EXCHANGE RATE PASS-THROUGH TO CONSUMER PRICES IN PAKISTAN: DOES MISALIGNMENT MATTER?

ATIF ALI JAFFRI

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SUPERVISOR:

Dr. REHANA SIDDIQUI
DEAN, RESEARCH, PIDE,
ISLAMABAD

CO-SUPERVISOR:

Dr. SHAHNAZ A. RAUF
TEAM LEADER, ACADEMICS,
N.I.B.A.F, ISLAMABAD

PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS, ISLAMABAD
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ACRONYMS AND ABBREVIATIONS

ADs	Authorized dealers
ADF	Augmented Dickey-Fuller
AIC	Akaike's information criterion
ARDL	Autoregressive distributed lagged procedure
BEER	Behavioral equilibrium exchange rate
BN	Beveridge-Nelson
BOP	Balance of payment
CHEER	Capital enhanced measure of equilibrium exchange rate
CPI	Consumer price index
CRR	Cash reserve requirement
DF	Dickey-Fuller
DGE	Dynamic general-equilibrium
EBS	Export bonus scheme
ECM	Error correction model
ER	Exchange rate
ERER	Equilibrium real exchange rate
ERPT	Exchange rate pass-through
FCAs	Foreign currency accounts
FCPI	Foreign consumer price index
FDI	Foreign direct investment
FEER	Fundamental equilibrium exchange rate
FIBR	Floating inter-bank exchange rate
FINF	Foreign inflation
GDC	Growth in domestic credit
GDP	Gross domestic product
GDPG	Growth in GDP
GNP	Gross national product
IEB	Internal-external balance
IFS	International financial statistics
IMF	International monetary fund
INF	Inflation
INS	Information notice system
LCP	Local currency pricing
LFDI	ln of FDI
LNEER	ln of NEER
LOPEN	ln of export receipts
LPROD	ln of industrial production index
LREMIT	ln of workers' remittance inflows
LREER	ln of real effective exchange rate
LRER	ln run real exchange rate
LRERPT	Long-run Exchange Rate Pass-through
MIS	Misalignment
MNCs	Multinational corporations
NEER	Nominal effective exchange rate
NOEM	New open economy macroeconomics
NTBs	Non-tariff barriers

OECD	Organization for economic cooperation and development
OLS	Ordinary least square
PEER	Permanent equilibrium exchange rate
PCP	Producer currency pricing
PPI	Producer price index
PPP	Purchasing power parity
QIM	Quantum index of manufacturing
REER	Real effective exchange rate
RER	Real exchange rate
RERM	Real exchange rate misalignment
SARB	South Africa's reserve bank
SBP	State bank of Pakistan
SPI	Sensitive price index
TOT	Terms of trade
UAE	United Arab Emirates
VAR	Vector auto regression
WPI	Wholesale price index

ABSTRACT

This study investigates the impact of exchange rate changes on domestic consumer price inflation (commonly known as exchange rate pass-through (ERPT)) in Pakistan for the period 1993M7 to 2007M4. The model developed to estimate ERPT incorporates the existing level of real exchange rate misalignment as an independent variable besides nominal effective exchange rate (NEER) changes and foreign consumer price index (FCPI) changes. The equilibrium real exchange rate is estimated through behavioral equilibrium exchange rate (BEER) approach which benefits from the cointegration technique to estimate long run relationship between real effective exchange rate (REER) and fundamental determinants. The study concludes that the ERPT from NEER changes to CPI inflation in Pakistan is very low (close to zero). The impact of foreign inflation on domestic inflation is positive and statistically significant. The impact of previous period's misalignment is found significant in managed exchange rate regime, however, in case of overall sample misalignment does not affect inflation. Low pass-through into consumer price inflation enhances effectiveness of nominal exchange rate as a shock absorber. The low pass-through into consumer price inflation is suitable for adoption of inflation targeting in Pakistan. It is important for policy makers to know both the level of misalignment and the degree of pass-through for effective implementation of monetary and exchange rate policies.

CHAPTER 1

INTRODUCTION

Exchange rate pass-through (ERPT) is defined as the percentage change in domestic prices resulting from one percent change in exchange rate.[1] Exchange rate changes can affect domestic prices through direct and indirect channels (see Figure 1.1)[2]. Under the direct channel, changes in exchange rate have an effect on domestic prices through changes in the price of imported inputs and finished goods. Let E be the exchange rate in terms of domestic currency per unit of foreign currency and P* the foreign-currency price of the imported good, then EP* represents the domestic-currency price of the imported good. If P* remains fixed and E depreciates (rises) then the domestic-currency price of the imported good will rise in proportion. The result is called the pass-through from the exchange rate to imported prices.[3] The change in import prices also translates into changes in the producer and consumer prices of an economy if producers raise their prices in line with the increase in import prices. However, pass-through is only complete if (a) markup of prices over costs is constant and (b) marginal cost of foreign exporter is constant (see Goldberg and Knetter, 1997: 1248).

Under the indirect channel, the ERPT refers to the competitiveness of goods in the international markets. A depreciation of the exchange rate makes domestic products relatively cheaper for foreign buyers, and as a consequence exports and aggregate demand rise and induce an increase in the domestic price level. Since nominal wage contracts are fixed in the short run, real wages will decrease. However, when real wages approach to their original position over time, the cost of production rises and the overall price level increases.

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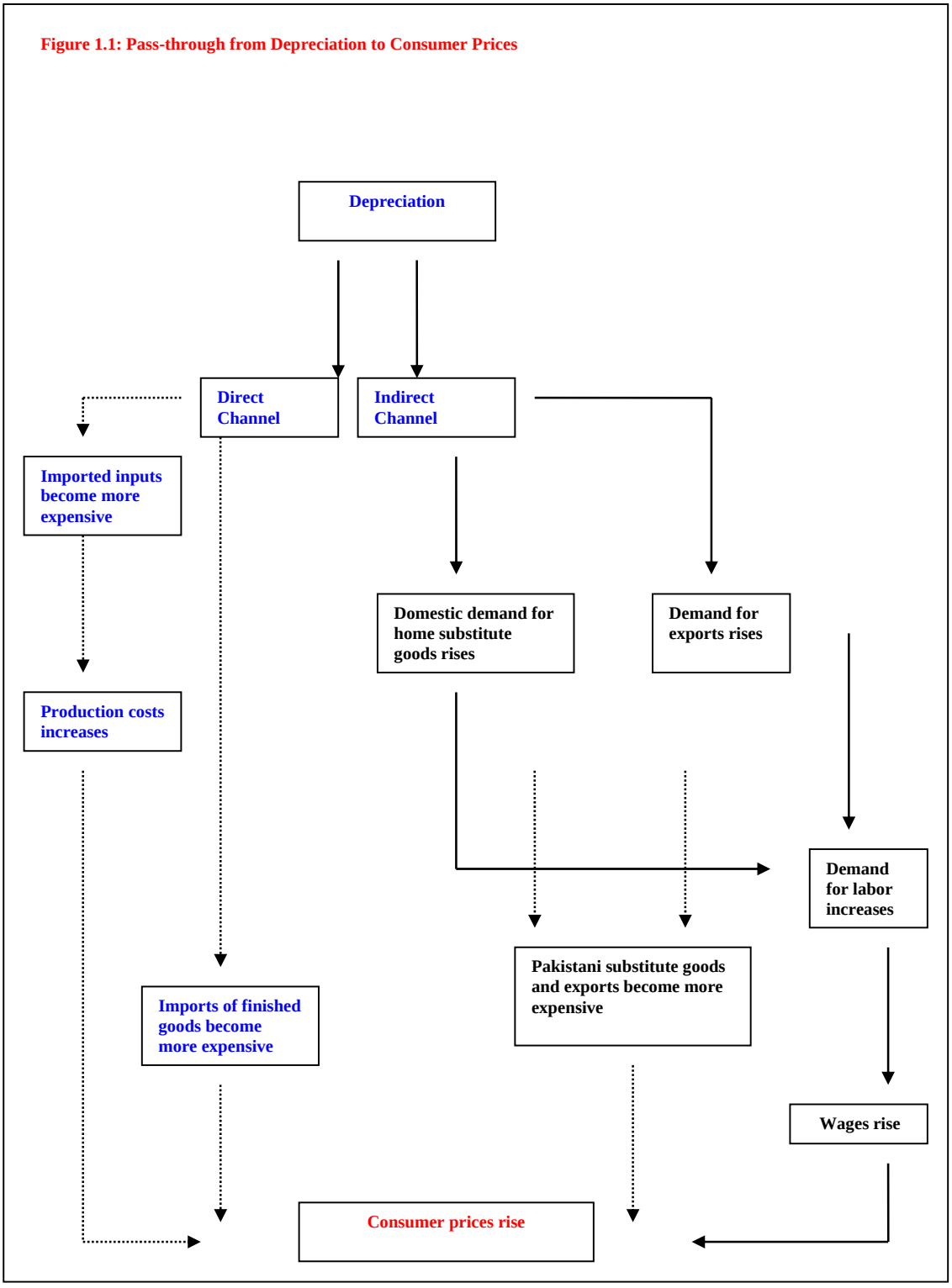
[1] See Menon (1995), Goldberg and Knetter (1997) and Choudhri and Hakura (2002) for an extensive literature review on exchange rate pass-through.

[2] Taylor (2000) suggests a further channel via expectations. According to this view pass-through is highest when exchange rate changes are perceived to be persistent and prices adjust because of the expectations of the public.

[3] In a traditional literature on trade, perfectly flexible elasticities of exports and imports assumptions resulted improvement in trade balance(Marshall-Lerner condition) and full pas-through into import prices. However, recent literature on ERPT mostly finds incomplete pass-through.

Figure 1.1: Pass-through from Depreciation to Consumer Prices



The issue of ERPT has regained importance in debates about appropriate monetary and exchange rate policies. According to Choudhri and Khan (2002), "if the devaluation–inflation link exists, then devaluation comes with an important cost that necessarily must be factored into the exchange rate policy. Furthermore, it implies that the authorities can only affect the real exchange rate temporarily." According to Choudhri and Hakura (2001), "a low exchange rate pass-through is thought to provide greater freedom for pursuing an independent monetary policy and to make it easier to implement inflation targeting". Edwards (2006) argues that, "if the inflationary effects of exchange rate changes are large, the authorities will have to implement monetary and fiscal policies that offset the inflationary consequences of exchange rate changes."

The real exchange rate misalignment (RERM) refers to a sustained departure of the real exchange rate (RER) from its long-run equilibrium real exchange rate (ERER).Whereas, an equilibrium real exchange rate is defined as a real exchange rate consistent with both internal and external balance.[4] Empirically, an exchange rate is labeled overvalued (undervalued) when it is more appreciated (depreciated) than the equilibrium real exchange rate. According to Goldfajn and Werlang (2000), "RER misalignment is the most robust determinant of exchange rate pass-through for emerging markets".[5] They find that initial RER overvaluation negatively affects inflation and ERPT coefficient. If initial RERM is overlooked by a researcher estimating long-run ERPT coefficient, then results would be misleading because exchange rate changes affect prices differently under overvaluation and undervaluation.

The existence of linkages between RERM and the rate of inflation has been more commonly established in the theoretical literature.[6] Montiel (2002) describes automatic price adjustments under both overvaluation and undervaluation of domestic currency. In a

[4] By external balance means a situation in which the deficit in the current account balance can be financed by a sustainable foreign capital inflows. Whereas, internal balance refers to a situation where market for nontradables clears.

[5] Goldfajn and Valdes (1999) show that initial overvaluation is an important determinant of future depreciations. These depreciations need not to call for higher inflation, if they simply restore the real exchange rate to its steady state. On the other hand, large depreciations that are not based on required adjustments in relative prices would either induce inflation or reverse itself through a future nominal appreciation (the stylized fact is that the correction of excess nominal depreciation tend to occur through higher inflation).

[6] However, recently these linkages have been confirmed empirically in a number of studies e.g Kamin (1996, 1997), Kamin and Klau (1997), and Klau (1998).

situation of overvaluation, interest rate rise through real interest arbitrage will lead to a reduction in expenditure leading to control in inflation and realignment of exchange rate. Besides expenditure decline, expenditure switching will also be at work. Overvaluation means that domestic goods have become costly or less competitive, thus dropping the demand for these goods until their relative price falls. Similarly, in the situation of undervaluation, the mechanism works in opposite.

Pakistan has experienced different exchange rate regimes since its independence in 1947(see Table 3.1).[7] For nearly thirty-five years, Pakistan maintained a fixed peg exchange rate regime. On January 8, 1982 the State Bank of Pakistan (SBP) adopted managed floating exchange rate regime, which continued until July 20, 1998 when the SBP initiated switching from managed floating to free floating exchange rate regime. Pakistan experienced a dual exchange rate system between July 22, 1998 and May 18, 1999. From July 22, 1998 to July 20, 2000 exchange rate regime was entirely transformed from managed floating to free floating. Now free-floating exchange rate regime is operating in Pakistan.[8]

Pakistan has faced consistently high inflation in 1970s, 1980s and up to 1998. However, between 1999 and 2004 inflation remained low which again reversed in 2005 (see Table 3.1). Inflation was 11.9% in 1970s, 7.5% in 1980s and 9.7% in 1990s. After remaining around 4 percent for almost three years, inflation rose to peak at 9.3 percent by end-June 2005 against annual inflation target of 5 percent.[9]

Inflation targeting is a monetary regime consisting of following five elements:[10] (a) the central bank publicly announces medium to long-term quantitative inflation targets; (b) central bank has full commitment to price stability as its primary objective of monetary policy all other objectives are subordinated; (c) use of information on a wide set of variables to set policy instruments and forecast targets;[11] (d) monetary policy

[7] Table 1 provides year-wise overview of ER changes and related variables. Table 2 provides an overview of exchange rate, monetary, fiscal and investment policies during major ER variation periods in Pakistan.
[8] However, the SBP intervenes in the foreign exchange market to cope with excess volatility, and, to maintain exchange rate stability.
[9] Inflation targeting is not formally practiced in Pakistan, but SBP publishes annual inflation target in its Monetary Policy Statements e.g. see, Monetary Policy Statement 2005 January-June, SBP
[10] See, Carare and others, 2002, Croce/Khan, 2000, and Mishkin, 2000
[11] Inflation targeting involves forecasting targets, which requires quarterly time series data on a number of variables. In most of the developing countries like Pakistan these time series data sets (e.g. quarterly GDP) are not available.

objectives and decisions are communicated to the market in a transparent manner; and (e) central bank is accountable for accomplishing the inflation target. Pakistan's monetary policy have some of these ingredient. An annual inflation target is publicly announced, and the SBP elucidates its past and future actions in the semiannual Monetary Policy Statement (MPS), as well as quarterly and annual reports. However, price stability is not the SBP's only goal, growth and exchange rate stability are not always subordinated to the objective of achieving an inflation target.

The possible adoption of inflation targeting by SBP requires a low ERPT. The introduction of inflation targeting is generally associated with free floating regime which is characterized of higher exchange rate volatility. In that case, it becomes very important for a central bank to know the impact of exchange rate variation on domestic prices (i.e. ERPT). If pass through is low (high) then it would be easy (difficult) for central bank to implement inflation targeting (see, Edwards, 2006).

In this study, ERPT is seen more broadly as the change in consumer prices that can be attributed to a prior change in the nominal exchange rate.[12]In case of Pakistan, there are very few studies on ERPT. The existing studies provide mix results regarding relation between exchange rate and prices. In most of the studies there is no evidence of significant effect of devaluation on domestic price inflation (e.g. Siddiqui and Akhtar, 1999 and Choudhri and Khan, 2002). However, no study has attempted to correlate RERM with ERPT. This study considers the fact that realignment of RER could only be effective if policy makers know both the level of misalignment and the existing devaluation-inflation link. The study contributes in the existing literature for Pakistan by, a) reviewing comprehensively, theoretical and empirical literature on both ERPT and RERM, b) developing a model to estimate ERPT while taking into account existing level of real exchange rate misalignment, c) estimating the ERER through fundamentals and calculating RERM, d) estimating the ERPT in the short-run and in the long-run for Pakistan , e) providing policy implications for appropriate monetary and exchange rate policies.

[12] In case of Pakistan, four different price indices are published: the consumer price index (CPI), the wholesale price index (WPI), the sensitive price index (SPI) and GDP deflator.

The remaining part of the study is divided into the following chapters. Chapter 2 reviews some selected theoretical and empirical literature on ERPT and RERM. Chapter 3 presents a brief review of different exchange rate regimes and inflation experienced in Pakistan, since 1971. Chapter 4 discusses theoretical framework and model estimated in this study. Chapter 5 describes data and estimation techniques. Chapter 6 presents estimation results of real exchange rate misalignment in Pakistan by applying BEER approach. Chapter 7 explains empirical results of the estimation of ERPT model. Finally, conclusion and policy implications are discussed in Chapter 8.

CHAPTER 2

REVIEW OF SELECTED STUDIES

2.1: Literature on ERPT

2.1.1: Theoretical Literature on ERPT

There are different strands of theoretical literature on ERPT relationship. The preliminary work on the pass-through relationship was initiated as a result of empirical investigations of export and import demand and supply elasticities. This strand of literature shows pass-through as a function of the elasticities of demand and supply. The broad finding of such studies was that the larger less-open economies experiencing much lesser pass-through than the smaller more-open countries. The main criticism on this approach was absence of information about the time lag involved in exchange rate changes affecting prices. Further, it ignores the factors responsible for responses of producer prices to exchange rate changes.

The second strand of literature on ERPT considers the role of market structure and product differentiation in determining the pass-through relationship.[13]Under perfectly competitive markets, elasticity of demand for an individual firm is infinite and price is equal to the marginal cost. However, under imperfect competition, prices are fixed above the marginal cost and the level of pass-through depends on the power of firms to defy price changes by manipulating their mark-ups over marginal cost. The mark-up of firms depends on: (i) the extent of substitution between the domestic and imported products, and (ii) the extent of market integration. Dornbusch (1987) considers the Dixit-Stiglitz (1977) model and Salop's (1979) model of competition on a circle to capture the impact of imperfect substitutability and product differentiation on the ERPT. The study finds direct relationship between the degree of pass-through and the degree of substitutability between the home and imported good. Fischer (1989) studies the Bertrand competitors case and where foreign firm produces for both the home and export market not involved price discrimination. He concludes that observed ERPT depends upon market structure. In the case of segmented markets where limited arbitrage exists, a higher ERPT would be

[13] See, Goldberg and Knetter (1997) for a comprehensive literature review of such studies.

resulted after appreciation when domestic market is monopolistic comparing to the foreign market. The case of a Cournot industry considered by Dornbusch(1987) has been extended by Sibert (1992) to study the effects that various collusion and market shares of foreign firms have on pass-through. He finds that Dornbusch's finding that pass-through is rising in the number of foreign firms generalizes to a variety of behavioral assumptions.

An extended oligopoly pricing literature puts together with exchange rates by highlighting on other ways of integrating international competitive pressures into the identifying of optimal prices. Froot and Klemperer (1989) look at pricing strategies that aim to guard market shares, and how transitory versus permanent exchange rate changes involve in these decisions. They find that while the price reaction to a transitory appreciation could go either way, an appreciation considered as permanent leads to foreign firms pricing very aggressively in the host country market in order to increase their market shares.

The third strand of literature on pass-through considers the role of multinational corporations (MNCs). The MNCs can protect themselves in a number of ways against exchange rate changes. The most familiar way is to utilize internal or intra-corporate exchange rates for intra-firm transactions.[14] To realize global profit-maximizing objectives the MNCs have been utilizing these techniques from a long time. Further, these exchange rates have been utilized to guard intra-corporate debtors against the full valuation effects of higher exchange rate variations, and to distribute finances between subsidiaries of the MNCs according to its worldwide liquidity policy. Menon (1995) estimates pass-through elasticities for Australian manufactured imports and 40 product categories contained within. He finds that pass-through is incomplete for most products, with significant difference across products. Further, he explains most of the variation in pass-through by the existence of multinational corporations and non-tariff barriers (NTBs).

The fourth strand of literature emphasizes the role of NTBs to international trade in affecting the pass-through relationship. Bhagwati (1988) claims that major reason for

[14] Intra-firm trade means transactions between a parent and its owned subsidiary or between two subsidiary or affiliated firms.

change in pass-through relationship has been the rise in NTBs in the early 1980s. Branson (1989) favors this view by presenting the process by which NTBs influence the pass-through relationship. He explains that depreciations in the presence of import restraints will usually cut into the import premium first, thus captivating much of its impact, before that it is transfered in prices. Pass-through is only realized when depreciations are large enough to push prices to the point where quantity restrictions are no longer binding.

In contrast to traditional literature, recently, pass-through has been examined from a macroeconomic perception, drawing both on the common finding from microeconomic literature and new open economy macroeconomic (NOEM) literature. In NOEM literature (mainly based on Obstfeld and Rogoff (1995)) nominal rigidities and market imperfections are introduced into a dynamic general-equilibrium (DGE), open economy model along with micro foundations. Betts and Devereux (1996, 2000) extended this model to allow for pricing to market, and therefore incomplete pass-through.

In this approach, ERPT will depend on different pricing strategies, such as whether the firm practices producer currency pricing (PCP) or local currency pricing (LCP). If prices are preset in the currency of the producer, then the home-country price of foreign good will move one-for-one with changes in the nominal exchange rate; thus there is full pass-through. On the other hand, if a firm practices LCP, then prices are set in local currency, and changes in the nominal exchange rate will have no pass-through in the short run. Choudhri et al. (2005) examine the performance of various NOEM models in explaining the ERPT in a broad range of prices. They conclude that the best-fitting model captures various features discussed in different strands of the literature: sticky prices, sticky wages, distribution costs and a combination of LCP and PCP.

The NOEM literature has also examined the extent to which ERPT can depend on a country's inflation performance or monetary policy. Taylor (2000) presents a hypothesis that the recently-observed turn down in pass-through to aggregate prices are due to low inflation environment, which gave new dimension of research on the subject (see, for example, Goldfajn and Werlang, 2000; Choudhri and Hakura, 2001; Campa and Goldberg, 2002; and Otani, Shiasuka and Shirota, 2003).

A relatively less explored area of research is the role of existing level of misalignment in ERPT relationship. Goldfajn and Werlang (2000) show that RERM is the most robust determinant of inflation for emerging markets, while the initial inflation is the most important variable for developed counties. Goldfajn and Valdes (1999) show that initial overvaluation is an important determinant of future depreciations. They argue that depreciations of nominal exchange rates are not inflationary if they simply restore RER to its equilibrium. However, larger depreciations that are not based on required adjustment in RER are either inflationary or reverse itself through future appreciation of nominal exchange rates.

In conclusion, there are various strands of theoretical literature on ERPT relationship. In a traditional literature, the initial studies show pass-through as a function of the elasticities of demand and supply of imports and exports in international trade. Another strand of literature on ERPT considers the role of market structure and product differentiation in determining the pass-through relationship. There are a number of studies which explain pass-through by the presence of multinational corporations and non-tariff barriers. In contrast to traditional literature, recently, pass-through has been examined from a macroeconomic perspective, drawing both on the common finding from microeconomic literature and NOEM literature. In this regard, a number of studies have examined the reasons of recent decline in pass-through. Among these, Taylor (2000) presents a hypothesis that the recently-observed declines in pass-through to aggregate prices are the result of low inflation environment. In this dimension, a relatively less explored area of research is the role of existing level of misalignment in ERPT relationship.

2.1.2: Empirical Literature on ERPT

There is a large body of empirical literature on ERPT to domestic producer and consumer prices, but most of literature relates to developed countries. The studies on ERPT can be largely separated into four major strands. The first strand of literature on pass-through consists on studies examining the impact of exchange rate changes on imports prices. Goldberg and Knetter (1997) have extensively reviewed this type of studies. The second strand of literature examines pass-through into import prices for

specific industries (e.g Feinberg,1989; and, Goldberg, 1995). The third category of studies examines pass-through into aggregate prices like Consumer Price Index(CPI) and Wholesale Price Index(WPI). In recent times, Taylor (2000) presented a new hypothesis that the recently-observed decline in pass-through to aggregate prices are the result of low inflation environment, which gave new dimension of research on the subject (for example, Goldfajn and Werlang, 2000; Choudhri and Hakura, 2001; Campa and Goldberg, 2002; and Otani, Shiasuka and Shirota, 2003). In the following, the recent empirical literature on ERPT to domestic prices is reviewed.

By using a recursive VAR method, McCarthy (1999) examines the impact of exchange rates and import prices on domestic Producer Price Index (PPI) and Consumer Price Index (CPI) in nine industrialized countries for the period from 1976:1 to 1998:4. For this purpose, the study develops a model of pricing along distribution chain. In this model, inflation at a particular distribution stage (import, producer, and consumer) in period t encompasses various components including expected inflation at that stage based on previous period's information, the effects of period t domestic "supply" and "demand" shocks on inflation at that stage, the effect of external exchange rate shocks on inflation at particular stage, the effects of inflation shocks at the previous stages of the distribution chain, and inflation shock at that particular stage. By applying recent VAR techniques of impulse responses function (IRF) and variance decomposition, the study finds that external factors have a modest impact on inflation. Further, pass-through is somewhat higher in countries with a bigger share of import.

Recently a number of studies used the McCarthy (1999) methodology for analyzing ERPT in various countries. Among these are Bhundia (2002) for South Africa; Leigh and Rossi (2002) for Turkey; Rowland (2003) for Colombia; Gueorguiev (2003) for Romania; Belaisch (2003) for Brazil, and Hyder and Shah (2003) for Pakistan.

Bhundia (2002) investigates the ERPT into consumer prices, excluding interest rate on mortgage bonds (CPIX).[15] The study finds that exchange rate shocks result in a gradual increase over time in CPIX- on average, eight quarters after a 1 percent shock to the nominal effective exchange rate, the level of CPIX increases by 0.12 percent(i.e. pass-

[15] This paper focuses on CPIX inflation because it is the operational target of the South Africa's Reserve Bank (SARB), while most attention is paid to the pass-through profile over two years, as this is the horizon over which monetary policy has the most impact on inflation.

through is 12 percent). In contrast to CPIX, the pass-through elasticity in case of producer price inflation was observed about 72 percent after eight quarters, showing that positive shocks to producer price inflation can bring back CPIX inflation to target. The author concludes that the impact of currency depreciation in South Africa has been captivated at intermediary stages of production. However, shocks to producer prices have tended to have a considerable impact on CPIX. Consequently, policies framed toward mitigating inflationary pressures at the producer price level would help the SARB to bring CPIX inflation back to target and keep it there.

To investigate the impact of exchange rate movements on different prices in Turkey, Leigh and Rossi (2002) develop a five variable recursive VAR model. The endogenous variables included in the VAR has ordering as follows: oil prices in domestic currency, real output, bilateral nominal exchange rate between Turkish Lira and US Dollar, WPI and CPI indices. Authors conclude that (i) the pass-through impact last for a year but most felt in initial four months, (ii) the impact of exchange rate changes on WPI prices is stronger as compared to CPI prices, and (iii) as compared to other emerging economies, pass-through in Turkey is not only strong but also fast. There a number of reasons of fast pass-through including high level of dollarization and currency substitution in Turkey and price indexation to the lira-dollar exchange rate. Another reason is that high inflationary expectations exist which contribute to high pass-through. Further, an oligoplistic structure of industry in Turkey allows wholesalers to pass-on external shocks to Turkish economy by increasing prices with more ease.

Using two different frameworks, both based on VAR models, Rowland (2003) analyzes the ERPT to domestic prices in Colombia. The first framework uses an unrestricted VAR framework, which is in line with McCarthy (2000), and the second based on multivariate cointegration in accordance with Johansen (1988). Impulse-response functions are used in both the frameworks to study the dynamics of ERPT. The author concludes that pass-through to producer prices in Colombia is modest as compared to limited pass-through into consumer prices.

In a recent paper, Gueorguiev (2003) has followed McCarthy (1999) and modified the model for Romanian environment. Author concludes that the pass-through is large and relatively fast in the case of Romania. Further, the pass-through from the exchange

rate of Lei against the U.S dollar (Lei/US$) is larger compared with alternative benchmarks for producer and consumer prices alike.

Using monthly data from July 1999 to December 2002, Belaisch (2003) estimates ERPT in Brazil. Author finds that pass-through to consumer prices in Brazil is limited but rapidly ends after two quarters. The study finds that after one year of exchange rate shock 17 percent impact of exchange rate changes is translated into consumer prices whereas about 6 percent of the shock in the same quarter. On the other hand, pass-through into WPI price is found to be higher and quick. The author provides several possible factors responsible for slow pass-through including: the availability of domestically produced goods as substitutes for imports; the slow adjustment of non-tradable prices and wages; the feeling that depreciation was temporary; and the depressed level of economic activity and firms' decision to curtail their profit instead of increasing prices.

By employing both time series and panel methods *Anderton (2003)* analyzes the pass-through of changes in the effective exchange rate of the Euro to extra-euro area import prices in manufacturing. The results of the study show a pass-through of around 50 to 70 percent, and weight of between 50% - 30% of pricing-to-market. Further, about half of the impact of exchange rate shock is realized in the first quarter whereas most of the pass-through is recorded in five quarters.

Recently, Taylor (2000), presented a hypothesis that the recently-observed declines in pass-through to aggregate prices are the result of low inflation environment, which gave new dimension of research on the subject (for example, Goldfajn and Werlang, 2000; Choudhri and Hakura, 2001; Campa and Goldberg, 2002; and Otani, Shiasuka and Shirota, 2003).

Goldfajn and Werlang (2000) examine determinants of exchange rate pass-through for a sample of 71 countries. in the period 1980-1998. The study finds that major determinants of the degree of pass-through of depreciations (appreciation) are the cyclical component of output, the degree of initial overvaluation of real exchange rate, the initial rate of inflation, and the degree of openness of the economy. The major findings of the study include that pass-through estimation results depend on span of horizon being analyzed. Twelve months ERPT coefficient were found higher than 4 times of the 3-month coefficients. The significant contribution of the study in empirical literature on

ERPT is that it argues that initial real exchange rate misalignment is the most important factor to take into account while estimate pass-through in developing countries. The study highlights the fact that exchange rate movements affect inflation differently under overvaluation and undervaluation. Choudhri and Hakura (2001) use the same data set used in Goldfajn and Werlang (2000) to test a hypothesis originally proposed by Taylor (2000) that a low inflationary environment leads to low ERPT to domestic prices. The empirical findings of the study confirm the positive relation between the extent of pass-through and the average inflation rate in a country. Based on their findings the authors argue that the dependence of the ERPT on the inflation regime makes it easier for policy makers to set a target of low inflation rate.

Campa and Goldberg (2002) estimate the exchange rate pass-through to import prices for 25 OECD countries by using quarterly data from 1975 to 1999.The study offers several interesting findings regarding ERPT into import prices. The major findings of the study include: (a) in short run import prices reflect 60 percent of exchange rate changes as compared to 80 percent in the long run, (b) assumption of complete pass-through is rejected for several countries, (c) macroeconomic variables have a significant but limited role in explaining cross-country differences in the extent of ERPT, (d) pass-through is depends on inflation environment and exchange rate volatility, and, pass-through for manufacturing products and food items are generally lower, however, energy and raw material have pass-through elasticity near to one.

Otani et al. (2003) estimate pass-through to the aggregate import prices in Japan for the data period from 1980s through 2001. Authors conclude that pass-through into Japan's import prices from exchange rate changes declined in the 1990s. Their results confirm Campa and Goldberg's (2002) findings that in 1990s pass-through into import prices declined in main industrial countries. Further, the decline in pass-through in Japan mainly came from the decline in ERPT in every product, instead of the move of import share to manufactured goods with lower ERPT from raw materials with high ERPT.

Choudhri et al. (2005) study the performance of various new open economy models developed to estimate the exchange rate pass-through for different prices. For this purpose, paper develops a general small economy model integrating local currency and producer currency models, and incorporate a number of features of different

specifications of wage-price dynamics besides global price discrimination based on distribution costs. The authors conclude that both LCP and PCP models are not without troubles. They argue that a hybrid model giving almost same weights to LCP and PCP firms offers a considerably improved estimates of exchange rate pass-through.

Hossain (2002) examines the causal relationship between exchange rate and prices in Bangladesh for the data ranging 1973 to 1999. By applying the Error Correction Model and Granger Causality Test, the study finds that past consumer price inflation generally led to currency devaluation in Bangladesh. The impact of inflation on currency devaluation weakened after the financial reforms introduced by government in early 1980s. Interestingly, the study finds insignificant effect of devaluation on inflation robustly during the sample period.

In conclusion, the ERPT to domestic aggregate prices is affected by various factors including openness of trade, level of initial inflation, and most importantly by initial exchange rate misalignment. The literature further point outs that: (i) pass-through is low in consumer prices as compared to import and producer prices; (ii) Long run pass-through coefficient increases the longer is the horizon analyzed; (iii) pass-through is larger in countries with larger import shares; and (iv) pass-through coefficient has declined over the years. It might be due to moving towards more flexible exchange rate policy resulting in lower misalignment of RER.

