Real Exchange Rate Deviation in the Pre and Post Financial Crisis

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Abstract

This article aims at investigating whether financial crisis have had significant impact on deviation of real exchange rate in three selected groups of (developed, developing and resource based) countries. To do that, we estimated a cross country basic real exchange rate determination model for 1990-2012 and extracted historic trend of real exchange rate deviation. The results imply that financial crisis has had significant but dissimilar impact on real exchange rate movement (deviation) in the selected countries. But the essence of impacts in developed countries has been much sensible than in developing and resource based (oil exporting) countries.

Key Words: Real Exchange Rate, Deviation, Financial Crisis, Developed/ Developing and Oil exporting Countries.

JEL classification: O24, F31, H12

Introduction

Historically, recession has been known as a significant decline in activity across the economy, lasting longer than a few months. It is observable in industrial production, employment, real income and wholesale-retail trade. The review of economic history of the world implies different economic recessions during last decades such as: The Post-War Recession (1948 -9), The Oil Crisis Recession (1973 -1975), The Gulf War Recession (1990 -91) and recent financial recession on 2008-9. The recent financial crisis spread from the United States to the rest of the world quickly. Before the crisis, there was a fairly widespread consensus on that the large global imbalances in US current account positions and underlying capital movement ultimately require a large depreciation of the US dollar in order to improve US competitiveness and hence a sustainable reduction in the US trade deficit, and the fear was that such an adjustment may be large and disruptive.

However, as Fratzscher (2009) discussed, one of the striking characteristics of the crisis has been a substantial appreciation, rather than depreciation, of the US dollar which could be due to exchange rate manipulation (depreciation) by the majority of countries against US dollar. It seems that besides fiscal, monetary and commercial policies, countries' central banks have preferred to intervene in foreign exchange markets in order to achieve a variety of overall economic objectives such as: controlling inflation, maintaining competitiveness, or maintaining financial stability. The precise objectives of policy and how they are reflected in currency manipulation depend on a number of factors, including the stage of a country's development, the degree of financial market development and integration, and the country's overall vulnerability to shocks. This view is particularly rooted in the situation experienced in the 1930s, during which, countries devalued their currencies to boost exports, in response to widespread high unemployment and negative economic conditions.

Behaviors of countries' foreign exchange markets imply a considerable deviation from equilibrium level but in different manners. It seems that economic authorities have manipulated their nominal exchange rate in order to meet their national economic needs such as trade balance improvement, especially during recent financial crisis.

But it seems that nominal exchange rate devaluation can be considered as necessary condition for competitiveness improvement or trade deficit elimination and this policy must be supported by relative price (of tradable and non-tradable) maintenance as sufficient condition. Real exchange rate entails these two (necessary & sufficient) conditions as well. For instance, if a country implemented nominal exchange rate devaluation policy during recent financial crisis but it couldn't eliminate domestic (compared to global) inflation and consequently the real exchange rate wasn't improved, the policy had no significant gain for it. So the question is: "What were the impacts of countries macroeconomic performances during recent financial crisis on real exchange rate? To answer this question the paper is to provide a quantitative assessment of nature and historic trend of real exchange rate deviation over the world focusing on the periods just before and after recent crisis. To do that, and in order to consider the intrinsic difference of countries, we estimate a cross country basic real exchange rate determination model, using three distinct samples of (developing, developed and resource based) countries for 1990-2012.

The rest of the paper is organized as follows: The following section presents review of literature on real exchange rate determination and deviation. Section 3 reports the data and estimation. Finally, Section 4 illustrates the empirical evidence for sample countries and then presents the conclusion.

