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On the Determinants of Exchange Rate Misalignments

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Abstract. The literature on exchange rate misalignments (ERM) is very extensive as well as the literature on exchange rate determinants. To our knowledge, however, no study has analyzed the determinants of exchange rate misalignments. With the increasing movements of capital flows observed since the climax of the crisis, the ERM are became a crucial issue for policy makers. For a large panel of emerging and industrialized countries and on the period 1982-2008, we identify, empirically, the main determinants of ERM obtained by a Fundamental Equilibrium Exchange Rate (FEER) approach (Aflouk et al., 2010). Our analysis put forward trade openness, the nature of international specialization and exchange rate regime, combined with the degree of financial liberalization as determinant variables of ERM.

JEL Classification: F31; F32; O11.

Key Words: Exchange rate misalignments, trade openness, international specialization, exchange rate regime, financial liberalization.

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1. Introduction

As noted by Feldstein (2011), the return of risk appetite of investors, after the climax of the crisis in 2008, has leaded some emerging countries to reinstitute capital controls to stop the appreciation of their currencies because they fear the negative impact on growth of an increasingly overvalued currency.

These emerging countries experience a surge of capital inflows mainly because of favorable interest rate differentials with developed economies. This favorable interest rate differential is the outcome of economic policy lead by developed countries (mainly the United States) in order to sustain aggregate demand after the burst of the crisis in 2008.

In this general context, the objective of the paper is to analyze the main determinants of exchange rate misalignments (ERM) obtained by a FEER approach (Aflouk et al., 2010). The FEER is defined as the level of exchange rate which allows the economy to reach the internal and external equilibriums at the same time (Williamson, 1983). The internal equilibrium is defined as the full utilization of productive resources of a country without generating inflation pressures. The external equilibrium corresponds to a sustainable current account.

Davidson (2003) considers that the only analytical difference between Williamson's views and the arguments of market fundamentalists is the speed towards which the exchange rate will revert to its equilibrium value and achieve social optimum. We argue that the FEER approach can be a useful tool for policy makers to compute currencies realignments in an international monetary cooperation which aims to eliminate global imbalances.

In a first step, using a model of world trade, FEERs are estimated for the main currencies (the dollar, the euro, the yen, the yuan and the pound sterling). In a second step, FEERs can be estimated for each emerging country, using simple national models and linking the estimation of national FEERs to the multinational model's results to get bilateral misalignments of each currency.

The literature on ERM is very extensive as well as the literature on exchange rate determinants. To our knowledge, however, no study has analyzed the determinants of exchange rate misalignments. With the increasing movements of capital flows observed since the climax of the crisis, the ERM are became a crucial issue for policy makers. For a large panel of emerging and industrialized countries (the United States, the United-Kingdom, the Euro area, Japan, Korea, China, Brazil, India, Mexico, Argentina, Chile, Colombia,

Indonesia, Malaysia, Philippines, Thailand and Uruguay) and on the period 1982-2008, we identify, empirically, the main determinants of ERM. Our analysis put forward trade openness, the nature of international specialization and exchange rate regime, combined with the degree of financial liberalization as determinant variables of ERM.

The remainder of the paper is organized as follows. Section 2 describes the main characteristics of the trade model used to estimate ERM. Section 3 identifies three groups of variables which explain the ERM. Section 4 concludes.

2. Trade Model

2.1 The multinational model

The model describes the trade structure of the main countries or areas, namely, the United States, Japan, China, the Euro area, the United Kingdom and the Rest of the World using standard foreign trade equations: export and import volume equations, export and import price equations. Each country is successively treated as a residual and in that case export and import volumes are determined as residual of the equations of world trade equilibrium in value and in volume while their export and import prices are determined in the same manner as for other trading partners. We notice that this multinational specification gives a full account of interdependent effects in volume and prices of exports and imports of all countries. We incorporate a consumer prices equation to take into account the feedback effect between the consumer prices and the import prices. The real effective exchange rate is defined relatively to the consumption prices. Finally, the current account is defined as the trade balance augmented of debt service.

