EXCHANGE RATE DETERMINATION IN HIGH FRAGILE EMERGING COUNTRIES

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Abstract

There exist exchange rate determination problem together with removing the restrictions on financial capital movements after 1970's. In the economics literature various type of models that are purchasing power parity, Mundell Fleming Model, Sticky Price Monetary Approach, Flexible Price Monetary Approach and Hibrit Model are explicated and tested for countries' economies. There may be more threats for the high fragile emerging countries. Argentina, Russia and Chile are included to the "fragile five" countries i.e. Turkey, Brazil, India, Indonesia and South Africa.

Central Bank of USA (FED) announced to reduce the bond purchases and applied this issue gradually. Mostly emerging countries but also others suffer damage to their economies because of this argument. In this study the fragile countries that are mentioned above are examined whether their exchange rates behave like one of the determination model in the 1980-2011 periods. Our hypothesis is these countries behave like ***Flexible Price or Sticky Price Monetary Model*** consistent with the literature. Unit root test and cointegration are used to test the hypothesis.

Keywords: Exchange rate determination, fragile countries, cointegration

Introduction

In the last decade there is an enormously increasing interest to cointegration analysis on monetary model of the exchange rates determination. The studies in the literature have mainly data from the developed countries. From the perspective of the emerging markets, the difficulty with the theoretical construct model may be that it does not have a long history like it does in the major industrialized countries**(**Bahrumshah, Mohd and Ahn, 2009:1762)

Most of the authors dealing with determination of exchange rate using monetary models have found significant and successful results(Frankel,1979; Hacche and Townend, 1981; Hooper and Morton, 1982; Hoffman and Schlagenhauf, 1983; Frankel, 1984; Macdonald and Taylor, 1991; Macdonald, 1999; Tawadros,2001; Westerlund and Basher, 2006; Chin, Azali and Matthews, 2007; Uz and Bildir, 2009). Some of them found that monetary model is not consistent with data(Djong and Husted, 1993; Dutt and Ghost, 2000; Alteville, 2006; Bahrumshah, Mohd and Ahn, 2009). Çavuşoğlu (1997) and Korap (2008) indicate that there may be a long run relationship but there is no consistent monetary model. Basher and Westerlund (2008) differently use the structural breaks and find a successful monetary model. Literature review up to date is given in Table 1

Table 1. Literature Review

Authors	Country	Period	Methodology	Result
Dornbusch (1976b)	------	-----	theoretical	
Mussa (1976)	------	-----	theoretical	
Frankel (1979)	Germany, USA	1974:M7 - 1978:M2	OLS	He found consistent results comparing with Dornbusch.
Hacche and Townend (1981)	USA, France, Germany, Japan and İtaly	1972-1980	OLS	They found negative relationship between domestic interest rate and exchange rate.
Hooper and Morton (1982)		1973:Q2 - 1978:Q4	OLS	They found consistent results.
Hoffman and Schlagenhauf (1983)	France, England, Germany, USA	1974:M6 – 1979:M12	ARMA	Monetary model is consistent with the current exchange rate movements.
Frankel (1984)	Germany, France, England, Japan and Canada	1974:M1- 1981:M6	Cochrane -Orcutt	Interest rate differential is found consistent for the aggregate data.
Macdonald and Taylor (1991)	Germany, USA, Japan and England	1976:M1 – 1990:M12	OLS	They asserted that monetary model could be used as a long run exchange rate determination model.
Djong and Husted (1993)	Germany, France, Canada, Japan, Holland and England	1974:1 - 1988:12	Cointegration	Their test fails for the monetary model.
Çavuşoğlu (1997)	Turkey, USA	1984:Q1 – 1996:Q2	Cointegration	He found a cointegration relationship but the model was not sufficient to explain the exchange rate movements.
Macdonald (1999)	Japan, Germany, USA	1973:Q2 – 1993:Q4	VECM	Monetary model is more successful then the PPP approach.
Dutt and Ghost (2000)	Japan, USA	1959:M1 – 1996:M12	KPSS, Johansen - Juselius	They said that Monetary approach is not a long run equilibrium model.
Tawadros (2001)	Australia, USA	1984:M1 – 1996:M1	Dynamic VECM	Dynamic vector error correction model is successful for both forecasting and estimating.
Altaville (2006)	Euro Zone, USA	1979:Q1 – 2004:Q4	Cointegration	There is an instable relationship between the variables.