2 Review of Literature

2-1- Empirical Background

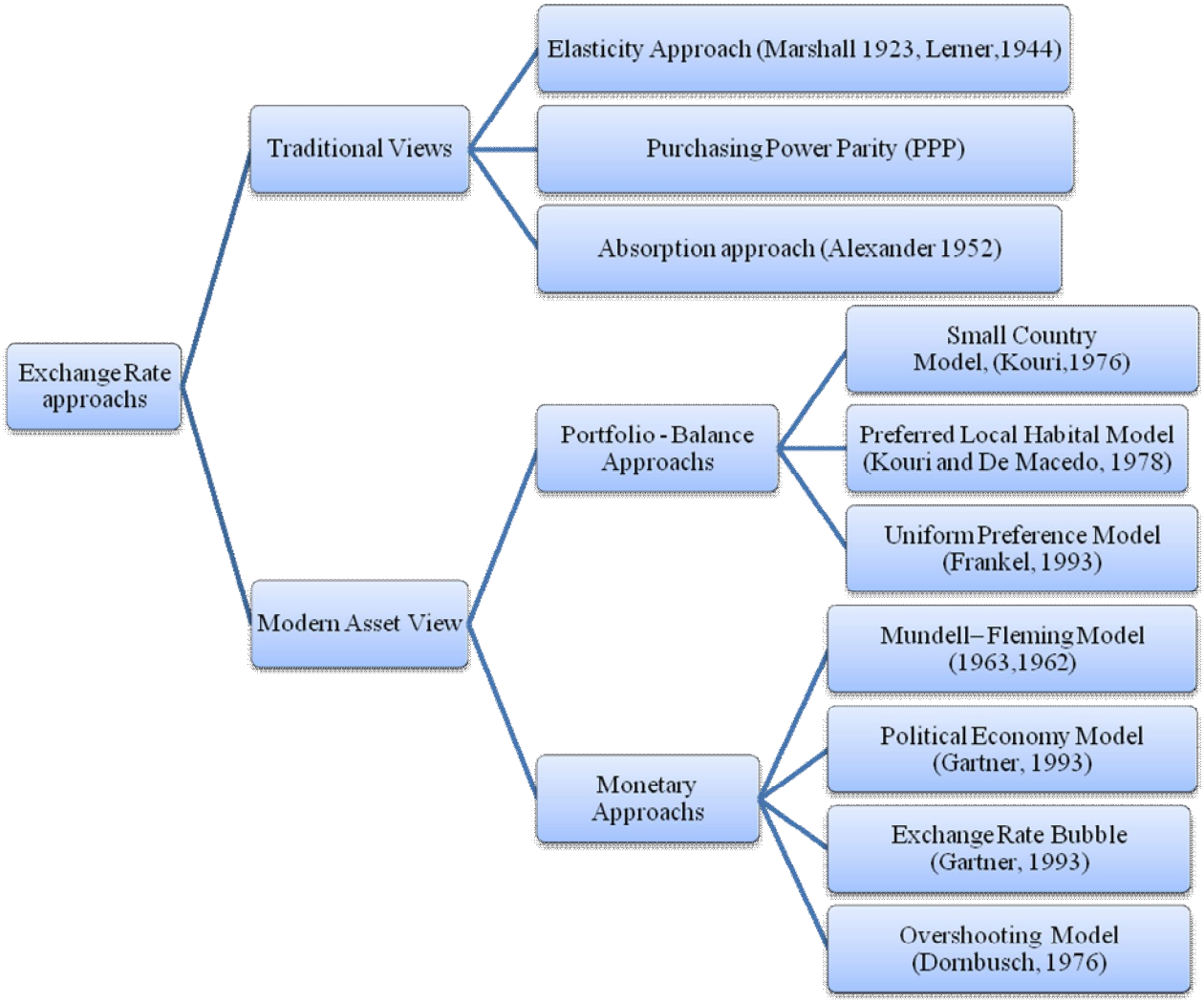
Due to the pivotal role of exchange rate in linking the domestic economy to the global economy, countries often try to manage their exchange rate in a desired band due to their targets and preferences. Behaviors of countries' foreign exchange markets imply a considerable deviation from equilibrium level of the exchange rate especially in developing countries. It seems that economic authorities have accepted the disadvantages of misaligned exchange rate in favor of their national preferences. For instance, some countries set their exchange rate undervalued to stimulate their current account, a phenomenon known as "Beggar thy Neighbor" or "Currency War", which has recently been intensified in international trade relations. On the other hand, some countries set their exchange rate overvalued to prevent global inflation penetrating into their domestic economies.

During recent years, a number of studies have tried to estimate the equilibrium exchange rate or its deviation in countries (Gan and et al. (2013), Keblowski and Welfe (2010), Chen and MacDonald (2015)). For instance, Buchs (2005) showed that the exchange rate in Brazil has been slightly overvalued; or Su, Tsangyao, and Chang (2011) stated that Purchasing Power Parity (PPP) is valid only for some Latin American countries, whereas the majority of the exchange rates in these countries do not follow an equilibrium rule. Similarly, some other researchers including Giannellis and Koukouritakis (2013), Vieira and MacDonald (2012), Aflouk, Jeang, and Saadaoui (2010), Saadaoui (2015), Omojimite (2011) and Boero and et al.(2015) have tried to put emphasis on fundamentals and to quantify absolute value of deviation in order to understand the essence or historic trend of exchange rate deviations.

