NEW EVIDENCE ON REAL EXCHANGE RATE MISALIGNMENT AND THE ROLE OF EXCHANGE RATE REGIME

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Abstract. For a sample of 43 countries in the period of 1999-2014, we investigate the effect of de facto exchange rate regimes on exchange rate misalignment. To this end, a panel smooth transition model is used. In contrast to recent studies, our finding indicates that non-floating exchange rate regimes lead to a reduction in the misalignment level and its volatility. However, the result is sensitive to the lagged of misalignment. Moreover, our visual inspection demonstrates a relationship between a higher misalignment and the subsequent crisis. Hence, the extent of misalignment in relation to fundamentals could be a leading indicator to anticipate a crisis.

Keywords: Exchange rate regimes, Real exchange rate misalignment, Fully Modified Ordinary Least Squares, Panel Smooth Transition Model

1 Introduction

The economic implications of exchange rate arrangements are always a debate among economist. Especially, the effect of exchange rate regimes on exchange rate misalignment and its volatility has been a subject of considerable interest.

Although a currency's value in the floating regime is determined by the foreign exchange market, in a fixed exchange rate system, a country's government decides about the worth of its currency. Regarding literature, fixed regimes are considered more stable. Floating exchange rate regimes, on the other hand, show a greater degree of uncertainty and volatility.

There is some theoretical and empirical evidence that exchange rate misalignment is lower in fixed exchange rate regimes than in flexible ones. To put it another way, sometimes it is argued that fixed exchange rate regimes help to reduce exchange rate misalignment and its volatility. However, opposite evidence has been provided by more recent studies (David M. Kemme and Saktinil Roy (2005), Virgine Coudert and Cecile Couhard (2008), Oliver Holtemöller and Sushanta Mallick (2008, 2013), Rodrigo Caputo and Igal Magendzo (2009) and Rodrigo Caputo (2015)), i.e. high misalignment is more strongly associated with fixed regimes than floating ones. Moreover, as to literature, numerous factors may set the stage for a nonlinear adjustment mechanism in the response of misalignment to economic factors (particularly, exchange rate regimes).

The objective of this paper is to contribute to the literature by investigating the impact of defacto exchange rate regime on both the misalignment level and its volatility. Moreover, in order to account for nonlinearities in the linkage between exchange rate misalignments and economic determinants, we use a panel smooth transition model.

The results indicate that the introduction of fixed exchange rate regime helps to reduce the misalignment level and volatility only when the latter are already low. The difference between our results and recent studies may then stem from different methodology and sample to investigate the mechanism. In essence, by using Panel Smooth Transition Model (PSTR), it is possible to assess the dependence of misalignment fluctuations on exchange rate regimes.

The remainder of the paper is organized as follows. After the Introduction, model and methodology are discussed in Section II. Data and the results of the study are elaborated in Section III. The conclusion and proposed suggestion are presented in the last Section.

2 Model and Methodology

Following Holtmoller and Mallick (2013), we employ a panel version of a fundamental equilibrium exchange Rate or FEER model to obtain the long-run equilibrium REER for each country and then residuals from these regressions use to measure the extent of misalignment.

According to Holtmoller and Malick' (2013) statements in their paper, a simple model which supports our selection of variables to be included in the long-run real exchange rate equation is outlined as follows.

The current account (CA) as the difference between exports (volume X at price P_x, in national currency) and imports (volume M at price P_m) is defined. Meaning that:

$$CA = P_x . X - P_m . M \tag{1}$$

Since other components of the current account are supposed to be exogenous with respect to the real exchange rate, the primary current account balance is considered in this paper. Moreover, when the exchange rate is in its long-run equilibrium position, the net capital flows might be zero. Hence, the interest income component is ignored.