2.1.3: ERPT Literature on Pakistan

By applying a monetarist framework of open economy, Ahmad and Ram (1991) estimate relationship of inflation rate with other macroeconomic variables. In particular, this paper attempts to capture the possible effect of imported inflation. The study applies OLS using four alternative measures of inflation rate and two alternative definitions of money supply. The data period comprises from 1960-61 to 1987-88. In this framework the economic agents form their expectations through error learning process. The determinants of inflation included in the model are the growth rate of real GNP, the growth rate of unit value index of imports, the growth rate of nominal stock of money, one period and two period lagged inflation rates. In addition to the three commonly used price indices WPI, CPI and GNP price deflator, the paper uses the implicit price deflator

of total domestic absorption (DAPD) in calculating inflation rate. Authors conclude that growth in import prices; monetary expansion and inflation in the past are the major causes of inflation in Pakistan. Further, the growth in output helps in controlling inflation but not very convincingly.

Khan and Qasim (1996) estimate an overall inflation equation for Pakistan along with estimation of two equations for CPI food price inflation and CPI non-food price inflation. To estimate these equations, the study uses a consistent time series data ranging from 1971-72 to 1994-95. After performing appropriate test for stationarity, various price equations are estimated using cointegration and error correction model. Authors conclude that higher monetary expansion caused by substantial borrowing from the banking system to finance fiscal deficit has been the major reason of rise in inflation in Pakistan. The expansionary fiscal policy stance has also worsened BOP position of the country resulting in frequent rupee devaluations causing increase in price level. Authors suggest a tight fiscal policy to curtail import growth and to improve the BOP position, thereby minimizing frequent currency adjustments.

Ahmad and Ali (1999) examine the relationship of nominal exchange rate and domestic price level with each other and other economic variables in a dynamic context. The price level and exchange rate are determined in a simultaneous model that contains sufficient built-in dynamics. This framework allows tracing the pattern and speed of adjustment in price level and exchange rate in response to various shocks. The data period comprises from 1982:2 to 1996:4. Authors conclude that the relationship between price level and exchange rate is not unidirectional, though the short run effect of devaluation on inflation is estimated to be smaller than the effect of inflation on devaluation. Authors suggest that the SBP should follow a consistently tight monetary policy. In case, consistent policy is not followed, the benefits of tight monetary policy would be temporary only and monetary shocks will continue to generate inflation and in turn devaluation of the Rupee.

To investigate the effect of changes in foreign prices and changes in monetary and real variables on domestic prices Siddiqui and Akhtar (1999) apply cointegration and estimate an Error Correction Model. The data covers the period from 1972 to 1998. Authors conclude that there is no evidence of short run unidirectional or bi-directional

causality between domestic prices and real exchange rate. Furthermore they find evidence of causality from output to exchange rate.

Choudhri and Khan (2002) challenge the popular view that devaluation tends to cause inflation in Pakistan. The paper estimates a difference model for quarterly data comprising from 1982:1 to 2001:2. The study finds no evidence of a significant pass-through of Rupee devaluations to consumer prices in short run. Consistent with recent empirical literature, the study finds close to zero response of inflation in the first year as well as after two years. Further, the variance decomposition shows that exchange rate shocks explain 97 percent of the variance of this variable after 10 quarters and 96 percent of variance after 20 quarters. The results confirm that asset market shocks dominate exchange rate changes, and a weak response of CPI to these shocks accounts for the lack of a significant pass-through.

To examine the ERPT, Hyder and Shah (2003) apply a recursive VAR framework originally proposed by McCarthy (1999). The paper has studied the ERPT to domestic wholesale and consumer prices in Pakistan for the data period from January 1988 to December 2002. The key results of the study are: (i) the exchange rate changes affect domestic price inflation moderately; (ii) the ERPT is felt strongly in WPI as compared to CPI; (iii) the impact of exchange rate on domestic prices is stretched over eighteen months, however, in first four months most of the effect is realized; (iv) within the WPI commodity groups, the ERPT is higher in Fuel & Lightening and Manufactures group while in case of CPI, ERPT is more pronounced in Transport & Communication and Fuel & Lightening group; e) the pass-through in the food group is lower both in WPI and CPI.

In conclusion, there are very few studies on ERPT for Pakistan. The existing studies provide mixed results regarding causation between devaluation and inflation. In most of the studies there is no evidence of significant effect of devaluation on domestic price inflation. Previous literature on ERPT for Pakistan has ignored the distinction between short-run and long-run ERPT (exceptions are Ahmad and Ali(1999) and Choudhri and Khan(2002)). Further, no previous study has estimated LERPT by taking into account existing level of misalignment. This study fills the gap: by integrating RERM and ERPT in a single analytical framework, and thus estimating ERPT by taking into account of RERM.

2.2: Literature on RERM

2.2.1: Theoretical Literature on RERM

Exchange rate misalignment estimation is one of the most difficult empirical problems in open-economy macroeconomics. Mainly the unobservable nature of the equilibrium real exchange rate makes it difficult to ascertain how far actual real exchange rate is from level consistent with macroeconomic fundamentals. As informal assessment, the current value of the RER is compared with its value in some base year; however, it relies on the assumption of unchanged fundamental. In formal assessment, the current RER is compared with its equilibrium value determined through any formal method. These judgments usually base on econometric techniques mostly cointegration to discover a long-term relationship between the real exchange rate and a number of macroeconomic fundamentals. The box 2.1 lists briefly various approaches used to assess equilibrium RER.[16] However, the Behavioral Equilibrium Exchange Rate (BEER) approach used in this study is discussed in detail.

The BEER Approach:

In the BEER approach, econometric technique is employed to identify a behavioral relation between the actual RER and relevant economic variables called fundamentals. The BEER approach uses cointegration technique that allows the equilibrium relationship between the RER and its determinants to be determined directly. The estimated cointegrating equation can be used to approximate the long run RER and to gauge misalignment. Unlike FEER approach, this approach provides a measure of the equilibrium exchange rate which is stock-flow consistent and which is independent of assumptions about sustainability. However, the approach can be used to provide a measure of equilibrium which does calibrate fundamentals at sustainable levels (MacDonald, 2000).

The choice of economic fundamentals is made on theoretical guidance. There is an extensive literature on the choice of appropriate fundamentals following Edward's seminal work on the subject. Montiel (1999) developed a model that synthesized previous

[16] See MacDonald (2000) and Bella et. al. (2007) for the details of the approaches listed in Box 2.1.

models of the equilibrium real exchange rate. In his model, the long-run equilibrium real exchange rate is determined by the steady-state values of pre-determined variables and permanent (sustainable) values of both policy variables and exogenous variables.

The variables that may perform as the long-run determinants includes the following components: domestic supply-side factors particularly the Balassa-Samuelson effect arising from faster productivity growth in the traded-goods sector than in the non-traded goods sector; liberalization of commercial policy; changes in the international economic environment e.g. capital inflows and foreign interest rates; and, fiscal factors such as permanent changes in the composition of government spending between traded and non-traded goods.[17]

After identifying fundamentals consistent with the theory, a cointegrating vector presenting a long run relationship between RER and fundamentals is found. In the final step, sustainable values of fundamentals are substituted in the cointegrating relation to obtain equilibrium real exchange rate. RERM is then calculated as a difference between actual and equilibrium exchange rates.

[17] In developing countries, it is difficult to find high frequency data on fiscal variables.

Box 2.1: Approaches of Estimation of RER Misalignment

1. The Macroeconomic Balance Approach (MB)

This approach involves following steps: (i) estimation of relationship between current account balance and fundamentals; (ii) estimation of "CA norm" by medium term projected fundamentals of various countries, and (iii) calculation of the difference between actual CA and its norm; this is derived by applying the elasticity of the current account balance to the RER.

2. The External Sustainability Approach (ES)

This approach involves following steps: (i) determining the CA balance that would stabilize the NFA at a given "benchmark" position; (ii) comparing the TB or CA balance obtained with those expected to prevail in the medium term; and (iii) estimating the RER adjustment required to end the difference between the medium term trade balance and CAB and NFA-stabilizing TB and CA balances.

3. The Equilibrium RER Approach (EREER)

This approach involves following steps: (i) estimation of an equilibrium relationship between RER and a set of fundaments econometrically; (ii) calculation of the RER on the basis of the current value for the fundamentals, and an equilibrium RER on the basis of the projection of fundamentals in the medium term; and (iii) the calculation of the RER adjustment needed to restore equilibrium calculated as a difference between the actual and equilibrium RERs.

4. Behavioral Equilibrium Exchange Rate (BEER)

See detail above

5. Permanent Equilibrium Exchange Rate (PEER)

The PEER approach underscores that the total RER misalignment at any given moment depends on transitory or short-term factors and on the departure of fundamentals from the their long-term value; usually, the decomposition into permanent and transitory components is obtained by using the Gonzalo-Granger method (Gonzalo and Granger, 1995).

6. Fundamental Equilibrium Exchange Rate (FEER)

In the FEER approach, Williamson (1994) defines the equilibrium exchange rate as the real effective exchange rate (REER) that is considered with macroeconomic balance, which is generally interpreted as when the economy is operating at full employment and low inflation (internal balance) and a current account that is sustainable, i.e., that reflects underlying and desired net capital flows (external balance). .

7. Desired Equilibrium Exchange Rate (DEER)

This approach is similar to FEER approach; the only difference is that it takes into account of desired objectives instead of sustainable in FEER approach.

8. Natural Real Exchange Rate (NATERUX)

This approach makes distinction between medium and long-terms, and considers stock of capital and net external debt. Among these approaches, the BEER and the PEER are the natural counterpart for the ERER approach. Similarly, FEER and DEER approaches have commonalities with MB approach. Whereas, NATEREX has similarities to the ES approach.

Source: MacDonald(2000), and, Bella(2007)

2.2.2: Empirical Literature on RERM

In the empirical literature on real exchange rate misalignment, Edwards has a pioneering work on single-equation reduced-form model. Edwards (1988a) uses pooled data for 12 developing countries ranging 1962-84 to estimate a model in which the actual RER depends on both monetary and real variables. The independent variables include rate of change in total factor productivity(TFP), the terms of trade(TOT), the share of government consumption in GDP, a proxy to account severity of capital controls, a proxy of trade openness, lagged dependent variable, and other variables interpreted as not affecting the LRER, but potentially causing the RER to deviate from the LRER. The estimation results confirm the expected signs of all variables except for productivity variable. The results show that transitory aggregate demand expansion leads to appreciation of long run real exchange rate and depreciation of nominal exchange rate affects real exchange rate in SR. Further, the study finds that the speed of error correction is low.

Kamin (1996) estimates an error correction model for Mexico to find relationship between RER and inflation. In this framework inflation is determined by the gap between the actual RER and the exchange rate that clears the market for non-traded goods; and inflation recorded in previous periods. The results confirm importance of initial level of RER in determining inflation in Mexico, which has important policy implications. An important implication of this result for exchange rate policy designing in Mexico is that there is a tradeoff between two equally important goals of having a competitive exchange rate and of low inflation.

Kamin (1997) provides empirical evidence for a number of countries to reconfirm his earlier finding for Mexico in Kamin(1996) that an empirical relationship holds between the rate of inflation and the level of the RER. Instead of using a framework based on tradable and non-tradable goods, this study uses domestic and foreign good framework. The study concludes that the inflation response to the RER is far larger in case of Latin American countries as compared to counterpart Asian or industrialized countries. This might be the reason that has allowed the Asian countries to continuously focusing on maintaining exchange rate competitiveness and export growth. Further, the

study finds no support of prior inflationary patterns and trade openness of the country to describe differences in response of inflation to real exchange rates.

By applying OLS and Instrumental Variable methods, Klau (1998) confirms the relationship between the level of RER and the rate of inflation for Asia, Latin America and selected industrialized countries. The author concludes that inflation–prone countries are faced with a permanent dilemma: should policy preference be given to controlling inflation or to sustaining competitive exchange rate by frequent currency devaluations. This policy clash tends to be worsened by a crucial observation that in both groups of countries currency devaluations have expansionary effects on economic output, against previous empirical evidence of narrowing impact of currency devaluations on output.

Elbadawi and Soto (1997) estimate equilibrium real exchange rate for seven developing countries, including four Sub-Saharan African countries. The study discards the PPP approach by following fundamentals based estimation of equilibrium real exchange rate for the data period from 1966 to 1999. Apart from minor differences, the results of the study favor the idea of equilibrium real exchange rate through fundamentals.

To estimate Egypt's ERER, Mongardini (1998) applies popular Edward's methodology. In this paper, the author finds different order of integration and thus applies augmented autoregressive lagged procedure (ARDL) introduced by Pesaran and Shin (1995).[18] The author concludes that while Egypt's REER was extensively overvalued before 1993, it has since converged towards equilibrium at the end of 1996, and was observed only 7 percent overvalued. Further, study concludes that Paris Club debt relief phased in during the phase 1991-96 had a considerable effect on Egypt's REER.

Edwards & Savastano (1999) address a number of exchange rate related issues in emerging economies: (a) the performance of different exchange rate regimes; (b) the extent to which PPP holds in the emerging economies; and (c) models to judge RER misalignment. They conclude that, although, there is a large body of literature on the subject there are still a number of unsettled issues. Particular, the discussion on the

[18] Pesraran and Shin (1995) show that augmented ARDL estimates are asymptotically consistent and valid inferences on the long run results can be made using asymptotic theory. The benefit of the ARDL procedure is that it can be applied irrespective of whether the variables follow an I(0), I(1) process or are fractionally integrated. This clearly makes the estimation procedure independent of the assumed order of integration and therefore provides statistically more reliable estimates.

optimal exchange rate regime has been held back due to absence of pure floating exchange rates regimes in the developing countries. Actually, the majority of exchange rate regimes regarded as "floating" are practicing some sort of managed system. Another issue that has gained a lot of attention in recent years is whether there exists a negative relationship between productivity differentials and RER i.e. Balassa-Samuelson effect. The literature reviewed in this study provides some preliminary evidence in favor of this relation.

To find the impact of export diversification and trade protection on the RER of Algeria, Sorsa (1999) includes oil price, government consumption, level of protection and volume of oil as real variables. The study supports the hypothesis that in long run only real variables influence RER whereas nominal variable are not significant. The author supports the use of single equation estimation approach for determining long run real exchange rate in Algeria. He concludes that reduction in trade protection or trade openness would depreciate RER in Algeria. This will increase the competitiveness, and provide incentives to invest in no-oil exports.

Using annual data for Cote d Ivoire and Burkina Faso, Baffes et al. (1999) estimate ERER and misalignment. They derive equilibrium relationship between RER and a set of macroeconomic "fundamentals," including government spending patterns and the terms of trade. They argue that international credit constraints and changes in trade policy are potentially important features of these countries. They report four measures of the ERER for Cote d Ivoire: the fitted RER, its corresponding five-year moving average, an equilibrium rate based on Beveridge-Nelson (BN) decompositions of the fundamentals, and one based on the counterfactual simulations described. For Burkina Faso, they replace the BN decomposition with the fitted trend for the RER. The results of the paper support the FEER approach.

MacDonald (1999) addresses three main controversies regarding the role and usefulness of economic fundamentals in explaining exchange rate behavior. First, the ability of fundamentals to explain or capture the longer run trends in the behavior of exchange rates; second, the ability of fundamentals to produce exchange rate forecasts which are an improvement over the simple martingale model; and, finally the sources of real exchange rate variability. The author concludes that fundamentals have a clear and

significant role to play in determining the in sample and out-sample performance of exchange rate models, such as monetary model. He further concludes that exchange rates are predictable at horizons as short as one month ahead. And, both short-run and long-run modeling of exchange rate is alive.

MacDonald (2000) provides a critical overview of various ways of establishing an ERER. Given the fact that PPP is not appropriate (due to slow mean reversion) for determining an equilibrium exchange rate, he discusses a few approaches which provide well-defined measures of ERER. These approaches include Capital Enhanced Measure of Equilibrium Exchange Rate (CHEER), Behavioral Equilibrium Exchange Rate (BEER) and different variants of Internal-External Balance (IEB) approach.

By proposing a new methodology, a time-varying parameter model within a single equation framework, Ozlale and Yeldan (2002) measure exchange rate misalignment for Turkey. They argue that PPP models do not elucidate the dynamics of exchange rate, at least in the short and medium run. As an alternative, single equation models are suggested to have an idea about real exchange rate misalignment. But, the literature also highlights weaknesses of such models. By taking into account this fact, this study employs a time-varying parameter model within a single equation framework to measure exchange rate misalignment for Turkey. Where return to normality assumption about the parameters is assumed. The authors conclude that after 1994; the Turkish Lira was overvalued for four successive years. After that, except first four months of 2000 and small period of 2001(April to May), Lira was observed structurally undervalued.

Using fractionally integrated threshold models Gilles et al. (2003) estimate real exchange rate misalignment in Hungary. These models allow simultaneously taking into account two types of persistence: a long-memory behavior due to the influence of real factors and nonlinear behavior where persistence is associated with regime-dependent effects. The paper concludes that two types of persistence have to be taken into account in order to explain the misalignment of Hungarian real exchange rate: a permanent component due to the influence of real factors and a nonlinear component, where persistence is associated with time-dependent effects.

Spatafora and Emil (2003) confirm a link between equilibrium real exchange rate(ERER) in Russia and fundamentals like productivity and terms of trade (TOT). A

small structural model designed for Russians economy decomposes changes in the actual RER into permanent and transitory components. The permanent changes (TOT and industrial productivity) reflect changes to the ERER and transitory variations (the excess growth in net international reserves, the excess supply of domestic credit, the increase in the fiscal deficit relative to lagged high powered money) reflect shocks to monetary policy. The proxy of TOT, used in this paper, is the world price of Russian Urals oil.

MacDonald and Ricci (2003) find that based on the Johansen (1995) cointegration estimation methodology, much of the long-run behavior of the REER of South Africa can be explained by real interest rate differentials, GDP per capita, real commodity price (approximated by TOT), trade openness, the fiscal balance, and the extent of net foreign assets. Authors argue that in the first half of the 1990s the RER was near to its equilibrium level and that successive depreciation until early 2002 can be accounted for by the observed movement in the explanatory variables. In the opening quarter of 2002, the average value of Rand emerged undervalued by 25 percent.

By applying a structural VAR model, Wang (2004) identify three types of macroeconomic shocks-supply, real demand, and nominal shocks-and their impact on output, the real exchange rate, and relative price. The results show that real demand shocks are the major source of fluctuations in real exchange rate in China over the period 1980-2002. The paper also finds that supply shocks are at least as important as nominal shocks in contributing to real exchange rate variations in China.

In conclusion, recent empirical literature on RERM rejects the PPP approach of ERER due to its slow mean reversion property. Most of the studies emphasize role of fundamentals in explaining exchange rate behavior. There are a large number of approaches used to estimate ERER (see Box 2.1). The BEER approach is commonly used for developing countries in which large and complex models are often not feasible because of data limitations. Some of the studies decompose changes in real exchange rate into its permanent and transitory components. Furthermore, response of inflation to real exchange rate is also an important but less frequently addressed question in current literature on exchange rate misalignment.

2.2.3: RERM Literature on Pakistan

In case of Pakistan, a few studies have been made to empirically examine exchange rate misalignment. These include Chishti and Hassan (1993); Afridi and Siddiqui (1994); Afridi(1995); Siddiqui et. al (1996), Siddiqui and Salam (2000) and Hussain (2002). Although this area of research is not much explored, following work may be considered as a starting point in doing further research.

By applying a small open economy model of Edwards (1988), Chishti and Hassan (1993) identify the real and monetary factors that determine the behavior of real exchange rate in Pakistan. Monetary variables consist of excess supply of domestic credit and government deficit as proportion of monetary base, while real factors comprise of terms of trade, tariff, nominal devaluation, technical progress, capital inflow and spread of official exchange rate and parallel black market rate. Contrary to existing empirical studies their results support long-run effects of the nominal variables such as excess credit and deficit financing. The paper has been criticized on the use of improper proxies for excess supply of domestic credit, productivity and openness. Excess supply of domestic credit is specified as the difference between growth of domestic credit and growth of GDP. The correct specification would be (growth of domestic credit) – (GDP growth +devaluation+ foreign inflation). Technological progress has been proxy by real GDP growth rate; this includes growth attributable to capital and labor. Further, openness is proxied by tariff revenue collection, whereas, more appropriate proxies are average effective tariff rate, and trade as percentage of GDP. In his comments on this paper, Usman Afridi pointed out that the VAR technique adopted in this paper is questionable. No theoretical basis exists for use of this technique as such no policy implication can be suggested.

To determine the equilibrium path of real exchange rate in Pakistan, Afridi (1995) estimates a model originally developed by Edwards (1989). His theoretical underpinnings and selection of variables are improvements over previous studies. His main contribution is the selection of proper variables and particularly measurement of those variables. Technological progress has been measured by Solow residual and real per capita GDP growth rates. Government expenditure on nontradables is measured by aggregating expenditure on education, health, transport and communication, housing, rural

developments, and social welfare. However the study ignores the fact that in the presence of nonstationary variables OLS may give biased results.

In their well known paper, Siddiqui et al. (1996) estimate both single-and-simultaneous equation models. The results show that both monetary and real sector variables affect the equilibrium path of real exchange rate. On the basis of these results, authors conclude that controlling only the monetary side of the economy may not be adequate to maintain RER stability and competitiveness. Instead of repeated devaluation, control of domestic prices may be another option to maintain a stable RER. The authors further conclude that simultaneous model produces better results. An important contribution of this study is that it addresses the simultaneity problem in estimation of single equation models. However, the paper has been criticized on the basis of following points: first, the use of OLS in the presence of nonstationary variables may produce spurious results; second, the annual data used from 1960 to 1994 contains major structural breaks.

By assuming that equilibrium real exchange rate is determined by "real" factors, Siddiqui and Salam (2000) analyze the determinants of equilibrium exchange rate. The paper also analyzes the trade pattern of Pakistan over the time. Real exchange rate is defined as the product of nominal exchange rate and the ratio of prices of tradable to non-tradable goods. Main determinants of equilibrium exchange rate, included in the model are terms of trade, foreign economic assistance, openness, and technological progress. Authors conclude that the role of Japan is becoming important and is reflected in sharp fluctuation in Rs/YEN exchange rate. The price of other major currencies in terms of Rupee increased 4-5 times after 1982 whereas price of Japanese Yen increased 9-times. Analyzing the determinants of the equilibrium path of exchange rate shows that the terms of trade, resource inflow and openness are important determinants of ERER.

In a recent study Hussain (2002) applies cointegration and vector error correction methodologies to compute Pakistan's ERER and its misalignment. By using annual data from 1950-51 to 1999-2000 he estimates the short and long run impacts of the real and monetary variables on RER. The ERER depends on terms of trade, openness, government consumption, capital inflows and GDP growth. The study claims that except the Balassa effect all results are according to the theory. The study may be criticized on the basis of

following facts: first, the annual data used contains serious structural breaks; second, the results on the Balassa effect are not in line with the theory; third, the proxy used for government consumption on nontradables may be replaced by a relatively better measure as suggested by Afridi (1995); fourth, in order to know Balassa effect data on total factor productivity (e.g. Solow Residual) may be used; fifth, excess credit is not properly defined, following Afridi (1995), instead of defining excess credit as the difference between growth rate in domestic credit and previous year's growth rate it should be defined as (GDC-GDPG-INF*-DEV).

In conclusion, the existing RERM literature on Pakistan contains issues like appropriateness of determinants of equilibrium real exchange rate, simultaneity problem in estimation of single equation, and sustainability of fundamentals. Most of the studies have followed Edwards (1988) framework, thus concluding that both monetary and real sector variables affect the equilibrium path of real exchange rate. However, no previous study has used real effective exchange rate to calculate misalignment, despite the fact REER is more relevant to assess the competitiveness of exports. Further, previous studies ignored the fact that misalignment may affect inflation. In this study, RERM has been incorporated as an independent variable in the pass-through model.

Appendix 2.1: Literature Review Tables

Table 2.1: Recent Empirical Literature on ERPT

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
1	McCarthy (1999)	Pass-through of ER and import prices to domestic PPI and CPI inflation	Recursive VAR model of distribution chain, Impulse Response Function, Variance Decomposition	Quarterly data from 1976:1 to 1998:4 of floating exchange period of **selected advance countries**	1. External factors have modest effect on domestic price inflation. However in 1990s external factors had a sizeable disinflation effect. 2. Higher pass-through is associated with higher import shares (degree of openness of the economy).
2	Bhundia (2002)	The degree of exchange rate pass-through to CPIX index.	Recursive VAR model followed by McCarthy(1999), Impulse Response Function	Quarterly time series data of **South Africa** from 1975:1 to 2001:1	The nominal exchange rate depreciation up to November 2001 is attributable primarily to negative real shocks, which explain why CPIX inflation did not increase significantly until December 2001.
3	Leigh and Rossi (2002)	The impact of exchange rate movements on different prices.	Five variable recursive VAR model following McCarthy(1999), Variance Decomposition	Monthly time series data of **Turkey** from January 1994 to April 2002	1. The impact of exchange rate on prices is over after about a year but is mostly felt in the first four months, 2. The pass-through to wholesale prices is more pronounced compared to the pass-through to consumer prices
4	Rowland (2003)	Impact of ER variation on domestic prices	Unrestricted VAR model suggested by McCarthy (1999), Johansen 's framework of multivariate cointegration	Monthly data of **Colombia** from 1983 to October 2002	Even if import prices respond rapidly to an exchange rate, ERPT to producer prices is modest while the pass-through to consumer prices is very limited.
5	Gueorguiev (2003)	1. Does pass-through depends on the choice of exchange rate benchmark? 2. Has pass-through declined?	Recursive VAR model of McCarthy (1999) is modified for Romanian environment. Impulse Response Function, variance decomposition	Monthly data of **Romania** from June 1997 to January 2003.	1. The pass-through is large and relatively fast in the case of Romania. 2. The pass-through depends on the choice of an exchange rate benchmark. 3. Pass-through in producer prices has dropped and pass-through to consumer prices has not declined.
6	Belaisch(2003)	Whether the exchange rate pass-through has risen in recent years?	Recursive VAR model of McCarthy(1999), Impulse response function, OLS.	Monthly data of **Brazil** from July 1999 to December 2002	Pass-through to consumer prices in Brazil is limited but rapid ending after two quarters.

Table 2.1: Recent Empirical Literature on ERPT (continued)

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
7	Hahn(2003)	Impact of external shocks on domestic prices and different stages of distribution.	VAR approach based on distribution chain of pricing, Impulse response function.	Quarterly data of **Euro Area** covering the time period 1970Q2 to 2002Q2	1. Pass-through is fastest and largest for import price shocks followed by exchange rate shocks and oil price shocks. 2. The size and the speed of the pass-through of external shocks decline along the distribution chain of pricing.
8	Anderton(2003)	Impact of exchange rate changes on euro area manufacturing import prices.	Single equation model of import price. Impulse response function	Time series and panel data of **Euro area** from 1989Q1 to 2001 Q4	The pass-through of changes in the effective exchange rate of the euro to the price of extra-euro area imports of manufactures is around 50%-70%, while pricing –to-market has an estimated weight of between 50%-30%
9	Goldfajn and Werlang(2000)	Relationship between exchange rate depreciation and inflation.	Panel regression method	Panel data of 71 countries in the period 1980-1998	1. RER misalignment is the most important determinant of inflation for emerging markets while the initial inflation is the most important variable for developed countries. 2. The pass-through coefficient increases the longer is the horizon analyzed.
10	Choudhri and Hakura(2001)	Whether low inflationary environment leads to a low exchange rate pass-through to domestic prices.	Difference model (as evidence of cointegration was not found).	Data of 71 countries in the period 1979-2000	1. There is strong evidence that relation between the pass-through and the average inflation rate is positive and significant across regimes and periods.
11	Campa and Goldberg(2002)	Estimation of exchange rate pass-through to import prices	Difference model; Ordinary Least Squares is applied on variables in log difference.	Quarterly data of **25 OECD** member countries from 1975 to 1999	Decline in pass-through in the 1990s is mainly attributable to the structural change in imports. Decline in pass-through is not common feature of all OECD countries but is seen in some of them.
12	Otani, Shiratsuka, and Shirota(2003)	Estimation of exchange rate pass-through to import prices.	Seemingly unrelated regression Rolling regression method	Monthly data of **Japan** from January 1978 to October 2002	Decline in pass-through in Japan's import prices in 1990s came from the declines in pass-through in each product imports, rather than the shift of import share from raw materials to manufactured goods with lower ERPT.

Table 2.1: Recent Empirical Literature on ERPT (continued)

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
13	Faruqee(2004)	Effect of exchange rate shocks on different prices over time.	VAR approach following Choudhri et. al. (2002); Impulse Response Function, Granger Causality test, Block exogeneity test,	Seasonally adjusted quarterly data of **non-U.S.G-7** countries ranging from 1979-1 to 2001-3	1. The short-run pass-through is very low in the euro area for a wide range of prices. 2. Pass-through tends to rise over time in the euro-area
14	Hossain(2002)	Test of Monetarist model of inflation.	Restricted monetarist model of inflation. Co integration and Error Correction Modeling Approach	Annual and monthly data of **Bangladesh** from 1972-73 to 1999	1. The effect of devaluation on inflation is not significant. 2. The effect of inflation on devaluation is significant. But effect became weaker after financial reforms in early 1980s.
15	Maliszewski (2003)	Estimation of Long-run and Short-run inflation equation s in Georgia	Cointegration, Error correction model for inflation	Monthly data of **Georgia** from Jan. 1996 to Feb. 2003	The inflation equation is stable, points to a dominant role of the exchange rate in the behavior of inflation, and pass-through is fast in Georgia.
16	Choudhri, Faruqee, and Hakura(2005)	Performance of different new open economy macroeconomic models in explaining ERPT in a wide range of prices.	VAR model including seven endogenous and two exogenous variables; Impulse Response Function	Seasonally adjusted quarterly series for annual rates of **non-U.S.G-7** countries from 1979-1 to 2001-3	The best fitting model incorporates a number of features highlighted by different strands of literature: sticky prices, sticky wages, distribution costs, and combination of LCP and PCP.

Table 2.1a: Recent Empirical Literature on ERPT in Pakistan

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
1	Ahmad and Ram(1991)	Whether import prices affect inflation?	Monetarist model of price inflation by applying OLS	Annual data of Pakistan from 1960-61 to 1987-88	1. The growth in import prices, monetary expansion and inflation in the past are the major causes of inflation. 2. The growth in output helps in controlling inflation but not very forcefully.
2	Khan and Qasim(1996)	Determinants of general food and non food inflation in Pakistan	Single Equation Models/ OLS, Cointegration, Error Correction Model	Annual data of Pakistan from 1971-72 to 1994-95	1. Borrowing from banks to finance budget deficit is main cause of inflation in Pakistan. 2. Frequent currency devaluation/depreciation has also caused inflation in Pakistan
3	Ahmad and Ali (1999)	Relationship between ER & Prices	Simultaneous Equation Model/ Two Stage Least Square Method	Quarterly data from 1982:2 to 1996:4	Relationship between price level and exchange rate is not unidirectional, though the short run effect of devaluation on inflation is estimated to be smaller than the effect of inflation on devaluation.
4	Siddiqui and Akhtar(1999)	Impact of changes in foreign prices and changes in monetary and real variables on domestic prices	Monetarist type model, Cointegration, ECM, Granger Causality Test	Annual data of Pakistan from 1972 to 1998	1. No significant uni-directional or bi-directional causal relationship between changes in exchange rate and domestic prices. 2.Money supply and level of domestic activity affect domestic prices
5	Choudhri and Khan(2002)	Whether inflation systematically related to exchange rate changes?	Difference Model, VAR Model, Impulse Response Function, Variance Decomposition	Quarterly data of Pakistan from 1982:1 to 2001:2	There is no evidence of a significant pass-through of Rupee depreciation to consumer prices in SR. Response of inflation to ER shocks is close to zero even after 2 years.
6	Hyder and Shah(2002)	Effect of ER movements on domestic WPI & CPI inflation in Pakistan	Recursive VAR suggested by McCarthy (1999), Impulse Response Function, Variance Decomposition Method	Monthly Data from January 1988 to December 2002	1. ER movement have moderate effect on domestic price inflation 2. ER pass-through is more stronger in WPI as compared to CPI 3. The impact of pass-through on domestic prices spread over 18 months, however, most effect is felt in first four months 4.Response is weak in food group & strong in Fuel & Lightening

Table 2.2: Recent Empirical Literature on RERM

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
1	Edwards(1994)	Response of RER movements to both nominal and real disturbances.	Single equation model was estimated for pooled data by using a fixed effect procedure with country specific fixed terms.	panel data for 12 developing countries over the period 1962-84	1. Except the productivity variable all explanatory variables had signs according to the theory. 2. Nominal devaluations can help to speed up the RER realignment.
2	Faruqee(1995)	Long-run determinants of real exchange rate.	Johansen's Cointegration technique	Post-war period data of **USA** and **Japan**	Sectoral productivity differentials explain a large portion of the trend variation in the real exchange rate in USA and Japan. However, for USA NFA also confirm a long-run relationship with real exchange rate.
3	Kamin(1997)	Response of inflation to RER.	Kamin (2001) model with domestic and imported goods framework instead of tradables and nontradables.	Annual data for the period 1970 to 1996 for 38 countries divided into three groups of Asian, Latin American and industrialized countries.	1. Responsiveness of inflation to the RER has been much higher in Latin America than in Asian or industrialized countries. 2. The relationship between misaligned RER and inflation poses problems for policy makers in achieving low inflation without loosing competitiveness.
4	Elbadawi and Soto(1997)	Estimation of Long-run equilibrium real exchange rate.	Extends Edward's(1989) and Rodriguez(1989) inter-temporal model; Cointegration and Error Correction were applied	for seven developing countries based on annual data from 1960 to 1994	Except minor differences, the results of the seven countries support the theory of ERER based on fundamentals.
5	Mongardini (1998)	Estimation of equilibrium real exchange rate.	Applies Edward's methodology. Due to different order of integration of variables ARDL presented by Pesaran and Shin (1995).	Monthly data of **Egypt** from Feb. 1987 to Dec. 1996	1. Egypt's ERER was overvalued before 1993. 2. Paris Club debt relief phased in during the period 1991-96 had a significant impact on Egypt's real effective exchange rat.