The recent financial crisis has caused highly volatile shocks globally across all asset classes, including foreign exchange. Many researchers have classed this crisis as one more severe than the Great Depression of the 1930s, in terms of its longevity and the extent of severity in economic and social costs, and also in policy interventions by governments around the globe (Choudhry and Hassan, 2015). This provides sufficient motivation for analyzing the impact of the financial crisis on different territories, mostly on stock and foreign exchange markets. The review of literature involves a considerable number of studies which have discussed topics such as: the exchange rate volatility during the current financial crisis to (Fratzscher, 2009), the role of monetary policies (Drakos and Kouretas, 2015), exchange rate impacts on trade flow (Choudhry and Hassan, 2015), (Eke and et al, 2015) exchange rate policy during financial crises (Fornaro, 2015), exchange rate regimes during financial crises(Tsangarides, 2010), exchange rate predictability (Buncic and Piras, 2015) and finally fluctuations of nominal or real exchange rate during financial crisis (Ben Ltaifa and et al.2009), (Kohler, 2010), (Taguchi, 2010), (McCauley and McGuire,2009), (Weber and Wyplosz, 2009). However, studies engaged in comparative study of countries' (real) exchange rates misalignment (as deviated from their equilibrium level) in pre and post crisis period are rarely found (Thorstensen and et al. (2014)).

According to what is said, the main aim of this paper is to provide a quantitative comparative assessment about the trend of real exchange[1] deviation in developing, developed and resource based economies. In so doing, we estimate a cross country basic real exchange rate determination model for 1990-2012 in order to derive countries' real exchange rate deviations.

Graph 1: Exchange Rate Determination Approaches



Source: Hoontrakul (1999)

2-2- Theoretical arguments:

Review of international finance theories implies variety of approaches about determinant factors of exchange rate. Hoontrakul (1999) classified these approaches as depicted in graph1. Since exchange rate determination models mostly focus on a specific approach for nominal exchange rate, we employed a hybrid model in this study for determining factors which influence the real exchange rate; this model is proposed by Chen and Chou (2015), Coulibaly and Gnimassoun (2013) and Couharde et al. (2012) which is inspired from Edwards (1988) and Baffes et al. (1999). They derived relevant determinants of the real exchange rate for developing economies which were properly summarized by Coulibaly and Gnimassoun (2013) as follows:

A. Terms of Trade (TOT)

This factor is measured by the ratio of export prices to import prices. The improvement of the terms of trade leads to an increased production of tradable goods and a reallocation of resources in favor of those sectors.

1 . By choosing real exchange rate, besides the nominal exchange rate, we try to capture the relative price level of countries too.

Consequently, the trade balance will be improved through rising exports leading to an appreciation of the equilibrium real exchange rate. At the same time, this process may be accompanied by a substitution between local products—which become more expensive—and imported products, leading therefore to a depreciation of the real exchange rate. Consequently, the impact of the terms-of-trade variable is undefined and depends on the income and substitution effects' magnitude. However, empirical works generally suggest that the income effect dominates the substitution one (Coulibaly and Gnimassoun, 2013, P.467).

B. Relative Productivity Differentials (PRO)

Based on the Balassa–Samuelson effect, a positive productivity shock in the tradable good sector relative to the non-tradable good sector leads to a wage increase in the former sector; and thus the moving of the workforce towards this sector. Thus, the real exchange rate appreciates through price increase in sheltered sectors since their demands exceed their supplies. The impact on the equilibrium real exchange is then expected to be positive (Coulibaly and Gnimassoun, 2013, PP.466-67).

C. Net Foreign Asset Position (NFA)

Basic macroeconomic models predict that debtor countries will need more depreciation of real exchange rate in order to generate the trade surpluses necessary to pay their external liabilities (Lee et al., 2008). Similarly, when countries have relatively high net foreign assets, they can "afford" a higher appreciation of their real exchange rate while remaining solvent even if it is likely to generate current account deficits. So, the expected effect is positive (Coulibaly and Gnimassoun, 2013, P.467).

D. Trade Openness (TO)

Trade openness is considered as proxy for trade policies. The elimination of tariff increases the level of trade and vice versa. The response of the real exchange rate depends on the impact of openness on the current account. If the current account deteriorates, the real exchange rate should depreciate to restore external equilibrium. On the contrary, the equilibrium exchange rate will appreciate when the reduction of tariff leads to a current account improvement. Consequently, the expected effect is ambiguous, but the empirical literature generally found a negative impact (Coulibaly and Gnimassoun, 2013, P.467).

E. Government Spending (GOV)

If public expenditures are mainly composed of tradable goods, their increase will lead to the depreciation of the real equilibrium exchange rate. However, it is usually assumed that government spending in developing countries is mainly composed of non-tradable goods. In this case, the increase of public spending leads to a rise in internal prices, which generates the appreciation of the real equilibrium exchange rate. The impact of this variable on the real exchange rate must be positive (Coulibaly and Gnimassoun, 2013, P.467). Thus, the real exchange rate (RER) can be considered as a function of the following variables stated by mainstream studies such Edwards (1989), Montiel (1999), Terra and Valladares (2010) and Schröder(2013).

RER= RER (TOT, PRO, NFA, TO, GOV) (1)

Equation 1 is the basic stylized model which expresses real exchange rate determinant factors and can be applied for estimation.