FEER implies a flow-equilibrium. The REER is defined as the ratio of domestic prices and world prices (P^*), measuring the price of home country goods (P) in terms of foreign goods. World prices are trade-weighted US-Dollar price averages and have to be converted to domestic currency using the nominal exchange rate (e), which is defined as the home currency price of currency i.

$$REER = \prod_{i=1}^{n} \left(\frac{P}{e_i P_i^*}\right)^{w_i} \times 100 \qquad \sum w_i = 1 \tag{2}$$

The exponential weights for each currency i are the w_i terms, representing effective trade weights and sum to unity.

The price equations are defined as functions of the real exchange rate. While import prices only rely on world prices, export prices can be defined as a weighted geometric average of world price (P^*) and domestic price (P),

$$P_x = (e P^*)^{-\alpha} . P^{1+\alpha} = REER^{\alpha} P \tag{3}$$

$$P_m = \left(\frac{eP^*}{P}\right)^{-\beta} = REER^{\beta} \tag{4}$$

whereas real imports depend on domestic demand, Y, Real exports can be explained by world demand, Y_f. Both exports and imports volume depend on the REER as follow:

$$X = REER^{\tau} (Y_f)^{\varphi} TP^{\omega} TT^{\rho}, where\ \tau < 0 \tag{5}$$

$$M = REER^{\delta} Y^{\vartheta} TP^{\psi} TT^{\theta}, where\ \delta > 0 \tag{6}$$

where TP is trade policy and TT is terms of trade. The impact of terms of trade on the trade balance (CA) is considered, because if the exchange rate regime is non-floating, it cannot neutralize the impact of TT shocks on trade, if not it would offset any TT shock. Owing to a negative income effect, negative terms of trade shock can worsen the trade balance, so it is important to control for such variations. According to Holtmoller and Mallick (2013), many emerging market economies grew significantly faster than industrial countries in recent years. Therefore, the national level for import demand (Y) and the world level for export demand (Y_f) are important for the explanation of long-term REER development.

Now for internal equilibrium, a simple domestic price formation equation is included and defined as a function of the ratio of output to its potential level $Y/\bar{Y}$. The internal equilibrium is determined as follows:

$$P = \left(\frac{Y}{\bar{Y}}\right)^{\kappa} \qquad (7)$$

Upon substitution of Eq. (3-7) in Eq. (1) and under the assumption of a zero normal current account balance, a reduced-form relationship for the long-run equilibrium real exchange rate ($\overline{REER}$) is derived as follows:

$$\overline{REER} = \left(\frac{Y^{\theta} TP^{\psi-\omega} TT^{\theta-\rho}}{\left(\frac{Y}{\bar{Y}}\right)^{\kappa} Y_f^{\varphi}}\right)^{\frac{1}{\alpha+\tau-\beta-\delta}} \qquad (8)$$

A very simple model with a relatively small set of fundamental variables is given, which can be monitored over time. The variables included here are similar to the behavioral models in this literature. For a non-zero constant level of current account, $CA = \overline{CA}$ (external equilibrium), an analytical solution for REER does not exist. All the same, the equilibrium REER can be computed numerically for any given level of CA. Under the usual assumptions on export and import elasticities, a negative relationship between the REER and the current account is obtained to achieve a higher current account, the REER has to depreciate making exports more attractive for foreigners and imports less attractive for the domestic population.

All in all, for our purpose, the following model relates the REER to a set of fundamental variables:

$$REER = f(TOT, OPEN, DGDP, WGDP, PCA, YGAP) \qquad (9)$$

Where REER,TOT, OPEN, DGDP, WGDP, PCA, and YGAP are log real effective exchange rate, log terms of trade, log degree of openness, log domestic GDP, log world GDP, Primary current account balance as percent of GDP and output gap (HP-filtered GDP), respectively. As to the literature, other variables have been included in equilibrium exchange rate regressions. However, only we relay the variables which they are necessary to achieve stationary residuals.