In this framework, the FEERs are defined as the real effective exchange rates compatible with the simultaneous realization of the internal and external equilibriums at medium term of each trading partner. The internal equilibrium means that actual output follows the potential output and the external equilibrium means that actual current account corresponds to the sustainable current account at medium term².

² See Jeong et al. (2010), Afrouk et al. (2010). The methodology used is a synthesis of previous works on the FEER (Borowski and Couharde, (2003), Jeong and Mazier, (2003)) and of the Symmetric Matrix Inversion Method (SMIM) recently proposed by Cline (2008). The external equilibrium is obtained thanks to econometrics estimates of structural current account balances (Lee et al., 2008). The internal equilibrium is defined as the state of full utilization of productive resources, without inflation pressures. For sake of simplification, a restrictive approach, limited to the measure of the potential output, is adopted.

On the whole, each multinational model comprises 35 endogenous variables (x , m , px , pm , pd for the six countries or areas and the five bilateral exchange rates e) for 35 equations (x , m , b for the five countries other than the residual one, px , pm , pd for the six countries and the two world trade equilibrium equations). The real effective exchange rates are calculated *ex post* using bilateral exchange rates and consumer prices.

2.2 The national model

For each emerging country, except China, it is possible to estimate an equilibrium exchange rate using a foreign trade model in which the world demand and the world trade prices are exogenous. It is not necessary for a relatively small country at the world scale to use a multinational model to estimate equilibrium exchange rates (Jeong and Mazier, 2003). The equations specify the trade volume and price equations for a small country facing world economy. Solving this simplified model in logarithmic differential form gives r , the misalignment³ in real effective terms:

$$r_i = \left[\frac{\left(\left(b_i / \left[\mu_i T_i (1 - \sigma_{petxi} - \sigma_{xi}) \right] \right) + \eta m_i di_i - \eta x_i d_i^* \right)}{\left((1 - \alpha x_i) \varepsilon x_i + \varepsilon m_i \alpha m_i + \alpha x_i - \alpha m_i \right)} \right] \quad (1)$$

Where b is the difference between the observed current account and the equilibrium one, as percentage of GDP, d^* is the world demand in volume and di is the internal demand in volume, written in logarithmic differential compared with the equilibrium, $\sigma_{petx} = EP_{pet}M_{pet}/PXX$ is the ratio of net oil imports on non-oil exports and $\sigma_x = iEF/PXX$ is the ratio of foreign debt service on non-oil exports, μ the openness ratio and T the ratio of export to import.

The FEER approach focuses on the real effective exchange rates. However, the nominal bilateral exchange rate against the dollar of each currency can be more intelligible. We can find out e , the degree of misalignment in bilateral nominal term; the partner countries' misalignments are given by the previous multinational model:

$$e_i = r_i - \sum_{j \neq i} \lambda_{ij} (px_j - e_j) \quad (2)$$

³ It seems important to recall that ERM is defined as the gap, in percentage, between observed exchange rates and equilibrium exchange rates.

We can also compute the effective ERM based on consumer prices:

$$rc_i = (1 - \alpha m_i \mu_i) r_i + \sum_{j \neq i} \nu_{ij} (pd_j - e_j) - \sum_{j \neq i} \lambda_{ij} (px_j - e_j) \quad (3)$$

Where px is the global export price and pd is the consumer price.

3. Determinants of ERM

Panel unit root tests conducted on the series of misalignments for the 17 countries on the 1982-2008 period show that these series follow a stationary process. Furthermore, ERM, measured in absolute value, can be explained by three groups of variables.

- First, the degree of openness, measured as the half-sum of export and import in percentage of the GDP, has a negative impact on the misalignments. Indeed higher trade openness increases the impact of a variation of price competitiveness on current account. Consequently, a smaller variation of exchange rate is necessary to reach the external equilibrium, which implies smaller misalignments.