Westerlund and Basher (2006)	18 OECD countries	1973:Q1 – 1997:Q1	Panel Cointegration	Monetary model is found successful.
Chin, Azali and Matthews (2007)	Malaysia, USA	1981:Q1 – 2003:Q1	Cointegration	Monetary model is found successful.
Basher and Westerlund (2008)	18 OECD countries	1973:Q1- 1997:Q1	Cointegration	Monetary model is found successful with structural breaks.
Korap (2008)	Turkey, USA	1987:Q1 – 2006:Q4	Cointegration	Nominal exchange rate is cointegrated with the variables that are offered in the economics theory.
Bahrumshah, Mohd and Ahn (2009)	Malaysia, USA	1971:Q1 – 2006:Q3	Cointegration	Macroeconomic factors don't affect the exchange rate in the long run.
Chin, Habibullah and Azali (2009)	Indonesia, Malaysia, Philippines, Singapore, Thailand	1981:Q1- 1994:Q4	Cointegration, VAR	In the financial liberalization period divisia money has more consistent results than basic aggregate money.
Uz and Bildir (2009)	Argentina, Brazil, Taiwan and Turkey	1986:Q1– 2006:Q4	Cointegration	Interest rate is more sensitive than the other variables in the vector error correction model for determination of exchange rate.
Uz and Ketenci (2009)	Latvia, Poland, Slovenia, Turkey, Hungary and Slovakia	1993:Q1 – 2005:Q4	Cointegration	There exist no cointegration. However, coefficients in the monetary model are statistically significant.

The outline of the remaining parts of the paper is as follows. The data set is described and empirical results are discussed in data and methodology section, unit root and cointegration test results are given in empirical results section, and final section presents the some concluding remarks.

Data and Methodology

All data are gathered from International Financial Statistics online services reported by the International Monetary Fund (IMF) and World Bank data services. This publication has annual data for USA and 5 fragile countries from 1980 to 2012.

Following MacDonald & Taylor (1994), in Model 1, we have exchange rate (ER), domestic money supply (M), foreign money supply (M^*), domestic GDP (Y), foreign GDP (Y^*), domestic interest rate (i_s) and foreign interest rate (i_s^*) variables.

$$ER = \alpha + \beta_1 M + \beta_2 M^* + \gamma_1 Y + \gamma_2 Y^* + \varphi_1 i_s + \varphi_2 i_s^* + \varepsilon \quad (1)$$

The variables used in this paper are real gross domestic product, money supply, discount rate (real interest rate), and exchange rate. For a consistent monetary model we have to have $\beta_1 = 1, \beta_2 = -1, \gamma_1 < 0, \gamma_2 > 0, \varphi_1 > 0, \varphi_2 < 0$.

Empirical Results

For fragile 5 countries' macroeconomic variables unit root test results are given in Table 2.

Table 2.ADF Unit Root Test Results

Series	W Statistics(Probabilities)		
	Level	**First Difference**	**Results**
USA_GDP	-2.748(0.225)	-3.626(0.043)	I(1)
USA_M	-2.822(0.200)	-7.129(0.000)	I(1)
USA_i	-2,815(0.067)	-4.921(0.002)	I(1)
TR_GDP	-1.480(0.815)	-5.553(0.000)	I(1)
TR_M	-1.452(0.824)	-9.625(0.000)	I(1)
TR_i	-1.802(0.680)	-5.639(0.000)	I(1)
TR_ER	-1.958(0.600)	-5.114(0.001)	I(1)
BR_GDP	-0.815(0.953)	-5.766(0.000)	I(1)
BR_M	-1.347(0.593)	-5.417(0.000)	I(1)
BR_i	-3.398(0.069)	-5.333(0.000)	I(1)
BR_ER	-1.651(0.749)	-5.541(0.000)	I(1)
END_GDP	0.309(0.997)	-3.896(0.024)	I(1)
END_M	-1.397(0.147)	-8.575(0.000)	I(1)
END_i	-2.554(0.302)	-6.112(0.000)	I(1)
END_ER	-1.898(0.632)	-5.344(0.000)	I(1)
IND_GDP	0.062(0.995)	-2.786(0.212)	I(2)*
IND_M	-0.635(0.433)	-9.026(0.000)	I(1)
IND_i	-1.542(0.793)	-4.087(0.015)	I(1)
IND_ER	-3.232(0.098)	-6.909(0.000)	I(1)
SA_GDP	-1.193(0.894)	-4.600(0.004)	I(1)
SA_M	-1.618(0.098)	-6.270(0.000)	I(1)
SA_i	-0.807(0.357)	-6.648(0.000)	I(1)
SA_ER	-2.984(0.151)	-5.801(0.000)	I(1)

Note: The critical values for the ADF are from Davidson and MacKinnon (1993). (with constant and trend) Lag length in [ ]. The critical values for the KPSS are from Kwiatkowski et al.(1992). The critical values are 0.216, 0.146, 0.119 for 1%, 5% ve % 10 respectively.