A wide range of modern econometric techniques is used to study the existence of a long-run relationship among variables. The Fully Modified Ordinary Least Squares or FMOLS approach is applied to investigate the relationship between REER and its long- run determinants. Reliable estimates for small sample size are produced by the FMOLS method. Besides, the mentioned method provides a check for robustness of the results. FMOLS method was introduced for estimating a single co-integrating relationship that has a combination of I(1). FMOLS method utilizes Kernal estimators of the nuisance parameters that affect the asymptotic distribution of the OLS estimator. In order to achieve asymptotic efficiency, this technique modifies least squares to account for serial correlation effects and controls the endogeneity. (Rukhsana Kalim and Mohammad Shahbaz (2008)).

The FMOLS estimator for the i-th panel member is given by,

$$\beta_i^* = \left(\acute{X}_i X_i\right)^{-1}\left(\acute{X}_i y_i^* - T\delta\right) \qquad (10)$$

Where y^* is the transformed endogenous variable, δ is a parameter for autocorrelation adjustment, and T is the number of time periods.

In addition, there is also the possibility of nonlinear adjustment, for instance, in Taylor et. al., (2001) point of views the REER adjusts in a nonlinear fashion, in the sense that the speed of adjustment varies with the extent of the deviation from parity. Moreover, there is the possibility of an asymmetric type of adjustment, in which the speed of adjustment varies depending on whether the exchange rate is above /below its equilibrium level. Thanks to different benefits and costs of having an undervalued or overvalued exchange rate, some countries would like to live with an undervalued exchange rate in order to foster exports, while others may prefer an overvalued rate to avoid inflationary pressures. This type of nonlinearity in our empirical model is considered.

The nonlinear analyses let us investigate the slowness of the adjustment process towards the long-run equilibrium. Numerous factors explain a nonlinear dynamics. All these factors imply, either a nonlinear adjustment mechanism with time-dependence properties, or a nonlinear relationship between the economic fundamentals and the exchange rates. Hence, the Panel Smooth Transition Model (PSTR) is used for testing the nonlinearity link between misalignment and some economic factors.

Bruce E. Hansen (1999) developed a regression- dependent the panel threshold regression (PTR) model. If $\{MIS_{it}, s_{it}, x_{it}; t = 1, \dots, T, i = 1, \dots, N\}$ is considered as a balanced panel then t denoting time, i the individual, MIS_{it} the exchange rate misalignment or the dependent variable, S_{it} the threshold variable and x_{it} a vector of k exogenous variables. Therefore, the PTR model can be written as follows:

$$Mis_{it} = \begin{Bmatrix} \mu_i + \beta_1 x_{it} + \varepsilon_{it}, s_{it} \le c \\ \mu_i + \beta_2 x_{it} + \varepsilon_{it}, s_{it} > c \end{Bmatrix} \qquad (11)$$

In the model, the observations in the panel are divided into two regimes, depending on whether the threshold variable is lower or larger than the threshold c. The error term ε_{it} is independent and identically distributed. Regarding the time series context, the transition from one regime to another is abrupt and the model implicitly assumes that the two groups of observations are clearly identified and distinguished, which is not always feasible in practice.

Anders Gonzalez, Timo Terasvirta, and Dick van Dijk (2005) introduced a panel smooth transition regression (PSTR) model, by considering the case of two regimes, the PSTR model is given by:

$$Mis_{it} = \mu_i + \acute{\beta}_0 x_{it} + \acute{\beta}_1 x_{it} g(s_{it}; \gamma, c) + \varepsilon_{it} \qquad (12)$$

where $g(s_{it}; \gamma, c)$ is the transition function, normalized and bounded between 0 and 1, S_{it} the threshold variable which may be an exogenous variable or a combination of the lagged endogenous one, γ the speed of transition and c the threshold parameter. In a panel framework, the logistic specification can be used for the transition function:

$$g(s_{it}; \gamma, c) = \left[1 + exp\left(-\gamma \prod_{j=1}^{m} (s_{it} - c_j)\right)\right]^{-1} \qquad (13)$$

with $\gamma > 0$ and $c_1 \le c_2 \le \cdots \le c_m$. When m=1 and $\gamma \to \infty$, the PSTR model reduces to a PTR model. As to Gonzalez et al. (2005), it is sufficient to consider only the cases of m = 1 or m = 2 to capture the nonlinearities due to regime switching.