Table 2.2: Recent Empirical Literature on RERM(continued)

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
6	Sorsa(1999)	Impact of trade liberalization on real exchange rate	Single equation estimation of the determinants of the real exchange rate. OLS, Cointegration and ECM	Annual data of **Algeria** from 1980 to 1997	1. In the long run only real variables affect RER while nominal variable are insignificant 2. Trade liberalization should be important element in export diversification policy of Algeria.
7	Kamin(2001)	Impact of misalignment on inflation.	Based on Salter Swan Model, Cointegration, ECM, OLS	Monthly data from 1980-2 to 1995-12 of **Mexico**	Real exchange rate and de-trended output were significant determinants of inflation in Mexico. This result implies a trade off between the goals of a competitive exchange rate and low inflation.
8	Ozlale and Erinc(2002)	Measurement of exchange rate misalignment for Turkey	A time-varying parameter model within a single equation framework.	Monthly data of **Turkey** between January 1992 and December 2001.	Following the economic crisis in 1994; the Turkish Lira was overvalued for four consecutive years. Then excluding the first four months of 2000 and short period of April 2001 and May 2001, Lira was found structurally undervalued.
9	Asfaha and Huda(2002)	Impact of the misalignment on trade competitive ness	Edward's model, Cointegration, ECM	Quarterly data of **South Africa** from 1985:1 to 2000:4	The impact of the misalignment on trade competitiveness is felt over long-run and effect is felt only through time lags of about four quarters.
10	MacDonald and Ricci (2003)	Estimation of South Africa's equilibrium real exchange rate.	Johansen (1995) cointegration estimation methodology,	Quarterly data of **South Africa** from 1970Q1 to 2002Q1	1. In the first quarter of 2002, the average value of Rand appeared to be 25 percent more depreciated than equilibrium of the real exchange rate. 2. Half life of deviations was more than two years.
11	Spatafora and Emil(2003)	Estimation of Russia's equilibrium real exchange rate.	1. Model of Edwards(1994) and Mongardini (1998); 2. Co integration and ECM	Quarterly data of **Russia** from 1995-1 to 2002-3	ERER in Russia reflects both productivity and terms of trade (TOT).
12	Chobanov and Sorsa(2004)	Estimation of equilibrium real exchange rate and misalignment	NATREX and BEER approaches, Cointegration technique	Quarterly data of **Bulgaria** from 1997-3 to 2003-1	1. RER has been driven by fundamentals, such as productivity, terms of trade, gross savings, world interest rates, and foreign direct investment. 2. There is no evidence of misalignment.

Table 2.2: Recent Empirical Literature on RERM(continued)

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
13	Wang(2004)	Estimation of relative importance of different types of macroeconomic shocks to fluctuations in the real exchange rates in China.	Structural VAR model	Annual data of **China** from 1980 to 2002	1. Real relative demand shocks have been the most important sources of fluctuations over the period 1980-2002; while supply shocks have been the main factors accounting for variations in relative output and relative prices. 2. Supply shocks were at least as important as nominal shocks in contributing to real exchange rate variations in China.

Table 2.2a: Recent Empirical Literature on RERM in Pakistan

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to RERPM
1	Chishti , Salim and M. Aynul Hasan(1993)	Impact of fundamentals on Real Exchange Rate Variation in Pakistan.	Small Open Economy Model of Edward's(1988); VAR methodology	Both Annual and Quarterly Data from 1957 to 1991.	1. PPP does not hold in Pakistan. 2. Results support long-run effects of the nominal variables such as excess supply of credit and deficit financing.
2	Afridi, Usman (1995)	Impact of fundamentals on Real Exchange Rate Variation in Pakistan.	Small Open Economy Model of Edward's (1989); OLS technique	Annual Data from 1960 to 1990	1. Terms of Trade variable is found insignificant 2. Excess Demand for domestic Credit, Capital flows, and openness were found inversely related to the RER. 3. Government expenditure on non-tradables was found positively related to the RER. 4. Due to better specification, technological change variable shows support for Balassa effect.
3	Bhatti, Razzaque H. (1996)	Whether PPP holds for eight Pak-rupee exchange rates with major industrial countries?	Cointegration And mean reversion test	Quarterly Data from 1982-I to 1994-IV	1. PPP holds in all cases except U.K. 2. The test for mean reversion strongly supports the PPP.
4	Siddiqui, Rehana, Usman A. Afridi, and Zafar Mahmood (1996)	1. Impact of monetary and Real variables on Real Exchange Rate Variation, 2. Whether the estimates of RER-model suffer from simultaneity bias.	Theoretical Framework developed in Afridi (1995); Both Single and Simultaneous Equation Models by applying OLS and 2SLS	Annual Data from 1960 to 1994	1 .Both the monetary and real variables affect the equilibrium path of RER. 2. TOT is insignificant; Excess Domestic Credit Creation and Openness contribute to RER appreciation. 3. Simultaneous equation model gives better results than the single equation model.
5	Siddiqui, Rehana, and Ayesha Salam (2000)	1.Determination of ERER 2.Analysis of Trade Pattern of Pakistan with U.S.A and Japan		Annual Data from1972 to 2000	1. Japan is becoming important and is reflected in sharp fluctuation in Rs/Yen. 2. TOT, Resource Inflow and openness are important determinants of ERER.

Table 2.2a: Recent Empirical Literature on RERM in Pakistan (continued)

	Authors	Hypothesis	Empirical Approach	Data	Findings Related to RERPM
6	Hussain (2002)	Determination of Equilibrium Real Exchange Rate and Exchange Rate Misalignment	Cointegration and Error Correction Model,	Annual Data from 1951 to 2000	The ERER depends on TOT, Openness, Govt. Consumption, Capital Inflows and GDP Growth. The study claims that except the Balassa effect all results are according to the theory.
7	Ahmed and Khan (2002)	Whether PPP holds for six selected Asian countries.	Cointegration and Error Correction Model,	Annual Data from 1972 to 1997	1. Maximum number of cointegrating relationships between bilateral exchange rate and relative prices exist for Pakistan among selected six Asian economies. 2. Long run relationships between exchange rate and relative prices are less for CPI index as compared to WPI and GDP deflator.
8	Hyder and Adil (2005)	Estimation of Equilibrium Real Effective Exchange Rate and Exchange Rate Misalignment	Cointegration and Error Correction Model,	Annual Data from 1978 to 2005	The ERER depends on TOT, Openness, Govt. Consumption, relative productivity differential and Workers' remittances The study shows that current exchange rate is not far away from Equilibrium

CHAPTER 3

EXCHANGE RATE REGIMES IN PAKISTAN: AN OVERVIEW

Before presenting empirical model developed to estimate linkage between exchange rate changes and prices (chapter 4), this chapter briefly reviews different exchange rate regimes experienced by Pakistan since her independence in 1947. For nearly thirty-five years, Pakistan maintained a fixed peg regime for its exchange rate. The Rupee was first linked to the Pound Sterling in the early years after 1947, as Pakistan was a member of the Sterling Area. Later on, as the USA became more dominant across the globe, and as Pakistan's political relations improved with the USA, the US Dollar became the main currency with respect to the Pakistani Rupee. Pakistan decided to de-link the Rupee from Pound Sterling from September 17, 1971 and decided to link it to the U.S Dollar. Accordingly, as from this date the SBP began purchase and sale of U.S. Dollar from and to the authorized dealers along with Pound Sterling. However, from December 9, 1971 both purchasing and selling of Pound Sterling was ceased.

During FY1973-82, the exchange rate between the Rupee and US Dollar remained fixed at 9.9 Rupees per Dollar. During late 70s, Dollar appreciated against major currencies which deteriorated the competitiveness of Rupee due to its link with Dollar and authorities were compelled to adopt managed exchange rate regime in Pakistan. On January 8, 1982 the SBP adopted managed floating exchange rate regime, which continued until July 21, 1998 when the SBP decided to start transition from managed float to free float exchange rate system. In the start of transition, Pakistan moved to a dual exchange rate system with effect from July 22, 1998. However, the unification of the exchange rate system was realized on May 19, 1999. From July 22, 1998 to July 20, 2000 the exchange rate regime was completely switched from managed floating to free floating. Now free-floating exchange rate system is operating in Pakistan, however, SBP intervenes in the foreign exchange market only occasionally to tackle excess volatility and for lumpy oil payments.[19] In the following, an overview of different exchange rate regimes in Pakistan is presented (see Table 3.1 for an overview of year-wise changes in ER and related variables since FY1973).

[19] According to IMF classification, Pakistan's exchange rate is de facto pegged with US Dollar, however, SBP claims that free floating exchange rate regime is operating in Pakistan since July 2000.

3.1: Fixed Exchange Rate Regime

3.1.1: Before 1971 Partition:

After the creation of Pakistan, economic managers of the country decided to execute the Indian Currency Regulations of 1939 thereby linking the country's legal tender with Pound Sterling. The Pakistani Rupee remained linked to Pound Sterling for a considerable time and was de-linked on September 17, 1971.

During 1949, the Pound was devalued by around 30.5 percent which resulted in subsequent devaluation of currencies by member countries of Sterling Area including India. However, Pakistan did not devalue its currency because of several internal and external reasons. This decision affected the trade relations between Pakistan and India. However, during the first half of 1950s, Pakistan's balance of payments deteriorated due to international commodity depression of 1952, which caused a huge decline (up to 50 percent) in prices of exportable commodities. This resulted in a significant reduction in foreign exchange earnings of the country and consequently the currency was devalued on July 31, 1955 and was re-fixed at 0.186621 grams of fine gold which was equivalent to Rs 4.7619 per US Dollar.

The prime objective of devaluing the Rupee was to enhance the competitiveness of country's main exportable commodities like cotton and jute. The exports increased by 10 percent during 1955-56, however subsequently the exports declined in the next years. This was observed the rising domestic prices were blamed for this which eroded the competitiveness of exports.

The Rupee was considered to be fairly overvalued even after 30.5 percent devaluation of the currency because devaluation in 1955 was smaller than the actual overvaluation of Rupee at that time. This overvaluation affected the exports of the country which gradually declined after 1955 thereby adversely impacting the foreign exchange reserves position.

In order to improve the dwindling exports of the country, an Export Bonus Scheme (EBS) was initiated on January 15, 1959. The key intention of EBS was to facilitate increase in exports by raising exporter's earnings and to offer incentives for the import of goods without restraint. This scheme was modified in later years and further extended to include more commodities in order to facilitate exporters as well as importers. Although the EBS proved to be advantageous in enhancing the export earnings, but at the same time resulted in a distorted exchange rate system with multiplicity of exchange rates prevailing in the market. As a consequence of negative impact of this scheme, it was abolished from May 11, 1972.

3.1.2: After Partition in 1971:

On August 15, 1971, United States decided to cease the convertibility of its currency into gold. However, the decision was later on reversed on August 23, 1971. After the reopening of the international foreign exchange markets, the Pound Sterling gradually appreciated in terms of other currencies of the world. Given that the Rupee was linked to Sterling since independence of the country, it resultantly also appreciated against other major currencies which posed a threat to already declining exports of Pakistan. In order to avoid further worsening, the government decided from September 17, 1971, to de-link the Rupee with Pound Sterling and linked it with US Dollar. This decision was also considered indispensable as the bulk of international trade transactions of Pakistan were taking place in US Dollar.

To realign the exchange rate the US Dollar was devalued by 7.89 percent in December, 1971. [20] This development resulted in revaluation of Rupee by the same magnitude. The old parity of Rupee verses Dollar of Rs. 4.7619 per US Dollar being the same meant a de facto revaluation of Rupee by 7.89 % in terms of gold.

Despite of the fact, the EBS enhanced export earnings and industrial capacity in the country, it had demerits of multiple exchange rates both on exports and imports sides. The government decided to devalue Rupee by 56.73 percent from May 11, 1972 to deal with the problems involving multiple exchange rates in Pakistan.[21] The rupee was fixed at 0.0744103 grams of fine gold that was equivalent to Rs. 11 per US Dollar. As a result of this substantial devaluation, the export receipts increased significantly by 39.9 percent during 1972-73.

While in the short-term, the exports did increase considerably due to realignment, but later on the exports volume started to decline. The deterioration in foreign exchange earnings was largely due to relatively higher domestic inflation compared to trading partners which nullified the impact of devaluation. In short, the devaluation was unable to get rid of the longstanding exchange rate misalignment.

After a very short span, the US Dollar was further devalued with effect from February 1973, which again posed negative repercussions for Rupee. However, the economic managers of the country decided not to alter the pertaining exchange rate parity. This decision altered the

[20] US Dollar was devalued as per Smithsonian Agreement that ensured the realignment of major international currencies.

[21] For detail, see, " The Mirage of Power: An Inquiry into the Bhutto Years, 1971-1977," By Dr. Mubashir Hasan, pp. 90-104

Rupee-Dollar parity to Rs. 9.90 per US dollar, whereas it lingered fixed at 0.0744103 grams of fine gold. This Rupee-Dollar parity continued during the decade of 70s, whereas at the same time, other regional countries pursued fairly flexible exchange rate policies. Furthermore, during the same period, trade policies in Pakistan were primarily inclined towards import substitution rather than export promotion. Additionally, the export incentive schemes were considerably curtailed and export duties were levied on a large number of products. As a result, the export earnings of Pakistan deteriorated to a larger extent.

3.2: Managed Floating Exchange Rate Regime:

There was a marked appreciation in US Dollar during the second half of 1970s. This was because of the relatively less easy monetary policy stance adopted by successive US governments, which led to interest rate hike that in turn resulted in massive capital inflows in US economy thereby appreciating US Dollar. As the Rupee was linked to US Dollar, it was, therefore, largely overvalued which provided the basis for reduction in exports and increase in imports. In order to regain the export competitiveness, GOP decided to implement the managed floating exchange rate regime[22], through linking Rupee with trade-weighted basket of currencies of major trading partners of the country. Pakistan adopted the managed floating exchange rate regime from January 8, 1982, and de-linked its currency from US Dollar.

The managed floating system was executed in Pakistan through frequent adjustments in the value of Rupee, taking into account the current exchange rates and prices of major trading partners. Additionally, the macroeconomic fundamentals like inflation, balance of payments, remittances, fiscal deficit and industrial growth were also taken into consideration before setting the exchange rate. Since the beginning of 1991, the government initiated wide ranging exchange and payment reforms with the objective to provide favorable environment for investment in the country. These reforms mainly included liberalizing of credit facilities for trading companies, relaxing rules for import and export of currency notes, investments in bonds, remitting of dividends, transfer and trading of shares and many more. During the period from 1990 to 1998, the current account balance as a percentage of GDP deteriorated

[22] The managed floating exchange rate system is based on the mechanism of adjustments in exchange rate with the objective of reducing the balance of payment gap.

significantly (see Figure 3.1). Further, this deterioration coupled with low level of capital inflows and double digit inflation provoking pressure on exchange rate during the period.

Table3. 1: Year-wise Overview of ER Changes and Related Variables

Years	Nominal Exchange Rate (average)	Appreciation (Depreciation)	Reserves Held By SBP (end of FY), US$ million	Workers' Remittances (US$ million)	M2 Growth (%)	Discount Rate (Mid of F.Y), In Percentage	CPI Inflation (%)	
Fixed Exchange Rate Regime (Before January 8, 1982)								
FY 73	9.90	-	463	136.0	22.7	6	4.7	In 1970s average CPI inflation was 11.9%
FY 74	9.90	-	403	139.14	13.4	8	9.7	
FY 75	9.90	-	486	211.1	18.1	9	30.0	
FY 76	9.90	-	614	339.02	25.9	9	26.7	
FY 77	9.90	-	431	577.72	24.1	9	11.7	
FY 78	9.90	-	1,010	1,156.33	23.0	10	9.2	
FY 79	9.90	-	904	1,397.93	20.2	10	6.9	
FY 80	9.90	-	2,019	1,744.14	17.6	10	8.3	
FY 81	9.90	-	1,866	2,115.88	13.2	10	10.4	
FY 82	9.90	-	1,460	2,224.89	11.4	10	11.1	
Managed Floating Exchange Rate Regime (From January 8, 1982 to July 21, 1998)								
FY 83	12.71	28.8	2,758	2,885.67	25.3	10	4.7	In 1980s average CPI inflation was 7.5%.
FY 84	13.48	6.10	2,489	2,737.44	11.8	10	7.3	
FY 85	15.15	12.39	1,190	2,445.92	11.8	10	5.7	
FY 86	16.14	6.50	1,638	2,595.31	14.8	10	4.4	
FY 87	17.18	6.40	1,784	2,278.56	13.7	10	3.6	
FY 88	17.6	2.40	1,326	2,012.60	12.2	10	6.3	
FY 89	19.21	9.20	1,227	1,896.99	4.6	10	10.4	
FY 90	21.44	11.60	1,451	1,942.35	12.5	10	6.0	
FY 91	22.42	4.50	1,390	1,848.29	17.4	10	12.7	In 1990s average CPI inflation was 9.7%
FY 92	24.84	10.80	1,761	1,467.48	26.2	10	10.58	
FY 93	25.95	4.50	1,369	1,562.24	17.8	10	9.83	
FY 94	30.16	16.20	3,337	1,445.56	18.1	10	11.27	
FY 95	30.85	2.30	3,730	1,866.10	17.2	15	13.02	
FY 96	33.57	7.80	3,251	1,461.17	13.8	17	10.79	
FY 97	38.99	16.16	1,977	1,409.47	12.2	20	11.80	
FY 98	43.19	10.77	1,737	1,489.55	14.5	18	7.81	
Transition Period and Free Floating Exchange Rate Regime (Since July 22, 1998)								
FY 99	46.790 50.055*	15.88	2,371	1,060.19	6.2	16.5	5.74	
FY 00	51.771	3.44	2,149	983.73	9.4	13.0	3.58	Inflation averaged 5.3 percent during 1999-2006
FY 01	58. 438	12.88	2,666	1,086.57	9.0	13.0.	4.41	
FY 02	61. 426	5.11	5,439	2,389.05	15.4	10.0	3.54	
FY 03	58. 5	-4.8	10,727	4,232	18.0	7.5	3.10	
FY 04	57. 57	-1.60	11,182	3,871	19.6	7.5	4.6	
FY 05	59.36	3.11	10,687	4,168	19.3	9.0	9.3	
FY 06	59.86	0.84	11,471	4,600	15.2	9.0	7.9	

Sources: Economic Survey of Pakistan 2005-06,
SBP Annual Report 2005-06
* indicates composite exchange rate between 22nd July, 1998 to 19th May, 19
** Base year is 2000-01 for calculation of inflation since 1990-91.

During FY1991-98, the exchange rate modifications were made keeping in view the deteriorating balance of payment and foreign exchange position of the country (see Figure 3.2). During FY94, Rupee was devalued by 11.27 percent, predominantly as a result of decline in foreign exchange reserves which stood at US$ 182.5 million in July 1993. To overcome the worsening situation, government had to draw almost US$ 168.55 million from International Monetary Fund (IMF) under various agreements[23]. This utilization along with recovering current and capital account performance perked up foreign exchange reserves to US$ 2.3 billion by June 30, 1994.

In FY95, there were twelve adjustments in the exchange rate which were insignificant as aggregate devaluation was less than three percent. Furthermore, as a progress towards exchange and payment system reforms, GOP eliminated many restrictions on making payments for current international transactions in July 1994. This was a major advancement towards current account convertibility.

During FY96, the BOP position worsened noticeably, as current account deficit amounted to US$ 4.348 billion. As a consequence, the Rupee was adjusted downward by 7 percent in October 1995. In the next year, the balance of payment situation further worsened, and to ease pressures on external account, government announced a comprehensive stabilization program. The main features of the program included devaluation of Rupee[24], incentives for export growth and tightening of monetary and fiscal policies.

At the same time the premium on free market exchange rate started rising sharply ranging between 6-10 percent during Feb-Aug 1996 due to unfavorable political and economic conditions. Previously it ranged between 2-6 percent during December 1993 to January 1996. However, as a result of the effective stabilization package during 1996-97, the premium was brought down to 4.54 percent in December 1996.

During 1997-98, exchange rate was adjusted by 8 percent in October 1997, mostly on the grounds that the East Asian crises could adversely impact the acceleration in exports. The measures proved successful as the trade gap was contained to US$ 1.9 billion from US$ 3.1 billion in FY97. Similarly, the foreign exchange reserves also increased impressively from

[23] Standby and ESAF arrangements.
[24] Devaluation of rupee was 7.85 percent with effect from October 22, 1996.

US$ 935 million in FY97 to US$ 1.143 billion in FY98. Moreover, the premium on market exchange rate declined significantly to 3.29 percent in April 1998[25].

3.3: Transition of ER Regime from Managed to Free Floating

3.3.1: Two-Tier Exchange Rate System:

Following the nuclear test in May 1998, Pakistan faced enormous challenges in its exchange rate management. As the government decided to temporarily freeze the foreign currency accounts (FCAs)[26], the premium on free market exchange rate rose to 20.83 percent in August 1998. These undesirable developments in the aftermath of nuclear explosion caused the government in general and the central bank in particular, a huge credibility loss. To ease the unfavorable situation, government announced an incentive package for FCAs holders with the condition to convert their accounts in Rupees. Simultaneously, government also allowed opening of new FCAs with the approval of withdrawal in any foreign currency.

As a result of the events after the nuclear test, the government decided to adopt a two-tier exchange rate system with effect from July 22, 1998. The new exchange rate system was considered necessary as economic sanctions imposed on Pakistan, caused disruption in much needed financing from international financial institutions. The new system was adopted with the agreement of IMF. It was also decided in principle to gradually shift the existing exchange rate mechanism towards free float exchange rate system.

As a step towards implementation of these decisions, an exchange rate system encompassing three exchange rates (i.e. official exchange rate, floating inter-bank exchange rate (FIBR) and composite rate) was introduced from July 22, 1998. While the official exchange rate remained fixed, the FIBR was determined through market forces and the composite rate was established as an explicit ratio of the two exchange rates. The composite rate was based on a specified ratio of official rate and FIBR, which was initially fixed at 50:50 (50% official and 50 % FIBR) and was changed subsequently in favor of inter-bank rate to 20:80 on December 21, 1998 and further to 5:95 on March 11, 1999.

[25] The premium on market exchange rate was 1.9% in July-1997, 5.86% in February-1998 and 3.29% in April-1998.
[26] Withdrawal from foreign currency accounts were permitted in rupee only.

Figure3.1: Current Account Balance as percent of GDP

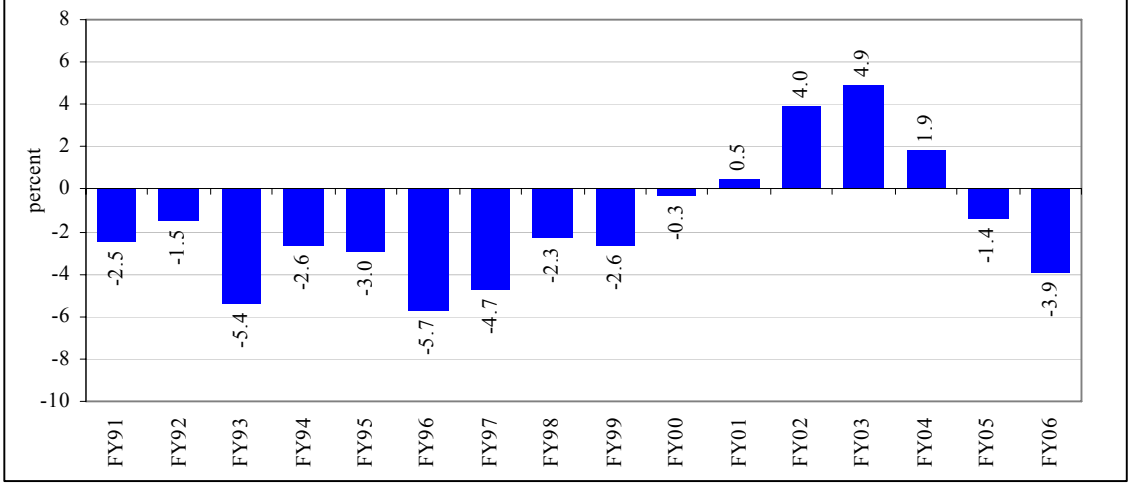
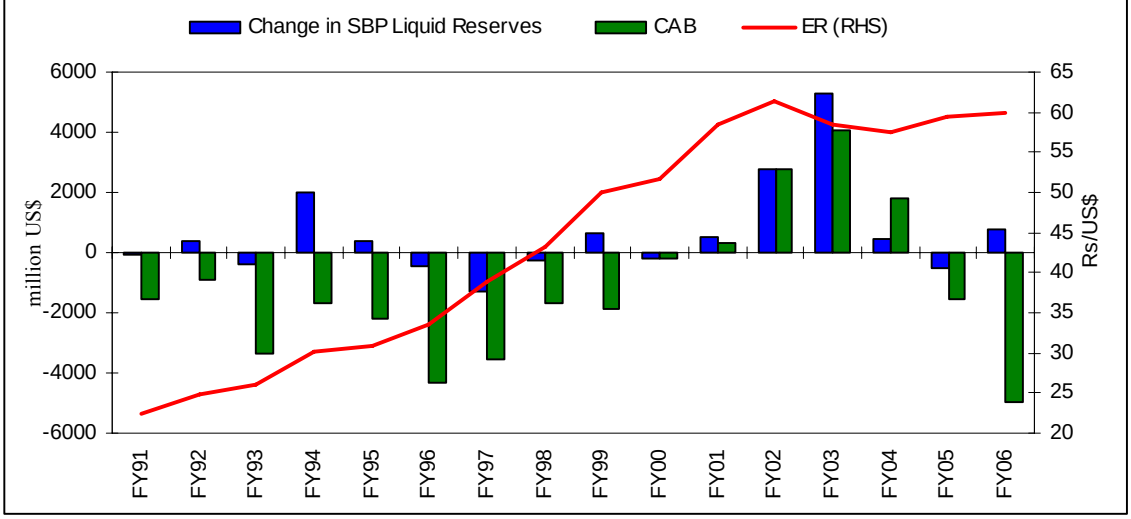


Figure 3.2: External Account and ER Changes b/w FY 1991-06



In two-tier exchange rate system, Rupee remained somewhat stable in the open market. However, in August 1998, pressures in open market developed[27], as the demand for foreign exchange for education and traveling purposes shifted to open market from composite rate. To address the situation, government initiated a number of measures like monitoring of outflows of foreign exchange, curbing speculative activities through moral suasion, announcement of exchange rates on daily basis by money changers, restriction on money changers on encashment of travelers' cheques[28] and most importantly broadening the scope of SBP's interventions in foreign exchange market. Resultantly, the pressure on Rupee was eased and the premium started declining sharply from 7.08 percent in December, 1998 to 0.98 percent in April, 1999.

3.3.2: Unified Exchange Rate System:

As the existing system was based on multiple exchange rates arrangement thus, the foremost intention of the government was to swiftly move towards the unified exchange rate system.[29] Therefore, through implementation of a single FIBR, the unification of the exchange rate system was realized on May 19, 1999. In this system, the exchange rate was solely determined through supply and demand forces in the inter-bank market.

While the effective exchange rate was set by market forces, SBP was permitted by IMF to intervene in the market for buying and selling of foreign exchange at its discretion. Authorized Dealers (ADs) were required to entertain all foreign exchange requirements, through their own price setting mechanism with the only condition that the spread between buying and selling could not exceed Rs 0.50 per US dollar. With the support of IMF technical assistance mission, SBP took a number of regulatory and institutional measures to facilitate market forces in determination of exchange rate.

After the exchange rate unification, the inter-bank market faced severe shortage of foreign currency. To normalize the situation, SBP intervened to provide necessary foreign exchange liquidity in the market. As a result of central bank's interventions in the inter-bank market, the Rupee stabilized and exchange rate moved in the range of Rs 52.45- Rs 54.40 per US dollar

[27] Rupee touched the level of Rs 63.75 per US dollar on September 4, 1998.
[28] This restriction was imposed on travelers cheques issued in Pakistan only.
[29] As under IMF's Article-VIII, a member country is not allowed, except temporarily and with Fund's approval, to engage multiple currency practice.

during the year. Consequently, the exchange rate witnessed only one percentage point depreciation compared to preceding fiscal year. Simultaneously, the kerb rate also remained stable during the period and remained within the range of Rs 53.7-Rs 55.15, registering an average of 4.5 percent premium during FY00[30].

3.4: Free-Floating Exchange Rate Regime

3.4.1: Pre September-11 Scenario

The managed floating exchange rate system was replaced with free float exchange rate system with effect from July 21, 2000. Following the implementation of free float regime, the exchange rate exhibited large instability due to a number of reasons, most importantly, the huge external deficit and high kerb market premium. As a result, Rupee depreciated by around 18.6 percent during FY01. Furthermore, low level of foreign exchange reserves complicated the situation due to inadequate capacity of the central bank to stabilize the exchange rate through market interventions (see Table 3.1).

To bring back stability in exchange rate, SBP took a number of effective monetary policy measures besides frequent interventions in the kerb market to control the premium and to manage liquidity in the inter-bank market. The SBP increased its discount rate from 11 percent to 12 percent on September 19, 2000, and further raised it to 13 percent on October 5, 2000. Likewise, the weighted average rate on six months treasury bills increased from 8.1 percent to 10.5 percent on October 5, 2000. Additionally, SBP also announced[31] to raise the Cash Reserve Requirement (CRR) to 7 percent from 5 percent. All these monetary measures proved highly effective in reducing pressure on Rupee thereby normalizing the exchange rate to a larger extent. Consequently, depreciation of Rupee improved the export competitiveness[32] of the country and reduced the current account gap considerably during FY01.

3.4.2: Post September-11 Scenario

The events of September 11, 2001 in general redesigned the dynamics of foreign exchange market in Pakistan. The effective measures taken by international financial

[30] The kerb premium was 8.2 percent during 1998-99 which was high compared to the premium of 4.5 percent during 1999-00.
[31] Cash Reserve Requirement was increased on October 7, 2000.
[32] Improvement in export competitiveness was also indicated from the depreciation in Real Effective Exchange Rate (REER) during the period.

institutions[33] resulted in the transfer of foreign exchange flows through official channels. The major advancement was a jump in workers' remittances during this period, which increased four times in a short period of two years. Further, FDI inflows also observed a substantial increase, which rose to US$ 3.5 billion in FY06 from US$ 0.3 billion in FY01 (see Figure 3.3).

The enormous growth observed in workers' remittances during FY02 and FY03 allowed current account surpluses and eventually increasing of foreign exchange reserves (see Figure 3.2). The current account balance to GDP ratio improved to 4.9 percent during FY03. However, later on it deteriorated to -3.9 percent during FY06 (see Figure 3.1).

The reserves held by SBP showed a great impetus after enormous foreign exchange inflows in the form of workers' remittances and capital inflows particularly FDI. Reserves held by SBP crossed US$ 10 billion in FY03 and were recorded US$ 10.5 billion by the end of FY06. This increase in reserves improved reserve adequacy ratios in FY03 and FY04 which declined in FY05 and FY06 (see Table 3.2). The reserves to GDP ratio reached to 14.6 percent during FY03 which later on declined to 10.26 percent in FY06. Similarly, import coverage ratio increased to 8.1 in FY03 and then declined to 3.9 in FY06. Although reserve adequacy indicators deteriorated in FY05 and FY06, they are still at comfortable level.

Table 3.2: Reserve Adequacy Ratios

	FY01	FY02	FY03	FY04	FY05	FY06
Liquid reserves(million US$)	3219	6432	10719	12328	12618	13137
Reserves to GDP share(%age)	4.96	8.77	14.62	14.77	11.44	10.26
Import coverage(in months)	1.6	4.5	8.1	7.2	4.6	3.9
Reserves to external debt	0.1	0.19	0.32	0.37	0.37	0.37

Source: SBP Annual Report FY06

The substantial level of reserves allowed SBP to intervene successfully in the foreign exchange market to maintain exchange rate stability despite having large current account deficits. During FY06 SBP injected US$ 9.0 billion in the foreign exchange market, 67.4 percent of which was for accommodating lumpy oil payments. A substantial portion of this market support was arranged through SBP inter-bank purchases which stood at US$ 6.1 billion in FY06. The SBP during the period was purchasing from the inter-bank when the market was long and selling when it was short. Till recently this policy has been successful in maintaining

[33] Central Bank of United Arab Emirates (UAE) introduced documentation requirement for any inward or outward flows beyond 5000 Dirham.

exchange rate stability. However, relatively high domestic inflation as compared to trading partners has appreciated real exchange rate (see Figure 3.5).

