The Determinants of Exchange Rate Regimes in Emerging Market Economies

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Abstract

The choice of exchange rate regime has become one of the most important issues one more time in many economies after the financial crises in recent years. In the wake of the financial crises, many countries, especially emerging market economies, opted for floating exchange rate regimes by forsaking the pegged regimes. Consequently, an old debate on the choice and determinants of exchange rate regimes has been triggered. Economists have started to debate what appropriate exchange rate regime for an economy is. When the tendency in recent years is taken into consideration, the choice of exchange rate regime of countries, especially emerging economies, needs to be analyzed. To do this, in this paper, we attempt to uncover how emerging market economies choose their exchange rate regimes. In other words, we try to find the economic and political factors underlying the choice of exchange rate regimes. The study includes 25 emerging market economies over the period 1970-2006. We use random effect ordered probit model in order to find the long run economic and political determinants of exchange rate regimes for emerging economies. The determinants of both the *de jure* and *de facto* exchange regimes are empirically analyzed in the paper.

Introduction

Following the financial crises in recent decade, many countries switched from one exchange rate regime to another (mostly rigid one to more flexible one). It has fueled the old debate on the choices and determinants of exchange rate regimes. Economists have started to argue what appropriate exchange regime for an economy is once more. Over the past 40 years, economists have developed various answers to this question. The first contribution to the debate came from optimum currency area (OCA) theory. It explains that how some macroeconomic aggregates of a country affect flexibility of an exchange rate regime to be adopted by that country. In the meanwhile, regime choices have also been discussed in terms of optimal stabilization policy, monetary policy credibility and currency crises. Since the second half of 1990s, the empirical literature (Edwards, 1996; Breger et al., 2000) has tended to explain the role of political and institutional variables in regime choices. The empirical studies using political variables generally say that there is a negative correlation between political instability and exchange rate flexibility. The last contribution to the debate was made by Calvo and Reinhart with fear of floating in 2000. It has brought about to realize that there is a serious difference between *de jure* and *de facto* exchange rate regimes. The economists say that owing to fear of floating, some macroeconomic variables affect choices of regimes in an opposite direction to what the previous theories say. Besides, fear of floating creates a difference between what countries say and what countries do. Because of the difference between the *de jure* and *de facto* exchange regimes, the de facto regimes are also taken into account in this paper.

In order to explain the determinants of exchange rate regimes, empirical researchers have applied theoretical guidelines to the observed choices of exchange rate regimes. In doing this, most studies have employed the *de jure* regimes that the governments announce, while few studies have used the *de facto* regimes that they actually pursue. Until recently, the distinction between *de jure* and *de facto* regimes has mostly been ignored in the literature. The studies by Gosh et al. (1997), and Levy-Yeyati and Sturzenegger (1999, 2005), and Clavo and Reinhart (2000) developed some classification methods to determine type of exchange rate regime of a country in a specific year or period. They have reached that there was a serious difference between the *de jure* and *de facto* exchange rate regimes. Although why countries put into effect exchange rate regimes different from their official announcements remains a puzzle in the literature, it appears that the *de facto* classifications are more reliable than the *de jure* classifications.

Although there are many studies on the determinants of exchange rate regimes, there are no studies analyzing especially emerging market economies at least as far as we know. With this motivation, we analyze emerging market economies in this paper. Since most of the papers haven't used panel estimation method and / or disregarded the panel characteristics of data, their results may be misleading. In order to overcome this problem, we use random effect panel probit model in analyzing emerging market economies. The rest of paper is organized as fallows. Section 2 presents the literature review. In section 3 and 4, the data and estimation method are explained respectively. The empirical results are presented in the next section. The paper results in conclusion in section 6.

Literature Review

The empirical findings on the determinants of exchange rate regimes are numerous and controversial. The reason for the differences among the findings mostly depends on the country samples taken into consideration, time periods, regime classifications used in the analyses, estimation methods and assumptions of econometric models.