Table 2 suggest that all of the variables are not stationary on the levels, all the variablesare integrated of the same order, i.e. I(1) except gross domestic product of India. Because of this we exclude India from the analysis.

All variables are seasonally adjusted by E-views 6-beta_X11. Lag length is found 1 as to Schwarz criteria. Using this lag length, Johansen-Juselius test results for all 4(Turkey, Indonesia, South Africa, Brasil) countries follow.

Table 3 Johansen-Juselius Cointegration and Normalized Cointegration Coefficients for Turkey

Eigenvalue	**Trace Test(TT)**	**0.05 Critical Value**	**Prob.****	**Hypothesized No. of CE(s)**
0.817550	154.6906	125.6154	0.0003	None *
0.724579	101.9510	95.75366	0.0175	At most *1
0.610290	61.97784	69.81889	0.1797	At most 2
0.404518	32.76491	47.85613	0.5698	At most 3
0.254186	16.69501	29.79707	0.6625	At most 4
0.216337	7.603377	15.49471	0.5087	At most 5
0.001493	0.046333	3.841466	0.8295	At most 6

Eigenvalue	Max–Eigen Statistics	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.817550	52.73966	46.23142	0.0089	None *
0.724579	39.97312	40.07757	0.0514	At most 1
0.610290	29.21293	33.87687	0.1630	At most 2
0.404518	16.06990	27.58434	0.6598	At most 3
0.254186	9.091638	21.13162	0.8250	At most 4
0.216337	7.557044	14.26460	0.4255	At most 5
0.001493	0.046333	3.841466	0.8295	At most 6

*** denotes rejection of the hypothesis at the 0.05 level**
****MacKinnon-Haug-Michelis (1999) p-values**

Normalized cointegrating coefficients (standard error in parentheses)

TR_ER	TR_GDP	USA_GDP	TR_M2	USA_M2	TR_I	USA_I
1.000000	0.001544	-0.009080	0.015745	-0.066185	-0.025463	0.130290
	(0.01232)	(0.01271)	(0.00175)	(0.01948)	(0.00719)	(0.03583)

Turkey cointegration results indicate that there is a long run relationship but no statistically significant monetary model totally.

Table 4 Johansen-Juselius Cointegration and Normalized Cointegration Coefficients for Brazil

Eigenvalue	Trace Test(TT)	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.925980	181.2019	125.6154	0.0000	None *
0.755471	103.0994	95.75366	0.0142	At most 1*
0.608654	60.84677	69.81889	0.2103	At most 2
0.430199	32.70186	47.85613	0.5733	At most 3
0.332664	15.82779	29.79707	0.7243	At most 4
0.110787	3.693938	15.49471	0.9267	At most 5
0.005696	0.171370	3.841466	0.6789	At most 6

Eigenvalue	Max–Eigen Statistics	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.925980	78.10257	46.23142	0.0000	None *
0.755471	42.25262	40.07757	0.0280	At most 1*
0.608654	28.14491	33.87687	0.2069	At most 2
0.430199	16.87407	27.58434	0.5908	At most 3
0.332664	12.13385	21.13162	0.5345	At most 4
0.110787	3.522568	14.26460	0.9060	At most 5
0.005696	0.171370	3.841466	0.6789	At most 6

*** denotes rejection of the hypothesis at the 0.05 level**
****MacKinnon-Haug-Michelis (1999) p-values**

Normalized cointegrating coefficients (standard error in parentheses)

BR_ER	BR_GDP	USA_GDP	BR_M2	USA_M2	BR_I	USA_I
1.000000	0.141179	-0.120333	0.001670	0.016575	-0.000215	0.235089
	(0.01138)	(0.00949)	(0.00011)	(0.02432)	(3.4E-05)	(0.02954)

Brazil cointegration results indicate that there is a long run relationship but no statistically significant monetary model.

