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„Determinants of Fixed Exchange Rate Regime“

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## **Abstract**

This paper has an aim to assess the potential factors related to higher probability of fixed exchange rate regime. The explanatory variables will be derived from four theoretical approaches: OCA theory, Mundell-Fleming model, financial crises and institutionally-political view. The given hypothesis will be verified on the basis of probit model. It will turn out that many suggested explanatory variables will be significant and two out of four approaches will be confirmed in the researched set of countries in period 1995 – 2004.

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## **Introduction**

The basic problem undertaken by author is a choice of the fixed exchange rate regime. That key economic category is the part of monetary policy which together with fiscal policy are the pillars of macroeconomic policy in every country. For that reason this topic is widely discussed among economists and policy-makers. Undoubtedly, a particular exchange rate regime imposes either restraints for national banks, benefits for economy or both. Many researchers, like Frankel (1999) stated that there is no single currency regime that would be appropriate for all countries or all the times. Nevertheless, there can be indicated vast amount of characteristics of each country that would help to choose the exchange rate regime. This paper has an aim to show that fixed currency regimes can be chosen with higher probability on the basis of: openness of economy, degree of economic development, size of economy, degree of geographical concentration of trade, economic growth, level of financial development, reserves, current account, external debt, quality in institutional development, monetary freedom and effectiveness of legislature.

The paper will start from brief literature survey that will indicate the main trends in studying the exchange rate regimes and will divide the literature into leading streams on account of used classification of exchange rate regime, a time-dependence of the change and the econometrical methods. Secondly, there will be provided a theoretical background for explanatory variables on the strength of contemporary researches. The remark will be concentrated around four approaches: OCA theory, Mundell-Fleming model, financial crises and institutionally-political view. Then, one will provide main hypotheses and sub-hypotheses, which will be verified on the basis of probit model. The next part will provide the definitions, source and descriptive statistics of explained and explanatory variables. Then,

it will be presented a model estimation, diagnostics, verification of hypotheses and its interpretations. The paper will close with concluding remarks.

## **Brief Literature Survey**

The core literature that encompasses the field of the exchange rate regime can be divided into two main streams: one concerning an effect of the particular exchange rate regime on the economy (see, e.g. Gsosh et al. 1996; Husain et al. 2004; Tsangarides 2010), the second – the determinants of the exchange rate regime choice (see, e.g. Juhn, Mauro 2002; von Hagen, Zhou 2002; Markiewicz 2005; Setzer 2005). This paper undertakes the latter. The factors that may influence the choice of exchange rate regime have sources in many economical theories and models. One of the mainly used approach is the optimal currency areas theory (see, e.g. von Hagen, Zhou 2002; Gudmundsson 2006). Thanks to this, there can be derived four potential determinants of the exchange rate regime choice, namely: openness of economy, exposure to asymmetric shocks (size of the economy), a trade concentration, wages and price flexibility. This research is also based on the Mundell-Fleming model, the theory of currency crises and the political and institutional framework. The other, not mentioned categories/theories that provides potential explanatory factors are: the monetary approach, the Dornbush overshooting model or the uncertainty model.

In literature one can meet with methodology differentiated on account of: used classification of exchange rate regime, a time-dependence of the change and the econometrical methods. Thus, the possible classification of exchange rate regime can be derived from *de iure* (IMF classification) or *de facto* classification (Reinhart, Rogoff 2004; Levy-Yeyati, Sturzenegger 2005). The difference between *de facto* and *de iure* classification is obvious, though the two sources of *de facto* classification needs a short explanation. The Reinhart, Rogoff's classification is the 5-year moving average, whilst the Levy-Yeyati, Sturzenegger's (henceforth LYS) is based on the yearly periods. There are researches who use both *de iure* and *de facto* classification (see, e.g. Markiewicz 2005, Juhn, Mauro 2002), only *de facto* classification (see, e.g. Setzer 2005), and in minority – the researches who use only *de iure* classification (see, e.g. von Hagen, Zhou 2002). This article is based only on the Ilzetzki,

Reinhart, Rogoff's (2008, henceforth IRR) de facto classification<sup>1</sup>, due to the fact that the IRR classification provides more satisfying fit<sup>2</sup>.

When took into account the time-dependence of the change between exchange rate regimes, it turned out that there are two possibilities: assume that change (exit or entry) from one exchange rate regime to another does not depend on time or prove that an exit from particular regime reflects the non-monotonic pattern of time-dependence. In this paper, the first approach is applied; the latter is presented in for example Setzer's (2005) work. Undoubtedly, the non-monotonic time-dependence in cases of the choice of the exchange rate regime exists, but it is hard to be applied in the simple econometric models. The only possibility to include the time-dependence assumes that it is monotonic, what do not reflect the reality. Authors who study the pattern of time-dependence (see, e.g. Duttagupta and Otker-Robe 2003; Setzer 2005, Walti 2005) stated that it must present non-monotonic pattern. Nevertheless, the majority of studies use the first – easier – approach (see, e.g. Juhn, Mauro 2002; von Hagen, Zhou 2002; Markiewicz 2005). The third issue on behalf of which one divides the literature is the econometrical method. Most of authors use probit model (see, e.g. Dreyer, 1978, Sfia 2007), logit (see, e.g. Honkapohja, Pikkareinen 1994), some multinomial logit (see, e.g. Juhn, Mauro 2002), ordered logit (see, e.g. Frieden et al. 2000) and the in minority – the Cox model (see, e.g. Setzer 2005). According to Sfia (2005), the mostly applied is probit model, and that is why it will be the main econometric tool in this research.

## Theoretical Background

The foundation for research was derived from four approaches: optimum currency areas (OCA), Mundell-Fleming model, theory of currency crises and political and institutional framework.

The first, the OCA<sup>3</sup> approach, according to Sfia (2007), concerns the idea that the decision about the exchange rate regime is being made on the basis of the extent of economic integration between countries. That, in turn, relies on the openness of economy, the size of

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<sup>1</sup> the latest version of Reinhart, Rogoff's (2004) classification.

<sup>2</sup> the ratios of correctly predicted observation for LYS and IRR classification equals to 77,73% and 93,23%, respectively. That is why, the IRR classification was chosen.