Figure3.3: Workers' Remittances and FDI Inlows During FY1999-06

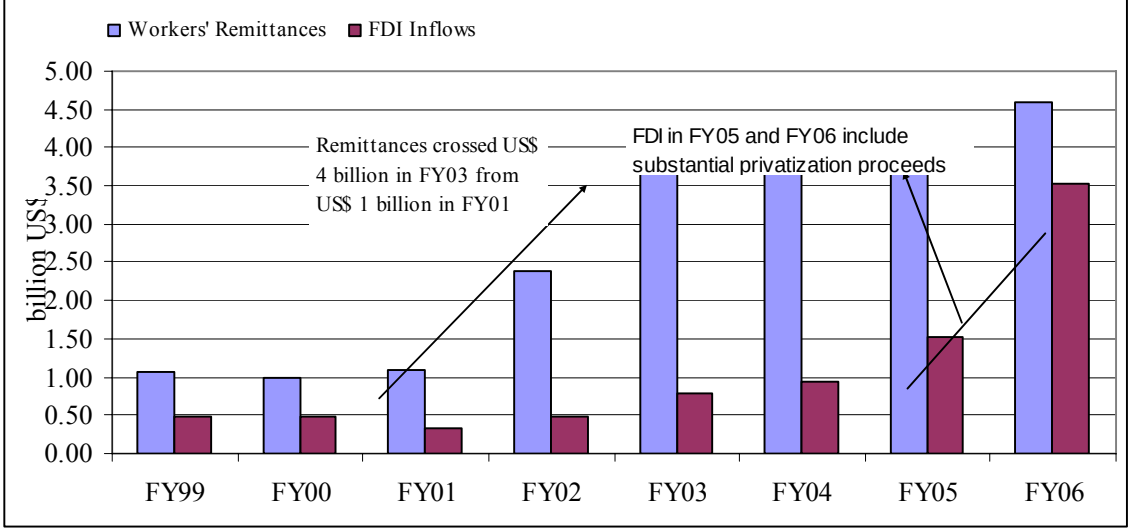
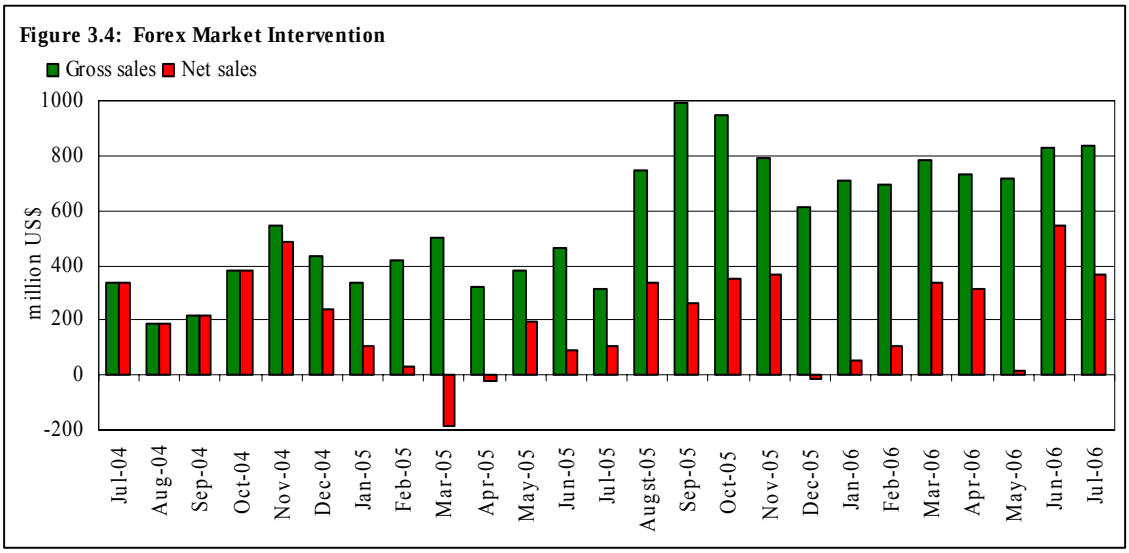
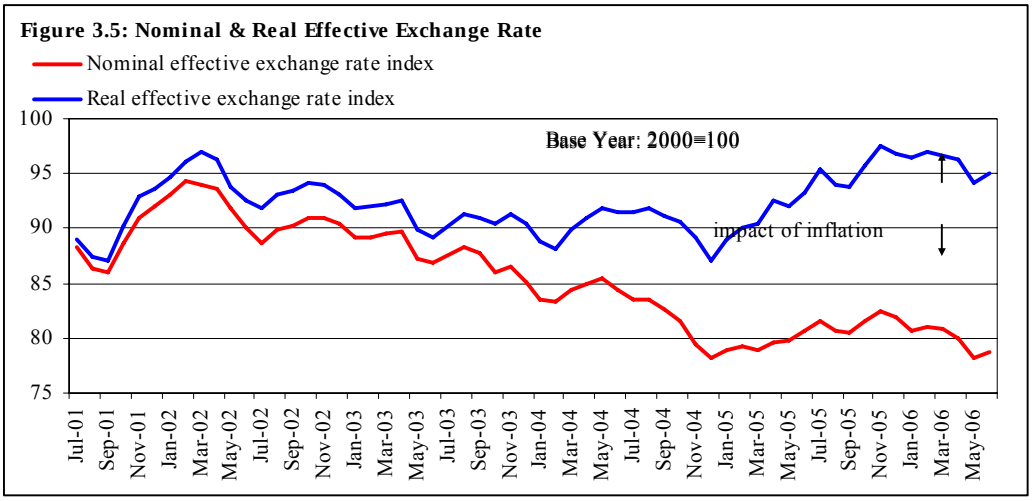


Figure 3.4: Forex Market Intervention





3.5: Conclusion

Pakistan has experienced different exchange rate regimes during past six decades, starting from fixed exchange rate regime, moving to managed float and finally adopting free floating exchange rate regime. However, the SBP occasionally intervenes in the foreign exchange market to cope with excess volatility and for lumpy oil payment.[34],[35] The SBP has accumulated reserves due to consistent and high remittance inflows in last few years. Further, the current account deficit of the country is more than offset by financial inflows thus building reserves. Up till now, due to adequate foreign exchange reserves nominal exchange rate has been stable despite having huge current account deficit.[36] However, reserve adequacy ratios are deteriorating which need to be strengthened through enhancing reserves. Despite stable exchange rate, high domestic inflation has posed a fear of real exchange rate appreciation and erosion of exports competitiveness, which in turn depends on the performance of economic fundamentals particularly capital inflows.

[34] The SPB's stance about exchange rate policy has been that exchange rate is determined in Pakistan through the market forces since July 21, 2000, and SBP intervenes only to tackle excess volatility in the market and to make lumpy oil payment. Recently, in July 2007 SBP made decision to shift oil payments to the inter-bank market in Pakistan.

[35] According to IMF's classification of Exchange Rate Arrangements and Monetary Policy Frameworks, Pakistan has de facto Peg Exchange Rate regime with US Dollar.

[36] In FY07, the current account deficit was recorded 4.8 percent of GDP. However, due to financial account surplus the overall BOP surplus of US$ 3.3 billion was observed.

CHAPTER 4

THEORETICAL FRAMEWORK

This chapter gives theoretical framework to estimate the relationship between exchange rate changes and domestic prices. Firstly, a theoretical overview of the link between exchange rate changes and prices is presented. Secondly, the theory of equilibrium real exchange rate (ERER) through fundamentals is discussed. Finally, integration of two concepts to develop an empirical model of ERPT is described.

4.1: Exchange Rate Pass-through (ERPT)

The term "exchange rate pass-through" has been used in the literature for relationship between exchange rate changes and resulting changes in various prices (e.g., export, import, producer, and consumer prices). According to Menon (1994) ERPT is "the degree to which exchange rate changes are reflected in the destination currency prices of traded goods". Krugman and Obstfeld (1997) state that, "the percentage by which import prices rise when the home currency depreciates by one percent is known as the degree of pass-through from the exchange rate to import prices." Similarly, Goldberg and Knetter (1997) define ERPT as "the percentage change in local currency import prices resulting from one percent change in the exchange rate between the exporting and importing country".

Traditional literature on ERPT has been limited to discussion of pass-through into import prices and related issues of market power and price discrimination in global markets (pricing to market).[37] Changes in import prices are also passed to producer and consumer prices. Thus, recent studies on ERPT use a broader definition of exchange rate pass-through, which is seen as the impact of changes in nominal exchange rate on domestic prices.

Exchange rate changes are believed to affect domestic prices through direct and indirect channels. Under the direct channel, changes in exchange rate have an effect on domestic prices through changes in the price of imported inputs and finished goods.

[37] Goldberg and Knetter (1997) provide a survey on ERPT into import prices.

Depreciation of the exchange rate also increases demand for exports as they become cheap for foreign buyers, this is known as indirect pass-through channel. Further, domestic consumers start substituting for domestic cheap goods by replacing expensive imported goods, resulting in rise of prices of domestic goods. Furthermore, since nominal wage contracts are fixed in the short run, exchange rate depreciation causes a decline in the real wages of laborers who start demanding higher wages, and increase in wages leads to rise in cost of production thus overall price level increases.

RERM is an important control variable in the estimation of ERPT. Under direct channel of ERPT, markups of prices over foreign cost are assumed constant. However, markups are not constant and depend on several factors including RERM. Markups are affected by RERM through the change in prices of domestic substitutes for importable commodities. At any point, if a currency is overvalued (undervalued) in real terms, it would lead decline (rise) in prices of domestic substitutes thus affecting markups. In case of indirect channel, existing misalignment affects demand for domestic substitutes and exportable commodities. Devaluation affects demand for domestic goods differently under both initial overvaluation and undervaluation of the domestic currency. Thus, it is important to take into account existing misalignment while estimating ERPT relationship.

4.2: Real Exchange Rate Misalignment (RERM)

The RERM refers to a sustained departure of RER from its long-run equilibrium real exchange rate (ERER). For a number of years, the appropriateness of RER has been a core issue for economists in developing countries. Particularly, they have been interested in investigating whether a country's RER is in equilibrium, or not.

4.2.1: Importance of Misalignment

According to Montiel (2002), "Misalignment presents macroeconomic problems because the adjustment of the actual real exchange rate to its long-run equilibrium value can be disruptive and costly".[38] Realignment of real exchange rate could be made by either changing nominal exchange rate or by adjusting prices of non-tradable. (i) If RER overvaluation (undervaluation) is realigned through nominal exchange rate it might cause

[38] Misalignment is also costly because it distorts resource allocation in the economy.

disruptive capital outflows (inflows). (ii) In case RER is realigned through adjusting prices of non-tradable, it may harm accomplishing macroeconomic stability.

Misalignment also affects economic growth (Razin, 1997). An overvalued real exchange rate may harm domestic and foreign investment, thus affecting the capital accumulation process and eventually deteriorating economic growth. Further, a misaligned real exchange rate may affect the tradable sector, and the competitiveness of this sector with other countries in the world. Worsening of tradable sector will lead to dampen the growth process.

According to Edwards (1988), "Instable values of domestic currency and RER misalignment promote speculation and usually generate massive capital flight, which substantially reduce the social welfare of the country".

Misalignment may provoke a currency crisis. According to Kaminsky et al. (1998), "persistent overvaluation is seen as providing powerful early warning for currency crisis."

4.2.2: Approaches of RERM Estimation

There are a number of approaches to measure RER misalignment (see Box 2.1), however, among these Fundamental Equilibrium Exchange Rate (FEER) Approach, and Behavioral Equilibrium Exchange Rate (BEER) model are prominent. [39]

In the FEER approach, an appropriate model is used for estimating the equilibrium real exchange rate. Williamson (1994) defines the equilibrium exchange rate as the real effective exchange rate (REER) that is consistent with macroeconomic balance, which is a situation when the economy is working at full employment and low inflation (internal balance) and a current account that is sustainable, i.e., that reflects underlying and desired net capital flows (external balance). This exchange rate is referred in the literature as "fundamental" and it emphasizes economic fundamentals over the medium and long term. A comparison of REER with FEER gives the guess of exchange rate misalignment. The main shortcoming of FEER approach is that it needs extensive parameter estimation and judgment.

[39] The IMF uses three approaches for RER misalignment: a "macroeconomic balance" approach, a reduced form "equilibrium real exchange rate" approach, and an "external sustainability" approach (see, Methodology for CGER Exchange Rate Assessment, IMF Research Department, November, 2006).

Unlike the FEER approach, the behavioral link between REER and economic fundamentals in BEER approach is established through an econometric technique of cointegration. [40] The selection of economic fundamentals is based on theoretical guidance. There is an extensive theoretical literature on the choice of appropriate fundamentals following Edward's seminal work on the subject(see Box 4.1). Montiel (1999) developed a model which synthesizes prior models of the equilibrium real exchange rate. In his model, the long-run equilibrium real exchange rate is establish by the steady-state values of pre-determined variables and permanent (sustainable) values of both policy variables along with exogenous variables.

The variables that may perform as the long-run determinants comprise the following components: domestic supply-side factors particularly the Balassa-Samuelson effect arising from faster productivity growth in the traded-goods sector than in the non-traded goods sector; liberalization of commercial policy; changes in the international economic environment e.g. capital inflows and foreign interest rates; and, fiscal factors such as permanent changes in the composition of government spending between traded and non-traded goods.[41]

After identifying fundamentals consistent with the theory, a cointegrating vector presenting a long run relationship between RER and fundamentals is found. In the final step, sustainable values of fundamentals are substituted in the cointegrating relation to obtain equilibrium real exchange rate. RERM is then calculated as a difference between actual and equilibrium exchange rates.

[40] See, Edwards (1988, 1994), Montiel (1999), for the selection of fundamentals
[41] In developing countries, it is difficult to find high frequency data on fiscal variables.

Box 4.1: Economic Fundamentals for Determination of ERER

Theoretical models and empirical studies such as Elbadwai (1994), Edwards (1989), Montiel (1997), and Baffes et. al (1999) have proposed following fundamental variables for determining the behavior of ERER:

Productivity in the Tradable Sector: According to the so called Balassa-Samuelson effect, if productivity in the tradable sector grows quicker than in the non-tradable sector, the resulting higher wages in the tradable sector will put upward pressure on wages in the non-tradable sector, resulting in a higher relative price of non-tradable i.e., real exchange rate appreciation. Further, higher productivity in tradables improves trade balance of the country thus appreciating real exchange rate.

Trade Openness: The reduction in trade controls and other restrictions reduces the distortions in the economy and increase the trade flows or the openness of the economy. The increase in openness may appreciate or depreciate the price of foreign currency. If the increase in openness is associated with the rise in exports then the RER may appreciate and vice versa if the increase in openness has resulted increase in imports.

Capital Inflows: The reduction in capital controls may affect real exchange rate. The sign of capital inflow depends on whether these inflows are spent on tradable or non-tradable. If most of the portion of capital inflows is spent on non-tradable the real exchange rate appreciates (see, Baffes et. all. (1999)).

Workers' Remittances: Workers' remittances are accounted as current transfers in the current account of balance of payments accounting. On the one hand, remittances are supportive in improving current account balance of the country. On the other hand, if these private earnings are mostly spent on non-tradable it can lead to appreciation of real exchange rate. In the literature, this effect is known as a "Dutch disease".

Terms of Trade: The impact of terms of trade (TOT) on REER is theoretically ambiguous and can take either sign depending on the substitution and income effect. The impact of change in TOT includes the income and substitution effect. If the substitution effect dominates the RER will depreciate and if income effect dominates RER may appreciate.

In the literature, there are several other variables used as fundamental determinants of equilibrium real exchange rate. These include real investment as ratio of GDP, reserves, government consumption on nontradables and excess supply of domestic credit (see, for example, Edwards (1989), Hinkle and Montiel (1999), and Edwards and Savastano (2000). However, empirical analysis for developing countries like Pakistan differs in the choice of underlying real exchange rate fundamentals mainly because of data availability considerations.

4.3: Empirical Model

In this section, an econometric model to estimate ERPT while taking into account the existing RERM is developed. Starting with a standard microeconomic approach of modeling ERPT into import prices this study later on makes this model suitable to estimate ERPT at the aggregate level for CPI index and to incorporate the influence of RERM on inflation.

In the traditional literature on ERPT, the pricing behavior of foreign exporting firm is used to set a simple static profit-maximization problem.[42] Foreign firm solves the following profit-maximization problem:

$$\underset{p}{\text{Max}}\ \pi = ER^{-1}pq - C(q) \qquad (1)$$

In equation (1), π is profit in the foreign currency, ER is the exchange rate defined in terms of the domestic currency per unit of the foreign currency, p is the price of the good in the home currency, C(.) is a cost function in foreign currency, and q is the quantity demand of good.

Solving above problem gives the following first-order condition:

$$P = ER\ C_q\ \mu \qquad (2)$$

Here, C_q is the marginal cost and μ is the markup. Equation (2) shows that it is essential to take into account variations in these control variables to properly isolate the effects of exchange rate changes on import prices.

Previous studies on ERPT into import prices have employed import price equations derived within the mark-up framework (see Menon,1995 and Goldberg and Knettter,1997).This framework permits for interaction between domestic and foreign firms by restricting the effect of changes in exchange rate on competitiveness by changing the mark-up. Menon (1996) has hypothesized mark-up to depend on competitive pressures in the domestic market, and the exchange rate. The difference

[42] See, e.g., Dornbusch (1987), Knetter (1989), Marston(1990), Menon(1995), Goldberg and Knetter (1997) and Bailliu and Fujii (2004)

between the price(P_D) of domestic goods contesting with imports and the foreign exporter's production cost is used as a proxy for the competitive pressure. P_D also arrests the effect of domestic demand conditions on the decision of import pricing. Mark-up is consequently modeled as:

$$\mu = [\, P_D / (\, C_q \, ER \,)]^{\alpha} \qquad (3)$$

Substituting (3) into (2) and denoting natural logarithms by lower-case letters, we obtain a simple log-linear, reduced-form equation as follows[43]:

$$p_m = \alpha\, p_d + (1-\alpha)\, c_q + (1-\alpha)\, er$$
$$p_m = \alpha\, p_d + \beta\, c_q + \gamma\, er \qquad (4)$$

where α and β are measure the home country's demand conditions and foreign exporter's marginal cost, respectively, whereas γ measures ERPT. Variants of equation (4) are widely used in the literature of ERPT into import prices (see, Goldberg and Knetter, 1997). To use this model suitably for estimating ERPT at aggregate level, a few changes have been made as follows.

Firstly, the prices at aggregate level (like CPI) and the exchange rate are normally non-stationary. Therefore, models having these two variables are typically estimated in first-difference form (i.e. inflation equation).[44]

$$\Delta p_t = \alpha\, \Delta\, p_{dt} + \beta\, \Delta\, c_{qt} + \gamma\ \Delta er_t \qquad (5)$$

Secondly, following Montiel (2002) Δp_{dt} is related with real exchange rate misalignment.[45] He describes automatic price adjustments under both overvaluation and undervaluation of domestic currency.[46],[47]

[43] In our empirical estimation, we do not impose the cross-coefficient restrictions implied by our theoretical model.

[44] Equation (5) is consistent with enormous pass-through literature which takes into account the cost of foreign exporting firms and domestic demand conditions while estimating the impact of exchange rate changes on domestic prices(see e.g., Goldberg and Knetter, 1997).

$$\Delta p_{dt} = \lambda (rer - rer^{*})_{t-1} \quad (6)$$

Substituting (6) into (5) we obtain equation (7):

$$\Delta p_t = \alpha \lambda (rer - rer^{*})_{t-1} + \beta \Delta c_{qt} + \gamma \Delta er_t \quad (7)$$

In this equation, γ measures the impact of exchange rate change on inflation. The magnitudes of the coefficient of the overvaluation are relevant. The exchange rate devaluation that does not overshoot its required adjustment would not have severe consequences in terms of inflation. Further, misalignments that seem to exist for longer (shorter) period are associated with greater (lesser) exchange rate pass-through.

Thirdly, the literature on inflation dynamics has emphasised to account for the inertial behavior of inflation. This is accomplished by including lags of inflation as explanatory variables in equation (7).

$$\Delta p_t = \alpha \lambda mis_{t-1} + \beta \Delta c_{qt} + \gamma \Delta er_t + \delta \Delta p_{t-i} \quad (8)$$

Finally, foreign consumer price index (FCPI) is used as a proxy of exporter's cost and Nominal Effective Exchange Rate (NEER) as a proxy for exchange rate. This study

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[45] This kind of relation has been used in the literature in many studies, e.g., Adam and Gross (1986) and Kamin (1997, 2001), Klau (1998).

[46] According to Montiel (2002), "The adjustment mechanism has two components: changes in the level of expenditure and changes in the composition of expenditure. In the case of overvaluation, in an economy that is financially open, expenditure reduction will be brought about through an increase in the real interest rate through real interest arbitrage. High domestic interest rates associated with the expectation of real exchange rate depreciation will depress total spending, including spending on domestic goods, which will tend to reduce the domestic rate of inflation. Moreover, whether the economy is financially open or not, expenditure switching will be at work. An overvalued currency means that domestic goods will be expensive or less competitive, thus reducing the demand for such goods until their relative price falls. In the case of undervaluation, the mechanisms operate in reverse."

[47] The reason for substituting Δp_{dt} with misalignment (only) is to take into account domestic demand conditions. Pass -through models include the cost of foreign exporting firms and domestic demand conditions as control variables.

follows Choudhri and Hakura (2001) in extracting FCPI from Real Effective Exchange Rate (REER) and using NEER as proxy for exchange rate.[48]

$$\Delta p_t = \alpha\ \lambda\ mis_{t-1} + \beta\ \Delta\ fcpi_t + \gamma\ \ \Delta neer_t + \delta\ \Delta p_{t-i} + \varepsilon_t \qquad (9)$$

Equation (9) is our final equation. To estimate this equation we need to estimate series of mis. (which is defined as (log REER – log REER*)). The REER* is estimated through BEER approach.[49] The fundamentals listed in Box 4.1 involve some variables on which high frequency data for Pakistan is not available.[50] However, compromising on available data, following fundamentals are used to estimate REER*: industrial production index (PROD) is used as a proxy of productivity in tradables; exports plus imports in million US$ (OPEN) is used as a proxy of trade openness, and, foreign direct investment inflow in million US$ (FDI) is used as a proxy of capital inflows, and workers' remittances inflows in million US$ (REMIT) is used as an important current transfer in recent years.

[48] Choudhri and Khan (2002) have also followed this method of extracting FCPI from REER provided by INS. They have used nominal exchange rate between rupee and US dollar to estimate ERPT.
[49] See, section 4.2 for steps involved in the estimation of REER* through BEER approach.
[50] In case of Pakistan, monthly data on terms of trade, government consumption on nontradables, and investment is not available. Due to this reason these variable could not be included in the estimation of REER*.

CHAPTER 5

ESTIMATION METHODOLOGY & DATA DESCRIPTION

In this chapter, the estimation methodology and data trends are discussed.[51] Firstly, the concept of stationarity is presented in section 5.1. Secondly, the section 5.2 describes unit root tests for checking stationarity of time series. Thirdly, the concept of cointegration and its tests are presented in the section 5.3. Finally, the section 5.4 defines the variables used in the empirical model of this study.

5.1: Stationarity

A time series is a sequence of numerical data in which each item is associated with a particular instant in time.[52] A time series is said to be *strictly stationary* if the joint distribution of $Y_{t1,} \ldots\ldots Y_{tn}$, is the same as the joint distribution of $Yt_{1+\tau,} \ldots\ldots Y_{t\,n+\tau}$, for all n and τ. The distribution of the stationary process remains unchanged when shifted in time by an arbitrary value τ. Thus, the parameters that describe the distribution of the process do not depend on t, but on the lag τ.

In practice it is difficult to verify the concept of stationarity as it is defined in terms of distribution function. Due to this reason the concept of stationarity is preferably defined in terms of moments. A stochastic process$\{Y_t,\ t\in T\}$ is said to be *l*th-order stationary if for any subset $(t_1, t_2, \ldots, t_n)$ of T and any τ the joint moments are

$$E(Y_{t1}^{\ln}, \ldots\ldots, Y_{tn}^{\ln}) = E(Y_{t1+\tau}^{l1}, \ldots\ldots, Y_{tn+\tau}^{\ln})$$

where $l_1 + . \ . \ .\ln \leq l$. *Let us take positive integers for* $l_1 + l_2$. . . , ln and *l. When l =1, i.e.,* $l_1 = 1$

$$E(Y_t) = E(Y_{t+\tau}) = \mu \text{ (a constant)}$$

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[51] Sections 5.1-5.3 are given for reader's help, however, this material does not represents author's contribution.

[52] Source: Maddala (1998), " Introduction to Econometrics", Chapter 13, pp. 525-576

the process $\{Y_t\}$ is said to be first-order stationary. When, l =2, the possible cases are (l_1 = 1, l_2 = 0), (l_1 = 2, l_2 = 0), and (l_1 = 1, l_2 = 1). According to three cases the process $\{Y_t\}$ has its joint moments as follows;

$$E(Yt) = E(Y_{t+\tau}) = \mu \text{ (a constant)}$$
$$E(Y^2_t) = E(Y^2_{t+\tau}) = \sigma^2 \text{ (a constant)}$$
$$Cov(Y_{t1}, Y_{t2}) = cov(Y_{t1+\tau}, Y_{t2+\tau}) = \gamma_{t1,t2} = \gamma_\tau$$

where t_1- t_2 = τ. The mean and variance are constant and the covariance of Y_t depends only on the lag or interval $\tau = t_1 - t_2$, not on t_1 or t_2. The process Y_t is said to be of second order stationary. Second-order stationarity is also called weak or wide-sense or covariance stationarity. In modeling time series, second order stationarity is the most commonly used form of stationarity.[53]

A time series which is stationary after being differenced d times, is said to be integrated of order d, denoted as I(d). A series which is stationary without differencing is said to be I(0). It is an empirical fact that many important economic variables appear to be integrated of order 1, so that their changes are stationary.

The classical regression model assumes that variables are stationary. In the presence of nonstationary variables there might be spurious regression. A spurious regression has a high R^2 and t-statistic that appears to be significant, but the results are without economic meaning. The regression output "looks good" but the least square estimates are not unbiased and the customary tests of statistical inference do not hold.

At the informal level, weak stationarity can be checked by the correlogram of a time series, which is a graph of autocorrelation at various lags. For a stationary time series, the correlogram tapers off quickly, whereas for nonstationary time series it dies off gradually. At the informal level, it is a good way to start by inspecting correlogram of the series. However, at the formal level stationarity is checked by testing for the presence of unit root.

[53] Source: See Maddala and Kim (1998), " Unit Roots Cointegration and Structural Change", chapter 2, for the concept of stationarity.

5.2: Unit Root Tests

Consider the following model

$$y_t = a_1 y_{t-1} + \varepsilon_t \qquad (1)$$

Where ε_t is the stochastic error term that follows the classical assumptions, namely, it has zero mean, constant variance, and is non autocorrelated (i.e. white noise). We estimate the above equation and if the estimated value of a_1 is equal to one then, we say the equation is of a Pure Random Walk, Y_t is said to have unit root. Equation (1) is also represented in an alternative form as

$$\Delta y_t = (a_1-1) y_{t-1} + \varepsilon_t$$

$$\Delta y_t = \gamma\ y_{t-1} + \varepsilon_t \qquad (2)$$

Where, $\gamma = a_1-1$. So, testing the hypothesis $a_1 = 1$ is equivalent to testing the hypothesis $\gamma = 0$.

5.2.1: Augmented Dickey-Fuller Test (ADF)

Dickey and Fuller (1979) develop a method to formally test for nonstationarity. They consider three different regression equations that can be used to test for the presence of a unit root:

$$\Delta y_t = \gamma\ y_{t-1} + \varepsilon_t \qquad (3)$$

$$\Delta y\, t = a_0 + \gamma\, y_{t-1} + \varepsilon_t \qquad (4)$$

$$\Delta y_t = a_0 + \gamma\ y_{t-1} + a_2 t + \varepsilon_t \qquad (5)$$

The difference between the three regressions concerns the presence of the deterministic elements a_0 and a_2t. The first is a pure random walk model, the second ads intercept or drift term, and the third includes both a drift and a linear time trend. The parameter of interest in all the regression equations is γ; if $\gamma = 0$, the $\{y_t\}$ sequence contains a unit root. The test involves estimating one (or more) of the equations above using OLS in order to obtain the estimated value of γ and the associated standard error. Comparing the resulting t-statistic with the appropriate value reported in the Dickey-Fuller tables allows the researcher to determine whether to accept or reject the null hypothesis $\gamma = 0$.

In their Monte Carlo study, Dickey and Fuller (1979) found that the critical values for $\gamma = 0$ depend on the form of the regression and on sample size. The statistics labeled τ, τ_{μ},, τ_{τ} are the appropriate statistics to use for equations (3), (4) and (5) respectively. More recently, MacKinnon (1991) has implemented a much larger set of simulations than those tabulated by Dickey and Fuller. In addition, MacKinnon estimates the response surface using the simulation results, permitting the calculation of Dickey-Fuller critical values for any sample size and for any number of right-hand variables.

The simple unit root test described above is valid only if the series is an AR(1) process. However, if the series is correlated at higher order lags, the assumption of white noise disturbances is violated. To overcome the problem Dickey and Fuller suggested an extended version of their test which can incorporate additional lagged terms of the dependent variable in order to eliminate autocorrelation. The Augmented Dickey Fuller (ADF) test makes a parametric correction for higher-order correlation by assuming that the y series follows an AR(p) process and adjusting the test methodology. The ADF approach controls for higher-order correlation by adding lagged difference terms of the dependent variable y to the right-hand side of the regression. Above equations can be modified as follows:

1. without any constant and trend

$$\Delta y_t = \gamma\ y_{t-1} + \sum_{i=2}^{p} \beta i\, \Delta y_{t-i+1} + \varepsilon_t \qquad (6)$$

2. with constant but no trend

$$\Delta y_t = a_0 + \gamma\ y_{t-1} + \sum_{i=2}^{p} \beta i\, \Delta y_{t-i+1} + \varepsilon_t \qquad (7)$$

3. with constant and trend

$$\Delta y_t = a_0 + a_2\, t + \gamma\ y_{t-1} + \sum_{i=2}^{p} \beta i\, \Delta y_{t-i+1} + \varepsilon_t \qquad (8)$$

This augmented specification is then used to test:

$$H0: \gamma = 0,\ H1: \gamma < 0$$

An important result obtained by Fuller is that the asymptotic distribution of the t-statistic is independent of the number of lagged first differences included in the ADF regression. Moreover, while the parametric assumption that y follows an autoregressive (AR) process may seem restrictive, Said and Dickey (1984) demonstrate that the ADF test remains valid even when the series has a moving average (MA) component, provided that enough lagged difference terms are augmented to the regression.

5.3: Cointegration and Error Correction Model

Granger (1981) proposed the concept of cointegration, which recognized that even though several series had unit roots, a linear combination could exist, which would not. Engle and Granger (1987) elaborate the concept and present a definition of cointegration. Letting θ and χ_t denote the vectors (θ_1 , θ_2 , ……., θ_n) and (x_{1t} , x_{2t} , …. x_{nt}) , the system is in long-run equilibrium when θx_t = 0, The deviation from long-run equilibrium called the equilibrium error is e_t, so that

$$e_t = \theta x_t$$

The components of the vector χ_t = (x_{1t}, x_{2t}, …. x_{nt}), are said to be cointegrated of order d, b, denoted by χ_t ~ CI(d , b) if

1. All components of χ_t are integrated of order d.

2. There exists a vector θ = ($\theta_1, \theta_2, \ldots\ldots \theta_n$) such that the linear combination $\theta \chi_t$ = $\theta_1 x_{1t}$ + $\theta_2 x_{2t}$ + ……..+ $\theta_n x_{nt}$ is integrated of order (d - b) where b > 0. The vector θ is called the cointegrating vector. The acceptance of cointegration between two or more series implies that there exists a long run relationship between them. However, this relationship may be disturbed by short run deviations from equilibrium and thus an Error Correction Model (ECM) may be an appropriate framework that is an extension of the Granger causality test where an error correction term is introduced into the test. If $\{y_t\}$ and $\{z_t\}$ are CI(1,1), the variables have the error correction form as follows:

$$\Delta y_t = \alpha_1 + \alpha_y (y_{t-1} - \theta_1 z_{t-1}) + \sum_{i=1} \alpha_{11}(i) \Delta y_{t-i} + \sum_{i=1} \alpha_{12}(i) \Delta z_{t-i} + \varepsilon_{yt} \quad (10)$$

$$\Delta z_t = \alpha_2 + \alpha_z (y_{t-1} - \theta_1 z_{t-1}) + \sum_{i=1} \alpha_{21}(i) \Delta y_{t-1} + \sum_{i=1} \alpha_{22}(i) \Delta z_{t-i} + \varepsilon_{zt} \quad (11)$$

where θ_i = the parameters of the cointegrating vector, ε_{yt} and ε_{zt} = white-noise disturbances (which may be correlated with each other), and α_1, α_2, α_y, α_z, α_{11}(i), α_{12}(i), α_{21}(i), and α_{22}(i) are all parameters.