3 Data and Estimation

Our study, pending on availability of data, covers a panel of 39 (developed[2], developing[3] and resource based[4]) economies for 1990-2012. In order to detect real exchange rate deviation, our methodology includes two main steps. The first step is to estimate our basic stylized model (eq.1) including main determinant factors of real exchange rate in order to derive residual for each country. The second step is to extract absolute value of deviation as done by Holtemöller and Mallick (2013), Terra and Valladares (2010), Dubas (2009), kemme and Roy (2006). They considered deviation as the difference between the observed RER and its predicted value (RER-$\widehat{RER}$).

[2]. Developed Countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, ,Italy, Japan, Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom.

[3]. Developing Countries: China, India, Turkey, Argentina, Chile, Greece, Hungary, Mexico, Poland, Brazil, Malaysia.

[4]. For resource based economis, we considered Oil Exporting Countries: Algeria, Angola, Ecuador, Iran, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Venezuela

Positive values imply undervaluation and negative values imply overvaluation of exchange rate. Our variables for estimation are expressed in table 1.

Before estimating Eq. (1), we have to make sure that all variables are stationary. We rely on most frequently used panel unit root tests (LLC ،ADF-Fisher ،pp-Fisher). The results are reported in table 2 (Developed Countries), 3 (Developing Countries) and 4 (Oil Exporting Countries). As can be seen in tables 2 and4, the null hypothesis of variables for having unit root at 5% is rejected. It means that all variables are stationary at this level. However, in table 3, some variables are non-stationary. We calculated their first difference and observed that they are I(1).So, we have to follow co-integration procedures. The results are reported in table 5 indicating the existence of long run relations among variables. Then, we apply F & Hausman test in order to understand basic model estimation condition for developed and oil Exporting Countries. The results (tables6 and 7) show that the proper option for estimation is panel & fixed effects form.

In the next step, due to diagnostic tests' results, we separately estimated the basic model for developed and oil exporting countries by OLS and for developing countries by FMOLS. The results of estimation are reported in table 8. Table 8 shows that all explanatory variables are significant at conventional (5% and 10%) levels and have expected sign highlighting the relevance of the theoretical model and the estimators. Finally, as expressed previously, we calculate real exchange rate deviation as the difference between the observed RER and its predicted value (RER-$\widehat{RER}$). The results are depicted separately for developed, developing and oil exporting countries in Figure 1-3. In these figures Positive/Negative values imply Undervaluation/ Overvaluation of real exchange rate.

4 Conclusions and Discussion

Since in our methodology positive values of deviation (RER-$\widehat{RER}$) imply undervaluation of real exchange rate and vice versa, by comparing the pre and post crisis behavior of real exchange rate deviation in our sample countries, we may come to these points about the three groups of countries:

A. Developed Countries:

- Most developed countries have experienced undervalued real exchange rate during the first half of 1990s.
- Most developed countries launched a course of overvaluation in real exchange rate in the second half of 1990s which in some cases has continued for a decade.
- By beginning of 2000s, most developed countries tried to terminate their overvaluation or keep undervaluation of their real exchange rate and continued it during next years.
- A significant recursive break is observed during the financial crisis (2008-09) in the majority of developed countries. Some of them including Australia, Finland and Austria were in undervalued condition, and some had overvalued condition (Italy, for example) and others were in relatively equilibrium condition (Belgium, Canada and Netherlands). This break is very mild for some countries such as Netherlands and Switzerland while it is considerable for other countries such as Denmark, Japan and Germany.
- United Kingdom and Spain are exceptions and no meaningful change is seen in their real exchange rate deviations during the financial crisis (2008-09).
- It seems that in post crisis period, the majority of developed countries are trying to keep undervalued the real exchange rate.

B. Developing Countries:

- No specific movement in real exchange rate deviations is seen during the crisis through graphs. However, during the crisis, in most developing countries, real exchange rate tended to revalue either through eliminating undervaluation or through intensifying overvaluation of real exchange rate. Nevertheless, it never returned to its previous position as happened in developed countries.
- Some partial resemblance can be observed in deviation trends of real exchange rate during the whole period of study between "Chile, Greeks and Brazil" or "Turkey and India".
- The growing undervaluation of real exchange rate in China in post crisis period seems to be the result of China's authorities' intervention in foreign exchange market in order to improve their trade balance. This may also be the reason for China's being accused of engaging in "Currency War".
- It seems that no specific common movement is observable in real exchange rate deviation of developing countries in post crisis period.