<sup>3</sup> Originally, the OCA is based on pioneering findings of Mundell (1961), McKinnon (1963), Kenen (1969).

economy and geographical concentration of trade. The greater the openness the greater the fluctuations of the nominal exchange rate are. In this case one expects the stronger propensity for the fixed currency regime – that is why the relationship between openness and fixed exchange rate regime should be positive. The second factor, the size of economy, reflects the openness. Thus, the larger the economy the smaller openness is - relationship between the size of economy, measured by GDP, and fixed exchange rate regime should hold negative. The third determinant, geographical concentration suggests that the greater diversification of economy's trade the less is the likelihood of asymmetric shocks. It means that in economy with high degree of trade with one partner it is suggested to peg the currency with its main partners. Hence, the relationship between geographical concentration of trade of fixed exchange rate regime should be positive. Beyond those aforementioned, there is usually one additional factor took into consideration (see, e.g. Calderon, Schmidt-Hebbel 2008), namely: the degree of economic development measured by the GDP per capita. It is suggested that high developed countries are more exposed to terms of trade shocks, that is why they will opt for the float exchange rate regime which is the better buffer – the relationships between fixed regime and GDP per capita should hold negative.

The second approach, the financial one, is based on the Mundell-Fleming model. This is the short run theory which assumes perfect capital mobility and has a ground in impossible trinity: simultaneously it is not possible to sustain high capital mobility, independent monetary policy and fixed exchange rate. Calderon, Schmidt-Hebbel (2008) came into idea that economies with higher level of financial development have no opportunity to sustain the intermediate currency regime. Together with the ongoing increasing innovation of financial market and globalization in terms of capital mobility, it leads to reduced possibility of effective capital control and the monetary policy. That is why, the countries with deep financial market should opt for floating exchange rate regime; the fixed one is related to high costs of sustaining the currency stability (Carmignani et al. 2006). The proxy for financial development can be the ratio of M2 in GDP – there is expected a negative relationships between fixed exchange rate and financial development. The other important factor is economic growth. On the basis of Mundell-Fleming model, it is expected that countries may opt for using the monetary policy to boost the economic growth, so they should choose the fixed exchange rate regime. There is expected a negative relationships, because the countries with lower level of economic growth have more incentive to do so.

Another often used approach is the theory of currency crises. Nowadays, according to Sfia (2007) intermediate currency regimes are leading to speculative crises. For that reason, economies are moving toward the corner solutions (fixed or float). Question is which one to choose? The answer may be revealed on the basis of macroeconomics conditions. When the economy has high external debt, they are eager to manage the level of exchange rate to improve the international credibility. In this case there is expected positive impact of debt on fixed exchange rate regime choice. What is more, the countries that want to manage their currency, they need a vast amount of reserves – that is why the higher reserves the higher probability of the fixed exchange rate regime is. Similarly can one look at the current account deficit. It is known that negative value of current account implies the rapid changes in capital flows, and then sudden currency depreciation. To avoid that country will revalue the exchange rate or make it fixed on lower level. Thus, the negative relationship is expected – the higher CA, the lower probability of fixed exchange rate regime is (Calderon, Schmidt-Hebbel 2008).

The last applied approach is the political and institutional framework. Recently, there are a lot of debates among economists about the impact of institutions on economy. There is no doubt, that in many cases they can be the cause of high performance of economy and they imply the choice of policy-makers (Rodrik 2001). Hence, the higher quality of institutional framework is, the less eager are the policy-makers to decide about the economy, especially about the exchange rate regime. Countries with lower credibility (=lower level of institutional development) will have the incentives to adopt the fixed currency regime to have an impact on economy's competitiveness (Sfia 2007). The other very important factor in determining the regime of currency is the monetary freedom, which can be assessed by the rate of inflation and price stability. It turned out that in this case the relationship is ambiguous. On the one hand, one expects that countries with weak monetary institution will opt for fixed exchange rate regime to increase its credibility (*credibility view*, Carmignani et al. 2006). On the other hand, as Sfia (2007) stated, the low inflation and stability of prices give the incentives for policy-maker to peg its currency to anchor inflation expectations (known as *consistency view*). In the case of credibility view, there is expected a negative relationship between monetary freedom and fixed exchange rate regime, in consistency view – positive one.

## Research Hypotheses

Aforementioned analysis of potential factor determining the choice of the fixed exchange rate regime leads to hypotheses, which will be confirmed on the set all countries in period 1995-2004, as follows:

**Hypothesis 1:** OCA theory is well fitted into explanation of the choice of the fixed exchange rate regime.

- a) **subhypothesis 1A:** the higher openness of economy (variable *open*), the higher probability of fixed exchange rate regime;
- b) **subhypothesis 1B:** the higher the degree of economic development, measured by GDP per capita (variable *gdp\_pc*), the lower the probability of fixed exchange rate regime;
- c) **subhypothesis 1C:** the higher the size of economy, measured by GDP (variable *gdp*), the lower the probability of fixed exchange rate regime;
- d) **subhypothesis 1D:** the higher degree of geographical concentration of trade (variable *geo\_con*), the higher the probability of fixed exchange rate regime;

**Hypothesis 2:** the financial approach (Mundell-Fleming model) is well fitted into explanation of the choice of the fixed exchange rate regime.

- a) **subhypothesis 2A:** the higher economic growth (variable *growth3y*), the lower probability of fixed exchange rate regime;
- b) **subhypothesis 2B:** the higher level of financial development, measured by M2 to GDP ratio, (variable *m2\_gdp*) the lower the probability of fixed exchange rate regime;

**Hypothesis 3:** theory of currency crises is well fitted into explanation of the choice of the fixed exchange rate regime.

- a) **subhypothesis 3A:** the higher reserves (variable *res\_m2*), the higher probability of fixed exchange rate regime;
- b) **subhypothesis 3B:** the higher current account (variable *ca*), the lower the probability of fixed exchange rate regime;



- c) **subhypothesis 3C:** the higher external debt (variable *ext\_debt*), the higher the probability of fixed exchange rate regime;

**Hypothesis 4:** the institutional and political framework is well fitted into explanation of the choice of the fixed exchange rate regime.

- a) **subhypothesis 4A:** the higher quality of institutional framework, measured by Index of Economic Freedom, (variable *overall*) the lower probability of fixed exchange rate regime;
- b) **subhypothesis 4B:** the higher monetary freedom, measured by Monetary Sub-Index of Economic Freedom, (variable *monetary*) the higher or lower (ambiguous) the probability of fixed exchange rate regime; the results depends which of two presented effect will prevail: if credibility view – the lower probability, if consistency – the higher one;
- c) **subhypothesis 4C:** the higher effectiveness of legislature (variable *effective*) the lower the probability of fixed exchange rate regime.

The presented hypotheses are fully justified and advisable with presented earlier theoretical background. Furthermore, those are the most significant factors and approaches that should explain the choice of the fixed exchange rate regime. The whole makes an important economic topic, because this analysis may indicate the potential factor on basis of which the policy makers can decide about pegging the currency or not. There is no doubt that exchange rate is very influential determinant of national economy – it has an impact on: trade, shocks absorption, risk and credibility.