5.3.1: The Johansen's Cointegration Test

Although the Engle and Granger (1987) procedure is easily implemented, it does have several important defects: (a) it heavily depends on the choice of the variables selected for normalization; (b) the method has no systematic procedure for the separate estimation of multiple cointegrating vectors; (c) another defect of the Engle-Granger procedure is that it relies on a two-step estimator. To avoid these problems, a number of methods have been developed. The Johansen (1988) and the Stock and Watson (1988) maximum likelihood estimators avoid the use of two-step estimators and can estimate and test for the existence of multiple cointegrating vectors. Furthermore, through these tests the researcher can test restricted version of the cointegrating vector(s) and the speed of adjustment parameters.

The Johansen's technique for estimating Cointegration is said to be superior because it is based on Maximum Likelihood procedure that provides test statistics to determine number of cointegrating vectors as well as their estimates. [54] Therefore, this study uses Johansen's technique.

The Johansen's technique is a multivariate generalization of the Dickey-Fuller test. Just as the augmented Dickey-Fuller test, the multivariate model can be represented as follows:

$$\Delta X_t = \pi X_{t-1} + \sum_{i=1}^{p-1} \pi_i \Delta X_{t-i} + \varepsilon_t \quad (12)$$

where $\pi = -(I - \sum_{i=1}^{p} A_i)$ *and* $\pi_i = -\sum_{j=i-1}^{p} A_j$

[54] Source: For details on Johansen's cointegration test, see Enders (2004).

In equation (12) the rank of the matrix π is equal to the number of independent cointegrating vectors. If rank (π) = 0, the matrix is null and (12) is the common VAR in first differences. On the other hand, if π is of rank n, the vector process is stationary. If rank (π) = 1, there is a single cointegrating vector and the expression πx_{t-1} is the error-correction term. For other cases in which 1< rank (π) > n, there are multiple cointegrating vectors.

By examining the significance of the characteristic roots of π, the number of distinct cointegrating vectors can be obtained. If the variables in x_t are not cointegrated, the rank of π is zero and all of these characteristic roots will equal zero. Since ln (1) =0, each of the expressions ln (1 - λ_i) will equal zero if the variables are not cointegrated. Similarly, if the rank of π is unity, 0 < λ_i > 1 so the first expression ln (1- λ_1) will be negative and all the other λ_i = 0 so that ln (1- λ_2) = ln (1- λ_3) = …. ..= ln (1 - λ_n) =0. Following two test statistics are used to test the number of characteristic roots that are insignificantly different from unity:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \qquad (13)$$

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \qquad (14)$$

where, $\hat{\lambda}_i$ = the estimated values of the characteristic roots (also called Eigen values) obtained from the estimated π matrix; and, T = the number of usable observations.

When the appropriate values of ‘r’ are clear, these statistics are simply referred to as λ_{trace} and $\lambda_{\max}$. The first statistic tests the null hypothesis that the number of distinct cointegrating vectors is less than or equal to ‘r’ against a general alternative. The λ_{trace} equals zero when all λ_i = 0. The further the estimated characteristic roots are from zero, the more negative is ln (1- $\hat{\lambda}_i$) and the larger is the λ_{trace} statistic. The second statistic tests the null hypothesis that the number of cointegrating vectors is ‘r’ against the alternative of 'r+1 cointegrating vectors.

Critical values for the λ_{trace} and the $\lambda_{\max}$ statistics are obtained using the Monte Carlo approach. Johansen and Juselius (1990) have provided the critical values of the λ_{trace} and the $\lambda_{\max}$ statistics.

5.4: Data Description

In this study, monthly data from 1993-M7 to 2007-M4 is used. The major source s of data are International Financial Statistics (IFS) and Statistics Department of State Bank of Pakistan. All indices are adjusted for 2000 base year. The variables used in the model are described as follows:

Consumer Price Inflation (INF)

In case of Pakistan, four price indices are published: the consumer price index (CPI), the wholesale price index (WPI), the sensitive price index (SPI) and GDP deflator. However, CPI is frequently used to find inflation and to reflect changes in cost of living of an average consumer. The CPI covers the retail price of 375 items in 35 major cities of the country. On the other hand, WPI covers the wholesale price of 106 major items prevailing in the city of origin of the commodities (see details in Appendix 3).

This study uses log differentials of overall CPI, and core CPI(excluding food and fuel) indices as proxies for inflation. To examine the trends of CPI prices and inflation, price indices and their log differentials are subsequently plotted in figures 5.1, 5.2, 5.3 and 5.4. From the figure 5.1 and 5.3 it is observed that ln CPI and ln core CPI are of increasing trend, which implies nonstationarity of price indices. However, the figures 5.2 and 5.4 show that inflation series are converging to its mean implying stationarity of the series.[55]

[55] Formal tests of stationarity are presented in the chapter 7.

Figure 5.1: LCPI = ln(CPI)

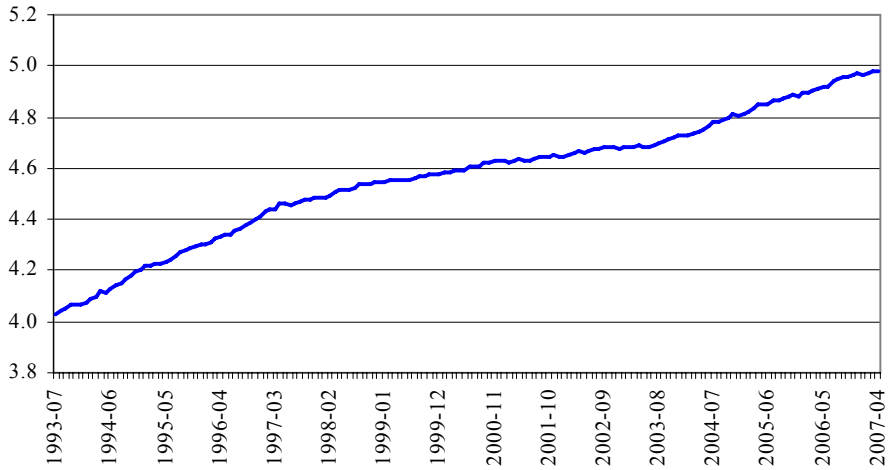


Figure 5.2: INF = LCPI -LCPI(-1)

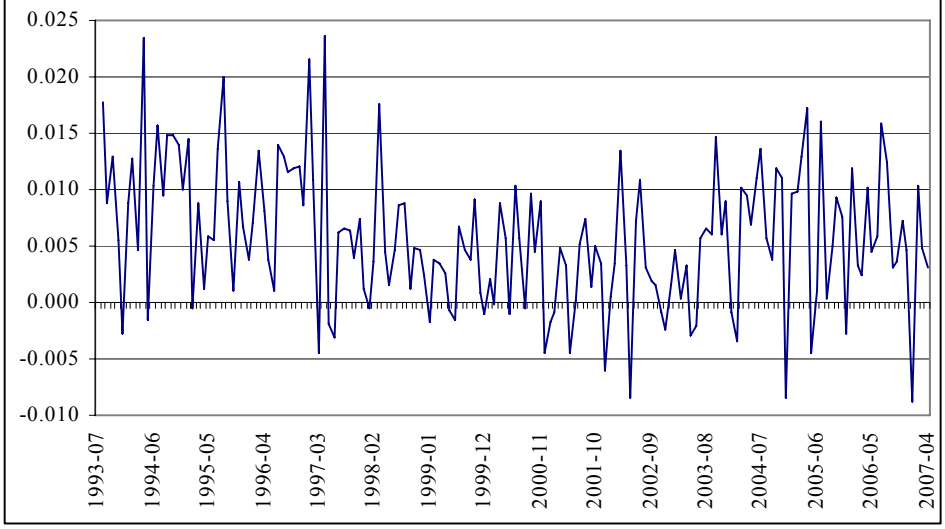


Figure 5.3: LCCPI = ln(CoreCPI)

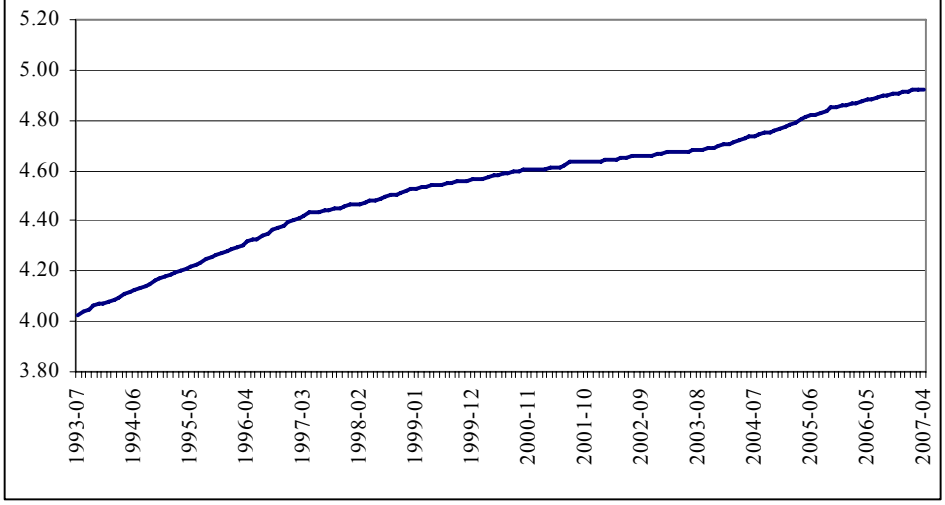
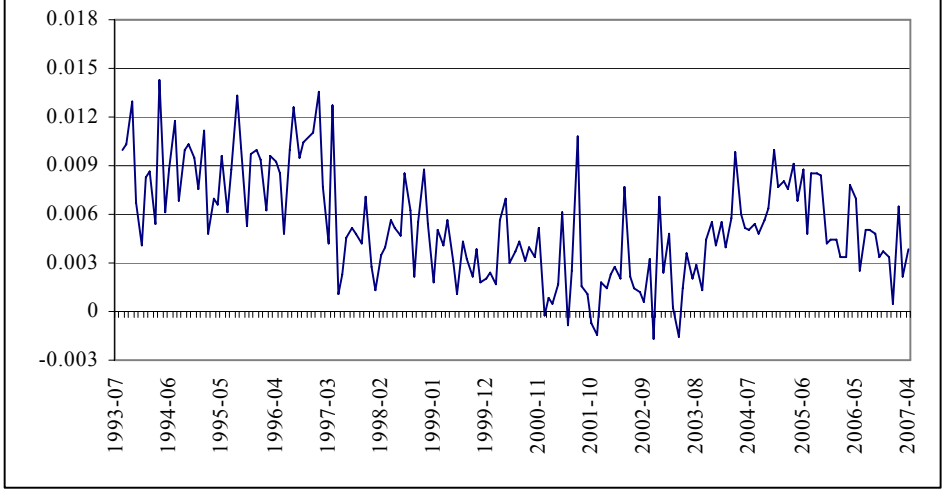


Figure 5.4: INFc=LCCPI - LCCPI(-1)



Exchange Rate Appreciation (GNEER)

The proxy for nominal exchange rate used in this study is nominal effective exchange rate (NEER) index.[56] NEER index represents the ratio (expressed on the base 2000 =100) of an index of Rupee's period average exchange rate to US Dollar and a weighted geometric average of exchange rates for the currencies of selected countries. The index is based on a method that takes account of each country's trade in both manufactured goods and primary goods with its partner, or competitor countries.[57] An increase in NEER represents appreciation of Rupee against currencies of trading partners and vice versa.

The plots of ln of NEER (LNEER) and its change (GNEER) are shown in figures 5.5 & 5.6. Figure 5.5 shows that NEER has decreasing trend which means that NEER is depreciating throughout the sample period. Further, it reflects that the series is nonstationary. However, the difference of the series converges towards its mean implying stationarity of the series.

Foreign Inflation (FINF)

In this study, foreign weighted consumer price index (FCPI) is used as a proxy of foreign exporter's cost. Foreign inflation (FINF) is defined as difference of ln of FCPI. Following Choudhri and Hakura (2001), FCPI is extracted from Real Effective Exchange Rate (REER).[58] The ln of FCPI is derived as the difference between ln of domestic CPI and ln of relative price index (RPI). Whereas, RPI is defined as the ratio of domestic CPI for a country to trade weighted averages of the CPI's of the trading partner countries.

The plots of ln of FCPI (LFCPI) and foreign inflation (FINF) are shown in figures 5.7 & 5.8. The figure 5.7 represents an increasing trend in foreign prices and series is nonstationary. However, the difference of the series shows convergence toward means i.e. stationarity of the series.

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[56] This study uses IFS data on REER and NEER, however, SBP also publishes these indices based on 21 countries and 16 currencies but the data is available only for the period from January, 2001.

[57] An IMF's working paper entitled "A Primer on the IMF's Information Notice System" (WP/97/71), provides background on the concept and methodology underlying the effective exchange rates.

[58] Choudhri and Khan (2002) have also followed this method of extracting FCPI from REER provided by INS. They have used nominal exchange rate between rupee and US dollar to estimate ERPT.

Figure 5.5: LNEER = ln(NEER)

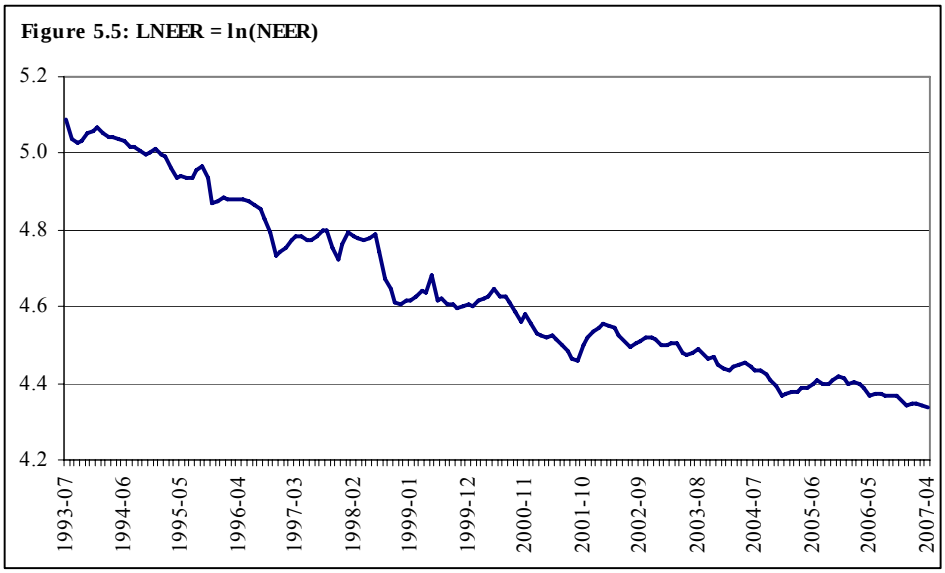


Figure 5.6: GNEER = LNEER - LNEER(-1)

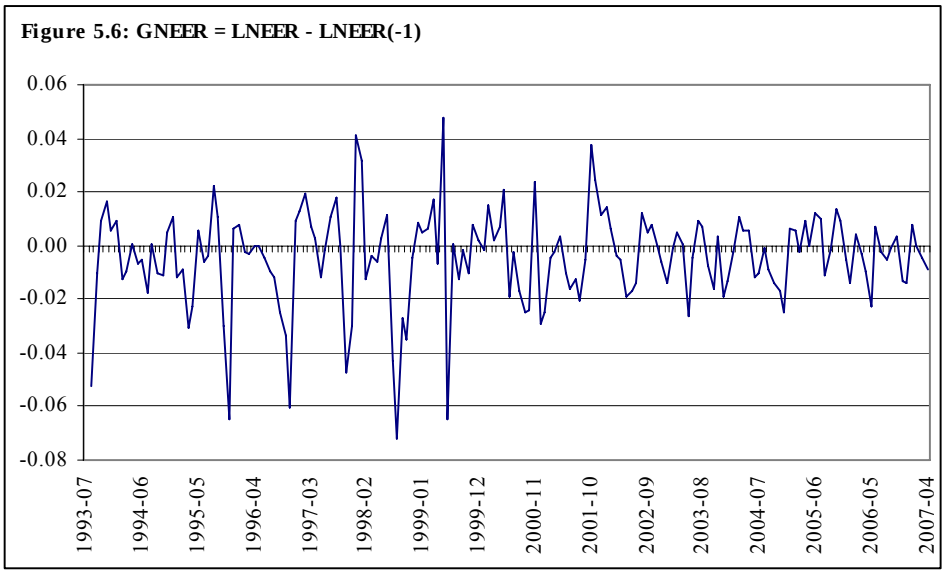


Figure 5.7: LFCPI = ln (FCPI)

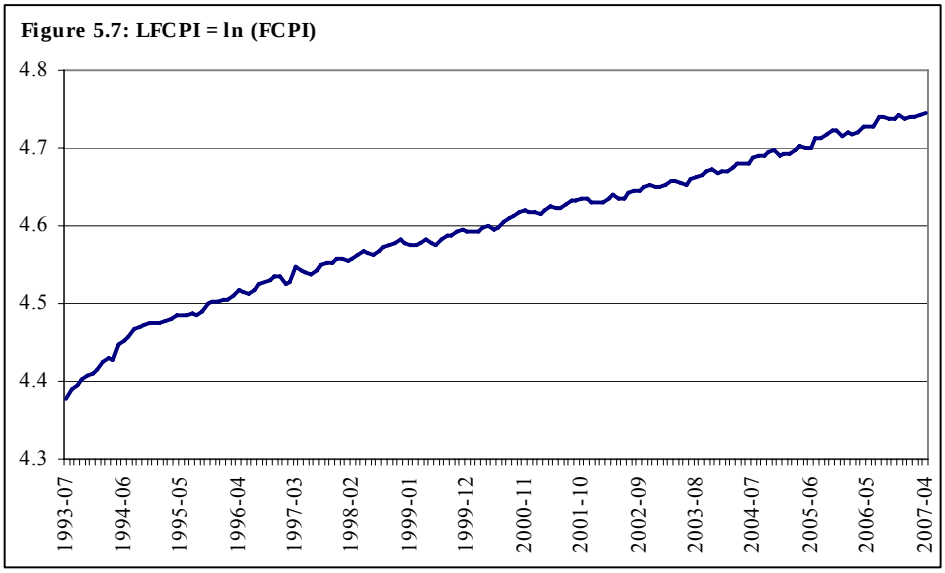
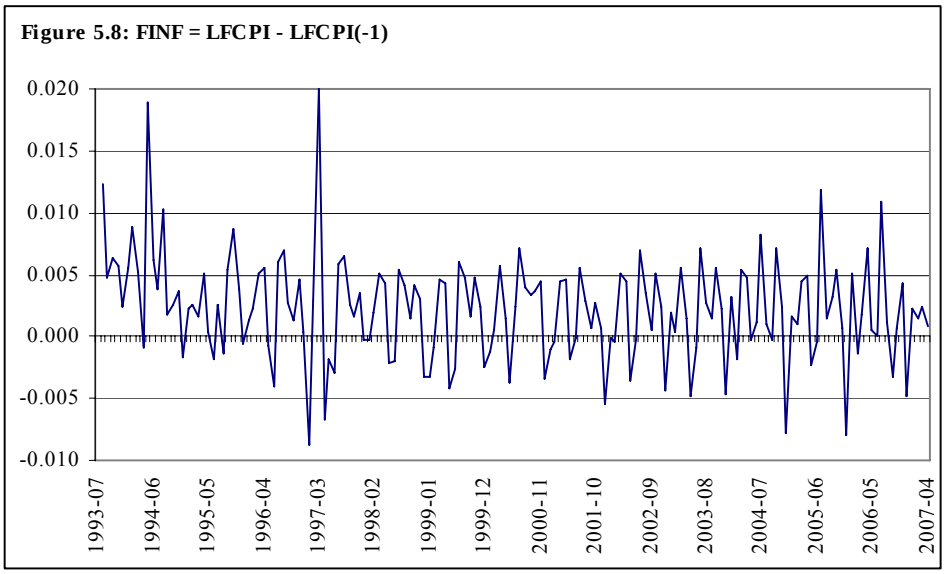


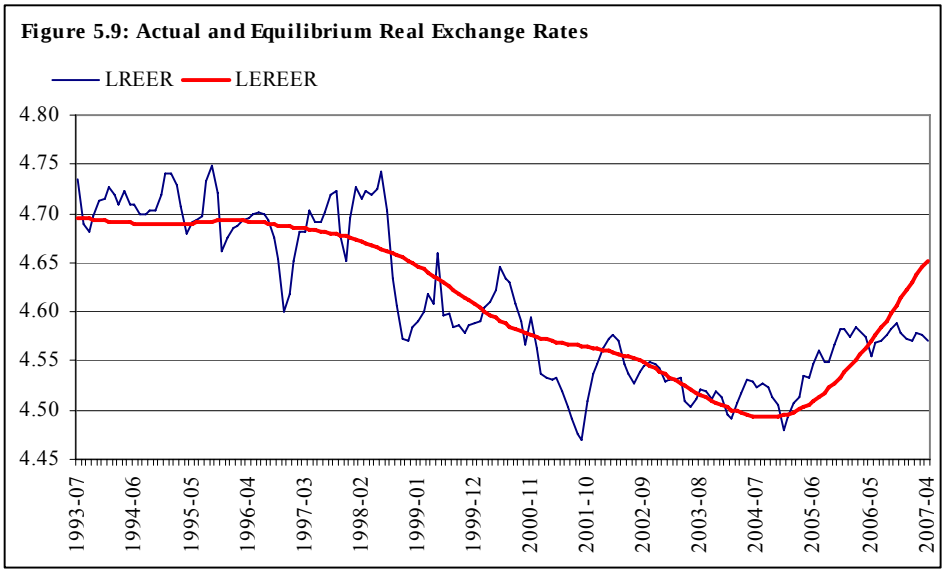
Figure 5.8: FINF = LFCPI - LFCPI(-1)



Misalignment (MIS)

Misalignment (MIS) is the difference between actual and equilibrium real effective exchange rates.[59] Real effective exchange rate index represents a nominal effective exchange rate index adjusted for relative movements in home CPI index and CPI indices of selected countries. An increase in REER represents appreciation of home currency and vise versa.

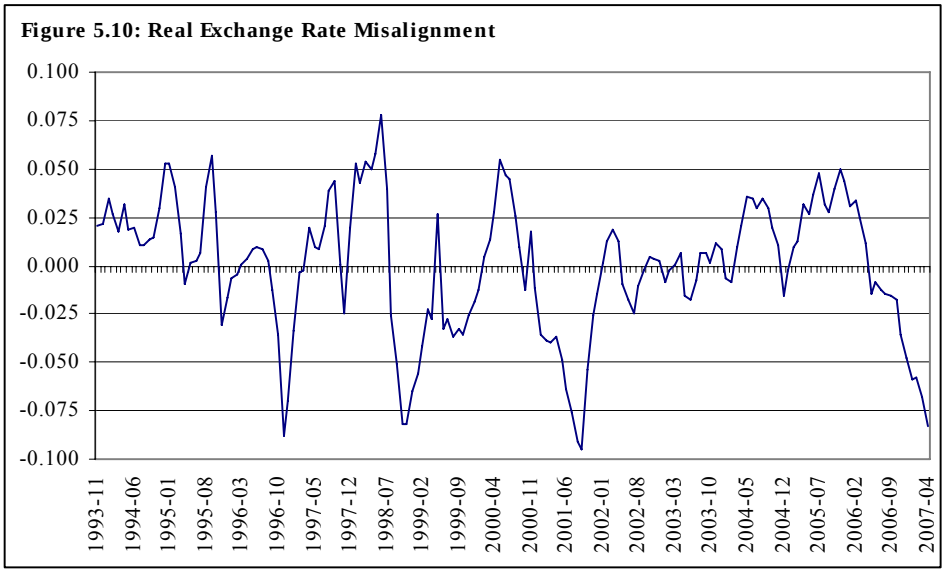
The equilibrium exchange rate is derived from Behavioral Equilibrium Exchange Rate (BEER) approach (see details in Chapters 4 & 6). In the figure 5.9, actual and equilibrium real effective exchange rates are shown, both in the natural log form. The difference between actual and equilibrium real effective exchange rate, which is misalignment (MIS), is shown separately in figure 5.10.[60]



[59] Using MIS as a regressor in another equation may carry some risk since it may be sensitive to the specification used in the long run relationship between REER and fundamentals. However, MIS has been used as a regressor in several studies e.g. Kamin (1997), Kamin and Klau (1997), and Klau (1998).

[60] In the sixth chapter, the stationarity of MIS and other variables in the model is properly checked through Augmented Dickey Fuller Test.

Figure 5.10: Real Exchange Rate Misalignment



CHAPTER 6

REAL EXCHANGE RATE MISALIGNMENT IN PAKISTAN: ESTIMATION RESULTS

This chapter illustrates estimation results of real exchange rate misalignment (RERM), the difference between actual and equilibrium real effective exchange rates. The equilibrium real effective exchange rate is estimated through Behavioral Equilibrium Exchange Rate (BEER) approach. The BEER approach benefits from cointegration technique to establish a long run relationship between Real Effective Exchange Rate (REER) and its fundamental determinants. In section 6.1, actual REER and determinants of equilibrium real exchange rate used in this study are discussed over the data period. In section 6.2, the results of unit root tests, Johansen's cointegration test between REER and its fundamental determinants are elucidated. Further, equilibrium real effective exchange rate and the level of misalignment calculated from the long-run relationship are also discussed in this section. Finally, section 6.3 discusses the results with reference to different exchange rate regimes in Pakistan.

6.1: Actual REER Index and Determinants of Equilibrium Real Exchange Rate

6.1.1 Actual REER Index

Real effective exchange rate (REER) is an index of the price of a basket of goods in one country relative to the price of the same basket in that country's major trading partners and competitors when measured in same currency. There are two equivalent ways of calculating the real effective exchange rate.[61] These two methods decompose the components of the REER index differently and provide supplementary empirical information useful in analyzing the evolution of the REER indices. The first method calculates the REER as a geometric weighted average of the bilateral RER of the home country with each of its main trading partners or competitors.

[61] Source: For detailed discussion on calculation of REER and NEER indices, see IMF's working paper 97/71 entitled "A Primer on the IMF's Information Notice System".

$$\text{REER}= \prod_{i=1}^{m} BRER_{f}^{\omega_{f}} \qquad (6.1)$$

where BRER is the bilateral real exchange rate in foreign currency. The second method calculates the REER as the product of nominal effective exchange rate index (NEER) and the effective relative price index (RPI).[62]

$$\text{REER}= \text{NEER}* \text{RPI}/100 \qquad (6.2)$$

The NEER index is defined as weighted bilateral nominal exchange rate of a country with respect to its major trading partners and competitors. Whereas, RPI is an index of a basket of goods in one country relative to the price of the same basket in that country's major trading partners and competitors.

$$NEER = \frac{ERIpak}{e^{\sum_i wi \ln ERIIi}} \times 100 \qquad (6.3)$$

$$RPI = \frac{CPIpak}{e^{\sum_i wi \ln CPIi}} \times 100 \qquad (6.4)$$

The REER obtained from equations (6.1) and (6.2) are exactly the same, as the two equations are equivalent mathematically. However, two methods provide different statistical information. Computing the REER as the weighted average of bilateral RERs can provide calculations of bilateral RER indices for individual countries or subsets of countries. Whereas, calculating the REER as the product of NEER and RPI, allows a separate analysis of the effects of movements in nominal exchange rates and foreign prices as shown in equation (6.2) above.

Figure 6.1 shows that both REER and NEER indices have depreciated over the sample period, however, NEER has more depreciated as compared to REER. It shows that prices in Pakistan have grown more rapidly as compared to her competitors, which is also reflected by the trend of RPI index in Figure 6.2.

[62] This method of calculating REER is also used by State Bank of Pakistan. However, SBP calculates REER for 22 trading partners of Pakistan having at least 1 percent share in our trade.

Figure 6.1: REER, NEER Indices

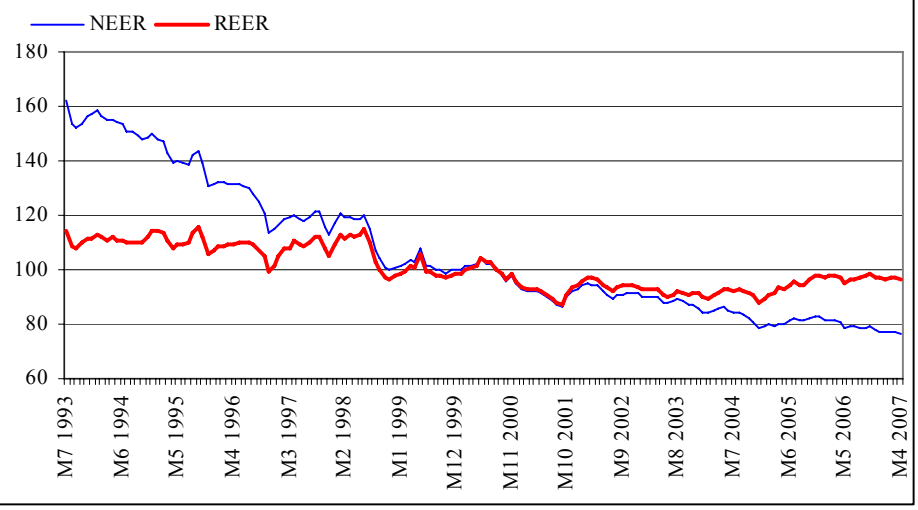
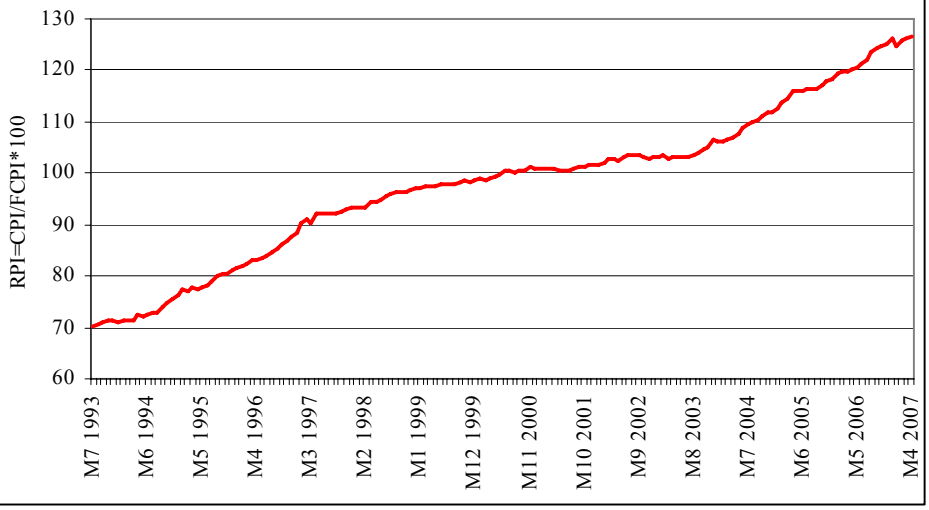


Figure 6.2: Relative Price Index



Determinants of Equilibrium Real Exchange Rate

The variables used as proxies of fundamentals include: log of industrial production index (LPROD) as a proxy for productivity in tradable sector; log of exports plus imports (LOPEN) as a proxy of trade openness; log of foreign direct investment inflow (LFDI) as a proxy of capital inflows, and, log of workers' remittances (LREMIT) as an important inflow in recent years.

Industrial Production

According to 'Balassa effect' hypothesis, higher productivity in tradable sector than nontradable sector results in the rise of real wages in tradable sector and the release of labor from nontradable sector, thus nontradable sector contracts leading to increase in the relative prices of nontradables and appreciation of equilibrium real exchange rate.

In the literature, different proxies of productivity growth in tradable sector have been used to test this hypothesis. These include total factor productivity growth, GDP growth; real per capita growth, industrial production growth, and time variable (see Edwards, 1989; Schafer, 1989; Cottani, Cavallo and Khan, 1990). However, in case of Pakistan, monthly data on GDP, per capita income, or total factor productivity is not available, thus the only option left was to use industrial production index to capture the so called Balassa effect.

Trade Openness

Trade openness is an important determinant of equilibrium real exchange rate. The reduction in trade controls and restrictions are considered to reduce distortions in the economy by increasing trade flows or openness. Trade openness is believed to be associated with efficient utilization of resources and high economic growth. However, openness may affect real exchange rate in both ways depending on whether liberalization is a result of increase in imports or vice versa. If trade liberalization is the result of increase in imports then real exchange rate may depreciate and vice versa if the increase in openness is a result of rise in exports.

