent depends on GDP growth in countries with fixed exchange rates than countries with floating exchange rates.

Regarding the econometric analysis, conducted for the case of Macedonia, we obtained the following results:

In conditions of fluctuating exchange rates, the rate of GDP growth shows a positive correlation with the fluctuating exchange rate (0.99122). Considering that GDP rate for Macedonia from 1993 to 1995 has negative rates, but we can say that he moved in a positive direction because the negative rates significantly decreased from -7.5% to -1.1% in 1995. As the currency depreciated against the Deutsche mark, the rate of GDP growth moved in a positive direction.

The *rate of inflation* is negative correlated (-0, 97) with the *fluctuating exchange rate* and it shows negative rates of 229.6% in 1993. From the correlation analysis we could noticed that as the exchange rate increases, inflation decreases.

Fluctuating exchange rate is positive correlated with the *unemployment rate* (0.7013) i.e. as the exchange rate of the denar goes up, the unemployment also increases.In that period, the GDP rate was negative, thus the unemployment rate of that period was negative too.

The *fluctuating exchange rate* is negatively correlated with the *trade deficit* (-0,987). That means that as the exchange rate increases, the trade deficit shrinks.

Macedonia since 1995- until today 2011, has been implementing a fixed exchange rate of the denar against the euro. After the econometric analysis of this period we obtained the following results:

The *fixed exchange rate* is positively correlated with *GDP growth* (0.117). The same correlation we obtained among the countries with fixed exchange rate. That is due to the stability of the fixed exchange rates, GDP shows positive growth rates.

The *fixed exchange rate* is positive correlated with the *rate of inflation* (0.22). If we compare the periods of fixed and fluctuating rate, we could notice that the rate of inflation is far lower in terms of a fixed exchange rate. As we already said that is because of the monetary discipline and credibility that this exchange rate imposes.

The *fixed exchange rate* is negatively correlated with the *trade deficit*, i.e. they move in opposite directions, as the exchange rate increases, the trade deficit decreases and vice versa.

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Appendices

Appendix 1- Descriptive statistics of countries with fixed exchange rate

```
Sample period    :   1 to   60
 Variable(s)     :     ER      UNEM      RGDP       INF      TRDEF
Maximum          :  15.6400  31.8000   13.9000   15.3000    5.0000
Minimum          :   .55900   4.3000  -18.0000   -1.2000  -53.0000
Mean             :   4.7383  14.6863    4.7600    4.2525  -14.4637
Std. Deviation   :   5.5705   8.1767    5.5346    3.3674   13.4865
Skewness         :   1.4032   .88425   -2.0303    .92970   -1.3902
Kurtosis - 3     :   .11989  -.26097    5.4611    .93983    1.0803
Coef of Variation:   1.1757   .55676    1.1627    .79187    .93244
```

Appendix 2- Estimated correlation matrix

```
 Estimated Correlation Matrix of Variables


****************************************************************************
              ER      UNEM      RGDP       INF      TRDEF
 ER        1.0000   -.25928    .20257  -.032561    .36528


 UNEM      -.25928   1.0000   -.19475   -.44101   -.69025


 RGDP       .20257  -.19475    1.0000  -.045774  -.080679


 INF      -.032561  -.44101  -.045774    1.0000    .026845


 TRDEF      .36528  -.69025  -.080679   .026845    1.0000


****************************************************************************
```

Appendix 3 – Regression analysis of the real GDP per capita with the fixed exchange rate

```
Ordinary Least Squares Estimation
****************************************************************************
 Dependent variable is RGDP
 60 observations used for estimation from   1 to   60
****************************************************************************
 Regressor          Coefficient      Standard Error       T-Ratio[Prob]
 C                    9.5945            2.3487             4.0849[.000]
 ER                    .24254            .12327            1.9676[.054]
 INF                 -.58405            .23393           -2.4966[.016]
 UNEM                -.51562            .13297           -3.8777[.000]
 TRDEF               -.28157            .074085          -3.8006[.000]
****************************************************************************
 R-Squared                 .26942   R-Bar-Squared                 .21629
 S.E. of Regression        4.8997   F-stat.   F(  4,  55)   5.0707[.001]
```

```
 Mean of Dependent Variable    4.7600   S.D. of Dependent Variable     5.5346
 Residual Sum of Squares       1320.4   Equation Log-likelihood    -177.8758
 Akaike Info. Criterion     -182.8758   Schwarz Bayesian Criterion -188.1117
 DW-statistic                  1.5622
*******************************************************************************



                          Diagnostic Tests
*******************************************************************************
*   Test Statistics  *      LM Version        *         F Version        *
*******************************************************************************
*                    *                        *                          *
* A:Serial Correlation*CHSQ(  1)=   2.5900[.108]*F(  1,  54)=  2.4362[.124]*
*                    *                        *                          *
* B:Functional Form  *CHSQ(  1)=   1.4039[.236]*F(  1,  54)=  1.2938[.260]*
*                    *                        *                          *
* C:Normality        *CHSQ(  2)= 54.1277[.000]*     Not applicable      *
*                    *                        *                          *
* D:Heteroscedasticity*CHSQ(  1)=   3.7533[.053]*F(  1,  58)=  3.8703[.054]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

Appendix 4- Descriptive statistics of the model with fluctuating exchange rate