As stated before, the econometric methods and regime classifications used in the papers are different from each other. Thus, it creates different results. For instance, some of the studies (Edwards, 1998; Berger et. al; 2000; and Meon and Rizzo, 2002) used a simple binary structure to classify exchange rate regimes into either fixed or flexible ones while the others (Poirson, 2001; Zhou, 2003; and Von Hagen and Zhou, 2007) used an ordered-choice or multinomial-choice structure in order to classify the regimes. Besides, the studies also differs form each other in terms of estimation methods. A commonly used estimation method in the papers (Heller, 1978; Holden et el., 1979; Melvin, 1985; Edwards, 1998; Rizzo, 1998; Poirson, 2001; and Juhn and Mauro, 2002) is cross section analysis. Due to technical difficulties in the estimation of panel data models, especially due to the heavy computational burden of numerical integrations, panel data models are rarely implemented in the literature. Few of the studies in the literature (Zhou, 2003; Kato and Uctum, 2005, Von Hagen and Zhou 2007) employed panel data models in order to empirically analyze the determinants of exchange rate regimes.

The studies on the determinants of exchange rate regimes largely consist of the papers including the developing countries (Rizzo, 1998; Breger et. al, 2000; Poirson, 2001; Zhou 2003; Von Hagen and Zhou, 2005, Bleaney and Francisco, 2005); or both the developing and developed countries (Meon and Rizzo, 2002; Juhn and Mauro 2002; Kato and Uctum, 2005, Levy-Yeyati and Sturzenegger, 2007). A few of the paper (Collins, 1996; Papaioannou, 2003; Markiewic, 2006) considered specific country groups such as Latin American countries, Central American countries, transition economies and etc. In the existing literature, as far as we know, there are no studies focused on emerging market economies. This motivates us to analyze emerging economies.

Most studies considered some of the optimum currency area variables, such as trade openness, size of economy, degree of economic development and geographical concentration of trade. In addition, some studies also included such macroeconomic variables as inflation, foreign exchange reserves, domestic credit, real exchange rate, and terms of trade. Also, a few studies contained political or institutional variables.

When the results of previous studies are considered, no results appear to be reasonably robust to changes in country coverage, sample period, estimation method, and exchange rate regime classification. For instance, trade openness is positively associated with the probability of adopting a flexible regime in the papers by Dreyer, 1978; Bernard and Leblang, 1999; Poirson, 2001; Juhn and Mauro, 2002; Von Hagen and Zhou, 2005), whereas it is negatively associated with the probability of adopting a flexible regime in the papers by Melvin, 1985; Rizzo, 1998; Berger et. al., 2000; and Meon, and Rizzo, 2002). Likewise, size of economy (Gross Domestic Product) is found to be positively associated with floating regimes in almost all studies, but not always significantly. Economic development (GDP per capita) is found to be significantly associated with floating regimes by four studies (Holden et. al.,1979; Savvides, 1990; Edwards, 1996,

and Von Hagen and Zhou, 2005) significantly associated with fixed regimes by three studies (Honkapojha and Pikkarainen, 1994; Edwards, 1999; Rizzo, 1998) and not significantly associated with any particular regime by another two studies (Collins, 1996, and Poirson, 2001). Inflation is always positively and significantly associated with floating except for one study (Von Hagen and Zhou, 2005). The similar results are valid for the other variables (the other macroeconomic, political and institutional variables). This suggests that the macroeconomic, political and institutional variables are not robust predictors of exchange rate regime choice. On the other hand, it doesn't mean this denies the potential importance certain variables for specific groups of countries, in certain time periods, or across some of the regime categories.

Data Description

All series are annual and cover the years 1970 to 2006. Our analysis takes into consideration 25 emerging market economies[1]. The World Development indicators and International Financial Statistic are main sources for most of the independent variables. All the political variables come from Database of Political Institution-2006. The variable representing capital account restriction (CAR) is taken the paper by Prasad, et. al. (2003). Based on theoretical suggestions and empirical findings, we take into consideration three groups of potential exchange rate regime determinants: OCA fundamentals, macroeconomic aggregates, and political and institutional features. The exact construction of data and data sources are reported in the Appendix I. The descriptive statistics of data and correlation matrix of explanatory variables are presented in the Appendix II and III respectively. The explanatory variables, their symbols and definitions are as follows:

For OCA fundamentals, we include trade openness (OPENNESS, measured as imports plus exports as a share of GDP), geographical trade concentration (GEOGTRADE, measured by the share of the largest trade partner in total trade), inflation differential (INFLATION, measured as USA inflation minus domestic inflation), size of economy (GPD, measured by gross domestic product in logarithm), and level of economic development (GDPpercapita, measured by log of GDP per capita). The OCA theory says that more open economies want to adopt less flexible regimes while larger economies and economies with higher level of GDP per capita want to adopt more flexible regimes.