Figure 6.3: Average Effective Tariff Rates in Pakistan

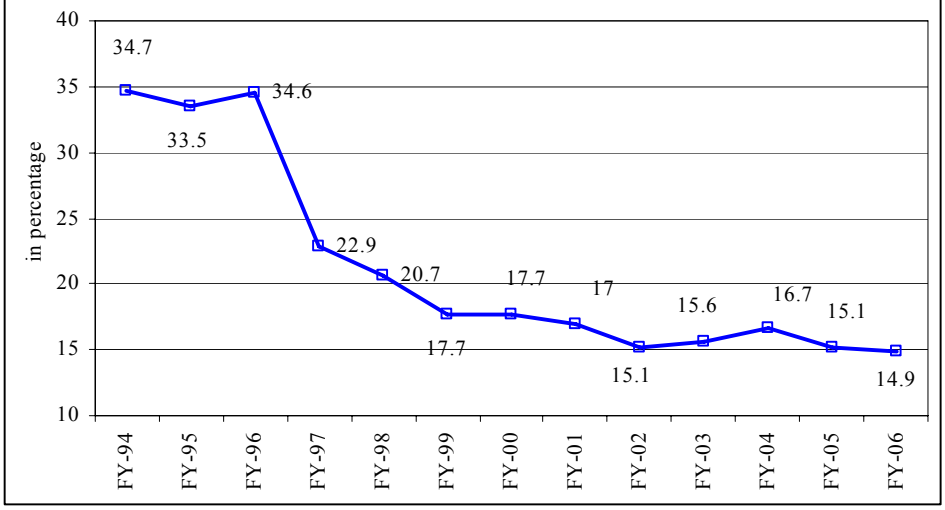
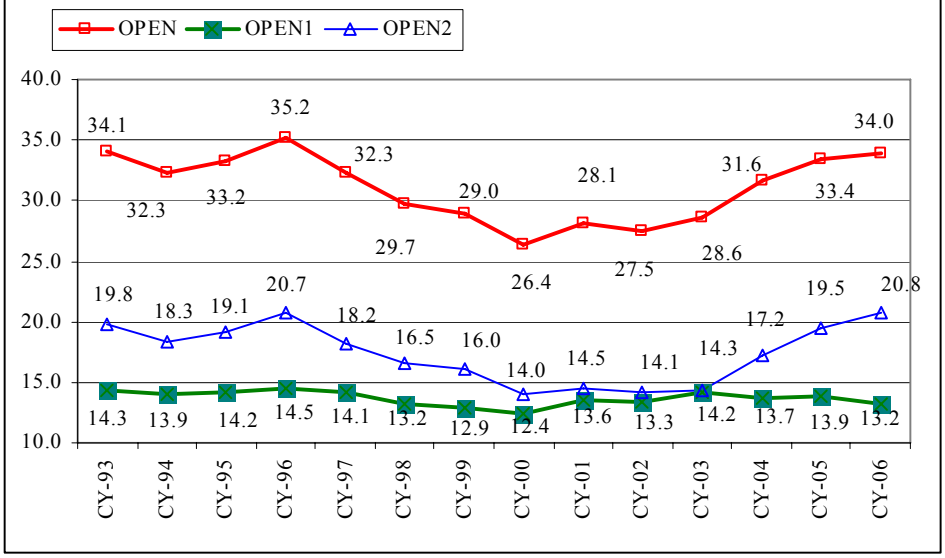


Figure 6.4:Trade Liberalization Indicators



Pakistan has experienced continuous trade liberalization throughout 1990s and the process of reforms is still going on.[63] Average effective tariff rate has fallen to 14.9 percent in FY2006 which used to be around 50 percent in early 1980s and around 40 percent in the beginning of 1990s (see Figure 6.3).

The ratio of imports plus exports in GDP (OPEN) of Pakistan has increased over time reaching 34 percent in CY2006 (see Figure 6.4). However, exports as the percentage of GDP (OPEN1) remained almost stagnant varying 12.4 percent to 14.5 percent during CY93-06. The movement in OPEN is dominated by the pattern in imports as a percentage of GDP (OPEN2). Figure 6.4 clearly demonstrates that trade liberalization in Pakistan is dominantly result of increase in imports, therefore, the impact of trade openness on real exchange rate is expected to be negative i.e. depreciating.

Foreign Direct Investment

Foreign direct investment (FDI) is an important source of capital financing in capital deficient countries like Pakistan. FDI can affect equilibrium real exchange rate in both ways i.e. appreciation or depreciation of domestic currency depending on the use of these inflows. If FDI is used to finance imports it does not affect equilibrium real exchange rate, however, its use for domestic nontradables will lead to the appreciation of domestic currency (see, Baffes, 1999).

In case of Pakistan, FDI was very low before FY05 and except FY96 it never surpassed US$ 1 billion. However, since FY05 FDI has emerged as a major inflow after exports earnings of Pakistan crossing US$ 5 billion in FY07 (see Figure 6.5). Since FY97, Pakistan has received around US$ 15 billion as FDI from countries all over the world. The major sources of FDI in Pakistan include USA, UK and UAE (see Figure 6.6).

An important aspect of FDI inflows in Pakistan is that it is concentrated to a few nontradable sectors. During FY02-07, US$ 12.4 billion FDI inflows in Pakistan were concentrated to a few sectors including oil and gas exploration, power, communications

[63] For details on the history of trade liberalization reforms in Pakistan, see, Kemal, Din, and Qadir (2003), Din, and Thoburn (2004).

and financial services (see Tables 6.1 & 6.2). These four sectors received more than 70 percent of total FDI during the period.

Figure 6.5: Foreign Direct Investment Inflows in Pakistan

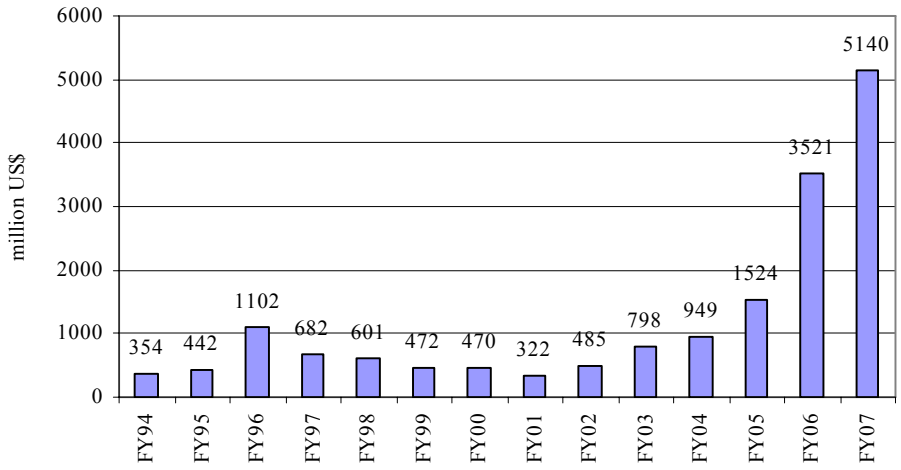


Figure 6.6: Major Sources of FDI Flows in Pakistan

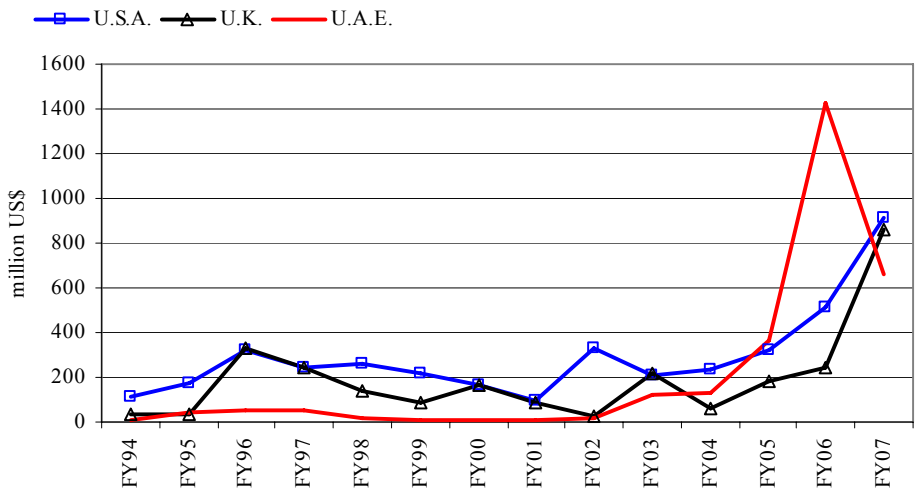


Table 6.1: Sector wise FDI (FY97-01)

million US$	FDI	Share in Total
Food, Beverages Tobacco	173	6.8
Chemicals, Pharmaceuticals & Fertilizers	324	12.7
Power	723	28.4
Transport , Storage & Communication	160	6.3
Financial Business	146	5.7
others	1,022	40.1
TOTAL	**2,548**	**100.0**

Source: State Bank of Pakistan

Table 6.2: Sector wise FDI (FY02-07)

million US$	FDI						Total	Share in
Sectors	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2002-07**	**Total FDI**
Oil & Gas Explorations	268	187	202	194	313	545	1709	13.8
Power	36	33	-14	73	321	193	642	5.2
Communications	13	24	222	518	1938	1899	4613	37.2
Financial Business	4	208	242	269	329	930	1982	16.0
Others	164	347	297	470	621	1573	3472	28.0
Total	**485**	**798**	**949**	**1524**	**3521**	**5140**	**12417**	**100**

Source: State Bank of Pakistan

The critiques are of the view that FDI in nontradable sectors would create balance of payments problems for Pakistan in coming years when repatriation of profit will start. This will build pressure on income account of the balance of payments of the country. Further, the profitability in the banking sector of Pakistan is very high, which is a major motivating factor for foreigners to invest in this sector. But high profitability in this sector is maintained by paying negative real interest rates to depositors.

The authorities argue that at the initial stages, developing countries should not be choosers. Once the investor's confidence in domestic economy builds they also start investing in tradable sectors. Further, the development of nontradable sectors like telecommunication and banking are considered helpful in enhancing productivity of tradable sector.

Workers' Remittances

Workers' remittances are an important source of capital for developing countries like Pakistan. These inflows are directly received by the families of remitters thus has direct impact on poverty reduction in the receiving countries. Further, these inflows are treated as unrequited current private transfers in the balance of payments accounts which curtail the current account deficits of the receiving country. However, despite of the importance of workers' remittances as source of financing of trade deficit, these inflows have important implications for equilibrium real exchange rate. If these inflows are largely spent on nontradable goods it may result in the appreciation of real exchange rate.

In case of Pakistan, workers' remittances have grown from US$ 1.5 billion in FY94 to US$ 5.5 billion in FY07 (see Figure 6.7). The major jump in remittances was observed after 9/11, when remittances increased to US$ 4.2 billion in FY03 from US$ 1.0 billion registered in FY01. The major cause of this shift was the strict stance of US government on money laundering. Further, after 9/11 many Pakistanis were not feeling safe in the United States and they preferred to transfer their money in Pakistan. However, consistent rise in remittances inflows suggests that now the 9/11 shock is over and this growth will pertain in the future.

The major source of remittances inflows in Pakistan are USA, UK, Saudi Arabia and UAE. Before FY01, Saudi Arabia was the largest source of workers' remittances in Pakistan but after that USA has become the leading source of remittance (see Figure 6.8).

Figure 6.7: Workers' Remittances Inflows in Pakistan

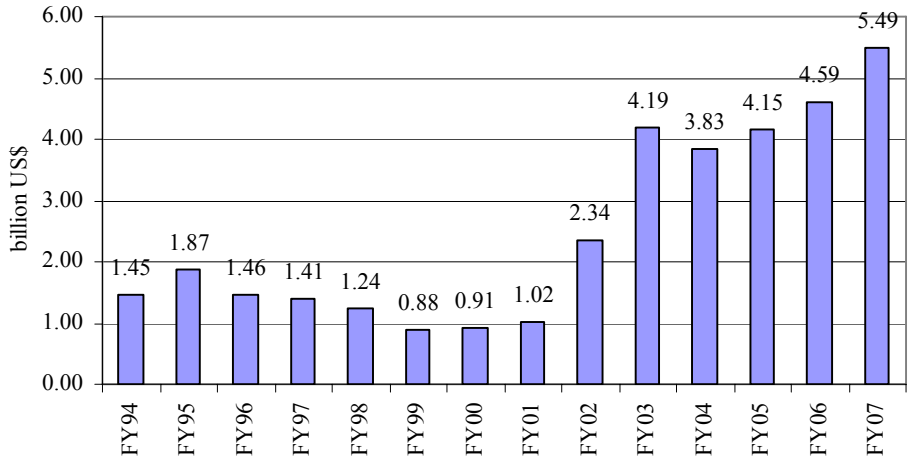
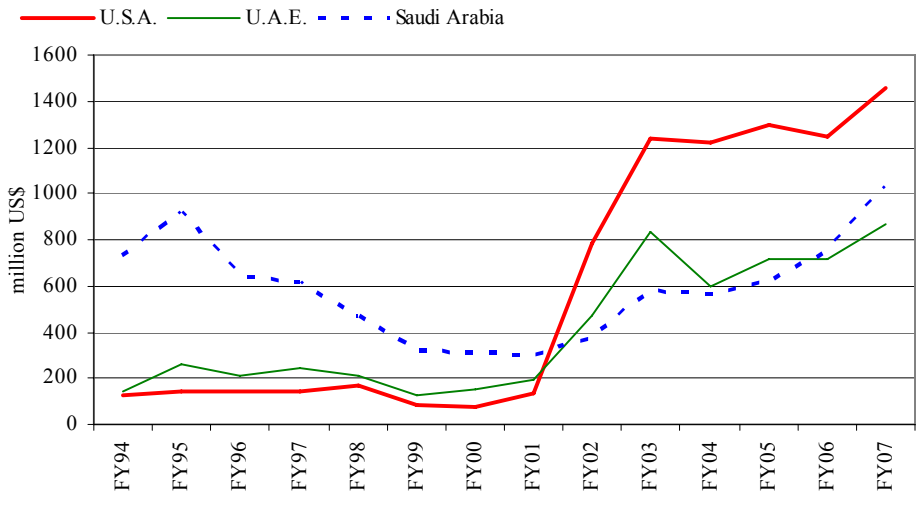


Figure 6.8: Three Major Sources of Remittances in Pakistan



6.2: Estimation of Real Exchange Rate Misalignment

Estimation of real exchange rate misalignment is a challenging task for policy makers in both the developing and developed countries because of its utility in assessing the external competitiveness of a country. External competitiveness is assessed at both informal and formal levels. Informal assessment are usually undertaken by graphical inspection of relative price measures, normally CPI based real effective exchange rates. Informal judgments in fact are based on Purchasing Power Parity (PPP) method for assessing RER misalignments. Therefore, REER index is compared with its value in some base period however, it implicitly assumes that fundamentals are unchanged during the period of assessment. In this regard, an important point to consider is that appreciation (depreciation) of the real exchange rate does not always reflect a loss (gain) of competitiveness. For example, an appreciation of real exchange rate might be due to productivity gains in tradable sector (Balassa effect). Therefore, the competitiveness assessments that are based only on the observation of the real exchange rate evolution through time can result in misleading conclusions (see Bella et al.,2007). Formal appraisal of the real exchange rate compares the current REER with its equilibrium value, determined through a proper method. The evaluation of real exchange rate generally depends on econometric techniques (cointegration analysis) to discover a long-term relationship between the REER and a group of macroeconomic variables popularly referred as fundamentals (see Chapter 4). In case of Pakistan, different publications(e.g. Economic Survey of Pakistan) report their analysis on the basis of actual real effective exchange rate and ignore the fact whether it is above or below than equilibrium exchange rate.

6.2.1: Unit Root Test

Before implementing the cointegration technique, the stationarity of LREER and fundamentals (LPROD, LOPEN, LFDI, and LREMIT) is checked through unit root tests. The stationarity properties of the data are checked, by applying Augmented Dickey-Fuller (ADF) tests. The results of ADF test are reported in table 6.3.

Table 6.3: Augmented Dickey-Fuller (ADF) Tests

Series in BEER Model	At Level		At First Difference	
	With Intercept	With Inter. & Trend	With Intercept	With Inter. & Trend
LREER	-1.79(2)	-2.92(2)	-10.67(0)***	-10.63(0)***
LREMIT	-0.60(2)	-1.57(2)	-12.96(1)***	-12.96(1)***
LFDI	-0.19(5)	-1.08(5)	-9.93(4)***	-10.00(4)***
LPROD	-2.50(13)	-0.45(13)	-2.93(13)***	-5.43(11)***
LOPEN	-0.11(13)	-1.25(13)	- 2.93(12)**	-3.73 (11)**

*; ** and *** denote significance of test statistic at 10%, 5% and 1% level of significance against the null hypothesis of unit root. The critical values are taken from MacKinnon (1996). Figures in the parenthesis represent lags selected on the basis of Akaike Information Criterion (AIC). We have also checked white noise of residuals in ADF tests.

Table 6.3 shows that variables included in BEER model (LREER and fundamentals) are nonstationary at level but are stationary at first differences-hence they are I(1), which fulfills the criterion for estimating long run relationship through cointegration technique.

6.2.2: Johansen's Cointegration Test

The Johansen's (1988) cointegration technique is used to estimate the long-run relationship between LREER and fundamentals (LPROD, LOPEN, LFDI, LREMIT). Unlike Engel Granger (1987), the Johansen's technique for estimating cointegration is said to be superior because it is based on Maximum Likelihood procedure that provides test statistics to determine number of cointegrating vectors as well as their estimates.[64]The results of Johansen's Likelihood Ratio Test for cointegration rank are presented in table 6.4.

[64] Although the Engle and Granger (1987) procedure is easily implemented, it does have several important defects: (a) it heavily depends on the choice of the variable selected for normalization; (b) the method has no systematic procedure for the separate estimation of multiple cointegrating vectors; (c) another defect of the Engle-Granger procedure is that it relies on a two-step estimator. The first step is to generate the residual series $\{\hat{e}_t\}$ and the second step uses theses generated errors to estimate a regression of the form $\Delta \hat{e}_t = a_1 \hat{e}_{t-1} + \ldots\ldots$ Thus, the coefficient a_1 is obtained by estimating a regression using the residuals from another regression. Hence any error introduced by the researcher in step 1 is carried into step 2. Fortunately, several methods have been developed that avoid these problems.

Table 6.4: Johansen's Cointegration Test Results

Series (LREER, LPROD, LOPEN, LREMIT, LFDI)									
Eigen Values in descending order: 0.1937, 0.12, 0.0484, 0.0385, 0.0010									
Trace -Stat					**Max-Stat**				
Null Hyp.	Alter. Hyp.	LR	5% C.V	1% C.V	Null Hyp.	Alter. Hyp.	LR	5% C.V	1% C.V
r = 0	r ≥1	70.16**	68.52	76.07	r =0	r =1	34.89**	33.46	38.77
r ≤ 1	r ≥2	35.27	47.21	54.46	r =1	r =2	20.71	27.07	32.24
r≤ 2	r ≥3	14.56	29.68	35.65	r =2	r =3	8.04	20.97	25.52
r≤ 3	r ≥4	6.52	15.41	20.04	r =3	r =4	6.35	14.07	18.63
r≤ 4	r =5	0.16	3.76	6.65	r =4	r =5	0.16	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5% (1%) level. The lag length (1-3) of VAR was selected based on AIC criterion. The Cointegration tests were conducted assuming series have trend but the cointegrating equation has only intercepts.

The results reported in table 6.4 show that both Trace test and Maximum Eigen value tests indicate single cointegrating vector at the 5% level of significance. The long-run relationship can be obtained by normalizing the cointegrating vector on LREER. In equation form, the normalized vector can be expressed as follows:[65]

LREER = 8.3094 + 0.0054 LPROD - 0.6094 LOPEN + 0.2329 LFDI - 0.013 LREMIT **(6.5)**

(0.166) (0.1609) (0.038) (0.0366)

-0.03 3.789 -6.133 0.3524

In this long run relationship, LPROD and LFDI have positive (appreciating) effect whereas LOPEN and LREMIT have negative (depreciating) effect on real effective exchange rate. The positive sign of LPROD is according to the so called Balassa Samuelson theory which states that productivity rise in tradable leads increase in demand of nontradables thus real exchange rate appreciates. The negative sign of LOPEN is according to the expectation. Trade openness may have positive or negative sign depending on whether liberalization is due to exports (positive sign) or imports (negative

[65] E. Views gives cointegration equation in deviation form, so independent variables and constant are brought to the right hand side in equation (6.1). The numbers in parentheses under the estimated coefficients are the asymptotic standard errors.

sign). In this study, trade (exports plus imports) is taken as proxy of trade openness, thus negative sign is justified as in case of Pakistan imports have grown faster than exports as a result of trade liberalization. As far as the impact of FDI on REER is concerned, it is positive and shows that increase in long-run capital inflows appreciate real exchange rate. FDI can affect equilibrium real exchange rate through both supply and demand channels. In the supply channel, FDI inflows increase the existing capital stock and bring spillover effects of technology transfer which in first round lead to increase in output and fall in prices of nontradables thus depreciating real exchange rate, and, in the second round the increase in output of nontradables expands disposable income and thus tends to appreciate the RER. The second round effect is dominated by first round supply effect. By contrast, the contemporaneous effect through demand channel is realized after FDI inflows if they are not crowding out domestic investment. This typical RER appreciation mechanism is highlighted by the literature as "Dutch disease" problem associated with foreign capital flows. Finally, the sign of LREMIT is negative showing that use of remittances for consumption of non-tradable is not dominant.

In the next step, combining the long run parameters of the cointegrating equation 6.5 with the sustainable components of the fundamentals, which are computed by Hodrick-Prescott Filter (HP Filter), derives the equilibrium real effective exchange rate (LEREER).[66]

$$LEREER = 8.3094 + 0.0054\ LPROD^* - 0.6094\ LOPEN^* + 0.2329\ LFDI^* - 0.013\ LREMIT^* \qquad (6.6)$$

Real exchange rate misalignment is then calculated as the difference between actual and equilibrium real effective exchange rates.

$$MIS = LREER - LEREER \qquad (6.7)$$

Figure 6.9 shows actual and equilibrium real effective exchange rates. When actual real effective exchange rate (LREER) is above the equilibrium real effective exchange rate (LEREER), it shows overvaluation and vise versa. The difference between

[66] Where, the asterisks over the variables indicate the sustainable components of the fundamental determinants of equilibrium real exchange rate.

actual and equilibrium real effective exchange rates (i.e. MIS) is plotted in the figure 6.10 **(**also see Appendix 5). Positive bars show overvaluation of REER and vice versa.

The results reject PPP school of thought and support Edwards and Elbadawi's view of fundamentals approach that equilibrium real exchange rate is not constant over time as supposed by PPP approach.[67] Equilibrium real exchange rates can change over time as a result of change in fundamentals like productivity and capital inflows. Further, the hypothesis that markets have well defined views of the equilibrium exchange rate determined by fundamentals is not convincing. Because, determining the equilibrium real exchange rate is quite difficult task even for economists, thus, markets do not have well-defined, rational expectations view of what is implied by the fundamentals. However, markets may develop a very well-defined view that a rate being defended by the authorities is inconsistent with the fundamentals.

During the sample period, five episodes of both overvaluation and undervaluation were identified (see Figures 6.10). Among these, two were overvaluation episodes and the rest were undervaluation episodes.[68]

In the first episode (from 1997M4 to 1998M7), the overvaluation was observed up to 8 percent. The foreign exchange market at that time was reflecting this situation with market premium up to 6 percent. The premium on market exchange rate was 1.9% in July1997, 5.86% in February 1998 and 3.29% in April1998.

During 1997-98, exchange rate was adjusted by 8 percent in October 1997, mostly on the grounds that East Asian crises could adversely affect exports. The measure proved successful in containing trade gap and increasing foreign exchange reserves. Further, real exchange rate became undervalued for a short period of time starting from the second half of 1998. In the second episode (from 1998M8 to 1999M4), undervaluation was observed up to 8 percent

After observing undervaluation in FY99, the position started to revert in FY00 as nominal exchange rate observed stability due to low current account deficit and absence

[67] The absolute version of PPP holds that the equilibrium exchange rate between two currencies will be such as to equate purchasing power in the two countries involved. The relative version of PPP holds that the equilibrium exchange rate must change so as to offset differential inflation between the two countries and thus leave the real exchange rate unchanged.

[68] In this study, an episode is defined as undervaluation or overvaluation of more than 4 percent for a period of at least 6 months (see, Golfajn and Veldas(1999) for the definition of an episode).

of IMF program. However, in FY01 the Rupee/Dollar parity weakened dramatically by 18.6 percent which was depreciation of cumulated two fiscal years. This depreciation is reflected in a short third episode of misalignment in Figure 6.10. In the third episode (from 2000M12 to 2001M12), undervaluation was observed up to 9 percent.

In the fourth episode (from 2004M3 to 2006M4), overvaluation was observed up to 5 percent.[69] This overvaluation was due to high domestic inflation causing appreciation of real effective exchange rate. The CPI inflation was recorded 9.3 percent in FY05 and 7.9 percent in FY06. During this period, high foreign inflows particularly workers' remittances and FDI led to the appreciation of equilibrium real exchange rate, however, appreciation in actual real REER was above than recorded in equilibrium real exchange rate.

The overvaluation continued to exist up to the end of FY06, however, by the end of second quarter of FY07 situation started to revert mainly due to capital inflows. In the fifth episode (2006M5 to 2007M4), undervaluation was observed up to 8 percent. Huge capital and financial account surplus of BOP surpassed current account deficit of US$ 7 billion thus posting BOP surplus of US$ 3.3 billion in FY07. Further, foreign exchange reserves of the country improved to US$ 15.6 billion.

[69] Recently, International Monetary Fund (IMF Country Report No. 06/ 426) has also observed that Rupee is slightly overvalued.

Figure 6.9:Actual and Equilibrium Real Exchange Rates

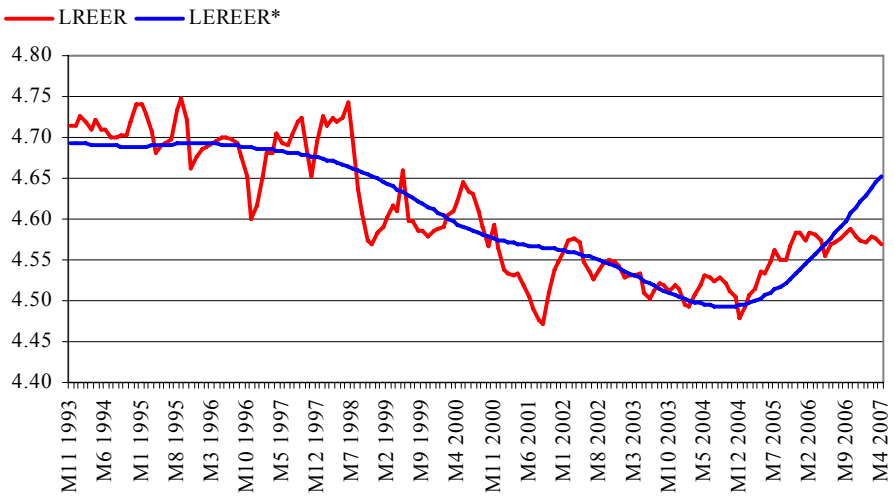
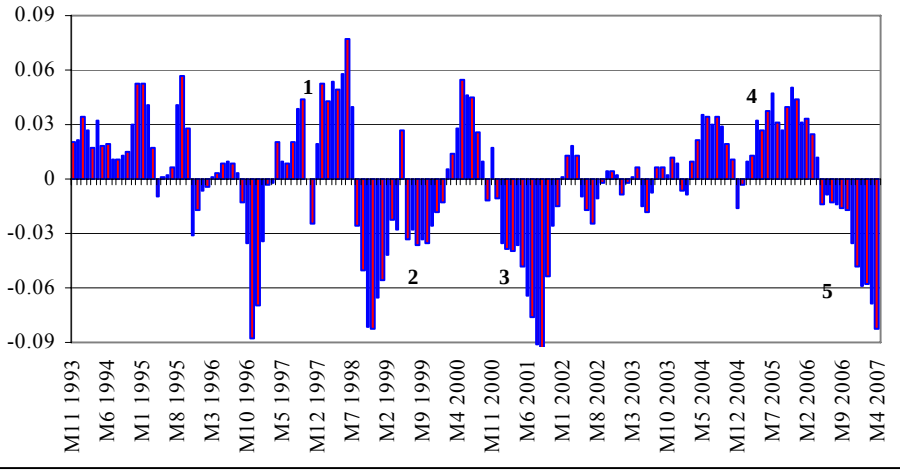


Figure 6.10: Real Exchange Rate Misalignment

+ve(overvaluation), -ve(undervaluation)



6.3: Misalignment under Different Exchange Rate Regimes

This section compares the degree of misalignment and its variation in different exchange rate regimes experienced by Pakistan during the sample period. Real exchange rate misalignment is not only confined to fixed exchange rate regime but it can also arise in a managed or flexible exchange regimes. Because, market determined exchange rate regime may deviate from equilibrium due to: a) foreign exchange market failure arising from herding and feedback trading which is based on price movements rather than fundamentals; b) transitory shocks may lead to a higher degree of volatility in exchange rate due to thin foreign exchange rate markets in developing markets (see, Hyder and Adil, 2005).

In Table 6.5, the degree of misalignment and its volatility are compared under managed exchange rate and transition, and free floating exchange rate regimes. The real effective exchange rate, on average remained overvalued under managed and transition exchange rate regime as compared to undervaluation observed in free-floating exchange rate regimes. Further, the range (difference of maximum and minimum values) reflects that the degree of dispersion was quite higher under first period as compared to second period. Similarly, the standard deviation (S.D) reflects higher degree of volatility under first period.

Table 6.5: Misalignment under Different ER Regimes

	Managed and Transition ER Regime 1993M11-2000M7	***Free Floating ER Regime 2000M8-2007M4***
Mean	0.42	-0.49
Max	7.75	5.02
Min	-8.76	-9.45
Range	16.51	14.5
S.D	3.6	3.30

Source: Estimations of this study

The results explained above clearly show that by adopting more flexible exchange rate regime in Pakistan, the level and volatility of real exchange rate

misalignment has reduced. These results are also consistent with Calvo and Mishkin (2003) showing that under flexible exchange rate regime exchange rate adjusts more rapidly to real shocks as compared to fixed and managed exchange rate regimes.

CHAPTER 7

EXCHANGE RATE PASSTHROUGH INTO CONSUMER PRICES IN PAKISTAN: EMPIRICAL FINDINGS

This chapter presents the estimation results of exchange rate pass-through (ERPT) model developed in chapter 4. In the opening part of the chapter, pass-through into consumer price inflation ($ERPT_{CPI}$) for the overall sample (1993M11-20007M4) is estimated in section 7.1. In section 7.2, $ERPT_{CPI}$ is estimated for two sub-samples to examine whether $ERPT_{CPI}$ has declined by adoption of more flexible exchange rate regime in Pakistan. After that, section 7.3 explains ERPT into Core CPI inflation ($ERPT_{CCPI}$) to check whether excluding food and energy groups from CPI basket pass-through is different from $ERPT_{CPI}$.[70]

7.1: Exchange Rate Pass-through into Consumer Price Inflation ($ERPT_{CPI}$)

Before estimating the ERPT model (equation 9 in chapter 4), the stationarity property of variables is checked by applying Augmented Dickey Fuller (ADF) tests. Table 7.1 shows that all variables in ERPT models (ΔlnCPI, ΔlnCCPI, Δ lnNEER, Δ lnFCPI, MIS) are stationary at level.

Table 7.1: Augmented Dickey-Fuller (ADF) Tests

Series in ERPT Model	With Intercept	With Intercept & Trend
Δ lnCPI	-5.50(2)***	-5.74(2)***
Δ lnCCPI	-2.78(3)*	-3.01(3)
Δ lnNEER	-9.0(1)***	-6.77(6)***
Δ lnFCPI	-5.30(12)***	-4.92(12)**
MIS	-4.12(1)***	-4.18(1)***

* ; ** and *** denote significance of test statistic at 10%, 5% and 1% level of significance against the null hypothesis of unit root. The critical values are taken from MacKinnon (1996). Figures in the parenthesis represent lags selected on the basis of Akaike Information Criterion (AIC). White noise of residuals in ADF tests has been checked.

[70] Core CPI inflation is calculated by excluding food and Energy groups from CPI commodity groups. See, appendix 2 for the composition of CPI and WPI indices.

The ERPT model is estimated by Ordinary Least Square (OLS) method, as it provides unbiased estimates of parameters in presence of stationary variables in the model.[71] The OLS methodology could be inappropriate if causality runs both ways between prices and exchange rate variables, however, using alternative methodologies such as two stage least squares (TSLS) could also have problems like unavailability of sufficient data and proper instrument for ΔNEER.[72] Similarly, difficulty in applying structural VARs is requirement of identification conditions by making assumptions about the timing of the effects of exchange rate on prices that is not convincing. Therefore, in the recent literature, Edwards (2006), Ito et. al. (2005), Campa and Goldberg (2002), and, Gagnon and Ihring (2004) have also used OLS method to estimate models similar to this study.[73]

Nominal effective exchange rate (NEER) and foreign weighted consumer price index (FCPI) have been used in this study as proxies for exchange rate and foreign producer's cost, however, many studies have used the bilateral exchange rate with US dollar and USA wholesale prices index (WPI). First, the effective exchange rate is the right concept to use when the total effect of the exchange rate changes is attempted to measure in a country with diversified trading partners.[74]Second, the exchange rate between Pak-Rupee and US-Dollar has observed little changes over the last several years; however, Pak-Rupee has continuously depreciated in effective terms against the currencies trading partners.