C. Oil Exporting Countries:

- The review of real exchange rate deviation in oil exporting countries implies different reactions during the crisis. For instance, while countries such as Nigeria, United Arab Emirate, Qatar, and Algeria experienced devaluation of real exchange rate, in countries such as Iran, Venezuela and Kuwait real exchange rates were re-valued and in Libya and Ecuador, real exchange rate deviation seems to have been indifferent.
- Real exchange rates' deviation in Algeria, Kuwait, Nigeria and Iran were fluctuating from positive (undervalued) to negative (overvalued) amount and vice versa. Meanwhile, the direction of deviations in Angola, Ecuador, Libya, Qatar, Saudi Arabia, Venezuela and United Arab Emirates were transformed from positive to negative position and vice versa.
- No specific movement in real exchange rate deviations is seen during the crisis through graphs. Thus, understanding crisis impact on real exchange rate deviation is difficult. Therefore, we have to continue the procedure statistically.

In order to assess the crisis impact on real exchange rate deviation, we divide the study periods to pre/ during / post crisis periods (1990-2007/2008-09/2010-12) and define two dummy variables; the first one captures the crisis period and the second covers post crisis period. In the next step, we include our dummy variables in our basic model and estimate it separately. The results are reported in table 9. The coefficients of dummy variables imply that financial crisis has had significant statistical impact on real exchange rate movement (deviation) in our sample countries. In order to have a reliable assessment about the essence of deviations, our sample countries are selected from different exchange rate arrangements[5]. However the study of foreign exchange regimes impacts on exchange rate fluctuation needs separate studies as did by Wilson and Ren (2007) and Rahman (2009). As result, our findings confirm conjectures about significant crisis impacts on real exchange rate, statistically. However these impacts were perfectly dissimilar in developed (recursive break), developing (revaluation) and oil exporting (heterogeneous) countries, through graphs.

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[5]. Sample Countries arrangements are as follows (International Monetary Fund, 2014):
Floating: Australia, Canada, Chile, Japan, Mexico, Norway, Poland, Sweden, United Kingdom, Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain
Floating: Brazil, New Zealand, Turkey, India, Hungary
Conventional peg: Qatar, Saudi Arabia, United Arab, Emirates, Venezuela, Denmark, Kuwait, Libya,
Crawl-like arrangement: China, Argentina, Switzerland
Stabilized arrangement: Angola
Other managed arrangement: Brazil, Turkey, India, Hungary
No separate legal tender: Ecuador

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Table 1: Data Source and Definition

Variable(s)	Code	Description	Source
Real Exchange Rate	RER	Ratio of the domestic CPI to: united states (as world proxy)[6] CPI multiplied by nominal exchange rate	World Bank (WDI)
Trade Openness	TO	Sum of imports and exports as a percent of GDP	UNCTAD
Government spending	GOV	Government consumption as a percent of GDP	UNCTAD
Terms of Trade	TOT	Unit Value of Exports divided by Unit Value of Imports indices which were constructed as: Px current lcu/ Px constant lcu= PX , and PM current lcu/ PM constant lcu = PM.	UNCTAD
Productivity Differentials	PRO	Labor Productivity as proxy, measured as GDP per Person Employed	Conference board Org.[7]
Net foreign asset	NFA	Sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities to GDP	World Bank (WDI)

Table2. Unit Root Tests Results for Developed Countries

	Levin, Lin & Chu		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Prob	Statistic	Prob	Statistic	Prob
ln RER	-38.28	0.0000	1089.07	0.0000	502.92	0.0000
lnOpen	-4.37	0.0000	49.79	0.0393	71.32	0.0002
lnTot	-3.14	0.0008	80.52	0.0000	156.52	0.0000
lnNfa	-102.76	0.0000	107.22	0.0000	997.67	0.0000
lnGov	-1.95	0.0255	48.31	0.0529	-1.81	0.0349
lnprod	-7.36	0.0000	67.29	0.0006	130.31	0.0000

Table3. Unit Root Tests Results for Developing Countries

	Levin, Lin & Chu		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Prob	Statistic	Prob	Statistic	Prob
ln RER	-6.40	0.0000	56.32	0.0001	190.71	0.0000
lnOpen	-6.27	0.0000	79.80	0.0000	139.001	0.0000
lnTot	-2.96	0.0015	59.25	0.0000	47.77	0.0012
lnNfa	-17.27	0.0000	326.29	0.0000	712.07	0.0000
lnGov	-4.75	0.0000	46.33	0.0018	35.18	0.0371
lnprod	-2.82	0.0024	53.10	0.0002	104.52	0.0000

6 . Bahmani-Oskooee and Kara (2000)

7 . https://www.conference-board.org/data/economydatabase

Table4. Unit Root Tests Results for Oil Exporting Countries

	Levin, Lin & Chu		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Prob	Statistic	Prob	Statistic	Prob
ln RER	-2.44	0.007	35.79	0.03	41.29	0.007
lnOpen	-3.45	0.000	40.48	0.009	36.65	0.02
lnTot	-4.002	0.000	45.07	0.002	60.94	0.0000
lnNfa	-32.44	0.000	287.30	0.0000	290.10	0.0000
lnGov	-3.93	0.000	48.75	0.0000	42.70	0.005
lnprod	-3.81	0.0001	58.32	0.0000	48.23	0.001

