ESTIMATING POTENTIAL CURRENCY CRISIS: EVIDENCE FROM SMALL AND OPEN ECONOMY

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Abstract: The main reason for the exchange rate sensitivity is the doubts in its credibility related to the trade, weaknesses in the financial sector, external shocks, political errors, country risk, etc. This paper discuss about potential currency crisis in the Republic of N. Macedonia for the period before pandemic and give the answer to what kind of lessons should we take into account regarding past period which is measured in the research. The paper presents the results of a possible crisis scenario in N. Macedonia and give statistical analysis of the relationship of the indicators of a currency crisis, examining two questions - are disorders in Macedonia that can cause a currency crisis and which generation currency crises would be the closest for Macedonia.
Keywords: currency crisis, foreign exchange market, Pearson coefficient, Linear regression analysis, exogenous shocks, Macedonia.

1. INTRODUCTION

The benefits from the globalization of the investment has its own price – the exchange rate risk and country risk. In the economy is well known that there are unpredictable changes in exchange rate which destroys the trust in currency. Monetary authorities must be careful in maintaining stable exchange rate regime.
Important data on the real economy, such as GDP, are usually months out of date, so waiting rarely results in a much clearer picture of the economic situation. Furthermore, "economic medicine takes a while to work, and needs to be taken earlier rather than later. This means that policymakers generally need to move in anticipation of changes in the economic situation, about which inevitably they are uncertain," (Fischer, 2013).
During the last fifteen years, with the development of a various models of currency crises, thus providing adequate explanations of disorders that occur in a financial system and collapse of the currency regime, there is an explosion of empirical analyzes that attempt to signal, predict and anticipate the possible existence of a currency crisis. Regarding this, the aim is to analyze the possibility of currency crisis occurrence in Macedonia.
The research starts with two questions:
1) Are disorders in Macedonia that can cause a currency crisis based on theoretical and empirical analysis?
2) Which generation currency crises would be the closest for Macedonia?
The paper presents the results of a possible crisis scenario in N. Macedonia and give statistical analysis of the relationship of indicators of a currency crisis. Data are sublimation of research results which demonstrates the vulnerability of the financial system of the Republic of N. Macedonia, in terms of the circumstances that could indicate possible currency crisis.

2. LITERATURE REVIEW

One of the most common problems when choosing an exchange rate regime is the sensitivity to attacks on the currency. The main reason for the exchange rate sensitivity is the doubts in credibility related to trade, weaknesses in the financial sector, external shocks, political errors, country risk, etc. The major role of the capital account in occurring currency crises should not be overlooked. In doing so, an assessment will have to be made as to how much a certain exchange rate regime can be defended (or the peg can be defended), or it should be abandoned.
On basis on real experiences in the world economy, a models of currency crisis generations have been generated in the literature.
The currency crisis can turn into a financial crisis, when the currency loss its stability, and thus confidence, as the amount of foreign exchange reserves is not so sufficient. Depending of the type of distortions that occur, the economic literature offers various theoretical models of currency crisis. Also, these crises reflect the distortions occurring in the financial system and the exchange rate.
Generally, the literature distinguishes three generations models of currency crisis.

The first generation model is called "speculative attack models". It explains the reasons for the occurrence of a currency crisis in Mexico and Argentina for the period from 1973 to 1982. The main reason is the conduct of an inadequate macroeconomic policy.
"Exit clause models" is the second generation model of currency crisis. According to this model, a country must have a fixed exchange rate that will be stable. But in situation with disturbances in the financial system, this is not a case for the exchange rate (Boshkov, 2018). This generation of currency crisis model reflects the disruption with the Exchange Rate Mechanism. The reason for this was the increase in the interest rates with the presence of a very low employment rate. In such a scenario, an economy considers abandoning the current exchange rate, for example, due to the benefits arising from an optimal currency area or the costs that alert the way of implementing an appropriate macroeconomic policy (Boshkov, 2018).
The possibility of transmission of the currency crisis is shown as a model of the third generation of the currency crisis. Explanations are in focus on a negative exogenous shock. Namely, the crisis is transmitted through trade as the depreciation of the currency of one country weakens the competitiveness of another. Also, the third generation model of currency crisis contains elements of the first and second generation models of currency crisis.