For macroeconomic aggregates, we employ current account deficit or surplus (CA, measured as current account deficit/surplus as a share of GDP), de facto capital account openness (CAOPENNESS; measured as sum of the absolute value of inward and outward gross capital as a ratio of GDP) , reserves (RESERVES, measured as total reserves as a ratio of Imports) , rate of growth of M2 (M2GROWTH, measured as annual growth rate of money plus quasi money), and terms of trade (TOT, measured as standard deviation of annual percentage change of terms of trade). The economic theory suggests that high reserves are associated with a fixed regime.

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[1] While determining emerging market economies, we use Morgan Stanley Emerging Index. This index includes 26 emerging economies. Owing to lack of data on Thailand, we exclude this country. The countries considered in this paper are Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Sri Lanka, Thailand, and Turkey.

In an attempt to reflect the political and institutional features, we consider capital account restriction (CAR), period of duration of chief executive in office (YRSOFFC), a variable showing that executive parties have an absolute majority in assembly (MAJORITY), and a variable representing whether executive party is nationalist (NATINALIST) or not. All the OCA and macroeconomic variables are lagged one period to avoid potential endogeneity problems. Most of the previous studies imply that there is a negative relationship between political stability and flexibility of an exchange rate regime.

As a dependent variable, the *de facto* classification called natural classification by Reinhart and Rogoff (2003) and the *de jure* classification based on the IMF's classification are used. Natural classification is coded as follows[2]: 1 for pegged regimes, 2 for limited flexibility arrangements, 3 for managed floating, 4 for freely floating, and 5 freely falling. Freely falling is a new category introduced by the authors that indicates high inflation period in which annual inflation rate is higher than 40 %. We also use the more detailed version of natural classification including the fifteen different regimes. Since natural classification classifies the regimes until the year 2001, the *de facto* classification is used in the estimated for the period 1970-2001. As a dependent variable, the new IMF exchange rate classification (*the de jure* classification) that has been in use since 1999 is employed in the analysis for the years 1999-2006, too. The *de jure* exchange rate regimes of countries are taken from the various IMF Annual Reports. In this classification the least flexible regime takes the lowest value while the most flexible regime takes the highest value: 1 for no separate legal tender, 2 for currency board, 3 other conventional fixed peg, 4 for pegged exchange rates within horizontal bands, 5 crawling bands, 6 for exchange rates within crawling bands, 7 for managed floating, and 8 for independently floating. In addition, we combine the IMF classifications before and after 1999 and construct a new dependent variable over the period 1996 to 2006[3].

Estimation Strategy

In this section, we present the econometric model which is applied to test the determinants of exchange rate regimes in emerging economies for the period 1970-2006. We use a random effect ordered probit model for an unbalanced panel of 25 emerging market economies. We describe the choices of exchange rate regimes in our sample using a discrete variable y_{it}, which takes a value of $y_{it} = 1$ if the least flexible regime selected by country i in year t, and $y_{it} = J$ for the most flexible regime. This choice based on the latent variable y^*_{it}, which is a function of the variables discussed above. A larger value of the latent variable indicates that a more flexible regime is desirable for the country and period under consideration. Given the discrete nature of regime choices, we assume that a country chooses the least flexible regime, $y_{it} = 1$, if

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[2] Reinhart and Rogoff (2003) classify exchange rate regimes into 15 and 6 subcategories. The last categories both in 15-way and 6-way classifications don't represent a exchange rate regime, and denote missing data category. So we exclude these categories from the classifications and regard them as 14-way and 5-way classifications in this paper.