In the regression for overall sample, seventeen lags of each independent variable except misalignment were initially considered to allow gradual adjustment of consumer

[71] According to Enders(2000), when all variables in the model are I(0), the appropriate estimation technique will be Ordinary Least Squares(OLS).
[72] Edwards(2006) has discussed this issue in detail.
[73] The external reviewers of this study raised no objection on the methodology of the study. According to Dr. W. Douglas McMilllan, the methodology is sound. Similarly, the other reviewer Prof. Thomas Mayer allowed the use of OLS technique by describing problems with alternate available approaches.
[74] Initially, the estimations were conducted by using bilateral exchange rates, however, Dr. Asad Zaman (a well known economist) advised to use effective exchange rates and foreign prices.

prices to changes in exchange rate.[75] However, following General to Specific method, most of the insignificant lags were dropped.[76]

The estimated model passes all the diagnostic tests such as normality, autocorrelation, hetroskedasticity, and RESET test for specification error. The adjusted R^2 shows that this is reasonably good fit. The CUSUM and CUSUM Q stability tests indicate that coefficients are stable (see Figure 7.1b). The results of the estimation of ERPT model are discussed below (see Tables 7.2).

Following Edwards (2006), Otani et al. (2003), and Campa and Goldberg (2002) the short-run exchange rate pass-through (SRERPT) is a measure of contemporaneous impact of increase in NEER appreciation on consumer price inflation. The expected sign of this coefficient is negative. Whereas, long-run exchange rate pass-through (LRERPT) takes into account for previous period's exchange rate changes and inflation, thus, estimating aggregated pass-through.

$$SRERPT = \theta_0 ;$$

$$LRERPT = \sum \theta_{2i} / (1- \sum \theta_{3i})$$

Table 7.2 shows that, MIS (-1) variable is insignificant and has weak magnitude. The NEER appreciation affects inflation after 4, 16 and 17 months lag, however, short-run $ERPT_{CPI}$ which is contemporaneous impact of NEER appreciation on inflation is insignificant with correct sign. The long-run $ERPT_{CPI}$ is equal to -0.07(see Box 7.1 for calculation of long-run ERPT). For the overall sample, the main determinant of inflation is foreign inflation. One percent rise in foreign inflation increases 0.75 percent domestic inflation without any lag. One percent lagged domestic inflation exerted 0.14 percent increase in domestic inflation after 3 month, which marginally increases to 0.15 percent after 11 months.

[75] This consideration was based on LR lag selection criterion from VAR Model including variables Δ lnCPI, Δ lnNEER , and Δ lnFCPI (see appendix 3).
[76] Due to limited number of observations, lag selection in regression 2 & 3 was selective based on significance of lags in the regression 1.

Table 7.2: Estimates of Pass-through Relation (Reg. 1: From 1993-M11 to 2007-M4)

Dependent Variable: Δ ln CPI		
Variables	**Coefficients**	**t-values**
Constant	0.002	3.18***
MIS $_{t-1}$	0.0068	0.60
Δ ln NEER	-0.002	-0.10
Δ ln NEER $_{t-4}$	-0.0423	-1.98**
Δ ln NEER $_{t-16}$	0.045	2.11**
Δ ln NEER $_{t-17}$	-0.0504	-2.50**
Δ ln FCPI	0.789	8.13***
Δ ln CPI $_{t-3}$	0.1433	2.15**
Δ ln CPI $_{t-11}$	0.1462	2.20**
Adj. R^2	0.37	
SE of Regression	0.0044	
Diagnostic Tests		
Jarque –Bera Normality Test	$Chi^2(2) = 3.82$ (0.15)	
Breusch-Godfrey LM Test	$Chi^2(1) = 0.62$ (0.43)	
Engle's ARCH LM Test	$Chi^2(1) = 3.38$ (0.09)	
Ramsey's RESET Test	$Chi^2(1) = 1.52$ (0.22)	

***,**, * reflect significance at 1%,5% and 10% respectively.
Figures in brackets are probabilities.
Source: Estimation of this study

Figure 7.1a: Histogram-Normality Test

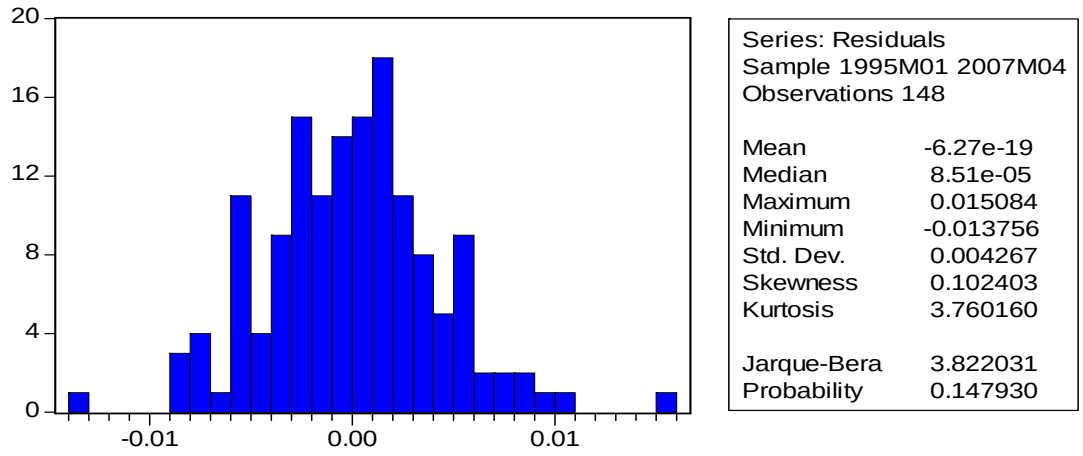
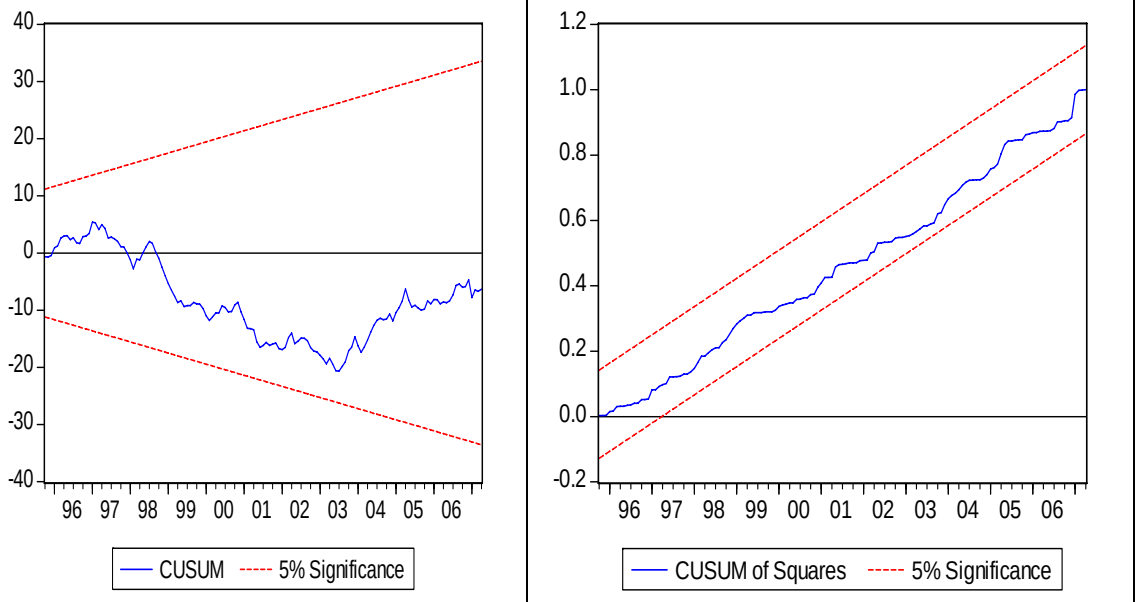


Figure 7.1b: Test for Stability of Parameters



Low $LERPT_{CPI}$ coefficient observed for the overall sample is consistent with recent empirical literature (see, Ito et al., 2005). In the literature, several reasons for low pass-through into CPI inflation are discussed. First, CPI includes components of domestic value added along with imported inputs and final goods. The share of imports on CPI is one important factor in evaluating the pass-through effects of exchange rate changes on CPI. Second, pass-through into CPI inflation may be affected by nature of monetary policy practiced by the central bank. If monetary policy is accommodative the pass-through would be higher, however, monetary policy of strict inflation targeting would be associated with low pass-through. According to Taylor's hypothesis pass-through would be lower in a low inflation environment regime. Third, domestic goods like retails and services face higher substitutability and competition which affects potential of passing-on any exchange rate changes to consumer prices. Fourth, pass-through into CPI declines under free floating exchange rate regime due to expectations that exchange rate changes of temporary nature would reverse soon thus changing prices is not considered a viable option in such cases.

Box 7.1: Short- run and Long-run Exchange Rate Pass-through

Consider the following model

$$\Delta \ln p_t = \alpha + \sum \beta_i \Delta \ln er_t + \gamma_i x_{i\,t} + \sum \theta_l \log \Delta \ln p_{t-1} + \varepsilon_t$$

where $\Delta \ln p_t$ is the inflation rate, $\Delta \ln er_t$ is the depreciation of exchange rate and $x_{i\,t}$ represents control variables to control foreign exporters' cost and domestic demand shifters (see, Goldberg and Knetter, 1997).

Campa and Goldberg (2002) define short-run pass-through (SRERPT)as the contemporaneous elasticity, measured by the coefficient βo. Besides, they define the long-run elasticity as the sum of the coefficients on the contemporaneous exchange rate and n lags of exchange rate terms $\sum \beta_i$.

However, in this study model also includes the lags of the inflation term, therefore, following Edwards (2006), and Otani et al. (2003) the definition of long-run exchange rate pass-through (LRERPT) of Campa and Goldberg (2002) as follows:

$$SRERPT = \beta_0$$

$$LRERPT = \sum \beta_i / (1 - \sum \theta_l)$$

This study uses two control variables: real effective exchange rate misalignment in the previous period mis(-1) to capture domestic demand conditions and weighted foreign consumer price inflation (FINF) to capture foreign exporters cost (See Chapter 4).

7.2: Exchange Rate Pass-through under Different ER Regimes in Pakistan

Low $LERPT_{CPI}$ generates several important questions which need to be addressed. These questions include: a) whether, previous period's real exchange rate misalignment affected ERPT relation differently under managed and flexible exchange rate regimes? b) has the $ERPT_{CPI}$ coefficient declined over time due to adoption of more flexible exchange rate regime by Pakistan? c) is the low $LERPT_{CPI}$ is due to the fact that CPI index also contains subgroups like food and energy whose prices are largely administrated? These questions are empirically investigated in the remaining part of this chapter.

a) $ERPT_{CPI}$ under Managed ER Regime *(Sub-sample 1: 1993M11 to 1998M7)**:***

In the first sub-sample, the coefficient of MIS (-1) is negative and significant indicating that 1 percent overvaluation in the previous period exerted almost 0.04 percent reduction in general CPI inflation(see Table 7.3) . Moreover, the contemporaneous impact of NEER appreciation on CPI inflation (i.e. SR-ERPT) was significant having coefficient of -0.05. Further, the LRERPT is equal to -0.19. As for as, foreign inflation is concerned, its impact is positive and is observed after the lag of 12 months. One percent increase in FINF causes 0.28 percent rise in INF after 12 months.

b) $ERPT_{CPI}$ under Flexible ER Regime *(Sub-sample 2: 1998M8 to 2007M4)**:***

The pass-through coefficients are close to zero. The maximum impact of foreign inflation is realized instantaneously without any lag. One percent increase in foreign inflation caused 0.96 percent increase in domestic inflation. The sign of lagged inflation is positive and maximum effect (0.12 percent) is realized after 8 months. Overall, under flexible exchange rate regime the dominant role of foreign inflation affecting domestic inflation is observed.

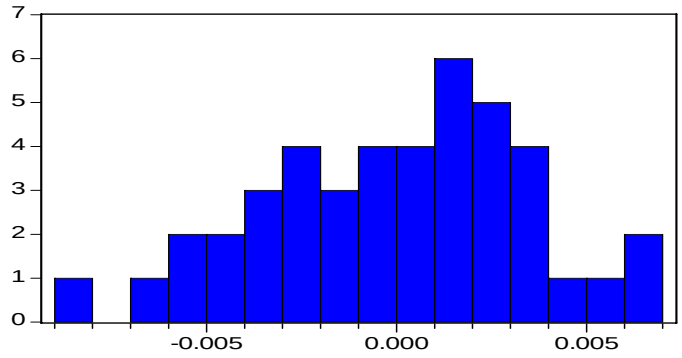
Contrary to managed ER regime, under flexible exchange rate regime pass-through coefficients are insignificant. Recent empirical literature (see e.g., Kara et al., 2007; Steel and King, 2004; and Darvas, 2001) provides evidence consistent to this finding. ERPT might be higher in managed exchange rate regime since changes in exchange rate might be regarded as more permanent than in floating exchange rate regime.

Table 7.3: Estimates of Pass-through Relation (Reg. 2: From 1993-M11 to 1998-M7)

Dependent Variable: Δ ln CPI		
Variables	**Coefficients**	**t-values**
Constant	0.0055	7.3979***
MIS $_{t-1}$	-0.0429	-2.29 **
Δ ln NEER	-0.0499	-1.77*
Δ ln NEER $_{t-4}$	-0.0654	-2.11**
Δ ln NEER $_{t-17}$	-0.079	-2.56**
Δ ln FCPI	0.1797	1.25
Δ ln FCPI $_{t-12}$	0.2798	2.37***
Adj. R^2	0.43	
SE of Regression	0.0038	
Diagnostic Tests		
Jarque –Bera Normality Test	$Chi^2(2)$ =0.61(0.73)	
Breusch-Godfrey LM Test	$Chi^2(1)$ = 0.3892 (0.53)	
Engle's ARCH LM Test	$Chi^2(1)$ = 0.1255(0.72)	
Ramsey's RESET Test	$Chi^2(1)$ = 0.4441(0.51)	

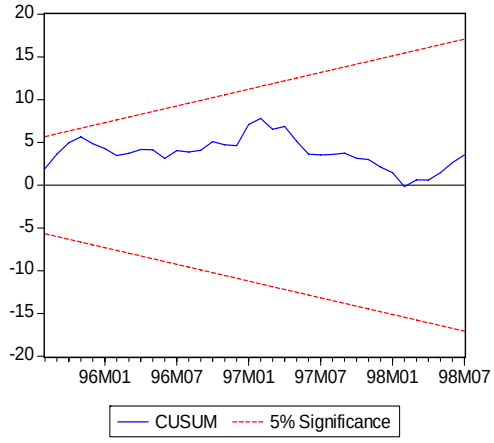
***,**, * reflect significance at 1%,5% and 10% respectively.
Figures in brackets are probabilities.
Source: Estimation of this study

Figure 7.2a: Histogram-Normality Test



Series: Residuals	
Sample 1995M01 1998M07	
Observations 43	
Mean	6.25e-19
Median	0.000516
Maximum	0.006654
Minimum	-0.008700
Std. Dev.	0.003512
Skewness	-0.248943
Kurtosis	2.690098
Jarque-Bera	0.616209
Probability	0.734838

Figure 7.2b: Test for stability of parameters



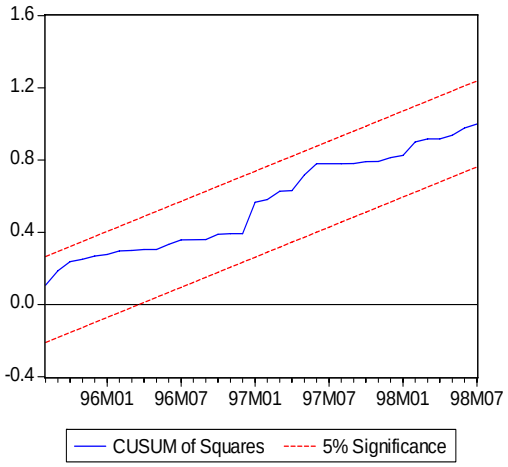
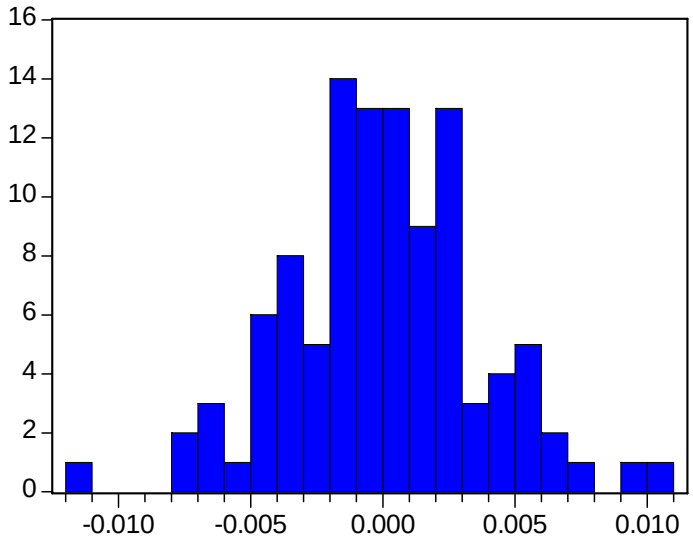


Table 7.4: Estimates of Pass-through Relation (Reg. 3: From 1998-M8 to 2007-M7)

Variables	Coefficients	t-values
Constant	0.0014	2.02**
MIS $_{t-1}$	0.0172	1.44
Δ log NEER	-0.001	-0.02
Δ log FCPI	0.96	8.88***
Δ log CPI $_{t-3}$	0.099	1.37
Δ log CPI $_{t-8}$	0.1164	1.67*
Δ log CPI $_{t-12}$	0.127	1.72*
Adj. R^2	0.48	
SE of Regression	0.0040	
Diagnostic Tests		
Jarque –Bera Normality Test	$Chi^2(2) = 3.82$ (0.15)	
Breusch-Godfrey LM Test	$Chi^2(1)=0.34$ (0.69)	
Engle's ARCH LM Test	$Chi^2(1) =5.685$ (0.02)	
Ramsey's RESET Test	$Chi^2(1) =$ 0.0205 (0.88)	

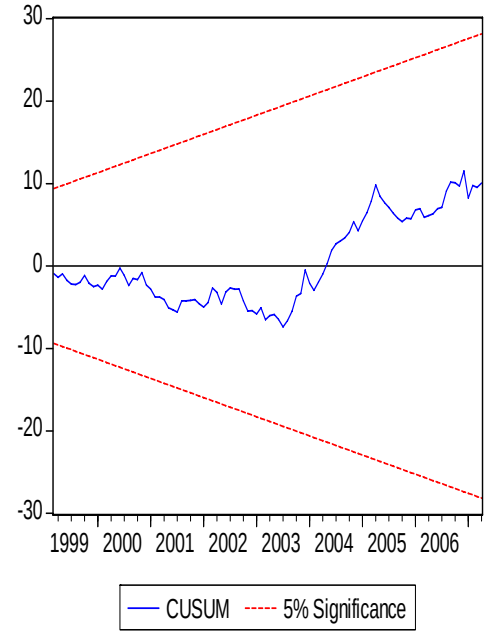
***,**, * reflect significance at 1%,5% and 10% respectively.
Figures in brackets are probabilities.
Source: Estimation of this study

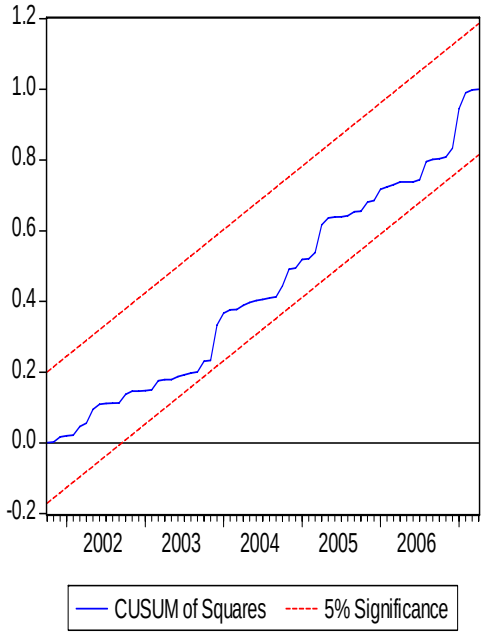
Figure 7.3a: Histogram-Normality Test



Series: Residuals	
Sample 1998M08 2007M04	
Observations 105	
Mean	-6.17e-19
Median	-3.17e-05
Maximum	0.010180
Minimum	-0.011374
Std. Dev.	0.003679
Skewness	-0.011610
Kurtosis	3.480715
Jarque-Bera	1.013364
Probability	0.602491

Figure 7.3b: Test for stability of parameters





7.3: Exchange Rate Pass-through (ERPT) into Core CPI Inflation

There are many reasons of low ERPT into CPI inflation described in the literature. One widely presented reason for low ERPT into CPI inflation is that CPI index also contains subgroups of food items and energy which are largely administrated and have less exchange rate pass-through (see, e.g., McCarthy, 2000). Therefore, excluding these administrated groups, ERPT would be higher. To test this hypothesis, in this section model has been estimated for nonfood non-energy consumer price inflation i.e. core inflation (see Table 7.2b).

The estimation results demonstrate that the coefficient showing contemporaneous impact of NEER appreciation on core inflation is statistically insignificant i.e. short-run ERPT is not different from zero. However, the long-run ERPT coefficient which was estimated previously -0.07 in case of general inflation, has increased to -0.21.

The comparison of $ERPT_{CPI}$ and $ERPT_{CCPI}$ reveals that by excluding food and fuel items from CPI commodity baskets ERPT increases. However, this increase is not substantial and despite ignoring food and fuel items, pass-through into consumer price inflation is very low.

Table 7.5: Estimates of Pass-through into Core CPI Inflation *(1993-M11 to 2007-M4)*

Dependent Variable: Δ ln CCPI		
Variables	**Coefficients**	**t-values**
Constant	0.0006	1.30
MIS $_{t-1}$	0.0062	0.89
Δ ln NEER	-0.0085	-0.71
Δ ln NEER $_{t-1}$	-0.0229	-1.84*
Δ ln NEER $_{t-3}$	-0.0178	-1.46
Δ ln NEER $_{t-9}$	-0.0197	-1.74*
Δ ln NEER $_{t-17}$	-0.0249	-2.26**
Δ ln FCPI $_{t-1}$	0.1025	2.00**
Δ ln FCPI $_{t-12}$	0.0598	1.22
Δ ln CCPI $_{t-1}$	0.2914	3.95***
Δ ln CCPI $_{t-3}$	0.2483	3.33***
Δ ln CCPI $_{t-8}$	0.1786	2.47**
Adj. R^2	0.45	
SE of Regression	0.0024	
Diagnostic Tests		
Jarque –Bera Normality Test	$Chi^2(2) = 1.22$ (0.54)	
Breusch-Godfrey LM Test	$Chi^2(1) = 1.82$ (0.18)	
Engle's ARCH LM Test	$Chi^2(1) = 0.03$ (0.85)	
Ramsey's RESET Test	$Chi^2(1) = 1.52$ (0.07)	

***,**, * reflect significance at 1%,5% and 10% respectively.
Figures in brackets are probabilities.
Source: Estimation of this study

Figure 7.4a: Histogram-Normality Test

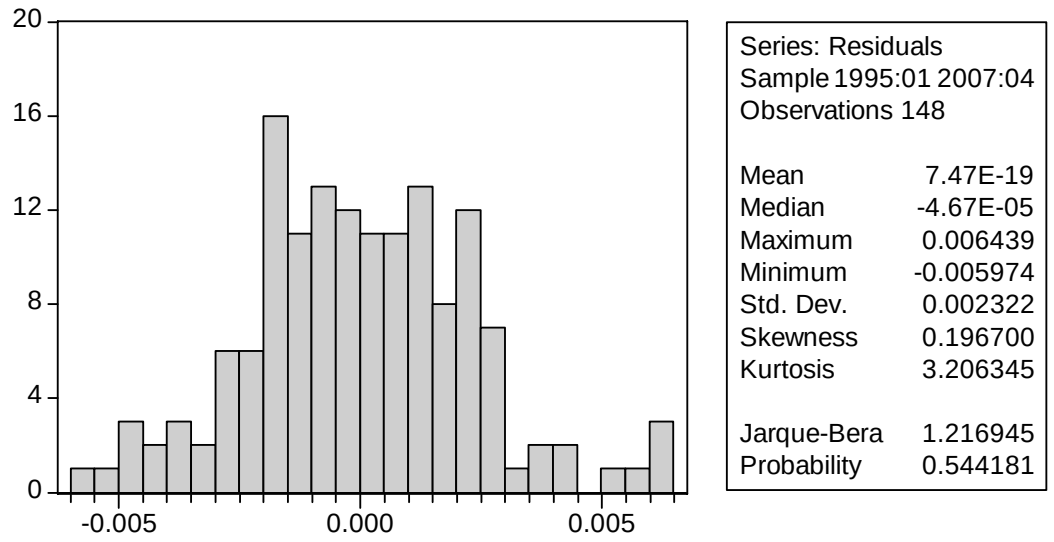
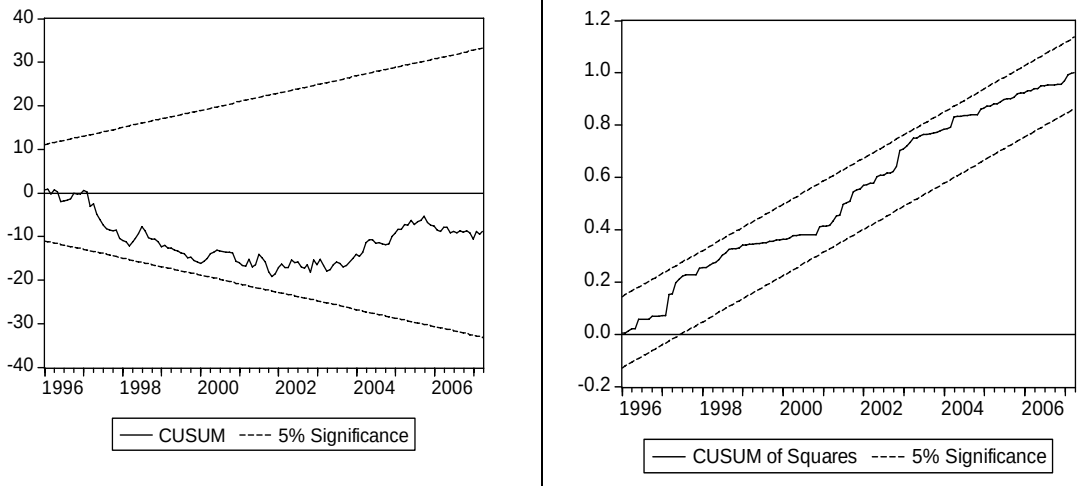


Figure 7.4b: Test for Stability of Parameters



Chapter 8

Conclusion and Policy Implications

This study investigates the impact of exchange rate changes on domestic consumer prices (commonly known as exchange rate pass-through (ERPT)) in Pakistan for the period 1993M11 to 2007M4.[77] In case of Pakistan, the literature on ERPT provides mix results, however, the dominant view is that there is no evidence of significant effect of devaluation on domestic inflation (e.g. Siddiqui and Akhtar, 1999 and Choudhri and Khan, 2002). The current literature on ERPT provides several explanations of low pass-through (e.g. Taylor, 2000; Goldfajn and Werlang, 2000 and Choudhri and Hakura, 2001). According to Goldfajn and Werlang (2000) initial real exchange rate overvaluation and initial inflation are the most robust determinants of exchange rate pass-through. In case of Pakistan, no previous study has incorporated misalignment in the pass-through model. This study develops an ERPT model which incorporates previous period's real exchange rate misalignment as an independent variable.

In a standard ERPT model specification, the price of an imported good in local currency can vary as a consequence of a change in the exchange rate, a change in marginal cost of foreign exporter, and a change in the markup of foreign firm (see Menon, 1996 and Goldberg and Knetter, 1997). However, firm's marginal cost and markup may also change in absence of any variation in exchange rate. It is important to take into account changes in these other determinants of the price when estimating ERPT into import prices to accurately isolate the effect of exchange rate changes on domestic prices. Real exchange rate misalignment may affect markups through its impact on prices of domestic substitutes for importable commodities. At any point, if a currency is overvalued (undervalued), it would lead to decline (rise) in prices of domestic

[77] Along with this sample, estimations were also conducted for two sub-samples (from 1993-7 to 1998-7, and from 1998-8 to 2007-4), because SBP started transition from managed to free-floating exchange rate regime in July 1998.

substitutes,[78] hence affecting markups. At aggregate level, ERPT into consumer prices is estimated by taking into account foreign cost and domestic demand conditions as control variables (see, Choudhri and Hakura, 2001). Real exchange rate misalignment affects domestic demand conditions, as overvaluation (undervaluation) causes decrease (increase) in demand of domestic expensive (cheaper) goods (see, Montiel , 2002; Kamin and Klau, 1998). In the following, concluding remarks based on the empirical findings of the study are presented:

First, regarding the real exchange rate misalignment during the sample period 1993M11 to 2007M4, five episodes of both overvaluation and undervaluation were observed. Three of these were undervaluation episodes and remaining two were overvaluation episodes. Since January 2005, both actual and equilibrium real effective exchange rates are appreciating, however, equilibrium exchange rate has appreciated more rapidly thus posting 6 to 8 percent undervaluation in the first four months of 2007 (see figures 6.9 & 6.10).

Second, overvaluation in the previous period significantly reduced inflation in managed exchange rate regime, although, coefficient of MIS(-1) was low. However, the coefficient of MIS(-1) was found insignificant in the overall sample (regression 1) due to the dominance of second sub-sample which includes transition period of exchange rate regime.

Third, short-run and long-run exchange rate pass-through from NEER appreciation to consumer price inflation in Pakistan is very low (close to zero).[79]

Fourth, the comparison of long-run ERPT coefficients reveals that pass-through into CPI inflation is lower as compared to pass-through into Core CPI (non-food non-fuel) inflation.

Fifth, the impact of foreign inflation on domestic inflation is positive. In all three regressions, foreign inflation significantly and dominantly affects domestic inflation.

Sixth, lagged inflation also affects current inflation positively.

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[78] i.e., $\Delta p_{dt} = \lambda (rer - rer^{*})_{t-1}$. This kind of relation has been used in the literature in many studies, e.g., Adam and Gross (1986); Kamin (1997, 2001) and Klau (1998).

[79] This finding is consistent with existing empirical evidence on ERPT for Pakistan. See, e.g., Choudhri and Khan (2002), and, Choudhri and Hakura (2001).

Policy Implications:

1. The ERPT from nominal effective exchange rate to CPI inflation in Pakistan is very low. Low exchange rate pass-through has some important policy implications:
   a. Low pass-through into consumer price inflation enhances effectiveness of nominal exchange rate as a shock absorber. Much of the recent literature on pass-through, however, has ignored this "exchange rate effectiveness" question, and has focused only on the inflationary consequences of exchange rate changes (exceptions are Choudhri and Khan, 2002, and Edward, 2006). These studies have ignored the role of real exchange rate; however, it is important to make a difference between the exchange rate pass-through into domestic nontradeables and into the tradeables. While a low ERPT for tradeables will reduce the effectiveness of exchange rate, a low pass-through for nontradeables will improve its effectiveness.
   b. Low pass-through into consumer prices has important policy implication for the adoption of inflation targeting by SBP. According to Choudhri and Hakura (2001), "a low exchange rate pass-through is thought to provide greater freedom for pursuing an independent monetary policy and to make it easier to implement inflation targeting". A floating exchange rate system is a prerequisite for an implementation of inflation targeting regime since free capital mobility and independent monetary policy cannot coexist with a pegged exchange rate regime. The conjunction of inflation targeting with flexible exchange rates has raised question of exchange rate volatility and resulting fear of exchange rate pass-through. However, evidence of low pass-through supports the adoption of inflation targeting regime in Pakistan.
2. To realign real exchange rate towards equilibrium, policy makers must know both the level of existing RERM and pass-through relationship. For this purpose, misalignment may be estimated regularly like other macroeconomic variables.

3. Real exchange rate misalignment is a better indicator of external competitiveness than actual REER. According to Bella et al. (2007), "competitiveness assessments that are based only on the observation of the RER evolution through time can result in misleading conclusions". In case of Pakistan, different publications(e.g. Economic Survey of Pakistan) report their analysis on the basis of actual real effective exchange rate and ignore the fact whether it is above or below than equilibrium exchange rate.

Future research in this area for Pakistan, should address several questions including: a) effectiveness of exchange rate as a shock absorber; b) determinants of ERPT; and, c) comparison of different approaches to estimate RERM.

References

Ahmad, Eatzaz, and Farzana Naveed Khan, 2002, "Short Run Dynamics in Purchasing Power Parity: A Case of Selected Asian Countries," The Middle East Business and Economic Review, Vol. 14(2), 28-40

Adams, Charles, and Daniel Gros, 1986, "The Consequences of Real Exchange Rate Rules for Inflation: Some Illustrative Examples," IMF Staff Papers, Vol. 33, 439-76.