```
Sample period    :   1 to   60
 Variable(s)     :    FER       RGDP      INF       UNEM      TRDEF
 Maximum         : 280.3300    8.5000   93.3000   21.8000    6.2200
 Minimum         :   3.5100   -6.3000    .70000    5.7000  -26.5500
 Mean            :  70.3633    3.4687    8.0367   12.7752   -5.5808
 Std. Deviation  :  99.3845    2.7233   15.2262    4.7271    8.2489
 Skewness        :   1.2291   -1.6129    4.7560     .30117   -.94913
 Kurtosis - 3    :   -.18286   3.6134   22.3740   -1.1133     .032603
 Coef of Variation:   1.4124    .78511   1.8946     .37002   1.4781
```

Appendix 5- Regression analysis of the real GDP per capita with floating exchange rate

```
Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is RGDP
 60 observations used for estimation from   1 to   60
*******************************************************************************
 Regressor          Coefficient      Standard Error       T-Ratio[Prob]
 C                      3.0598            1.3350            2.2920[.026]
 FER                  -.0037502          .0040993          -.91484[.364]
 INF                   .027784           .026491           1.0488[.299]
 UNEM                  .030806           .093719            .32871[.744]
 TRDEF                -.010014           .054813           -.18269[.856]
*******************************************************************************
```

```
R-Squared                      .059193   R-Bar-Squared             -.0092297
S.E. of Regression              2.7358   F-stat.   F( 4, 55)    .86511[.491]
Mean of Dependent Variable      3.4687   S.D. of Dependent Variable     2.7233
Residual Sum of Squares       411.6592   Equation Log-likelihood     -142.9118
Akaike Info. Criterion       -147.9118   Schwarz Bayesian Criterion  -153.1477
DW-statistic                    1.1856
*******************************************************************************



                             Diagnostic Tests
*******************************************************************************
*    Test Statistics   *       LM Version       *         F Version        *
*******************************************************************************
*                      *                        *                          *
* A:Serial Correlation *CHSQ(  1)=  10.4706[.001]*F(  1, 54)=  11.4156[.001]*
*                      *                        *                          *
* B:Functional Form    *CHSQ(  1)=  .045155[.832]*F(  1, 54)=  .040670[.841]*
*                      *                        *                          *
* C:Normality          *CHSQ(  2)=  49.4581[.000]*      Not applicable     *
*                      *                        *                          *
* D:Heteroscedasticity *CHSQ(  1)=   1.3165[.251]*F(  1, 58)=   1.3012[.259]*
*******************************************************************************
    A:Lagrange multiplier test of residual serial correlation
    B:Ramsey's RESET test using the square of the fitted values
    C:Based on a test of skewness and kurtosis of residuals
    D:Based on the regression of squared residuals on squared fitted values
```

Appendix 6- Regression analysis for the real GDP per capita with the fixed exchange- the case of Macedonia rate

```
Ordinary Least Squares Estimation
*******************************************************************************
Dependent variable is RGDP
16 observations used for estimation from 1996 to 2011
*******************************************************************************
Regressor            Coefficient        Standard Error        T-Ratio[Prob]
C                      -24.3537              9.9391            -2.4503[.032]
ER                      .014654              .058509            .25046[.807]
INF                     .29340               .25674            1.1428[.277]
UNEM                    .73727               .27848            2.6475[.023]
TRDEF                  -.028944              .16630            -.17404[.865]
*******************************************************************************
R-Squared                      .41594   R-Bar-Squared                 .20356
S.E. of Regression              2.4250   F-stat.   F( 4, 11)    1.9584[.171]
Mean of Dependent Variable      2.5875   S.D. of Dependent Variable     2.7173
Residual Sum of Squares        64.6886   Equation Log-likelihood      -33.8790
Akaike Info. Criterion        -38.8790   Schwarz Bayesian Criterion   -40.8105
DW-statistic                    2.2228
*******************************************************************************



                             Diagnostic Tests
*******************************************************************************
*    Test Statistics   *       LM Version       *         F Version        *
```

```
*******************************************************************************
*                     *                          *                           *
* A:Serial Correlation*CHSQ(  1)=  .37220[.542]*F(  1,  10)=   .23816[.636]*
*                     *                          *                           *
* B:Functional Form   *CHSQ(  1)=  3.2942[.070]*F(  1,  10)=  2.5927[.138]*
*                     *                          *                           *
* C:Normality         *CHSQ(  2)=  2.1546[.341]*       Not applicable       *
*                     *                          *                           *
* D:Heteroscedasticity*CHSQ(  1)=  .84361[.358]*F(  1,  14)=   .77924[.392]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```