[3] The old IMF exchange rate classification before 1999 divides the exchange rate regimes into four categories: (1) pegged to single currency or currency basket, (2) limited flexibility, (3) managed floating, and (4) independent float. When we combine the old and new IMF classifications, categories 1 and 2 in the old classification are regarded as other conventional fixed pegs and exchange rates within crawling bands in the new classification respectively. Similarly, category 3 and 4 are received as managed floating, and independently floating in the new classification respectively.

latent variable is below a certain threshold, $y^*_{it} \leq m_0$. Similarly, the most flexible regime is chosen, $y_{it} = J$, if the latent variable is above another threshold, $m_{j-1} < y^*_{it}$, with $m_0 < m_{j-1}$.

$$
y_{it} = \begin{cases}
1 & \text{if } y^*_{it} \leq m_0 \\
2 & \text{if } m_0 < y^*_{it} \leq m_1 \\
3 & \text{if } m_1 < y^*_{it} \leq m_2 \\
. & \quad . \\
. & \quad . \\
j & \text{if } m_{j-1} < y^*_{it}
\end{cases}
$$

where the m_s is unknown cut point parameters (thresholds).

The estimated equation for the model is equation below.

$$
y^*_{it} = \beta' X_{it} + \varepsilon_{it} \quad \text{for } i = 1, 2, 3, \ldots.N, \text{ and } t = 0, 1, \ldots.T_i
$$

where X_{it}, β, t and i represent are a vector of explanatory variables, a vector of coefficients, country and time respectively[4]. The estimates of the coefficients of the vector X_{it} and of the thresholds, i.e, $m_1 < m_2 < m_3 \ldots < m_{j-1}$ are obtained by maximizing the likelihood function by using the quadratic hill climbing algorithm.

Empirical Results

In this section, we present the results of random effect ordered probit analyses, conducted by using the unbalanced panel data sets. We estimate several specifications both for the *de jure* and *de facto* classifications. The results of estimations are presented in Table 1. We estimate the four regressions varying across regime classifications and time periods. The results of the first and the second regression are obtained for the period 1970-2001 by using the 5-way classification (RR 5), and the 14-way classification (RR 14) developed by Reinhart and Rogoff (2003) as a dependent variable. The third and fourth regressions are estimated by using the new IMF classification and the combined IMF classification constructed by us respectively.

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[4] Note that the panel is unbalanced as T_i varies across i.

Table 1: Random Effect Ordered Regression Results For Emerging Economies

	1970–2001	1970–2001	1999–2006	1996–2006
Variable	RR 5	RR 14	IMF1[a]	IMF2[b]
GDP	0.0555	0.2176 ***	0.1810	0.6285 ***
	(0.0838)	(0.0797)	(0.3624)	(0.2021)
GDPpercapita	0.9409 ***	0.5272 ***	0.9347 ***	-0.7449 ***
	(0.1154)	(0.1066)	(0.3514)	(0.2040)
OPENNESS	0.0094 ***	0.0011	0.0054	0.0002
	(0.0032)	(0.0027)	(0.0076)	(0.0045)
INFLATION	-0.0014 ***	-0.0013 ***	0.0338	0.0171
	(0.0005)	(0.0005)	(0.0223)	(0.0142)
GEOGTRADE	-0.0104 *	-0.0082	0.0898 ***	0.0612 ***
	(0.0059)	(0.0055)	(0.0272)	(0.0177)
CAGDP	0.0128	0.0061	0.0503	-0.0174
	(0.0163)	(0.0152)	(0.0537)	(0.0299)
CAOPENNESS	0.0016	0.0017	0.1045 *	0.1044 ***
	(0.0129)	(0.0119)	(0.0554)	(0.0299)
RESERVES	-0.2864 ***	-0.1922 ***	-0.0474	-0.0376
	(0.0394)	(0.0352)	(0.1218)	(0.0781)
M2GROWTH	0.0044 ***	0.0042 ***	-0.0343 *	-0.0202
	(0.0011)	(0.0010)	(0.0196)	(0.0129)
TOT	0.1629 ***	0.0514 *	0.2489 ***	0.1397 ***
	(0.0287)	(0.0294)	(0.0721)	(0.0417)
CAR	0.7105 ***	0.4632 ***	-0.3131	0.0775
	(0.1967)	(0.1784)	(0.4675)	(0.3056)
YRSOFFC	.-0.044516 ***	-0.0307 ***	0.0038	-0.0084
	(0.0082)	(0.0070)	(0.0421)	(0.0185)
NATIONALIST	-2.4600 ***	-2.8011 ***	-0.3529	-0.5481
	(0.6286)	(0.5783)	(1.1684)	(0.7083)
MAJORITY	0.0298	0.0044	-0.7600	0.3492
	(0.1812)	(0.1896)	(0.4642)	(0.3594)
Observations	448	448	112	154
Log-likelihood	-632.0558	-361.4228	-84.1975	-152.9535
LR $\chi^2(14)$ [c]	18.125	23.304	43.0722	39.7188