Ahmad, Eatzaz, and Hari Ram, 1991, "Foreign Price Shocks and Inflation in Pakistan: A Monetarist Approach," Pakistan Economic and Social Review, Vol. 29(1), 1-20

Ahmad, Eatzaz, and Saima Ahmad Ali, 1999, "Exchange Rate and Inflation Dynamics," The Pakistan Development Review, Vol. 38(3), 235-251.

Afridi, Usman, 1995, "Determining Real Exchange Rates," The Pakistan Development Review, Vol. 34(3), 263-276.

Anderton, Bob, 2003, "Extra-Euro Area Manufacturing Import Prices and Exchange Rate Pass-through," ECB Working Paper No. 219, March (Frankfurt: European Central Bank).

Aron, J., Elbadawi, I., and B, Khan, 1997, "Determinants of the Real Exchange Rate in South Africa." Center for the study of African Economies, WPS/97-16, CASE Publishing, Oxford.

Asfaha, Samuel, G. and S. N. Huda, 2002, "Exchange Rate Misalignment and International Trade Competitiveness: A Cointegration Analysis for South Africa," Trade and Industrial Policy Strategies (TIPS): Annual Forum 2002 at Glenburn Lodge, Muldersdrift.

Baffes, J., Elbadawi, I. A. & O' S. A. Connel, 1999, "Single Equation estimation of the Equilibrium Real Exchange Rate," Montiel, P.J. & Hinkle, L. E. (eds.). Exchange Rate Misalignment: concepts and measurement for developing countries. New York: Oxford University Press.

Bailliu, J. & E. Fujii, 2004, "Exchange Rate Pass-Through and the Inflation Environment in Industrialized Countries: An Empirical Investigation," Bank of Canada, Working Paper 2004-21.

Balassa, Bela, 1964, "The Purchasing Power Parity Doctrine: A Reappraisal," Journal of Political Economy, Vol. 72(6), 584-596.

Balassa, Bela, 1990, "Incentives, policies and export performance in Sub-Saharan Africa," World Development, Vol. 18, 383-91.

Baldwin, R.E., 1988, "Hysteresis in Import Prices: the Beachhead Effect," American Economic Review, Vol. 78, 773-85.

Belaisch, Agenes, 2003, "Exchange Rate Pass-Through in Brazil," IMF Working Paper No. 03/141 (Washington: International Monetary Fund).

Bella, Gabriel Di, Mark Lewis, and, Aurelie Martin, 2007, "Assessing Competitiveness and Real Exchange Rate Misalignment in Low-Income Countries," IMF Working Paper No. 07/201 (Washington: International Monetary Fund).

Betts, Caroline, and Michael B. Devereux, 1996, "The Exchange Rate in a Model of Pricing to-Market," European Economic Review, Vol.40, 1007-21.

Betts, Caroline, and Michael B. Devereux, 2000, "Exchange Rate Dynamics in a Model of Pricing to Market," Journal of International Economics, Vol.50, 215-44.

Bhagwati, J.N., 1988, "The Pass-through Puzzle: the missing prince from Hamlet," mimo., Columbia University, December.

Bhundia, Ashok J, 2002, "An Empirical Investigation of Exchange Rate Pass-through in South Africa," Working Paper No. 02/165, IMF.

Branson, W. H., 1989, "Comment on Exchange rate pass-through in 1980s: the case of U.S. Imports of manufactures," Hooper and Mann (1989) Brookings Papers on Economic Activity 1, 330-33

Carare, Alina and others, 2002, "Establishing Initial Conditions in Support of Inflation Targeting," IMF Working Paper 02/102 (Washington: International Monetary Fund).

Calvo, Guillermo A., and Carmen Reinhart, 2002, "Fear of Floating," Quarterly Journal of Economics, 117(2): 379-408.

Calvo, Guillermo A., Carmen M. Reinhart and Carlos A. Vegh, 1994, "Targeting the Real Exchange Rate: Theory and Evidence," IMF Working Paper No. 94/22 (Washington: International Monetary Fund).

Campa, Jose Manuel and Linda S. Goldberg, 2002, "Exchange Rate Pass Through into Import Prices: A Macro or Micro Phenomenon?" NBER Working Papers Series 8934, NBER.

Chinn, Menzie, D., 1999, "Measuring Misalignment: Purchasing Power Parity and East Asian Currencies in the 1990s," IMF Working Paper No. 99/120 (Washington: International Monetary Fund).

Chishti, Salim and M. A. Hasan, 1993, "What Determines the Behavior of Real Exchange Rate in Pakistan," The Pakistan Development Review, Vol. 32(4), 1015-29.

Chobanov and Sorsa, 2004, "Competitiveness in Bulgaria: An Assessment of Real Effective Exchange Rate," IMF Working Paper No. 04/37 (Washington: International Monetary Fund).

Choudhri, Ehsan U; and Dalia S. Hakura, 2001, "Exchange Rate Pass-through to Domestic Prices: Does the Inflationary Environment Matter?" IMF Working Paper No. 01/194 (Washington: International Monetary Fund).

Choudhri, Ehsan U; Hamid Faruqee,; and Dalia S. Hakura, 2005, "Explaining the Exchange Rate Pass-through in Different Prices," Journal of International Economics, vol. 65, 349-374.

Choudhri, Ehsan U., and Mohsin S. Khan, 2002, "The Exchange Rate and Consumer Prices in Pakistan: Is Rupee Devaluation Inflationary?" The Pakistan Development Review, Vol. 41(2), 107-120.

Clark, P., and MacDonald, 1998, "Exchange Rates and Economic Fundamentals: A Methodological Comparison of BEERs and FEERs," IMF Working Paper No. 98/67 (Washington: International Monetary Fund).

Croce, Enzo and Mohsin S. Khan, 2000, "Monetary Regimes and Inflation Targeting," *Finance & Development*, Vol. 37(3), 48–51.

Darvas, Zsolt, 2001, "Exchange Rate Pass-through and Real Exchange Rates in EU Candidate Countries," Discussion Paper No. 10/01, Economic Research Centre of the Deutsche Bundesbank.

Devereux, John, and Michael Connolly, 1996, "Commercial Policy, the Terms of Trade, and the Real Exchange Rate Revisited," Journal of Development Economics, Vol. 50, 81-99.

Dickey, David, and Wayne A. Fuller, 1979, "Distribution of the Estimates for Autoregressive Time Series with a Unit Root," Journal of the American Statistical Association, Vol. 74, 427-31.

Dixit, A. K., 1989, "Hysteresis, Import Penetration and Exchange Rate Pass-through," Quarterly Journal of Economics, Vol. 104(2), 205-228

Dixit, A. K. and Stiglitz, J. E., 1997, "Monopolistic competition and optimum product diversity," American Economic Review, Vol. 67, 297-308

Dornbush, Rudiger, 1987, "Exchange Rates and Prices," American Economic Review, Vol. 77, No. 1, March, pp. 93-106.

Drine, I., and C. Rault, 2003, "On the Long-run Determinants of Real Exchange Rates for Developing Countries: Evidence from Africa, Latin America and Asia."

Edwards, S, 1988, “Exchange Rate Misalignment in Developing Countries,” Baltimore and London: The Johans Hopkings University Press: 1-78.

Edwards, S. 1988a, “Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing countries,” Journal of Development Economics, Vol. 29, 311-341.

Edwards, S., 1989, “Real Exchange Rates, Devaluation, and Adjustment,” Massachusetts: The MIT Press: 1-56.

Edwards, S., 2006, “The Relationship between Exchange Rates and Inflation Targeting Revisited,” NBER Working Paper No. 12163.

Edwards, S., and Miguel A. Savastano, 1999, “Exchange Rate in Emerging Economies: What Do We Know? What Do We Need to Know?” NBER Working Paper No. 7228.

Elbadawi, Ibrahim, 1994, “Estimating Long-Run Equilibrium Real Exchange Rates,” In John Williamson, ed., Estimating Equilibrium Exchange Rates. Washington, D.C: Institute for International Economics.

Elbadawi, Ibrahim A., and R. Soto, 1994, “Capital Flows and Long-term Equilibrium Real Exchange Rates in Chile,” Policy Research Paper 1306. The World Bank.

Elbadawi, Ibrahim A., and R. Soto, 1997, “Real Exchange Rates and Macroeconomic Adjustment in Sub-Saharan African and other Developing Countries,” Journal of African Economics, Vol. 6(3), 1-56.

Enders, Walter, 2004, “Applied Econometric Time Series,” Second Edition, Wiley Series in Probability and Statistics.

Engle, Robert E., and Clive W. J. Granger, 1987, “Cointegration and Error-Correction: Representation, Estimation, and Testing,” Econometrica 55, 251-76.

Faruqee, Hamid, 1995, “Long-Run Determinants of the Real Exchange Rate: A Stock-Flow Perspective,” IMF Staff Papers, Vol. 42(1), 80-105 (Washington: International Monetary Fund).

Faruqee, Hamid, 2004, “Exchange Rate Pass-through in the Euro Area: The role of asymmetric pricing behavior,” IMF Working Paper, 04/14 (Washington: International Monetary Fund).

Fischer, E., 1989, “A model of exchange rate pass-through,” Journal of International Economics, 26, 119-37

Froot, Kenneth A., and Paul P. Klemperer, 1989, “Exchange Rate Pass-through when Market Shares Mattersa,” American Economic Review, 79(4), pp. 637-54.

Gagnon, Joseph E., and Jane Ihring, 2004, " Monetary Policy and Exchange Rate Pass-through," International Journal of Finance and Economics, 9(4): 315-338.

Goldberg, Pinelopi K. and Michael M. Knetter, 1995, "Measuring the Intensity of Competition in Export Markets," Mimeo.

Goldberg, Pinelopi K., and Michael M. Knetter, 1997, "Goods Prices and Exchange Rates: What Have We Learned?" Journal of Economic Literature, Vol. 35(3), 1243-1272, September.

Goldfajn, I. and Valdes, R., 1999, "The Aftermath of Appreciations," Quarterly Journal of Economics, Vol. 114(1), 1999.

Goldfajn, IIan, and Sergio Werlang, 2000, "The Pass-through from Depreciation to Inflation: A Panel Study," Departamento De Economia Puc-Rio Texto Para Discussao No. 424.

Gueorguiev, Nikolay, 2003, "Exchange Rate Pass-Through in Romania," IMF Working Paper No. 03/130 (Washington: International Monetary Fund).

Habermeier, Karl, F and Mario M., 1999, "Long-Run Exchange Rate Dynamics: A Panel Data Study," IMF Working Paper No. 99/50 (Washington: International Monetary Fund).

Hahn, Elke, 2003, "Pass-through of External Shocks to Euro Area Inflation," ECB Working Paper No. 243, March (Frankfurt: European Central Bank).

Hinkle, Lawrence E. and Peter J. Montiel, 1999, "Exchange Rate Misalignment: Concepts and Measurement for Developing Countries," Oxford University Press: New York.

Hooper, Peter and Catherine L. Mann, 1989, "Exchange Rate Pass-through in the 1980s: the case of U.S Imports of Manufactures," Brookings Papers of Economic Activity, 1.

Hossain, Akhtar, 2002, "Exchange Rate Responses to Inflation in Bangladesh," Working Paper No. 02/166, IMF.

Hussain, Shah, 2002, "Trade Liberalization and Exchange Rate Policy of Pakistan," An M. Phil. dissertation, Department of Economics, Quaid-i-Azam University, Islamabd.

Hyder, Zulifqar, and Sardar Shah, 2003, "Exchange Rate Pass Through to Domestic Prices in Pakistan," Working Paper No. 5, State Bank of Pakistan.

Hyder, Zulifqar, and Adil Mahboob, 2005, "Equilibrium Real Effective Exchange Rate and Exchange Rate Misalignment in Pakistan," Papers and Proceedings 1st SBP International Conference on " Monetary-cum-Exchange Rate Regime: What Works Best

for Emerging Market Economies?" Karachi, 14-15 November, 2005, State Bank of Pakistan.

Isard, P., and H. Faruqee, 1998, "Exchange Rate Assessment: Extensions of the Macroeconomic Balance Approach," IMF Occasional Paper No. 167 (Washington: International Monetary Fund).

Johansen, Soren, 1988, "Statistical Analysis of Cointegration Vectors," Journal of Economic Dynamics and Control, Vol. 12, 231-54.

Johansen, Sore, and Katerina Juselius, 1990, "Maximum Likelihood Estimation and Inference on Cointegration with Application to the Demand for Money," Oxford Bulletin of Economics and Statistics 52, 169-209.

Kamin, Steven B., 1996, "Real Exchange Rates and Inflation in Exchange-Rate Based Stabilizations: An Empirical Examination," Board of Governors of Federal Reserve System, International Finance Discussion Paper No. 554.

Kamin, Steven B., 1997, "A Multi-country Comparison of the Linkages between Inflation and Exchange Rate Competitiveness." Bank for International Settlements, Monetary and Economic Department, BASLE, Working Paper No. 45.

Kamin, Steven B., 2001, "Real Exchange Rates and Inflation in Exchange–rate Based Stabilizations: An Empirical Examination," Journal of Development Economics, Vol. 64, 237-253.

Kamin, Steven B. and Marc Klau, 1997, "Some multi-country evidence on the effects of real exchange rate on output," BIS Working Papers, No. 48.

Kaminsky, G., 1987, "The Real Exchange Rate in the Short Run and in the Long Run," San Diego: University of California, San Diego (mimeographed).

Kara, Hakan; Hande Kucuk-Tuger, Umit Ozale; Burc Tuger, and Eray M. Youcel,2007, " Exchange Rate Regimes and Pass-through: Evidence from the Turkish Economy," Contemporary Economic Policy, Vol. 25, No. 2, 206-225

Khan, Ashfaque H., and Mohammad A. Qasim, 1996, "Inflation in Pakistan Revisited." The Pakistan Development Review, Vol. 35, No. 4, pp.747-759.

Klau, Marc, 1998, "Exchange Rate Regimes and Inflation and Output in Sub-Saharan Countries," Bank for International Settlements, Monetary and Economic Department, BASLE, Working Paper No. 53.

Krugman, Paul R., and Maurice, Obstfeld, 1997, "International Economics - Theory and Policy," Fourth Edition, Chapter No. 16, 439-485.

Leigh, Daniel, and Marco, Rossi, 2002, "Exchange Rate Pass-through in Turkey," Working Paper No. 02/204, IMF.

MacDonald, Ronald, 1999, "Exchange Rate Behavior: Are Fundamentals Important," The Economic Journal, Vol. 109 (November).

MacDonald, Ronald, 2000, "Concepts to Calculate Equilibrium Exchange Rates: An Overview," Discussion Paper 03/00, Economic Research Group of the Deutsche Bunesbank.

MacDonald, Ronald, and L. Ricci, 2003, "Estimation of the Equilibrium Real Exchange Rate for South Africa," IMF Working Paper No. 03/44 (Washington: International Monetary Fund).

Maliszewski, Wojciech, 2003, "Modeling Inflation in Georgia," IMF Working Paper No. 03/212 (Washington: International Monetary Fund).

McCarthy, Jonathan, 1999, "Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies," BIS Working Paper, No. 79 (Bank for International Settlements, Basel).

McCarthy, Jonathan, 2000, "Pass-through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies," Staff Reports 11, Federal Reserve Bank of New York.

Menon, Jayant, 1995, "Exchange Rate Pass-through," Journal of Economic Surveys, Vol. 9(2), 197-231.

Menon, Jayant, 1996, "The Degree and Determinants of Exchange Rate Pass-through: Market Structure, Non-tariff Barriers and Multinational Corporations," The Economic Journal, 106 (March), 434-444.

Milan et. al, 2004, "Pakistan: Selected Issues and Statistical Appendix," International Monetary Fund, IMF Country Report No. 04/415.

Mishkin, Frederic S., 2000, "Inflation Targeting in Emerging Market Countries," NBER Working Paper 7618, Cambridge, Massachusetts: National Bureau of Economic Research.

Mongardini, Joannes, 1999, "Estimating Egypt's Equilibrium Real Exchange Rate," IMF Working Paper No. 98/5 (Washington: International Monetary Fund).

Montiel, Peter J., 1999, "Determinants of the Long-run Equilibrium Real Exchange Rate: An Analytical Model," in Lawrence E.H and Peter J. Montiel, ed., "Exchange Rate Misalignment: Concepts and Measurement for Developing Countries. New York: Oxford University Press: 264-290.

Montiel, Peter J., 2002, "The Long-Run Equilibrium Real Exchange Rate: Theory and Measurement," in Mohsin S. Khan, Saleh M. Nsouli, and Chorng-Huey Wong, ed., "Macroeconomic Management Programs and Policies," International Monetary Fund: 307-344.

Nelson, Charles, and Charles Ploseser, 1982, "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications," Journal of Monetary Economics, 10, 130-62.

Newbold, Paul, 1990, "Precise and Efficient Computation of the Beverige-Nelson Decomposition of Economic Time-series," Journal of Monetary Economics, Vol. 26, 453-457.

Obstfeld, Maurice, and K. Rogoff, 1995, "Exchange Rate Dynamics Redux," Journal of Political Economy, Vol. 103, 624-60.

Otani, Akira; Shiratsuka, Shigenori; and Toyoichiro, Shirota, 2003, "The Decline in the Exchange Rate Pass-Through: Evidence from Japanese Import Prices," Discussion Paper No. 2003-E-1, Institute for Monetary and Economic Studies, Bank of Japan.

Ozlale, Umit, and Erinc Yeldan, 2002, "Measuring Exchange Rate Misalignment in Turkey," Bilkent University, Department of Economics, Working Paper

Quirk, Peter, Christensen, Benedicte Vibe, Huh, Kyung-Mo, and Sasaaki, Toshihiko, 1987, "Floating Exchange Rates in Developing Countries: Experience with Auction and Inter-bank Market," IMF Occasional Paper, Vol. 53, Washington, DC: International Monetary Fund.

Razin, Ofair, 1997, "Real Exchange Rate Misalignment and Growth," NBER working Paper No. 6174, National Bureau of Economic Research.

Rodiguez, C. A., 1989, "Macroeconomic Policies for Structural Adjustment," Policy Research Working Paper 247, The World Bank.

Rogoff, Kenneth, 1996, "The Purchasing Power Parity Puzzle," Journal of Economic Literature, Vol. 34(June): 647-68.

Rowland, Peter, 2003, "Exchange Rate Pass-through to Domestic Prices: The Case of Colombia," Central Bank of Colombia.

Sibert, A., 1992, "Exchange Rates, market structure, prices and imports," Economic Record, 68(202), 233-39

Siddiqui, Rehana, and Ayesha Salam, 2000, "Exchange Rate Variability and Relations Between Pakistan and Japan," A paper presented at a conference organized by Quaid-i-

Azam University, Islamabad and Japan Foundation, Japan on October 24-25, 2000 in Islamabad.

Siddiqui, Rehana and Naeem Akhtar, 1999, "The Impact of Changes in Exchange Rate on Prices: A Case Study of Pakistan," Pakistan Development Review, Vol. 38(4), 1059-66.

Siddiqui, Rehana, Usman Afridi and Zafar Mahmood, 1996, "Exchange Rate Determination in Pakistan: A Simultaneous Equation Model," The Pakistan Development Review, 35(4): 683-692.

Sorsa, Pritta, 1999, "Algeria- The Real Exchange Rate, Export Diversification, and Trade Protection," IMF Working Paper No. 99/49 (Washington: International Monetary Fund).

Spatafora, Nikola and S. Emil., 2003, "The Equilibrium Real Exchange Rate in a Commodity Exporting Country: The Case of Russia," IMF Working Paper No. 03/93 (Washington: International Monetary Fund).

State Bank of Pakistan, Annual Reports (various issues).

State Bank of Pakistan, Monetary Policy Statement, 2005, Jan-Jun.

Steel, Douglass, and, Alan King, 2004, "Exchange Rate Pass-through: The Role of Regime Changes," International Review of Applied Economics, Vol. 18, No.3,301-322.

Taylor, John, 2000, "Low Inflation, Pass-through and Purchasing Power of Firms," European Economic Review, Vol. 44, 1389-1408.

Wang, Tao, 2004, "China: Sources of Real Exchange Rate Fluctuations," IMF Working Paper No. 04/18 (Washington: International Monetary Fund).

Williamson, J., 1985, "The Exchange Rate System," Policy Analysis in International Economics 5. Washington: Institute for International Economics.

Williamson, John, ed., "Estimating Equilibrium Exchange Rates," Washington, DC: Institute for International Economics, 1994.

Zhang, Zhichao, 2001, "Real Exchange Rate Misalignment in China: An Empirical Investigation," Journal of Comparative Economics, Vol. 29, pp. 80-94.

Zavadjil et. al., 2004, "Pakistan: Selected Issues and Statistical Appendix," IMF Country Report 04/415.

Appendix 1: Major Trade Partners of Pakistan

Table 1: Major Exports Markets (Percentage Shares)

Country	FY74	FY81	FY87	FY93	FY99	FY02	FY03	FY04	FY05	FY06	FY07*
U.S.A	5.3	6.1	10.1	13.9	21.8	24.7	23.5	23.9	23.9	25.5	28.4
Germany	4.6	4.3	7.0	7.8	6.6	4.9	5.2	4.9	4.8	4.2	4.1
Japan	6.2	6.4	10.9	6.8	3.5	1.8	1.3	1.1	1.1	0.8	0.8
UK	6.8	4.0	7.1	7.1	6.6	7.2	7.1	7.6	6.2	5.4	5.8
Hong Kong	11.0	3.9	2.8	6.6	7.1	4.8	4.6	4.7	3.9	4.1	4.0
Dubai	1.8	3.5	2.8	5.9	5.4	7.9	9.0	7.3	3.3	5.6	4.0
S. Arabia	3.9	6.0	7.1	4.7	2.4	3.6	4.3	2.8	2.5	2.0	1.8
Sub-Total	39.6	34.2	47.8	52.8	53.4	54.9	55.0	52.3	45.7	47.6	48.9
Other Countries	60.4	65.8	52.2	47.2	46.6	45.1	45.0	47.2	54.3	52.4	51.1
Total	100	100	100	100	100	100	100	100	100	100	100

Source: Economic Survey of Pakistan (Various Issues)
*July-November

Table 2: Major Sources of Imports (Percentage Shares)

Country	FY74	FY81	FY87	FY93	FY99	FY02	FY03	FY04	FY05	FY06	FY07*
U.S.A	25.6	10.9	11.0	9.4	7.7	6.7	6.0	8.5	7.6	5.8	8.1
Japan	9.4	11.6	16.4	15.9	8.3	5.0	6.6	6.0	7.0	5.6	5.7
Kuwait	3.7	8.0	7.4	3.3	5.9	7.1	6.6	6.4	4.6	6.2	5.4
S. Arabia	6.6	12.8	5.3	5.4	6.8	11.6	10.7	11.4	12.0	11.2	11.5
Germany	7.8	5.0	7.5	7.4	4.1	4.3	4.6	3.9	4.4	4.7	4.1
UK	7.1	6.1	6.7	5.2	4.3	3.4	2.9	2.8	2.6	2.8	2.3
Malaysia	-	-	3.0	5.1	6.7	4.4	4.6	3.9	2.6	3.0	3.0
Sub-Total	60.2	54.4	57.3	51.7	43.8	42.5	42.0	42.9	40.8	39.3	40.1
Other Countries	39.8	45.6	42.7	48.3	56.2	57.5	58.0	57.1	59.2	60.7	59.9
Total	100	100	100	100	100	100	100	100	100	100	100

Source: Economic Survey of Pakistan (Various Issues)
*July-November

Appendix 2: Price Indices in Pakistan

Features	Price Indices		
	CPI	**WPI**	**SPI**
Cities Covered	35	17	18
Markets covered	71	51	16
Items covered	375	53	106
Number of commodities Groups	10	-	5
Number of Quotations	106,500	10,404	1550
Income Groups	4	Rs. 300/Month	-
Occupational Groups	All categories combined	3(Urban)	-
Reporting Frequency	Monthly	Weekly	Monthly

Source: Economic Survey of Pakistan

Appendix3: Composition of CPI and WPI Indices

Table 1: Composition of CPI Index	
Groups	**Weights (in %)**
Food Beverages & Tobacco	40.34
Apparel, Textile & Footwear	6.10
House Rent	23.43
Fuel & Lighting	7.29
Household Furniture & Equipment	3.29
Transport & Communication	7.32
Recreation & Entertainment	0.83
Education	3.45
Cleaning, Laundry & Personal Appearance	5.88
Medicare	2.07
General	**100**

Source: State Bank of Pakistan

Table2: Composition of WPI Index	
Groups	**Weights (in %)**
Food	42.12
Raw Material	7.99
Fuel, Lighting & Lubricants	19.29
Manufacturers	25.87
Building Materials	4.73
General	**100**

Source: State Bank of Pakistan

Appendix 4: VAR Lag Order Selection Criteria

Endogenous Variables: Δ log CPI, Δ log NEER, Δ log FCPI				
Lag	**LogL**	**LR**	**AIC**	**SC**
0	1569.84	NA	-21.32	-21.29*
1	1577.09	14.10	-21.29	-21.04
2	1598.94	41.62	-21.47*	-21.04
3	1605.61	12.43	-21.44	-20.82
4	1609.56	7.20	-21.36	-20.57
5	1614.58	8.94	-21.31	-20.38
6	1616.44	3.25	-21.22	-20.06
7	1628.95	21.26	-21.27	-19.92
8	1633.02	6.77	-21.20	-19.67
9	1637.36	7.02	-21.13	-19.43
10	1648.81	18.07	-21.16	-19.28
11	1657.63	13.55	-21.17	-19.09
12	1688.69	46.48	-21.47	-19.20
13	1692.34	5.32	-21.39	-18.95
14	1696.19	5.44	-21.32	-18.70
15	1706.05	13.55	-21.33	-18.53
16	1709.88	5.09	-21.26	-18.27
17	1730.24	26.32*	-21.42	-18.24
18	1734.07	4.80	-21.35	-17.99

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
AIC: Akaike information criterion
SC: Schwarz information criterion

Appendix 5: Actual REER, EREER, and Misalignment

Year/Months	Actual LREER	LEREER	Misalignment (in percentage)
1993 M11	111.46	109.20	2.05
1993 M12	111.51	109.14	2.14
1994 M1	112.94	109.09	3.47
1994 M2	112.02	109.04	2.70
1994 M3	110.9	108.98	1.74
1994 M4	112.46	108.93	3.19
1994 M5	110.94	108.89	1.87
1994 M6	111.01	108.85	1.97
1994 M7	109.94	108.81	1.03
1994 M8	109.93	108.78	1.05
1994 M9	110.19	108.75	1.31
1994 M10	110.33	108.74	1.45
1994 M11	112.03	108.73	2.99
1994 12M	114.58	108.73	5.25
1995 M1	114.6	108.73	5.25
1995 M2	113.25	108.75	4.05
1995 M3	110.64	108.78	1.69
1995 M4	107.78	108.82	-0.96
1995 M5	109.03	108.87	0.14
1995 M6	109.2	108.93	0.25
1995 M7	109.74	108.98	0.69
1995 M8	113.58	109.04	4.08
1995 M9	115.44	109.09	5.66
1995 M10	112.22	109.12	2.80
1995 M11	105.86	109.14	-3.05
1995 12M	107.32	109.15	-1.69
1996 M1	108.39	109.15	-0.70
1996 M2	108.62	109.13	-0.47
1996 M3	109.16	109.10	0.06
1996 M4	109.44	109.06	0.35
1996 M5	109.94	109.01	0.85
1996 M6	110.01	108.95	0.97
1996 M7	109.77	108.88	0.81
1996 M8	109.11	108.81	0.27
1996 M9	107.33	108.74	-1.30
1996 M10	104.88	108.66	-3.54
1996 M11	99.48	108.58	-8.76
1996 12M	101.22	108.51	-6.95
1997 M1	104.82	108.43	-3.38

1997 M2	107.98	108.34	-0.34
1997 M3	107.98	108.26	-0.26
1997 M4	110.36	108.18	2.00
1997 M5	109.08	108.09	0.91
1997 M6	108.89	107.99	0.83
1997 M7	110.08	107.89	2.01
1997 M8	112.06	107.78	3.90
1997 M9	112.48	107.66	4.38
1997 M10	107.58	107.52	0.05
1997 M11	104.8	107.38	-2.44
1997 12M	109.33	107.23	1.94
1998 M1	112.85	107.08	5.25
1998 M2	111.59	106.91	4.29
1998 M3	112.59	106.72	5.35
1998 M4	111.95	106.53	4.96
1998 M5	112.64	106.32	5.77
1998 M6	114.66	106.10	7.75
1998 M7	110.2	105.87	4.01
1998 M8	102.98	105.62	-2.54
1998 M9	100.17	105.36	-5.05
1998 M10	96.83	105.09	-8.18
1998 M11	96.54	104.80	-8.21
1998 12M	97.91	104.50	-6.51
1999 M1	98.53	104.18	-5.58
1999 M2	99.61	103.86	-4.18
1999 M3	101.22	103.52	-2.25
1999 M4	100.39	103.18	-2.74
1999 M5	105.64	102.82	2.70
1999 M6	99.13	102.47	-3.31
1999 M7	99.28	102.10	-2.80
1999 M8	98.04	101.73	-3.70
1999 M9	98.06	101.36	-3.31
1999 M10	97.46	100.98	-3.55
1999 M11	98.07	100.60	-2.55
1999 12M	98.42	100.23	-1.82
2000 M1	98.59	99.87	-1.29
2000 M2	100	99.51	0.49
2000 M3	100.51	99.17	1.34
2000 M4	101.62	98.85	2.76
2000 M5	104.05	98.55	5.43
2000 M6	102.94	98.26	4.65
2000 M7	102.53	98.00	4.52
2000 M8	100.33	97.76	2.59

2000 M9	98.45	97.54	0.93
2000 M10	96.17	97.34	-1.21
2000 M11	98.89	97.17	1.76
2000 12M	95.93	97.01	-1.11
2001 M1	93.5	96.86	-3.53
2001 M2	93.02	96.73	-3.91
2001 M3	92.81	96.61	-4.01
2001 M4	93.01	96.50	-3.68
2001 M5	91.83	96.40	-4.86
2001 M6	90.36	96.31	-6.38
2001 M7	89.18	96.22	-7.60
2001 M8	87.8	96.14	-9.08
2001 M9	87.4	96.06	-9.45
2001 M10	90.94	95.98	-5.39
2001 M11	93.43	95.89	-2.60
2001 12M	94.42	95.80	-1.45
2002 M1	95.85	95.70	0.16
2002 M2	96.8	95.58	1.26
2002 M3	97.21	95.46	1.82
2002 M4	96.58	95.33	1.31
2002 M5	94.3	95.18	-0.93
2002 M6	93.4	95.02	-1.72
2002 M7	92.49	94.84	-2.51
2002 M8	93.61	94.65	-1.10
2002 M9	94.21	94.43	-0.24
2002 M10	94.61	94.20	0.43
2002 M11	94.31	93.95	0.38
2002 12M	93.92	93.68	0.25
2003 M1	92.59	93.40	-0.87
2003 M2	92.88	93.11	-0.25
2003 M3	92.88	92.82	0.07
2003 M4	93.1	92.52	0.62
2003 M5	90.84	92.23	-1.52
2003 M6	90.32	91.94	-1.78
2003 M7	91	91.66	-0.72
2003 M8	92.01	91.39	0.67
2003 M9	91.71	91.13	0.63
2003 M10	91.07	90.89	0.20
2003 M11	91.72	90.66	1.17
2003 12M	91.23	90.44	0.87
2004 M1	89.65	90.24	-0.65
2004 M2	89.32	90.05	-0.82
2004 M3	90.73	89.89	0.93

2004 M4	91.64	89.74	2.09
2004 M5	92.83	89.62	3.52
2004 M6	92.63	89.52	3.42
2004 M7	92.16	89.44	2.99
2004 M8	92.52	89.40	3.43
2004 M9	92.06	89.40	2.94
2004 M10	91.18	89.42	1.95
2004 M11	90.43	89.48	1.06
2004 12M	88.16	89.57	-1.58
2005 M1	89.43	89.69	-0.29
2005 M2	90.72	89.86	0.96
2005 M3	91.24	90.06	1.31
2005 M4	93.24	90.29	3.21
2005 M5	93.06	90.57	2.71
2005 M6	94.31	90.88	3.70
2005 M7	95.68	91.23	4.76
2005 M8	94.54	91.62	3.14
2005 M9	94.57	92.04	2.71
2005 M10	96.24	92.50	3.97
2005 M11	97.78	92.99	5.02
2005 12M	97.74	93.52	4.41
2006 M1	97.02	94.08	3.08
2006 M2	97.9	94.66	3.37
2006 M3	97.63	95.27	2.45
2006 M4	96.99	95.90	1.13
2006 M5	95.17	96.55	-1.44
2006 M6	96.4	97.22	-0.85
2006 M7	96.65	97.92	-1.30
2006 M8	97.23	98.63	-1.43
2006 M9	97.78	99.36	-1.60
2006 M10	98.37	100.11	-1.75
2006 M11	97.34	100.88	-3.57
2006 12M	96.88	101.65	-4.81
2007 M1	96.58	102.44	-5.89
2007 M2	97.43	103.24	-5.79
2007 M3	97.2	104.05	-6.81
2007 M4	96.53	104.86	-8.28