Table 5.Cointegration Test Results for Developing Countries

	Statistic	Prob
ADF	-2.13	0.01
Residual variance	0.007	
HAC variance	0.007	

Table 6: F & Hausman Test Results for Developed Countries

		Statistic	Prob
Effects Test:	Cross-section F	21.232703	0.0000
Hausman Test:	Cross-section random	331.551642	0.0000

Table 7: F & Hausman Test Results for Oil Exporting Countries

		Statistic	Prob
Effects Test:	Cross-section F	803.903580	0.0000
Hausman Test:	Cross-section random	14.375908	0.0134

Table 8.Estimations Results
(Dependent Variable: Real Exchange Rate)

Oil Exporting Countries Model	Developing Countries Model	Developed Countries Model	**Explanatory Variables**
0.65 (25.06)	0.24 (4.71)	-0.36 (-2.03)	lnOpen
-0.20 (-13.08)	-.0.30 (-2.88)	-1.01 (-4.70)	lnTot
-0.01 (-7.32)	-0.002* (-1.42)	-1.01 (-3.81)	lnNfa
-0.19 (-9.73)	-0.26 (-2.36)	-0.45* (-1.68)	lnGov
-0.36 (-12.89)	-0.52 (-8.70)	-3.47 (-11.63)	lnprod
5.50 (16.24)	-	37.66 (13.48)	C

Note: Numbers are variables coefficients and (t-statistics).
Most of the coefficients are significant at 95% level except coefficients denoted by * which is significant at 90%level.

Table 9.Estimations Results

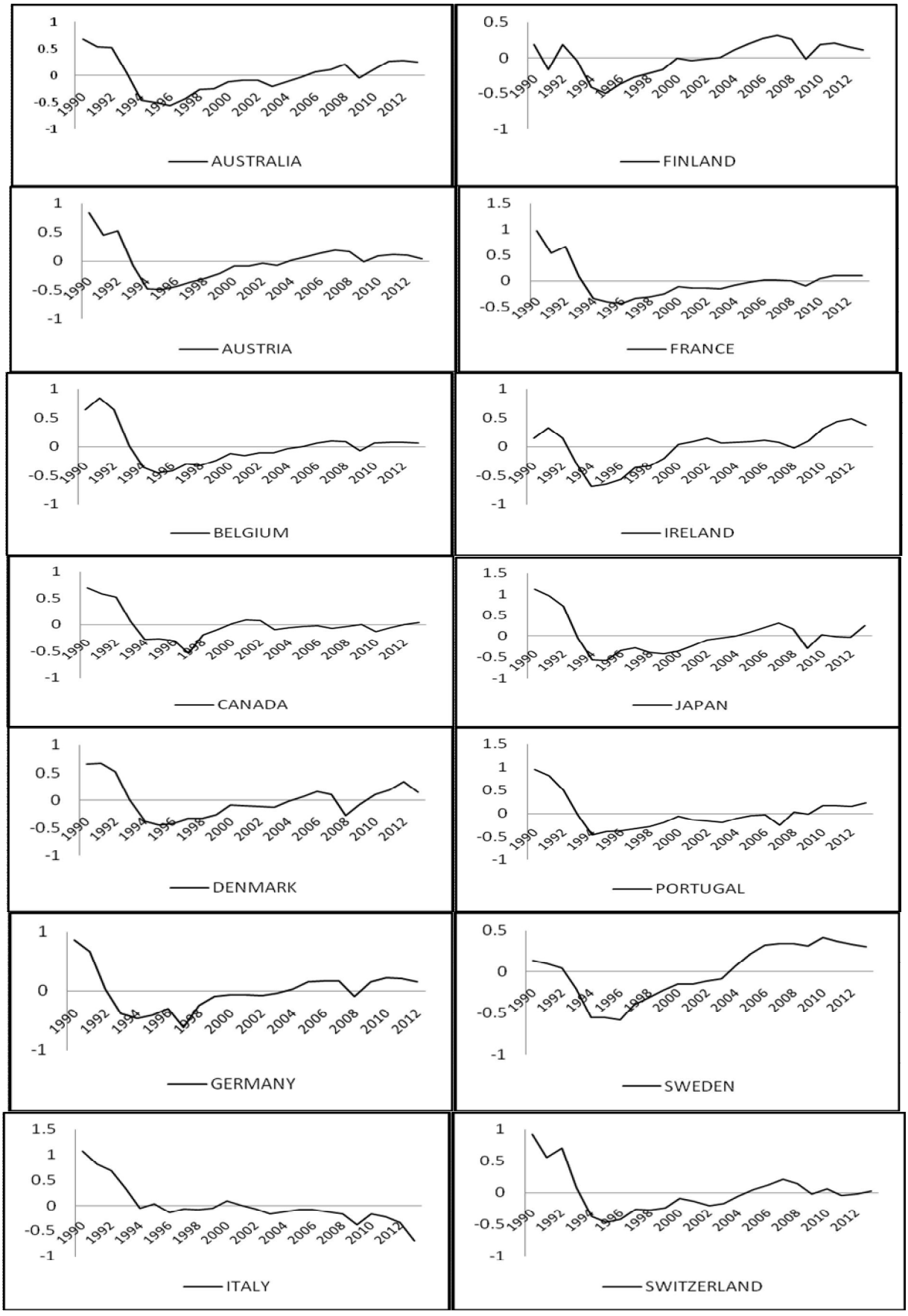
(Dependent Variable: Real Exchange Rate)