Notes: The figures in parentheses are standard deviations.
* z statistics are significant at the 10 % level; ** significant at the 5 % level; *** significant at the 1 % level.
[a] : The IMF1 represents the IMF classification since 1999.
[b] : The IMF2 is constructed by combining the IMF classifications before and after 1999.
[c] : The χ^2 value is defined as 2 (L_1-L_0), where the L_0 is the value of log-likelihood function with only the constant term, and L_1 is the value of the log-likelihood function when all the explanatory variables are included.

A positive sign of a coefficient means that an increase in the associated variable raises the probability of adopting a flexible exchange rate regime. Most of the signs of optimum currency variables in the first and the second regressions are found as expected. For example, the size of economy, level of development (geographical concentration of trade) are expected to have a positive (negative) sign and their signs are

found to be positive (negative). Although the sign of openness is expected to be negative, it is found to be positive. In contrast to the variables mentioned above, inflation affects negatively the probability of selecting a flexible exchange rate regime. Although most of the signs are as expected, the size of economy in the regression I and, OPENNESS and GEOGTRADE in the regression II are statistically insignificant. MAJORITY is positive, but insignificant in both the two regressions.

RESERVES, YRSOFFC and NATIONALIST are negatively and significantly associated with a flexible regime while M2GROWTH, TOT, CAR are positively and significantly associated with a flexible regime. The result related to YRSOFFC says that political stability is in favor of adopting a fixed regime. Like YRSOFFC, the sign of NATIONALIST implies that nationalist governments want to adopt more fixed regimes. In the three regressions, the current account deficit /surplus and de facto capital account openness are statistically insignificant.

Most of the variables in the regressions III and IV used the *de jure* classification are statistically insignificant. In contrast to the expected sign, it is found that the level of development decreases the probability of adopting a flexible regime in both the regressions. Similarly, contrary to the expected sign, the geographic concentration of trade is significantly and positively associated with a flexible regime.

When the four regressions are taken into consideration, the only two variables (level of development and TOT) are statistically significant. Nevertheless, the level of economy has a positive sign in the regressions I and II, whereas it has a negative in the regressions III and IV. When the *de facto* and *de jure* classifications are compared to each other, it appears that the relationship between the *de facto* classifications and the determinants of exchange rate regimes are stronger than the relationship between the *de jure* classifications and the determinants of regimes.

Conclusion

In this paper, we apply a random effect ordered probit model to estimate the determinants of exchange rate regimes in 25 emerging market economies. We consider a wide range of potential regime determinants including the OCA fundamentals, macroeconomic aggregates, and political and institutional features. To avoid potentially misleading classification, we use two different measures of the dependent variable, namely de jure (official) and de facto (actual) choice of exchange rate regimes. The estimations of the de jure and de facto specifications generate different results for the variables. The de facto models produce a better fit. This is consistent with the notion that official regime changes carry a cost that exceeds the cost of changing the de facto regime, and that country use this as a policy instrument to adjust their exchange rate policy to macroeconomic developments earlier and faster than they respond with their official regime. Therefore, it can be said that the *de facto* classifications should be preferred in order to classify the exchange rate regimes in emerging economies. It is found that the de jure regimes are not enough to explain the relationship between the exchange rate policies and the variables. Almost all the macroeconomic and political variables in the *de jure* models are found to be statistically insignificant.