## Explained and Eplanatory Variables – definitions, source and descriptive statistics

- exchange rate regime – variable *err\_1* – regime of country's currency made on the basis of the Ilztezki, Reihhart, Rogoff's (2008) de facto fine classification. The original 15-levels classification was transformed, due to presented hypothesis, into binary one as follows: for original value from 1-10 there was ascribed 1 (fixed or almost fixed regime), and for original value on interval 11-14 there was ascribed 0 (float regimes). Table 1 presents the made transformation.

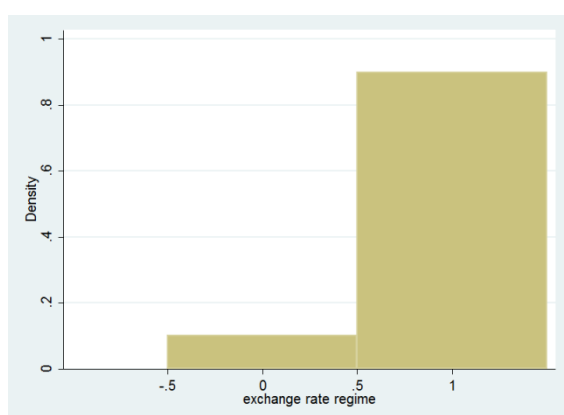
**Table 1.** Transformation of original IRR classification for study's use

Original code form IRR (2008)	type of currency regime	new ascribed values
1	No separate legal tender	1
2	Pre announced peg or currency board arrangement	1
3	Pre announced horizontal band that is narrower than or equal to +/-2%	1
4	De facto peg	1
5	Pre announced crawling peg	1
6	Pre announced crawling band that is narrower than or equal to +/-2%	1
7	De factor crawling peg	1
8	De facto crawling band that is narrower than or equal to +/-2%	1
9	Pre announced crawling band that is wider than or equal to +/-2%	1
10	De facto crawling band that is narrower than or equal to +/-5%	1
11	Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)	0
12	Managed floating	0
13	Freely floating	0
14	Freely falling	0
15	Dual market in which parallel market data is missing.	skipped

Source: own elaboration.

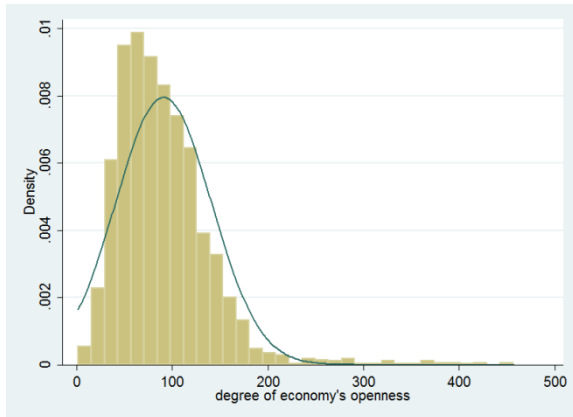
The descriptive statistics reveals that the state denoted by 1 is more frequent (89,92% of all observations).

**Fig. 1.** Histogram of the *err\_1* variable



- the openness of the economy – variable ***open*** – ratio [in percentage points] of export and import sum to GDP in current prices; this variables was derived directly from PWT 7.0 as *openc* variable.

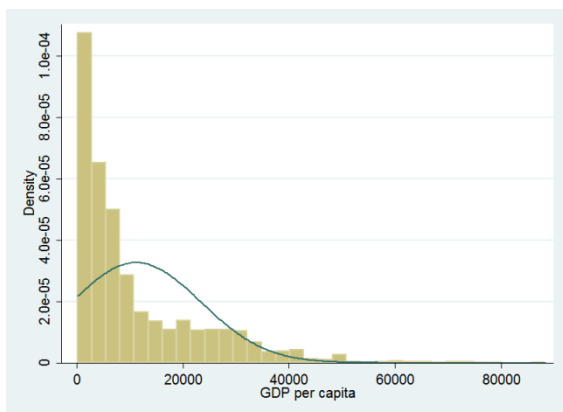
**Fig. 2.** Histogram of the ***open*** variable



The value of openness of the economy is observed on the interval 1,98 – 456,94% of GDP. The descriptive statistics and histogram reveals that one has right-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution.

- gross domestic product per capita – variable ***gdp\_pc*** – value derived from WDI (2012) as GDP per capita in constant 2000US\$.

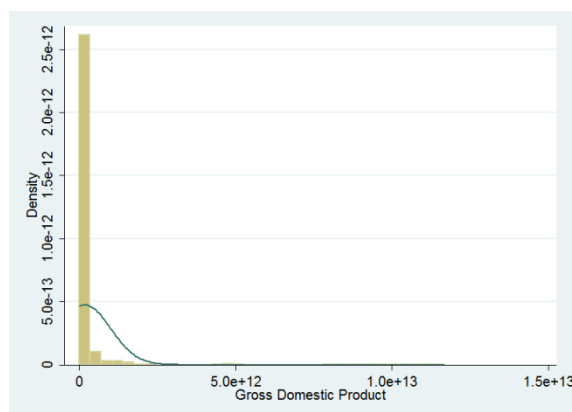
**Fig. 3.** Histogram of the ***gdp\_pc*** variable



The value of GDP per capita is observed on the interval 153,44 – 88 320,78 USD. The descriptive statistics and histogram reveals that one has right-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution

- gross domestic product – variable ***gdp*** – value derived from WDI (2012) as GDP constant 2000 US\$.

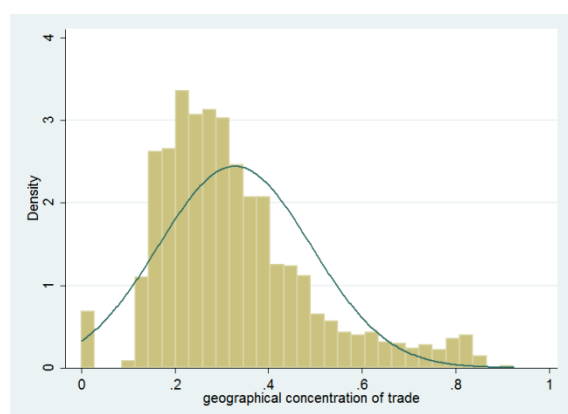
**Fig. 4.** Histogram of the ***gdp*** variable



The value of GDP is observed on the interval 50 565 832,04 – 11 671 492 957 945,90 USD. The descriptive statistics and histogram reveals that one has right-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution.

- the geographical concentration of trade – variable ***geo\_con*** – the ratio of maximum sum of export and import to the partners over gross sum of export and import; this variables was derived from COMTRADE database and was made available by Dr. Mycielska.