Oil Exporting Countries Model with Dummy (D2)	Developing Countries Model with Dummy (D2)	Developed Countries Model with Dummy (D2)	Oil Exporting Countries Model with Dummy (D1)	Developing Countries Model with Dummy (D1)	Developed Countries Model with Dummy (D1)	**Explanatory Variables**
0.66 (18.48)	0.29 (6.02)	-0.59 (-3.23)	0.66 (21.58)	0.24 (3.54)	-0.38 (-2.01)	lnOpen
-0.015** (-0.76)	-0.10** (-0.96)	-1.21 (-5.62)	-0.18 (-9.46)	-0.25 (-1.81)	-1.03 (-4.12)	lnTot
-0.005 (-3.81)	-0.003* (-1.57)	-0.01 (-3.67)	-0.01 (-5.02)	-0.003* (-1.04)	-0.01 (-2.54)	lnNfa
-0.10 (-5.34)	-0.007** (-0.06)	- 1.13 (-3.70)	-0.19 (-9.34)	-0.27 (-1.83)	-0.54* (-1.69)	lnGov
-0.09 (-3.42)	0.38 (-6.15)	-3.66 (12.40)	-0.31 (-9.82)	-0.48 (-6.05)	-3.51 (-9.65)	lnprod
			-0.09 (-3.21)	-0.10 (-1.94)	0.07 (2.02)	dum1
-0.30 (-7.82)	-0.18 (-5.51)	0.23 (4.26)				dum2
2.26 (5.59)		42.56 (14.33)	4.97 (12.18)		38.30 (10.71)	C

Note: Numbers are variables coefficients and (t-statistics).

Most of the coefficients are significant at 95% level except coefficients denoted by * and** which are significant at 90% level and insignificant.