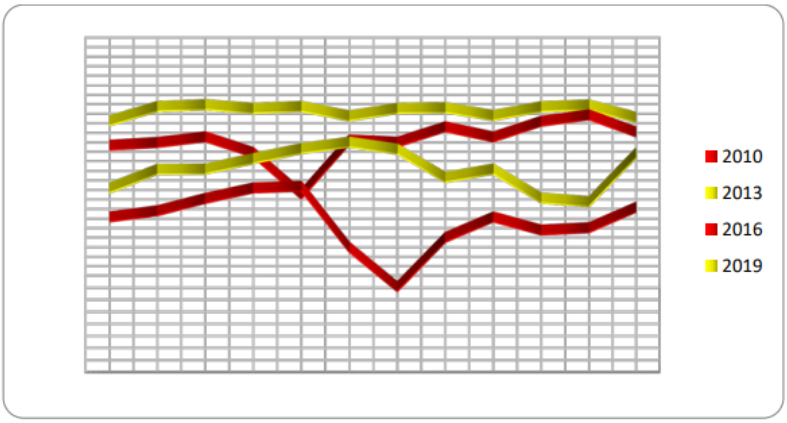
3. RESULTS OF POSSIBLE SCENARIO FOR CURRENCY CRISIS

When we talk about the exchange market pressure index, it is defined as a weighted average of the monthly rates of change in the nominal exchange rate of the national currency against a stronger foreign currencies and the monthly rate of change in gross international foreign exchange reserves denominated in the stronger foreign currencies. The exchange market pressure index is calculated:

$$ipdt = \%\Delta e_t - \alpha\%\Delta r_t \qquad (1)$$

where e denotes the exchange rate of the Denar against the euro at time t, while r refers to the amount of the gross international foreign exchange reserves denominated in Euros, and α is a measure of the standard deviation of changes in exchange rates and standard deviation of changes in foreign exchange reserves. The exchange market pressure index is defined as any increase in the depreciation of the Denar and reduction in foreign exchange reserves, leads to an increase in the value of this index.

Figure 1. Exchange rate pressure index values in Macedonia for the period 2010.-2019.



Source: Author's calculation

According the fact that:

$$\mathbf{ipdt > 2\sigma_{ipdt} + \mu_{ipdt};} \qquad (2)$$

7.60<10.84, it's obvious that there is no currency crisis in Macedonia for the period of 2010 to 2019.

Exchange market pressure index refers to the currency crisis (*ex post*), when its value crosses the threshold that is determinate at two standard deviations above the average index value. From such a specific threshold value, follows the definition of a currency crisis as a binary variable:

Currency crisis = 1, if $ipdt > 2\sigma_{ipdt} + \mu_{ipdt}$ **,** or
Currency crisis = 0, in any other case, (3)

Where σ_{ipdt} is standard deviation $ipdt$, and μ_{ipdt} arithmetic mean of the index.
In order to provide more precise targeting period of the year in which could be occurred a currency crisis, in addition to the aforementioned index, can be used *signal-to-noise ratio* - STNR), which is linked to *ipdt* and supports the accuracy of its data. In fact, the STNR is used to estimate the likelihood of a currency crisis in a country. It is essential to note that the STNR actually represents the reciprocal value of the coefficient of variation, which is calculated as the ratio between the standard deviations (σ) and the arithmetic mean (μ) of a value.
To calculate the STNR should be used the following formula:

$$\boldsymbol{STNR} = \frac{\mu_a - \mu_b}{\sigma_a + \sigma_b} \quad (4)$$

To enter the country in a zone that alerts the existence of a currency crisis and its possible scenario, then is necessary STNR to be greater than 1/10, or more than 10% if we expressed as a percentage. According to available data for Macedonia and implementation of the above formula, we estimated that for STNR for Macedonia for the period of 2010-2019 was 0.0732 or 7.32%. Because STNR = 7.32% and $7.32\% < 10\%$, Macedonia didn't enter in a zone that alerts the existence of a currency crisis.

In the research we include misery index (MI), which is calculated as the difference between the sum of the unemployment rate, interest rates and inflation rates, as well as the percentage change in GDP *per capita* in the observed countries. High values of misery index indicate a bad economic situation and *vice versa*, countries with low values are in better position.

The formula for calculating the misery index is:

MI = (unemployment rate + inflation rate + interest rate) - % ΔBDP *per capita*. (5)

According to available data, Republic of N. Macedonia had the 64 positions in ranking with the MI of 28.1 for 2020, for 2021 had the 57 positions in ranking with the MI of 21.1 in the world in terms of this indicator. From the ranking of Misery Index value for the Republic of N. Macedonia in 2022, the situation is worsened, regarding the 39 positions in ranking. The unemployment remains the main problem in Macedonian economy.
According some authors, the MI shouldn't be a simple sum of its elements, but that unemployment should carry a heavier weight. They suggested doubling the unemployment rate. So, for the first time, Hanke's 2022 Annual Misery Index is adopting double the unemployment-rate component, or,

HAMI = **[(Unemployment (%) * 2) + Inflation (%) + Bank-Lending Rate (%)] − Real GDP Growth (%) (6)**

Table 1. Misery Index value for Macedonia (2022)