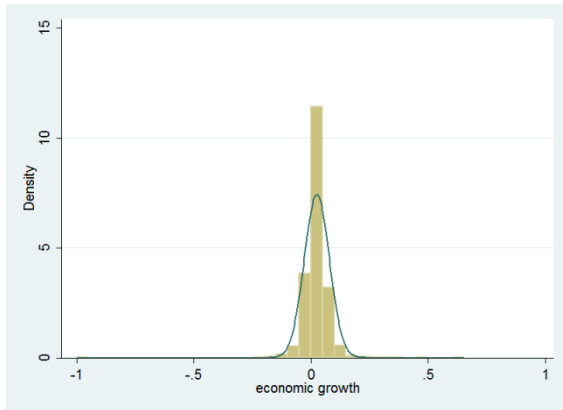
**Fig. 5.** Histogram of the ***geo\_con*** variable



The value of geographical concentration of trade is observed on the interval 10,43% - 92,46%. The descriptive statistics and histogram reveals that one has right-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution.

- the economic growth – variable **growth\_3y** – own elaboration of annualized rate of economic growth over last 3 years, calculated as  $\sqrt[3]{\frac{y_t}{y_{t-3}}} - 1$ , where  $y_t$  denotes the value of GDP per capita in period  $t$ .

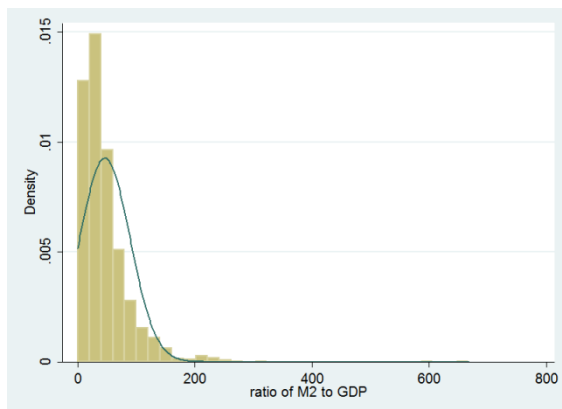
**Fig. 6.** Histogram of the **growth\_3y**



The value of economic growth is observed on the interval -21,28 – 65,23%. The values may be shocked, but the difference for GDP per capita for some countries changes very rapidly. The descriptive statistics and histogram reveal that there is left-skewness and kurtosis ( $m_4 > 3$ ) indicating that the peakedness of the graph is larger than for a standard normal distribution.

- financial development – variable **m2\_gdp** – the ratio of M2 to GDP, derived from WDI (2012).

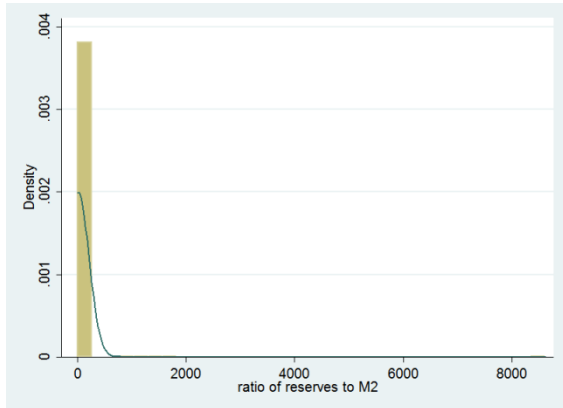
**Fig. 7.** Histogram of the **m2\_gdp** variable



The value of financial development is observed on the interval 0,46% - 668%. The descriptive statistics and histogram reveal that there is right-skewness and kurtosis ( $m_4 > 3$ ) indicating that the peakedness of the graph is larger than for a standard normal distribution.

- reserves – variable **res\_M2** – the ratio of reserves to M2 aggregate, derived from WDI (2012).

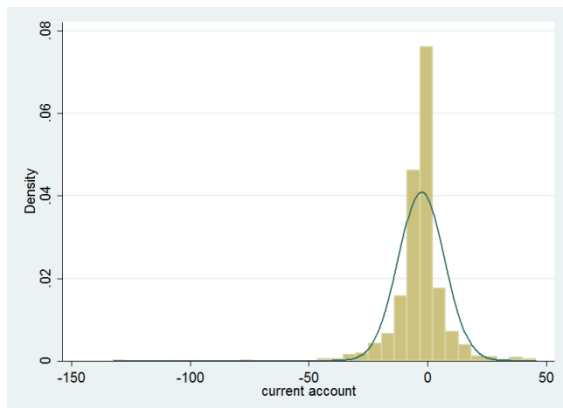
**Fig. 8.** Histogram of the **res\_gdp** variable



The value of reserves is observed on the interval 0,00% - 8 619%. The descriptive statistics and histogram reveals that one has right-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution.

- current account balance – variable **ca** – the ratio of current account to GDP, derived from WDI (2012).

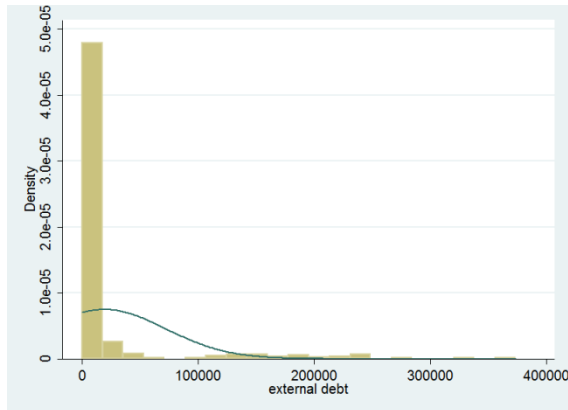
**Fig. 9.** Histogram of the **ca** variable



The value of current account balance is observed on the interval -132,79% - 45%. The descriptive statistics and histogram reveals that one has left-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution.

- the external debt – variable *ext\_debt* – the ratio of external debt to GDP, derived from WDI (2012).

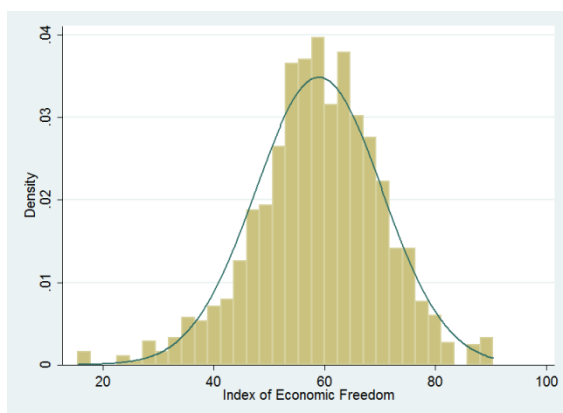
**Fig. 10** Histogram of the *ext\_debt* variable



The value of external debt is observed on the interval 36 mln – 373 773 mln USD. The descriptive statistics and histogram reveals that one has left-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is larger than for standard normal distribution.