Figure1. Real Exchange Rate Deviation in Developed Countries



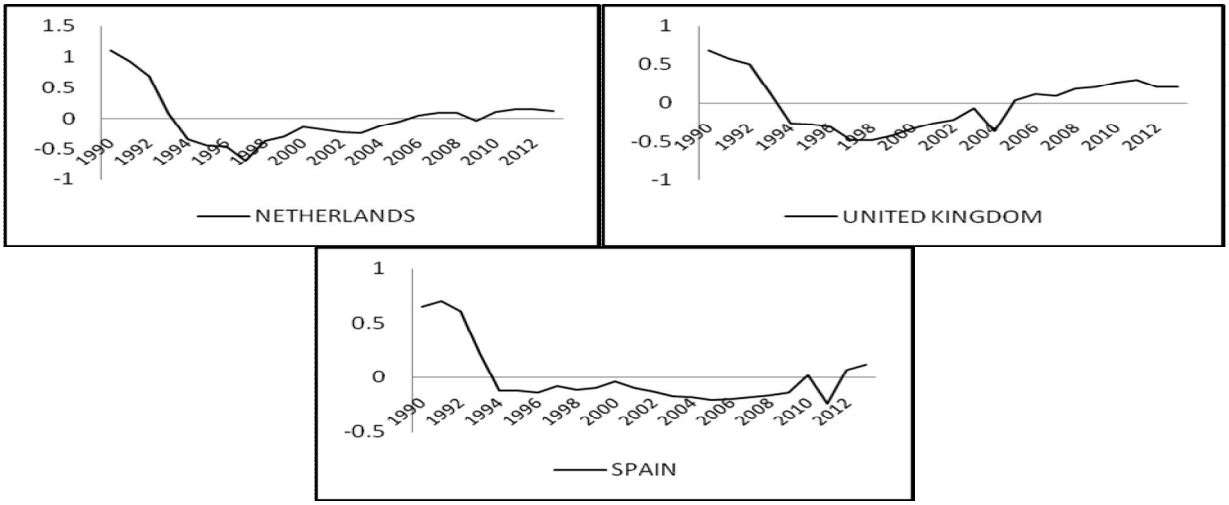
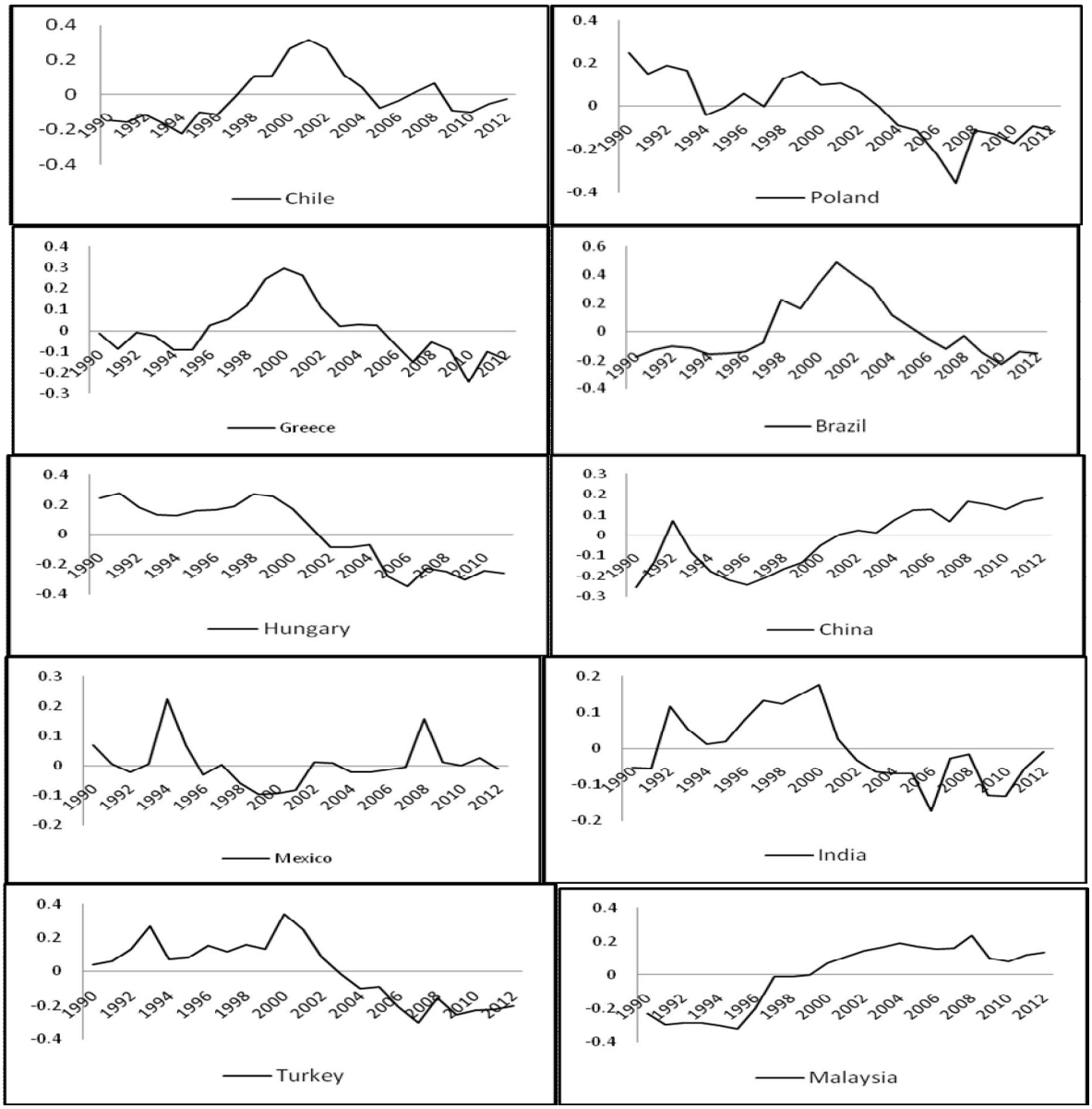


Figure2. Real Exchange Rate Deviation in Developing Countries



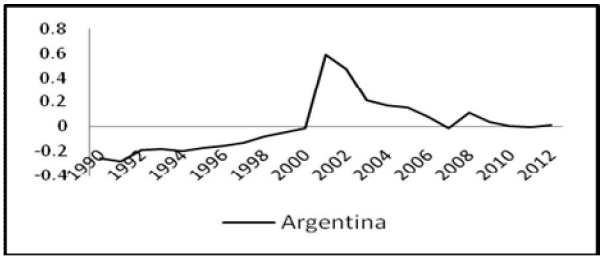


Figure3. Real Exchange Rate Deviation in Oil Exporting Countries