Based on the findings obtained from the de facto regressions, we may conclude that the choice of exchange rate regime adopted by 25 emerging economies for the periods under discussion have been influenced by the level of economic development, inflation differential and political factors, and not influenced by the current account deficit/surplus, (de facto) capital account openness.

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Appendix I

Table 2: Definition of Variables and Sources

Variable	Explanation	Database
GDP	Log of GDP (constant 2000 US$), lagged one period	WDI online
GDPpercapita	Log of GDP per capita (constant 2000 US$), lagged one period	WDI Online
OPENNES	(Exports + Imports) / 2, lagged one period	IFS Online
INFLATION	inflation differential: domestic inflation minus USA inflation, lagged one period	IFS Online
GEOGTRADE	Share of Export to the largest Trade Partner in total Exports, lagged one period	DOT Online
CAOPENNESS	Sum of the absolute value of inward and outward gross capital as a ratio of GDP, lagged one period	IFS Online
CA	Current account deficit or surplus as a share of GDP, lagged one period	WDI online
RESERVES	Total reserves in months of imports, lagged one period	WDI online
M2GROWTH	Annual Growth Rate of Money plus Quasi money, lagged one period	IFS Online
TOT	Standard deviation of annual percentage change of terms of trade	WDI online
CAR	Existence of Capital Account Restrictions, lagged one period	Prasad, et. al. (2003).
YRSOFFC	How many years has the chief executive been in office?	DPI 2006
NATIONALIST	Nationalist (1 if yes)	DPI 2006
MAJORITY	Does the party of the executive have an absolute majority in the houses that have lawmaking powers?	DPI 2006

Appendix II

Table 3: Summary Statistics of Variables Used in the Analysis (the period 1970-2006)

Variable	Obs	Mean	Std. Dev.	Min	Max
CA	715	-1.95	4.55	-18.18	18.04
OPENNESS	858	45.18	29.64	4.98	199.50
GDP	857	25.02	1.19	21.43	28.27
GDPpercapita	857	7.48	1.05	4.66	9.82
RESERVES	731	4.36	2.50	0.31	13.76
M2GROWTH	836	62.94	307.45	-43.74	6384.95
INFLATION	839	53.99	353.34	-13.37	7476.26
CAOPENNESS	714	7.68	5.80	0.06	51.24
TOT	564	8.18	3.84	1.67	17.15
CAR	730	0.84	0.37	0	1
GEOGTRADE	607	27.06	14.38	6	89
YRSOFFC	701	7.39	8.84	1	46
NATIONALIST	697	0.08	0.27	0	1
MAJORITY	626	0.60	0.49	0	1

Appendix III

Table 4: Correlation Matrix

Variable	CA	OPENNESS	GDP	GDP percapita	RESERVES	M2GROWTH	INFLATION	CAOPENNESS	TOT	CAR	GEOGTRADE	YRSOFFC	NATIONALIST
CA	1												
OPENNESS	0.058	1											
GDP	0.229	-0.408	1										
GDPpercapita	0.043	0.150	0.241	1									
RESERVES	0.230	-0.188	0.150	0.069	1								
M2GROWTH	0.027	-0.149	0.123	0.095	0.065	1							
INFLATION	0.027	-0.145	0.095	0.082	0.052	0.897	1						
CAOPENNESS	-0.109	0.415	-0.253	0.262	0.042	-0.042	-0.028	1					
TOT	0.040	-0.365	0.271	-0.442	0.104	0.146	0.110	-0.325	1				
CAR	0.025	-0.138	-0.061	-0.012	-0.163	0.087	0.086	-0.041	-0.217	1			
GEOGTRADE	-0.034	0.020	0.233	0.296	-0.283	-0.055	-0.057	-0.111	0.091	-0.153	1		
YRSOFFC	-0.008	0.234	-0.437	-0.134	-0.104	-0.107	-0.104	0.030	0.071	-0.129	-0.053	1	
NATIONALIST	0.024	-0.170	0.175	0.253	0.109	0.084	0.130	0.107	-0.189	-0.126	-0.055	-0.061	1
MAJORITY	-0.065	0.146	-0.319	-0.209	-0.162	-0.035	0.005	-0.009	0.075	-0.221	0.105	0.470	0.095