- Index of Economic Freedom – variable *overall* – the average for all 10 sub-indices of Economic Freedoms, derived from Heritage Foundation database (2010). It can take values form 0 – 100, where the higher value of index, the higher level of institutional development.

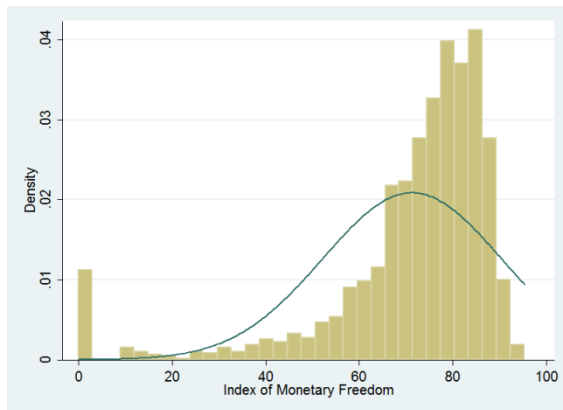
**Fig. 11.** Histogram of the *overall* variable



The value of Index of Economic Freedom is observed on the interval 15,58% – 90,51%. The descriptive statistics and histogram reveals that one has left-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is slightly larger than for standard normal distribution.

- Monetary Freedom – variable *monetary* – the one out of 10 Economics Freedoms derived from Heritage Foundation database (2010). It is calculated on the basis of inflation and price stability (the higher value of index is observed for lower value of inflation and higher price stability). It can take values from 0 – 100, where the higher value of index, the higher level of monetary freedom.

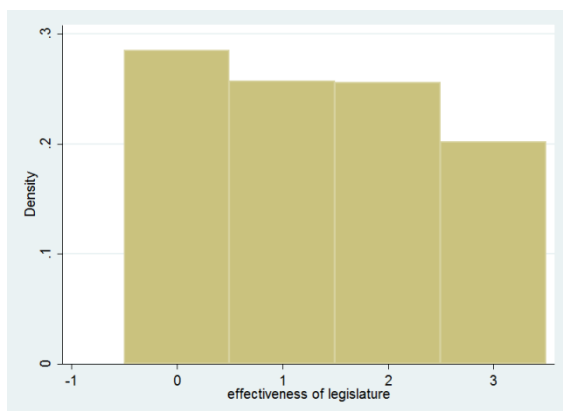
**Fig. 12.** Histogram of the *monetary* variable



The value of Monetary Freedom is observed on the interval 15,58% – 90,51%. The descriptive statistics and histogram reveals that one has left-skewness and kurtosis ( $m_4 > 3$ ) indicates that peakedness of the graph is slightly larger than for standard normal distribution.

- effectiveness of the legislature – variable *effectiveness* – the assessment of effectiveness made by Banks, reported by Norris (variable no. 272, 2009). It can take values from 0 to 4, where 4 indicates the highest effectiveness.

**Fig. 13.** Histogram of the *effectiveness*



The descriptive statistics as well as the picture shows that all levels of variable are observed on close frequency (20-28%).



## Model Estimation

Estimated model has analytical form as follows:

$$err\_1_i = \beta_0 + \beta_1 open_i + \beta_2 gdp\_pc_i + \beta_3 gdp_i + \beta_4 geo\_con_i + \beta_5 growth3y_i + \beta_6 m2\_gdp_i + \beta_7 res\_m2_i + \beta_8 ca_i + \beta_9 ext\_debt_i + \beta_{10} overall_i + \beta_{11} monetary_i + \beta_{12} effectiveness_i + \varepsilon_i, \text{ where } i = 1, \dots, 251 \text{ and}$$

$$err\_1_i = \begin{cases} 0, & \text{for failure (not – fixed exchange rate regime)} \\ 1, & \text{for success (fixed exchange rate regime)} \end{cases}$$

First estimation is presented in Table 2.

**Table 2.** Results of first estimation

-----						
Iteration 0:	log likelihood = -87.787656					
Iteration 1:	log likelihood = -56.738946					
Iteration 2:	log likelihood = -50.711456					
Iteration 3:	log likelihood = -49.030342					
Iteration 4:	log likelihood = -48.899737					
Iteration 5:	log likelihood = -48.898995					
Iteration 6:	log likelihood = -48.898995					
Probit regression				Number of obs	=	251
				LR chi2(11)	=	77.78
				Prob > chi2	=	0.0000
Log likelihood = -48.898995				Pseudo R2	=	0.4430
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err_1	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
-----+-----						
open	.0230991	.0105436	2.19	0.028	.002434	.0437643
gdp_pc	-.000104	.000048	-2.17	0.030	-.000198	-9.93e-06
gdp	2.56e-12	2.07e-10	1.24	0.616	-1.50e-12	6.61e-12
geo_con	1.563691	1.478504	1.06	0.290	-1.334123	4.461505
growth3y	-10.26383	5.966484	-1.72	0.085	-21.95792	1.430265
m2_gdp	-.0068381	.0095005	-0.72	0.472	-.0254586	.0117825
res_m2	2.556734	1.156205	2.21	0.027	.2906145	4.822853
ca	-.0505297	.0408348	-1.24	0.216	-.1305646	.0295051
ext_debt	2.30e-06	4.44e-06	0.52	0.605	-6.40e-06	.000011
overall	.0372343	.0383906	0.97	0.332	-.0380099	.1124785
monetary	.0283489	.0105223	2.69	0.007	.0077255	.0489723
effective	-.3965024	.1949581	-2.03	0.042	-.7786134	-.0143915
_cons	-3.660006	1.560493	-2.35	0.019	-6.718517	-.6014962
-----						
Note: 0 failures and 15 successes completely determined.						
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Source: own elaboration in Stata.

Despite the rejection of null hypothesis about joint insignificance of variables, single covariates are insignificant. It was justified to eliminate the variable with the highest value of p-value (*gdp*). That procedure was executed till the situation in which all independent variable were significant at least at 10% level of significance. Therefore, in next steps there were excluded: *m2\_gdp* (p-value = 0,89), *overall* (p-value = 0,431), and finally *ca* (p-value = 0,246). The fifth model seems to be satisfying, what is presented in table 3.