Table 5 Johansen-Juselius Cointegration and Normalized Cointegration Coefficients for Indonesia

Eigenvalue	Trace Test(TT)	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.950196	249.4875	125.6154	0.0000	None *
0.829462	156.4982	95.75366	0.0000	At most 1*
0.757202	101.6655	69.81889	0.0000	At most 2*
0.609889	57.78414	47.85613	0.0045	At most 3*
0.501099	28.60310	29.79707	0.0682	At most 4
0.179955	7.047337	15.49471	0.5721	At most 5
0.028522	0.897048	3.841466	0.3436	At most 6

Eigenvalue	Max–Eigen Statistics	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.950196	92.98931	46.23142	0.0000	None *
0.829462	54.83274	40.07757	0.0006	At most 1 *
0.757202	43.88135	33.87687	0.0023	At most 2*
0.609889	29.18104	27.58434	0.0309	At most 3*
0.501099	21.55576	21.13162	0.0436	At most 4*
0.179955	6.150290	14.26460	0.5940	At most 5
0.028522	0.897048	3.841466	0.3436	At most 6

*** denotes rejection of the hypothesis at the 0.05 level**
****MacKinnon-Haug-Michelis (1999) p-values**

Normalized cointegrating coefficients (standard error in parentheses)

END_ER	END_GDP	USA_GDP	END_M2	USA_M2	END_I	USA_I
1.000000	127.1493	-291.6703	-167.6387	-269.3884	234.1613	795.7156
	(10.4584)	(10.5622)	(11.1681)	(23.2670)	(15.4374)	(57.3209)

Indonesia cointegration results indicate that there is a long run relationship but no statistically significant monetary model.

Table 6 Johansen-Juselius Cointegration and Normalized Cointegration Coefficients for South Africa

Eigenvalue	Trace Test(TT)	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.858658	189.6357	125.6154	0.0000	None *
0.749192	128.9820	95.75366	0.0000	At most 1*
0.652392	86.10696	69.81889	0.0015	At most 2*
0.564263	53.34986	47.85613	0.0140	At most 3*
0.473858	27.59762	29.79707	0.0878	At most 4
0.219501	7.689922	15.49471	0.4991	At most 5
0.000240	0.007450	3.841466	0.9308	At most 6

Eigenvalue	Max–Eigen Statistics	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)
0.858658	60.65367	46.23142	0.0008	None *
0.749192	42.87508	40.07757	0.0236	At most 1*
0.652392	32.75710	33.87687	0.0676	At most 2
0.564263	25.75224	27.58434	0.0842	At most 3
0.473858	19.90769	21.13162	0.0734	At most 4
0.219501	7.682471	14.26460	0.4119	At most 5
0.000240	0.007450	3.841466	0.9308	At most 6

*** denotes rejection of the hypothesis at the 0.05 level**
****MacKinnon-Haug-Michelis (1999) p-values**

Normalized cointegrating coefficients (standard error in parentheses)

SA_ER	SA_GDP	USA_GDP	SA_M2	USA_M2	SA_I	USA_I
1.000000	0.145710	-0.178409	0.233907	-0.206266	0.131413	0.465019
	(0.02011)	(0.02153)	(0.03026)	(0.04185)	(0.04280)	(0.09216)

South Africa cointegration results indicate that there is a long run relationship but no statistically significant monetary model.

Conclusion

This paper's aim is to analyze relationship between exchange rate and economic indicators(GDP, short term interest rate, money supply) using time series data for fragile 5 countries over the period 1980-2012 within a multivariate framework. Exchange rate determination problem is going to be obvious after removing the restrictions on financial capital movements after 1970's. Most of the emerging countries also contributed this process. However, a wealthy financial capital movement needs strong social, legal and political stability. The countries that have problems are going to be categorized. So fragile 5 countries i.e. Turkey, Brazil, India, Indonesia and South Africa are like that. In the exchange rate literature trend is examining the emerging countries for determination. This study observes

the more specific group among the emerging countries. It is found that there exist a cointegration between the exchange rate and the money supply, short term interest rate and gross domestic product. However, neither sticky price nor flexible price monetary models are consistent and successful for 5 fragile countries. For the further studies, together with used economic indicators, one may use other macroeconomic indicators like inflation or long term interest term. Also it may be good to compare developing countries data with industrialized ones.

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