Rang	Country	Misery Index	Most influental factor
54	Serbia	41.138	Unemployment
39	**Macedonia**	**50.4**	**Unemployment**
84	Greece	31.128	Unemployment
18	BiH	75.9	Unemployment
98	Croatia	25.5	Unemployment
97	Albania	25.6	Unemployment
101	Bulgaria	24.6	Inflation
118	Slovenia	19.919	Unemployment
58	Hungary	40.242	Inflation
34	Montenegro	52.653	Unemployment

Source: EIU, 2023

4. STATISTICAL ANALYSIS OF CURRENCY CRISIS INDICATORS' CONNECTION

The paper applies linear correlation analysis for the degree of correlation between the exchange market pressure index and the measure of monetary openness of the country. Correlation analysis shows that the monetary measure of openness of the country is very important indicator in terms of the impact on the value of exchange market pressure index, which plays an important role in targeting potential disorders that lead to a currency crisis. This confirms the amount of the Pearson coefficient of 0.808, which indicates a high degree of quantitative agreement. Realized significance is 0.401 which means that the model is significant for the level of faults 0.05.

Table 2. Pearson coefficient

Correlations

		Ipdt	mmoz
Ipdt	Pearson Correlation	1	.808
	Sig. (2-tailed)		.401
	N	3	3
Mmoz	Pearson Correlation	.808	1
	Sig. (2-tailed)	.401	
	N	3	3

Source:Authors' calculation

Using linear regression analysis, we followed the relationship between the exchange market pressure index as dependent variables, and monetary measures of openness of the country as independent variables. Regression analysis shows that the determination coefficient 0.653, which indicates that the model is statistically representative to explain the existence of a currency crisis and explains about 65% of the variance of the dependent variable, i.e. *ipdt.*

Table 3. Linear regression analysis

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.808(a)	.653	.306	5.57810	.653	1.884	1	1	.401

Source:Authors' calculation

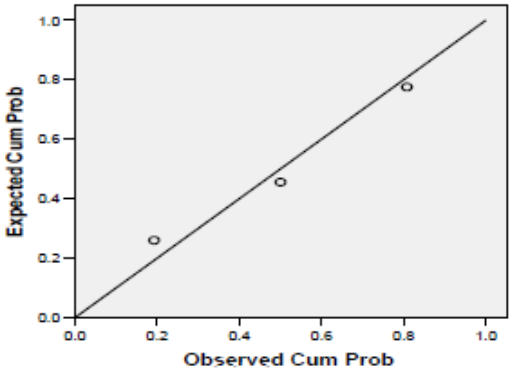
Table 4. Linear regression analysis

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-9.685	9.398		-1.030	.490	-129.104	109.734
	mio	.053	.039	.808	1.372	.401	-.438	.544

Source:Authors' calculation

Figure 2. The values around the regression line that prove the normal distribution points



Source:Authors' calculation

The realized level of significance is 0.401, and it's bigger than the risk of errors defined as 0.05, so the model is statistically significant. From this regression analysis results a beta coefficient of 0,808, which means that any change in monetary measures openness of the country by one unit, leads to changes in the exchange market pressure index to 0,808. From the graphical analysis, we see that the points lie roughly in the right diagonal line, indicating approximate normal distribution.

5. CONCLUSION

The changes that are occurring in the country and in the international environment affect the exchange rate regime. If a country has a history of high inflation, a pegged exchange rate, as in the case of the Republic of N. Macedonia, may be the most optimal solution for the country to manage expectations and quickly reduce the inflation. When the inflation is under control, the confidence in the currency returns. This create the opportunity for the country to be part of the international markets again, as the sensitivity to currency crisis will be reduced (in the best case it will be avoided). Such a situation requires better management and better supervision of the financial sector, as well capital control.

The results showed that in Macedonia for the period of 2010-2019 there is no currency crisis, and the value of the highest values of the exchange rate market pressure index suggest the potential of the first generation of the model. The results showed that there was not also possibility for currency crisis.

With high unemployment rate, the monetary authorities will be less able to defend the exchange rate with higher interest rates of speculative attacks, because this will exacerbate the problem of unemployment. The high level of public debt also increases the cost of defending the exchange rate and speculative attacks. When the devaluation expectations embedded in the nominal interest rate, the higher the interest expense on the debt will lead to an increase in maintenance costs of the exchange rate. Also, speculative attack may occur if the local currency is overvalued. An overvalued currency is the cause of a current account deficit, which is sometimes the cause of deflationary pressure. The monetary authorities in the situation always estimate the costs of defending the exchange rate are higher than the benefits. As could be seen, not only macroeconomic variables, but also the changes in the expectations of economic agents have crucial role in the model clauses outputs.

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