**Table 3.** Results of fifth estimation

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Iteration 0:	log likelihood = -87.787656					
Iteration 1:	log likelihood = -59.986032					
Iteration 2:	log likelihood = -52.639483					
Iteration 3:	log likelihood = -50.911488					
Iteration 4:	log likelihood = -50.800532					
Iteration 5:	log likelihood = -50.800393					
Iteration 6:	log likelihood = -50.800393					
-----						
Probit regression			Number of obs		=	251
			LR chi2(8)		=	73.97
			Prob > chi2		=	0.0000
Log likelihood = -50.800393			Pseudo R2		=	0.4213
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err_1	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
-----						
open	.0127408	.0055013	2.32	0.021	.0019584	.0235232
gdp_pc	-.0000399	.0000168	-2.37	0.018	-.0000728	-6.94e-06
geo_con	2.028877	.9652925	2.10	0.036	.1369384	3.920816
growth3y	-10.16845	5.467449	-1.86	0.063	-20.88445	.5475534
res_m2	2.965785	.9448208	3.14	0.002	1.11397	4.8176
ext_debt	6.55e-06	3.02e-06	2.16	0.030	6.19e-07	.0000125
monetary	.0298433	.006112	4.88	0.000	.0178639	.0418227
effective	-.3260032	.1660808	-1.96	0.050	-.6515156	-.0004907
_cons	-1.942017	.7428687	-2.61	0.009	-3.398013	-.4860215
-----						
Note: 0 failures and 11 successes completely determined.						
-----						

Source: own elaboration in Stata.

To compare the both, first and fifth estimation, a likelihood-ratio test was executed, which results conclude below table. The first model with 12 independent variables is denoted *big*, the fifth with 8 variable is denoted *small*.

**Table 4.** The results of LR test

-----			
Likelihood-ratio test	LR chi2(3)	=	1.96
(Assumption: small nested in big)	Prob > chi2	=	0.5813
-----			

Source: own elaboration in Stata.

Due to the non rejection of null hypothesis (p-value equal to 0,5813), the first model (with additional 4 variables) do not bring enhanced results, so the small model can be indicated as better one. For that reason the model presented in table 3 will be a benchmark for further analysis. The quantitative interpretation of results will be provided in further elucidation.

## Diagnostics

The obtained model presents satisfying results from qualitative point of view. The pseudo  $R^2$  equals to 42,13%, what means moderate fit of estimation. The general results show that: adjusted count  $R^2$  is close to 43%. The values of other  $R^2$ 's do exceed the value: 31,9%. Model explains large diversification of dependent variable moderately. What is more, there is a quite bit difference between model with the intercept only and with all independent variables (log likelihood difference – 36,99). It means that model has correct variables.

The picture and data of specification and sensitivity (look at table 6 and fig. 14) reveals that:

- sensitivity is very high: 98,21%,
- specification is moderately high: 57,14%,
- correctly classified observations account of 93,63%.

Then, the ROC curve (Fig. 15) shows that model is well fitted – field under curve equals 0,9137.

**Table 5.** Measures of Fit for probit

Log-Lik Intercept Only:	-87.788	Log-Lik Full Model:	-50.800
D(242) :	101.601	LR(8) :	73.975
		Prob > LR:	0.000
McFadden's R2:	0.421	McFadden's Adj R2:	0.319
Maximum Likelihood R2:	0.255	Cragg & Uhler's R2:	0.507
McKelvey and Zavoina's R2:	0.865	Efron's R2:	0.461
Variance of y*:	7.413	Variance of error:	1.000
Count R2:	0.936	Adj Count R2:	0.429
AIC:	0.476	AIC*n:	119.601
BIC:	-1235.559	BIC' :	-29.771

*Source:* own elaboration in Stata.

**Table 6.** Analysis of sensitivity and specificity in probit model

Classified	True		Total
	D	~D	
+	219	12	231
-	4	16	20
Total	223	28	251

Classified + if predicted  $\Pr(D) \geq .5$

True D defined as  $\text{err}_1 \neq 0$

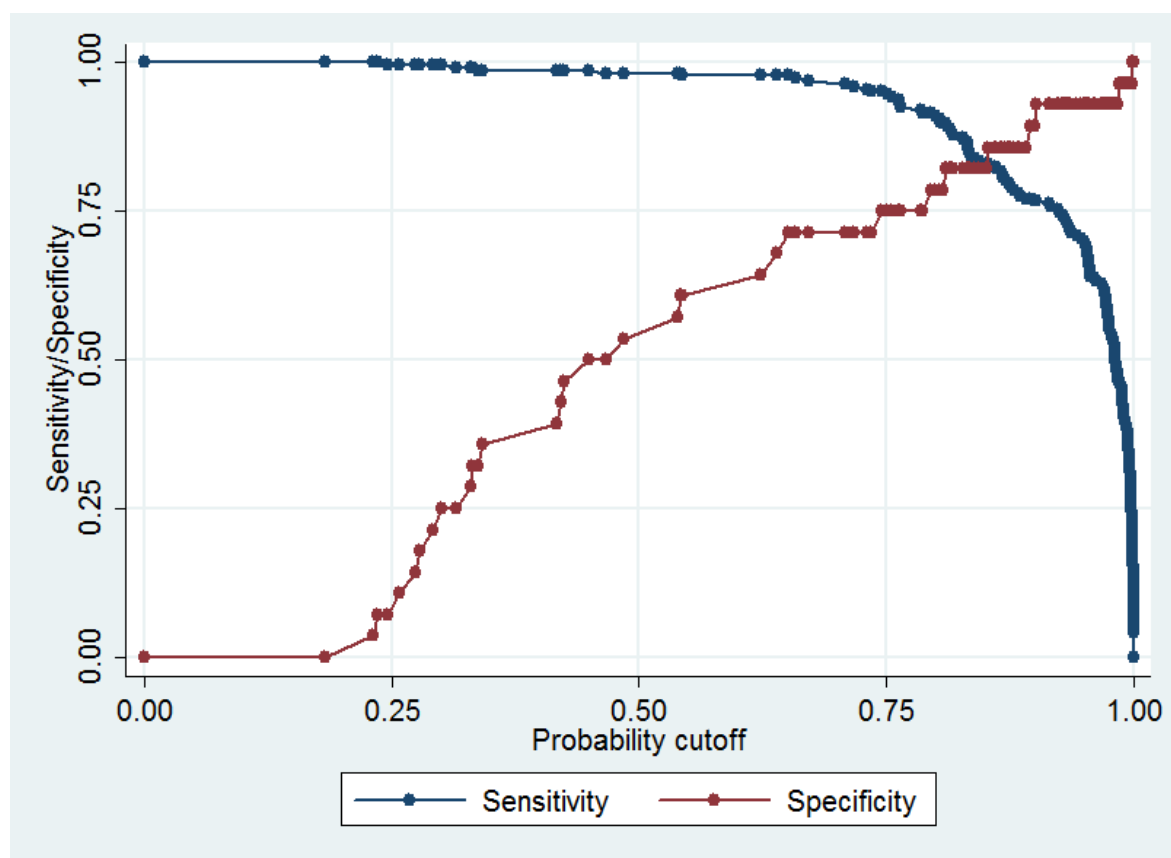
Sensitivity	$\Pr(+ D)$	98.21%
Specificity	$\Pr(- \sim D)$	57.14%
Positive predictive value	$\Pr(D +)$	94.81%
Negative predictive value	$\Pr(\sim D -)$	80.00%