- Second, the nature of international specialization has a strong influence on the misalignments' amplitude. This can be described through two kinds of indicators, the comparative advantage in manufactured goods on one hand, the regional specialization on the other. Higher comparative advantages in manufactured goods, like in many East Asian countries, mean stronger constraints on firms to preserve competitiveness, compared with the case where international trade is more specialized in raw materials, like in many Latin American countries. This external constraint limits the amplitude of exchange rate misalignments which can be supported at medium term. As a consequence, a negative relation is expected between manufacturing comparative advantage and misalignment. Regional specialization, measured as the share of exports towards the regional area (East Asia, South America and North America) in percentage of total exports, is another explaining variable of misalignments, also with a negative impact. Stronger regional integration implies more price competition, which limits misalignments.

- Third, exchange rate regime, combined with the degree of financial liberalization, is the last set of explaining variables. In a simplified approach, the IMF de jure classification between fixed, intermediate and floating regimes can be used. Fixed exchange rates regime leads to larger misalignments. Conversely, floating regime limits misalignments. If a value of +1 is given to fixed regimes, zero to intermediate ones and -1 to floating regimes, a positive

relation is expected between the exchange rate regime indicator and the amplitude of misalignment. The relative financial openness, based on a de jure measure of capital account openness (the Chinn-Ito index, 2008), is the second relevant factor. Higher financial liberalization facilitates monetary adjustments, which reduces exchange rates misalignments, while capital controls have the opposite effect. A negative relation is therefore expected between the financial openness indicator and misalignment. Last, the two previous variables, the exchange rate regime indicator and the financial openness, can be combined in a single indicator with a positive impact, as their interaction can reinforce each other. A floating regime with financial liberalization leads to smaller misalignments, while a fixed regime combined with financial liberalization, like in Argentina during the 1990s, induces large misalignments.

On the whole, equation (4) summarizes the different determinants of exchange rate misalignments with the variables defined as follow: *AERM*, absolute exchange rate misalignment in real effective terms; *OPEN*, trade openness measured as the half sum of export and import in percentage of GDP; *ACRMAN*, indicator of comparative advantage in manufactured goods, given by the CHELEM databank; *XREG*, indicator of regional specialization, equal to the share of exports towards the associate region, in percentage of total exports; *ERR*, exchange rate regime indicator, equal to +1 for fixed regime, 0 for intermediate one and -1 for floating one, according to the de jure IMF classification; *RKAOPEN*, relative financial openness, compared with the weighted world average and based on the Chinn-Ito index (2008). All the sources of the variables are given in appendix 1.

$$AERM_{it} = \gamma_i + \gamma_t + \delta_0 + \delta_1 OPEN_{it} + \delta_2 ACRMAN_{it} + \delta_3 XREG_{it} + \delta_4 ERR_{it} + \delta_5 RKAOPEN_{it} + \delta_6 ERR * RKAOPEN_{it} + \varepsilon_{it} \quad (4)$$

The equation is estimated with panel data on the period 1982-2008 for the emerging and industrial countries. The results of unit root tests are presented in appendix 2. The null hypothesis of the presence of unit root is rejected for all the series, except for the trade openness (*OPEN*) and the comparative advantage indicator (*ACRMAN*), which must be written in first difference in theory. The estimated coefficients of equation (4) are given in table 1. They are all significant with the predicted signs. The Fisher tests indicate the absence of country fixed effects for all specifications. They don't improve the quality of the adjustment, mainly because countries' specificities are already present in the explanatory variables. As shown by the White heteroskedasticity test, the residuals are not homoscedastic. In order to correct this problem, we use weighted least square estimators. In addition, we run a weighted two-stage least regression in order to deal with eventual problems of endogeneity. The results are largely similar (see appendix 3).