It should be noticed that the coefficients of the explanatory variables in Equation (12) are given by: $c_x = \beta_x + \beta_x^* g(s_{it};\gamma,c)$ with x=1, … , 4. When $g(s_{it};\gamma,c) = 0$, then $c_x = \beta_x$ and the estimated coefficients correspond to those of Regime 1. At the other extreme, i.e. when $g(s_{it};\gamma,c) = 1$, then $c_x = \beta_x + \beta_x^*$. Between those two points, c_x takes a continuum of values depending on the realization of the nonlinear transition function $g(s_{it};\gamma,c)$.

Moreover, Gonzalez, Trasvirta, and van Dijk (2005) suggested there is a three step strategy to apply PSTR models: (1) specification, (2) estimation and (3) evaluation and choice of the number of regimes. The aim of the identification step is to test for homogeneity against the PSTR alternative. Turning to the estimation step, nonlinear least squares are used to obtain the parameter estimates, once the data have been demeaned. Also, the evaluation step consists in (i) applying misspecification tests in order to check the validity of the estimated PSTR model and (ii) determining the number of regimes. To this end, González, Trasvirta, and van Dijk (2005) suggest a sequential procedure starting by estimating a linear model, then a PSTR model if the homogeneity hypothesis is rejected, a PSTR model with 3 regimes is no remaining heterogeneity hypothesis is rejected in PSTR 2 regimes model, and so on.

3 Results

Firstly, the long-run equilibrium relationship between the REER and its fundamental determinants for 43 countries is estimated. The countries in the sample are listed in the appendix. About the country selection, we rely on the availability of data for all the variables mentioned. The frequency is annual, from 1999 to 2014. Consequently, we implement a panel version of FMOLS approach. The countries included in our sample have experienced alternative exchange rate regimes. While over the time most eastern European countries moved from peg regime to a flexible one in 2007, other countries, usually middle east ones such Iran, Pakistan have done the opposite and experienced different changes in their exchange rate regimes during the period of investigation.

Based on the framework outlined in the previous section, the extent of REER misalignment from an equilibrium is calculated. The selected variables reflect broadly the most important determinants of real exchange rates though certainly not all of them. A similar approach is taken by Holtmoller and Mallick (2013). Even so, on account of the stationary problem, they didn't use the primary current account in the right-hand-side variables. Besides, following Holtmoller and Mallick (2013), we are not interested in the average size and sign of a particular coefficient here. Also, deviations of the REER from its long-run equilibrium are interpreted as a measure of REER misalignment.

Unit root tests results[1] for all variables except for YGAP, are similar and exhibits non-stationarity. The mentioned tests confirmed stationary of YGAP variable in its level. To obtain the extent of exchange rate misalignment, the following equation is estimated by FMOLS:

$$REER_{it} = \theta_{1i} TOT_{it} + \theta_{2i} OPEN_{it} + \theta_{3i} DGDP_{it} + \theta_{4i} WGDP_{it} + \theta_{5i} PCA_{it} + \varepsilon_{it} \quad (14)$$

Where REER, TOT, OPEN, DGDP, WGDP, and PCA are logarithems of the real effective exchange rate, terms of trade, the degree of openness, domestic GDP, world GDP and Primary current account balance as percent of GDP, respectively. In addition, i=1, 2… N denotes countries and t=1, 2… T time periods. All variables are measured in logarithms. θ_is are country-specific coefficients. The results are presented in Table (1). For testing the cointegration, Pedroni and Kao's panel cointegration tests are used. With reference to the mentioned tests, the null hypothesis of existence of the long run relationship could not be rejected. The results are presented in Table (2). As the deviations of the REER from its long-run equilibrium are interpreted as a measure of REER misalignment, then residuals from the equation (14) represents the extent of the misalignment.