False + rate for true ~D	$\Pr(+ \sim D)$	42.86%
False - rate for true D	$\Pr(- D)$	1.79%
False + rate for classified +	$\Pr(\sim D +)$	5.19%
False - rate for classified -	$\Pr(D -)$	20.00%

Correctly classified 93.63%

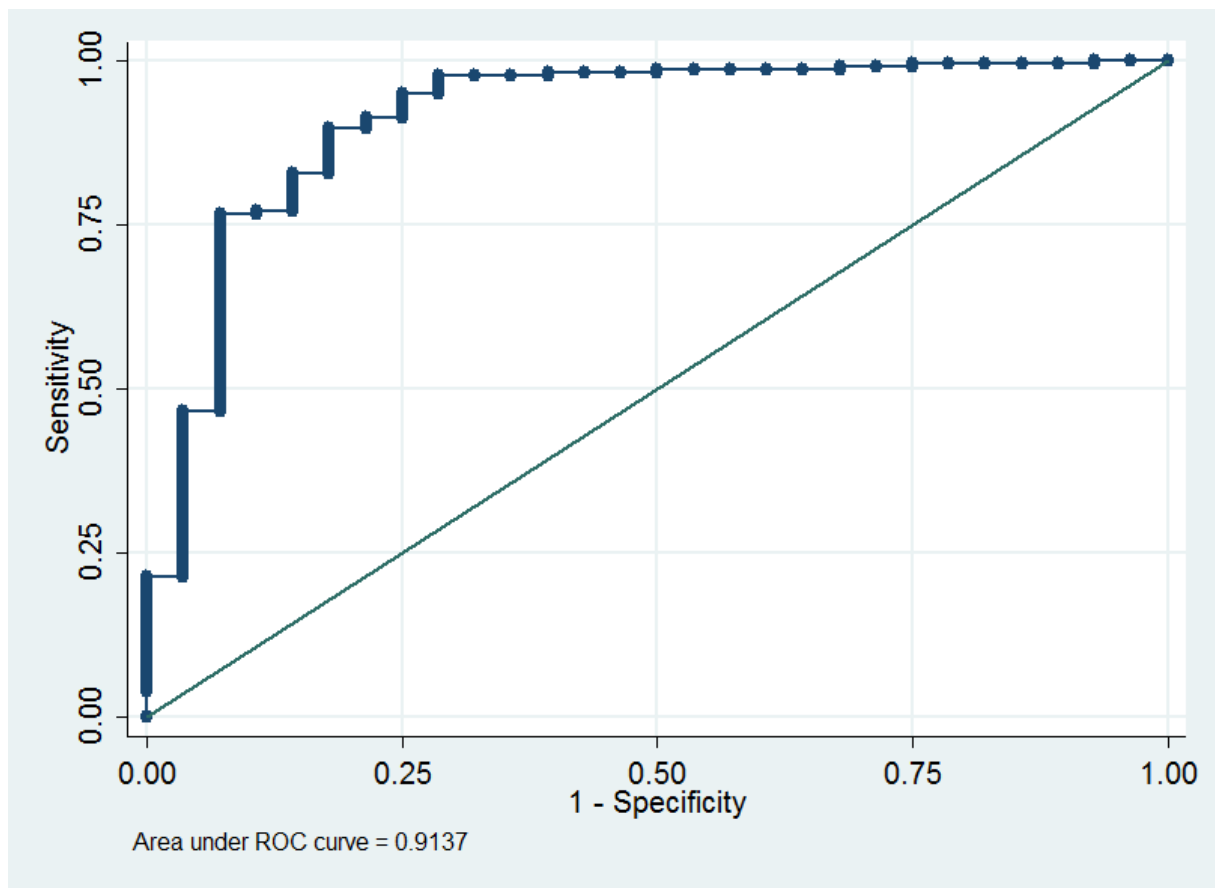
Source: own elaboration in Stata.

**Fig. 14.** Sensitivity and Specificity curves



Source: own elaboration in Stata.

**Fig. 15.** ROC curve



Source: own elaboration in Stata.

## Hypotheses verification

The main hypotheses were verified on the basis of joint significance of variables concentrated in each group out of four presented approaches. The test were executed on first estimated model (which was presented in table 2). The sub-hypotheses were verified on the basis of p-value for particular covariates. Hence, one comes to remarks as follows:

**Hypothesis 1:** confirmed; test for joint significance of *open*, *gdp\_pc*, *gdp*, *geo\_con* has p-value = 0,0036. It means that null hypothesis about joint insignificance is rejected.

**Subhypothesis 1A:** confirmed; positive sign of *open* variable, significant at 5% level.

**Subhypothesis 1B:** confirmed; negative sign of *gdp\_pc* variable, significant at 5% level.

**Subhypothesis 1C:** rejected; *gdp* variable excluded after first estimation; p-value = 0,616.

**Subhypothesis 1D:** confirmed; positive sign of *geo\_con* variable, significant at 5% level.

**Hypothesis 2:** rejected; test for joint significance of variables *growth3y*, *m2\_gdp* has p-value 0,2010. Failed to reject the null hypothesis about joint insignificance.

**Subhypothesis 2A:** confirmed; negative sign of *growth3y* variable, significant at 10% level.

**Subhypothesis 2B:** rejected; *m2\_gdp* variable excluded after second estimation; p-value = 0,89.

**Hypothesis 3:** rejected; test for joint significance of variables *res\_m2*, *ca*, *ext\_debt* has p-value 0,1273. Failed to reject the null hypothesis about joint insignificance.

**Subhypothesis 3A:** confirmed; positive sign of *res\_m2* variable, significant at 1% level.

**Subhypothesis 3B:** rejected; *ca* variable excluded after fourth estimation; p-value = 0,246.

**Subhypothesis 3C:** confirmed; positive sign of *ext\_debt* variable, significant at 1% level.

**Hypothesis 4:** confirmed; test for joint significance of *overall*, *monetary*, *effective* has p-value = 0,0001. It means that null hypothesis about joint insignificance is rejected.

**Subhypothesis 4A:** rejected; *overall* variable excluded after third estimation; p-value = 0,431.

**Subhypothesis 4B:** confirmed; positive sign of *monetary* variable, significant at 1% level.

**Subhypothesis 4C:** confirmed; negative sign of *effective* variable, significant at 5% level.

## Interpretation of Results

The qualitative interpretation as well as theoretical predictions of results will be made on the basis of  $\beta$ -parameters, odds ratios and marginal effect, what is concluded in table 7.