Table 1: Determinants of the real effective misalignments in absolute value

	<i>WLS Pooled</i>	<i>WLS Pooled</i>
<i>Constant</i>	0.24*** (34.93)	0.15*** (35.94)
<i>OPEN</i>	-0.34*** (-20.11)	-
<i>ΔOPEN</i>	-	-0.26*** (-4.67)
<i>ACRMAN</i>	-0.0008*** (-19.10)	-
<i>ΔACRMAN</i>	-	-0.001*** (-6.28)
<i>XREG</i>	-0.09*** (-5.79)	-0.03*** (-3.13)
<i>ERR</i>	0.04*** (9.36)	0.03*** (17.50)
<i>RKAOPEN</i>	-0.01*** (-6.80)	-0.009*** (-6.35)
<i>ERR*RKAOPEN</i>	0.01*** (6.97)	0.02*** (19.50)
<i>Adjusted R squared</i>	0.82	0.91
<i>F-Test (Pooled vs F.-E.)</i>	0.26	0.42
<i>White Test</i>	121.63	123.32
<i>Number of cross-sections</i>	17	17
<i>Number of Observations</i>	459	442

The t-statistics are in parenthesis. The symbol *** indicates statistical significance at the 1 percent level. Source: authors' estimates.

Beyond these first results on the determinants of exchange rate misalignments, analysis can be developed at the level of three groups of countries rather homogenous by their characteristics, the BRICs (Brazil, India and China) as the largest emerging countries with smaller degree of openness, the East Asian countries more specialized in manufactured products and, last, the Latin American countries with more often flexible exchange rate regimes and increasing capital account openness.

4. Conclusion

In a context of increasing movements of capital flows observed since the climax of the crisis (especially capital inflows towards emerging countries), the objective of the paper was to analyze the main determinants of ERM obtained by a FEER approach (Aflouk et al., 2010).

For a large panel of emerging and industrialized countries and on the period 1982-2008, we identify, empirically, the main determinants of ERM. Our analysis put forward trade openness, the nature of international specialization and exchange rate regime, combined with the degree of financial liberalization as determinant variables of ERM.

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Appendix 1: Sources

<i>Variable</i>	<i>Source</i>
<i>ACRMAN</i> , <i>XREG</i> , <i>OPEN</i>	<i>CHELEM</i> , <i>CEPII's Database</i> , 2009, 2010
<i>RKAOPEN</i>	<i>Chinn and Ito Index</i> 2008, <i>World Economic Outlook</i> , IMF, April 2010
<i>ERR</i>	<i>Annual Report on Exchange Arrangements</i> <i>and Exchange Restrictions</i> , IMF

Appendix 2: Panel unit root test for the determinants of the real effective misalignments in absolute value

	<i>Level</i>	<i>First Difference</i>
	<i>IPS</i>	<i>IPS</i>
<i>AERM</i> ¹	-6.42***	-18.08***
<i>ERM</i> ²	-6.62***	-14.99***
<i>OPEN</i>	4.62	-12.25***
<i>ACRMAN</i>	3.80	-12.60***
<i>XREG</i>	-2.15**	-2.97***
<i>RKAOPEN</i>	-12.45***	-13.00***
<i>EER</i>	-5.13***	-6.46***

Notes: (1) The acronym AERM stands for the absolute value of exchange rate misalignment in real effective terms. Notes: (2) The acronym ERM stands for exchange rate misalignment in real effective terms. The symbols **, *** indicate statistical stationarity at the 5 percent and 1 percent levels, respectively. Source: authors' calculations.

Appendix 3: Determinants of the real effective misalignments in absolute value with a two-stage least square estimator

	<i>WTSLS Pooled</i>
<i>Constant</i>	0.24*** (33.87)
<i>OPEN</i>	-0.34*** (-20.28)
<i>ACRMAN</i>	-0.0008*** (-20.18)
<i>XREG</i>	-0.09*** (-5.66)
<i>ERR</i>	0.04*** (7.26)
<i>RKAOPEN</i>	-0.01*** (-7.92)
<i>ERR*RKAOPEN</i>	0.01*** (6.57)
<i>Adjusted R squared</i>	0.83
<i>F-Test (Pooled vs F.-E.)</i>	0.43
<i>White Test</i>	134.81
<i>Number of cross-sections</i>	17
<i>Number of Observations</i>	442

The t-statistics are in parenthesis. The symbol *** indicates statistical significance at the 1 percent level. Dependent variables are instrumented by their first lagged values. Source: authors' estimates.