Table (1): Panel cointegration regressions (1999-2014) with FMOLS.

Variable	Coefficient	t-Statistic
OPEN	-0.290	-17.627
TOT	0.064	2.384
DGDP	-0.303	-5.216
WGDP	-0.049	-0.851
PCA	373000000	4.106

Notes: Here the dependent variable is the logarithm of REER and other variables are measured in logarithms too.

Table (2): Panel cointegration tests.

Test	Statistc	Prob
Pedroni group rho-Statistic	8.497	1.000
Pedroni group PP-Statistic	-8.536	0.000
Pedroni group ADF Statistic	-1.289	0.098
Kao test	-6.897	0.000

Notes: The null hypothesis is that estimated residuals from the long-run equation indicate a unit root. If the null hypothesis is rejected, we have a cointegration relationship.

In the next step, the level of REER misalignment is explained according to the theoretical framework. As to the literature, if adjustment of domestic prices relative to nominal variables shocks is slowly, REER dynamics could be affected by non-fundamental variables in the short- run, including the currency regime in place. Moreover, many factors imply the possibility of nonlinear convergence process of the real exchange rate towards its long run equilibrium value or moving misalignment to its long-run equilibrium value. Furthermore, by using the former notations for the PSTR model in the previous section, the model can be specified as follows:

$$\begin{aligned} Mis_{it} = \mu_{it} + \beta_1 Mis_{i\,t-1} + \beta_2 YGAP_{it} + \beta_3 DH_{it} \\ + \beta_4 LREER_{it} \\ + [\beta_1^* Mis_{i\,t-1} + \beta_2^* YGAP_{it} \\ + \beta_3^* DF_{it} + \beta_4^* LREER_{it}] g(s_{it};\gamma,c) \\ + \vartheta_{it} \end{aligned} \quad (15)$$

where, DH is a dummy variable that takes value 1 if the country has fixed and managed exchange rate regimes and 0 otherwise. Besides, $s_{it} \in S = \{Mis_{t-1}, LREER_{t-1}, DLREER_{t-1}\}$. By selecting the set S for s_{it}, we assume that what determines the adjustment speed of the real exchange rate misalignment towards its long run equilibrium may be either the fact that the currency appreciates or depreciates (through the sign of $DLREER_{t-1}$), the size of the past currency misalignment (Mis_{t-1}), or the precious magnitude of the REER.

The linearity in the mentioned model is tested by using the González, Trasvirta, and van Dijk (2005) test with different possible transition variables. First, we use the lagged estimated cointegrating vector as the appropriate threshold variable. The linearity test and results show in Table (3) and Table (4), respectively. The results show that when the past misalignment is used as the threshold variable, linearity is strongly rejected for our sample. Besides, the smallest p-value is obtained by using the past misalignment as the transition variable. Also, the main

[1] Unit root tests are not reported in order to save space, but they are available upon request.

parameters of interest are the coefficients in two extreme regimes β and $\beta + \beta^{*}$, the threshold parameter (c=283500000) and the speed of transition $(\gamma = 0.20)$. The estimated speed of transition indicates a very smooth movement between two of linear and nonlinear parts.

According to the estimation, the coefficients of the output gap and the lagged REER change respectively from -0.85 to -6.68 and from 0.18 to - 0.36 according to the model. Hence, by comparing the coefficients of the output gap and the lagged REER in the linear and nonlinear parts, our findings indicate that the output gap and the past level of REER have a significant effect on the misalignment in both parts, but their impact are stronger in the nonlinear model.