**Table 7.** Estimation for  $\beta$ , odds ratios and marginal effects

variable	$\beta$	p-v for $\beta$	odds ratios	marginal effects
<i>open</i>	0,01274 **	0,021	1,01282	0,000315
<i>gdp_pc</i>	-0,00004 **	0,018	0,99996	-0,000001
<i>geo_con</i>	2,02888 **	0,036	7,60554	0,050076
<i>growth3y</i>	-10,16845 *	0,063	0,00004	-0,250974
<i>res_m2</i>	2,96579 ***	0,002	19,40993	0,0732 *
<i>ext_debt</i>	0,00001 ***	0,03	1,00001	0,0000002
<i>monetary</i>	0,02984 ***	0	1,03029	0,000737
<i>effective</i>	-0,326 **	0,05	0,7218	-0,008046
<i>_cons</i>	-1,94202 ***	0,009		

Source: own elaboration.

It seems that two of mentioned four approaches have confirmation in econometric modeling. It turned out that OCA theory and institutionally-political framework are properly fitted to explain the choice of the fixed exchange rate regime. On the contrary, the theory about currency crises and financial approach seems not to have an acknowledgement in empirics. However, it does not mean that the latter two are not important. Those results suggest for future to use another variables to check whether currency crises and financial approach are justified.

In the researched set it is observed that the chance for fixed exchange rate regime is 1,01282-folds larger for country with higher openness than the average (90,91%). The marginal effect seems to be insignificant (p-value = 0,271). That finding is consistent with presented background – openness implies the greater fluctuations of the nominal exchange rate, and therefore the country is more eager to adopt the fixed currency regime.

The chance for fixed exchange rate is 0,99996-folds larger for countries with higher gross domestic product per capita than average (11 164,82 USD). The marginal effect seems to be insignificant (p-value = 0,295). That finding is consistent with presented background – the

high developed countries are more exposed to terms of trade shock, so they will opt for float exchange rate regime.

Unfortunately, the relationships do not hold in the case of the size of economy which is measured by GDP. In researched set there is no significant relationship holding between GDP and fixed exchange rate regime.

The chance for fixed exchange rate is 7,60554-folds larger for countries with higher degree of geographical concentration of trade than average (32,77%). The marginal effect seems to be insignificant (p-value = 0, 221). That finding is consistent with presented background – greater diversification of economy's trade implies the less likelihood of asymmetric shocks. It means that an economy with high trade with one partner will peg the currency with him.

The chance for fixed exchange rate is 0,00004-folds larger for countries with higher rate of economic growth than average (2,53%). The marginal effect seems to be insignificant (p-value = 0,259). That finding is consistent with presented background – one obtains the confirmation of Mundell-Fleming model, according to which one should expect that countries with slow performance may opt for using the monetary policy to boost the economic growth, so they should choose the fixed exchange rate regime.

The level of financial development does not find confirmation in researched set. One does not obtain significant relationship holding between M2 and fixed exchange rate regime.

The chance for fixed exchange rate is 19,40-folds larger for countries with higher value of economy's reserves than average (7,25%). It is the strongest relationships holding in researched set. The marginal effect also seems to be significant as the only one at 10% level: there is 7,32% point higher probability to have fixed exchange rate regime when country has more than 7,25% reserves in comparison to M2. That finding is consistent with currency crisis approach – when the countries want to manage their currency, they need a vast amount of reserves.

The current account balance seems not to have a significant impact on fixed currency regime.

The chance for fixed exchange rate is 1,000001-folds larger for countries with higher value of external debt than average (19 222 mln USD). The marginal effect also seems to be insignificant (p-value = 0,272). That finding is consistent with currency crisis approach – when economy has high external debt, they are eager to manage the level of exchange rate to improve the international credibility.



Index of Economic Freedom seems not to have a significant impact on the choice of the fixed exchange rate regime. However, the Monetary Freedom seems to do so. The chance for fixed exchange rate is 1,03029-folds larger for countries with higher value of monetary freedom than average (71,28%). The marginal effect seems to be insignificant (p-value = 0,194). That finding is consistent with institutional framework, more precisely consistency view – countries with lower credibility (=lower level of institutional development) will have the incentives to adopt the fixed currency regime to have the impact on economy's competitiveness. The alternative was the credibility view, which suggests negative relationships. In this case the effect of consistency prevailed.

The last variable – effectiveness of legislature seems to bring 0,7218-folds larger probability for fixed regime when the effectiveness of country's legislature is assessed higher. The marginal effect also seems to be insignificant (p-value = 0,228). That variable was rather the matter of curiosity, so there are no deep theoretical roots here. One expected that the higher effectiveness is, the less incentives have the policy-maker to adopt the fixed exchange rate regime, because the recent political tool works properly.

## **Summary**

Taking all into consideration, it seems that one obtains well fitted model that is deeply rooted in theoretical background. It turned out the probability of having the fixed exchange rate regime is consistent both with OCA theory and institutionally-political framework. On the contrary, the currency crisis approach as well as the Mundell-Fleming financial one seem not to have a confirmation in researched set of countries in period 1995 - 2004. It was confirmed that the higher probability of fixed exchange rate regime is associated with higher openness of the economy, higher geographical concentration of trade, higher value of reserves, larger external debt and higher level of monetary freedom. The lowering probability brings: level of development measured by GDP per capita, economic growth rate and effectiveness of legislature. The insignificant seems to be: size of economy, M2 aggregate, current account and level of institutional development measured by Index of Economic Freedom. The insignificance does not mean that those variables are not important – it is the signal for future research to make deeper inspection on those variables.

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## **Summary**

This paper has an aim to assess the potential factors related to higher probability of fixed exchange rate regime. The explanatory variables will be derived from four theoretical approaches: OCA theory, Mundell-Fleming model, financial crises and institutionally-political view. The given hypothesis will be verified on the basis of probit model. It will turn out that many suggested explanatory variables will be significant and two out of four approaches will be confirmed in the researched set of countries in period 1995 – 2004.

## **Field of work**

Economics

## **Zusammenfassung**

Diese Masterarbeit hat das Ziel, die potenziellen Faktoren zu erarbeiten, die die Wahrscheinlichkeit des festen Wechselkurssystems bestimmen. Die erklärenden Variablen werden aus vier theoretischen Ansätzen abgeleitet: Theorie optimaler Währungsräume, Mundell-Fleming Modell, Finanzkrisen und institutionell-politische Sicht. Die gegebene Hypothese wird anhand des Probit-Modells belegt. Es wird bewiesen, dass viele vorgeschlagene Variablen signifikant sind und zwei von vier Ansätzen werden in der recherchierten Reihe von Ländern im Zeitraum 1995-2004 bestätigt

## **Arbeitsfeld**

Volkswirtschaft

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