More importantly, despite a significant and negative influence of fixed exchange rate in the linear part (-0.028), once the misalignment crosses the threshold, the significant effect of it is not confirmed.

Table (3): Linearity Test and Tests of no remaining Non-Linearity

H0: Linear Model H1: PSTR model with at least one Threshold Variable (r=1)		
Test	**Statistics**	**pvalue**
Wald (LM)	W = 45.238	0.000
Fisher (LMF)	F = 11.255	0.000
LRT Tests (LRT)	LRT = 46.985	0.000
H0: PSTR with r = 1 H1: PSTR with at least r = 2		
Wald (LM)	W = 4.418	0.352
Fisher (LMF)	F = 1.011	0.401
LRT Tests (LRT)	LRT = 4.434	0.350

Notes: according to the mentioned tests, not only linear model is rejected but also it is showed that nonlinear model with r=1 is the best model.

Table (4): PSTR result for the level of misalignment

Linear Part		
Variable	**Estimated Parameters**	**T-statistics**
Mis(-1)	0.001	18.751
YGAP	-0.852	-3.300
LREER(-1)	0.186	2.374
DH	-0.028	-2.602
Nonlinear Part		
Mis(-1)	-0.001	-2.261
YGAP	-5.831	-4.535
LREER(-1)	0.179	2.371
DH	0.033	0.497
Gamma	0.200	
Threshold value	283500000	

Notes: the dependent variable is the estimated residuals of Eq. (14).

Furthermore, we investigate whether fixed exchange rate regimes help to reduce exchange rate volatility. As a consequence, the squared misalignment, which is a proxy for the volatility of the misalignment, is regressed on the exchange rate regime dummies. (Tables (5), (6)). As to the results, the fixed exchange rate not only has a significant but also a negative relationship with the volatility of misalignment in both linear and nonlinear regimes. However, its effect declines in the nonlinear part, i.e. its coefficient is -1.53 in linear part and -0.20 in the nonlinear one.

Table (5): Linearity Test and Tests of no remaining Non-Linearity

H0: Linear Model H1: PSTR model with at least one Threshold Variable (r=1)		
Test	**Statistics**	**pvalue**
Wald (LM)	W = 40.095	0.000
Fisher (LMF)	F = 19.842	0.000
LRT Tests (LRT)	LRT = 41.460	0.000
H0: PSTR with r = 1 H1: PSTR with at least r = 2		
Wald (LM)	W = 6.805	0.033
Fisher (LMF)	F = 3.161	0.043
LRT Tests (LRT)	LRT = 6.842	0.033

Notes: according to the mentioned tests, not only linear model is rejected but also it is showed that nonlinear model with r=1 is the best model.

Table (6): PSTR result for volatility of misalignment

Linear Part		
Variable	**Estimated Parameters**	**T-statistics**
Mis(-1)	0.001	14.727
DH	-1.539	-2.261
Nonlinear Part		
Mis(-1)	0.001	3.967
DH	1.330	0.260
Gamma	0.200	
Threshold value	283500000	

Notes: the dependent variable is the squared of misalignment that is estimated residuals of Eq. (14).

However, there is limited focus on linking fundamentals based real exchange rate misalignment and currency crisis. Using the extent of misalignment in relation to fundamentals could be an indicator to anticipate a crisis. In Fig. 1. We have visual inspection about the relationship between misalignment and the subsequent crisis.

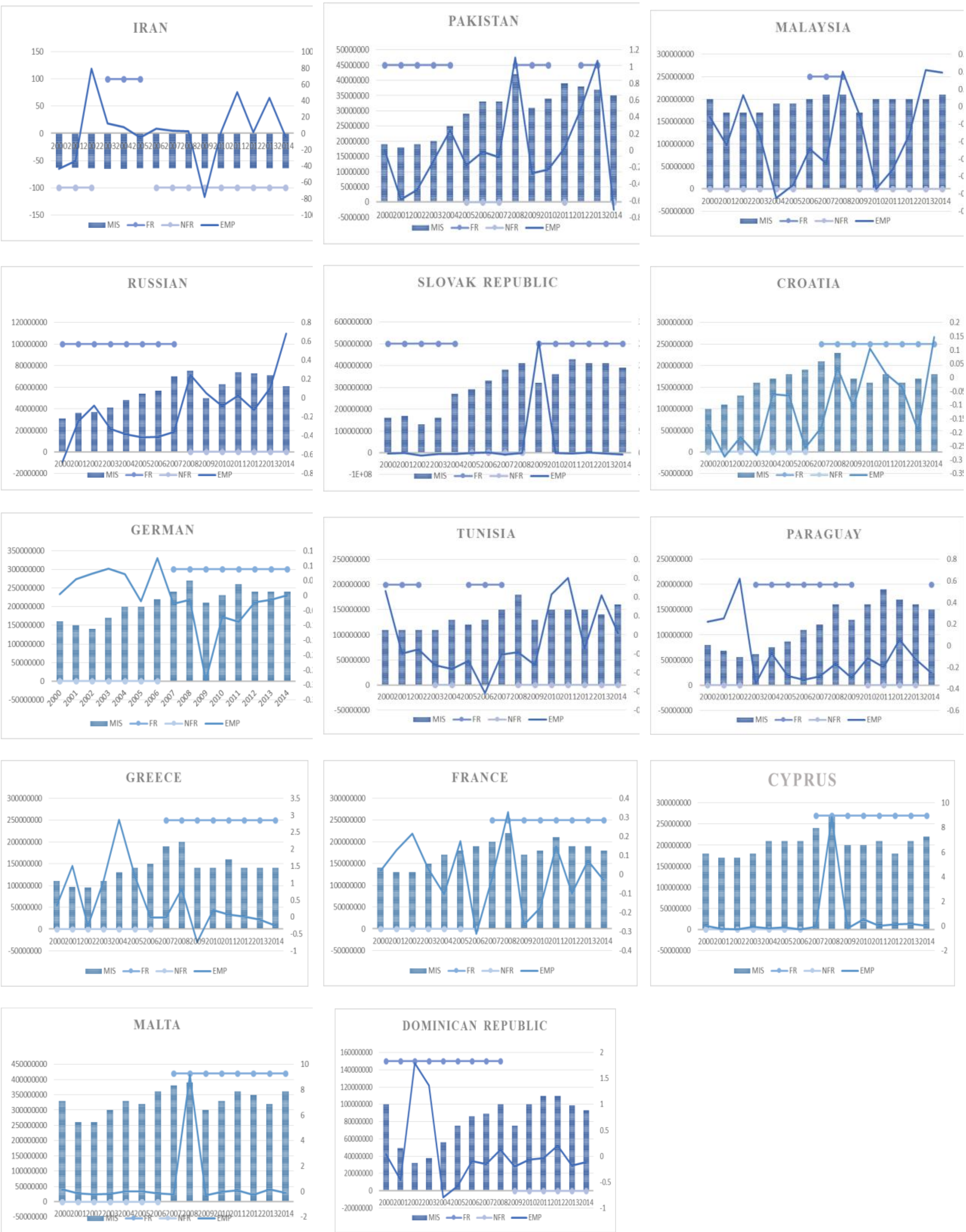

Fig.1. Misalignment and currency crises graphs for selected countries.

Notes: Shaded bars, lines, and the upper and lower axes indicate misalignments of the exchange rate, currency crises, floating exchange rate regime and non- floating ones, respectively. In this paper, we used exchange market pressure (EMP) as an indicator to show the market movements of the exchange rate and currency crisis. The definition of the EMP is related to the movements in exchange rates as well as in the reserves. By following Aizenman and Pasricha (2012), exchange market pressure is defined as,

$$EMP_t = \left(\frac{e_t - e_{t-1}}{e_t} - \frac{ir_t - ir_{t-1}}{ir_t}\right) \times 100 \quad (16)$$

with e_t denoting the local nominal exchange rate per 1 unit of the IMF's SDR (an increase denotes depreciation) and ir_t denoting international reserves (minus gold) in U.S. dollar in time t.

Intuitively, by examing the plots of misalignment, we find that misalignment correctly acts as a prelude to the currency crisis in the many cases. For instance, the misalignment was high, meaning the currency was overvalued immediately preceding the Iranian (2002) and the Slovakian (2009) crises.

Our results suggest that currencies in the most European countries especially emerging economies and in Asian regions as Malaysia, Pakistan, and Russia and from South American, Paraguay and Tunisia among African countries were substantially overvalued during the period prior to the currency crisis of 2008 leading to sharp depreciation. Besides, in all mentioned economies, the least misalignment was achieved in non-floating exchange rate regime.

The results for German, Malta, France, Cyprus, Ukraine, Dominican Republic and Paraguay suggest that misalignment increased from 2002 up to the onset of the crisis in 2008.

Following the severe financial crisis in 2006, Finland, German, Italy and Portugal dismantled their exchange rate anchor and switched to a regime of free float. However, except for Italy, in three others the highest misalignment has occurred in 2008 when the floating regime was dominated. As opposed to the mentioned countries, in some countries such as Luxembourg, Malta, Netherland, France, Cyprus, Greece, Croatia, Czech Republic, Hungary, Latvia, Romania, Malaysia, and Pakistan, after changing their exchange rate regimes from non-float to float one, they experience the currency crisis and the highest misalignment.

In the case of Iran which encountered the currency crises in 2002, 2011 and 2013, are shown in Fig. 1 and the Rial were overvalued before the financial crisis of 2002. More importantly, the minimum misalignment was achieved under the floating regime in 2003, but the maximum values of misalignment and exchange market pressure were shown under non-floating exchange rate regime, respectively in 2001 and 2002. As well as that, the recent currency crises occurred under non-floating rate regime in this economy.

Furthermore, our results show that there is declining evidence of crisis under a float in many economies of our dataset. What is more, the minimum values of exchange market pressure are seen more under floating regime. As a consequence, it can be confirmed that under a more flexible exchange rate regime, the vulnerability of the exchange rate regime to external shocks can decline.

4 Conclusion

Since real exchange rate fluctuations are important for competitiveness and the adoption of suitable fiscal and monetary policies, in this paper, we have studied the behavior of exchange rate misalignments under different exchange rate regimes by means of a panel smooth transition model. Based on 43 countries during the period of 1999-2014, we assess the misalignment of the real effective exchange rate (REER) from its equilibrium level, defined according to various macroeconomic fundamental on the type exchange rate regime.

Strong evidence of nonlinearity in the adjustment of the misalignment to fundamentals and the exchange rate regime is found. In particular, when the lagged misalignment is lower than its threshold level, the output gap and the lagged exchange rate level have less influence on the misalignment than when above the threshold. More importantly, only when the misalignment is low, fixed exchange rate regimes end in reducing the misalignment level and volatility. Our evidence shows that estimated misalignment could be a warning indicator of a currency crisis.

Appendix: Countries in the sample

Austria	Portugal	Ukraine	Samoa
Belgium	Spain	Algeria	Solomon Islands
Cyprus	Switzerland	Burundi	Dominican Republic
Finland	Croatia	Gambia	Guyana
France	Czech Republic	Malawi	Paraguay
Germany	Hungary	Nigeria	Trinidad and Tobago
Greece	Latvia	Sierra Leone	Uruguay
Ireland	Romania	Tunisia	
Italy	Slovak Republic	Iran	
Luxembourg	Armenia	Malaysia	
Malta	Georgia	Pakistan	
Netherlands	Russian Federation	Singapore	

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