eISSN
1811-5446

THE LAHORE JOURNAL OF ECONOMICS

Lahore School of Economics

Volume 19, No.1 **Jan-June, 2014**

The Lahore Journal of Economics
19 : 1 (Summer 2014): pp. 31–66

The Impact of Exchange Rate Volatility on Trade: A Panel Study on Pakistan's Trading Partners

Abdul Jalil Khan,[*] Parvez Azim,[**] and Shabib Haider Syed[***]

Abstract

This study investigates the impact of domestic and foreign currency-valued exchange rate volatility on the export and import demand functions with reference to Pakistan's trading partners. We use GARCH-based exchange rate volatilities and the least-squares dummy variable technique with fixed-effects estimation to measure the volatility impact on both demand functions. The study evaluates a series of exchange rates from 1970:01 to 2009:12 to compare the long-run impact of volatility with that of the short run. The results show that, when Pakistan employed the US dollar as the vehicle currency with its trading partners, volatility discouraged both imports and exports. In contrast, both the import and export demand functions remained unaffected by volatility distortions when Pakistan traded with its developing partners using bilateral exchange rates valued in domestic currency terms. In policy terms, this implies that Pakistan should opt for direct domestic currency when trading with middle- and low-income countries.

Keywords: GARCH models, foreign exchange markets, volatility, panel data, fixed-effects model, international financial markets, foreign exchange policy, trade, Pakistan.

JEL classification: C53, F31, F44, C23, G15, O24, F1.

1. Introduction

Exchange rates affect the true prices of commodities traded among countries of the world; it determines the price actually paid when each trade transaction is executed. At the same time, domestic inflation also plays a vital role in determining the changing patterns in the prices of tradable commodities (which may be intensified by exchange rate instability). However, using a single currency such as the US dollar (USD) as a vehicle currency can help insulate trade from such distortions by

[*] PhD scholar, Government College University, Lahore, Pakistan.
[**] Visiting faculty member, Government College University, Lahore; Dean, Faculty of Arts and Social Sciences, GC University, Faisalabad, Pakistan.
[***] Associate professor and former chairperson, Department of Economics, Forman Christian College University, Lahore, Pakistan.

keeping the domestic currency exchange rate stable, either by setting a fixed rate or controlling it through a peg. This strategy can help low-income developing countries address uncertainties in trade flows.

For developing countries, problems regarding trade intensify when, along with inflation, external elements emerge in the form of "shocks" or "news" and disturb the flow of international prices paid for commodities or stocks. Such elements disrupt smooth and regular exchange rate flows and are often manifested through currency crises and stock market crashes (see Hernández & Schmidt-Hebbel, 2002. Sometimes, such distortions may also be artificially generated in the form of "speculation." Exchange rates often exhibit highly unstable and indeterminable patterns in response to these shocks, and the resulting pattern is referred to as "volatility." If such a shock lasts long and has a temporal impact that causes a wave in the flow of exchange rates, and if these waves deter or delay the movement of exchange rates back to their original state, the consequent trade patterns will disturb the stream of expected returns by raising the probability of loss for the traders concerned.

It is important to understand how frequently such shocks might occur and how long they might persist. This necessitates the formulation of effective strategies and policies to protect traders' interests and to keep their incentive to trade intact. A review of the historical research on exchange rate volatility reveals that there is no consensus on how to estimate the precise impact of volatility on international trade flows; such methods tend to split into four streams (see Table 1). Increasingly, the literature leans toward two main outcomes: (i) a significant negative impact of exchange rate volatility on trade and (ii) no or an insignificant impact on trade. However, these outcomes remain highly subjective due to the nature, size, and type of sample; the frequency of data; the nature of the volatility proxy; and the estimation techniques employed for analysis (Ozturk, 2006). Nevertheless, the more common outcome observed in the literature is that of a significantly inverse relationship between trade and exchange rate volatility (see Table 5.1).

Traders usually respond in a variety of ways when facing a "risk" element. Since trade-related risk intensifies on arrival of a news/shock element in the market, many traders may try to expand their trade to compensate for the expected loss in profit margins by revising their portfolios (the "modern [risk portfolio]" school of thought). Others may reduce their trade volume by diverting investments from high-risk ventures to low-risk ones (the "traditional" school of thought).

As far as data frequency is concerned, many studies have employed relatively low-frequency data such as annual, biannual, or quarterly series to measure the volatility impact (see Berger, Sturm, & de Haan, 2000; Bénassy-Quéré, Fontagné, & Lahrèche-Révil, 2001; Bahmani-Oskooee, 2002; Crowley & Lee, 2003; Mustafa & Nishat, 2004; Kemal, 2005; Azid, Jamil, & Kousar, 2005; Chit, Rizov, & Willenbockel, 2008; Aliyu, 2008). In time-series analyses, most models are developed to estimate high-frequency data. However, if such models are applied to low-frequency data, this can give rise to skepticism about the results because the first three moments' parameters may strongly influence the results. Time-series econometricians thus caution against this use and hold that the consequent reliability of results needs at least 300 observations (Siddiqui, 2009).

High-frequency data contains values recorded on the basis of monthly, weekly, daily, or even minute-by-minute intervals. Recent studies on exchange rates have also started to employ high-frequency data (see Andersen, Bollerslev, Diebold, & Labys, 2001; Canales-Kriljenko & Habermeier, 2004; Qayyum & Kemal, 2006; Beine et al., 2006). We consider monthly data relevant to our study on the assumption that the derived demand for currency exchange emerges through the demand for exports or imports where order placement, production, and delivery entail a gestation period of probably more than a week.

Most previous studies have employed classical linear regression models and one-dimensional (time-series or cross-sectional) data, which have been unable to record the significant effect of exchange rate volatility on trade. This is considered a subjective limitation: when two-dimensional (panel) data and various models or estimation techniques (such as fixed effects or random effects) have been applied, the impact of exchange rate volatility proves to be significant but generally negative (Hondroyiannis, Swami, Tavlas, & Ulan, 2005, p. 5). This problem drives further exploration of the relationship between volatility and trade and a chance to determine the most suitable estimation technique and compatible data frequency to reach a more conclusive result.

Several studies have also employed the US dollar as a base for calculating foreign currency-valued exchange rates to analyze financial aspects of international trade. However, no other study has used two different currency bases to calculate and compare exchange rates in the context of volatility impacts on trade. Such a study would need to choose between domestic currency-based direct exchange rates and foreign currency-based indirect exchange rates so as to avoid financial market distortions, which would otherwise disturb trade flows as well.

To partially fill this gap, we apply two-dimensional exchange rates: the "per unit USD" as the foreign currency-valued (indirect) exchange rate and the "per unit PKR" as the domestic currency-valued (direct) exchange rate. This will allow us to compare the risk involved in using the "domestic currency" instead of the "vehicle currency" in the context of trade stability and growth with respect to Pakistan's trading partners. Moreover, speculative attacks in currency markets, US policy, and the artificial hoarding of dollars can distort foreign currency-valued exchange rates by instigating volatile behavior. The rationale for using these in international transactions among developing countries thus needs to be re-evaluated.

Earlier studies have widely tested time-series and cross-sectional data. The recent focus on panel data estimation techniques attempts to overcome the limitations imposed by time-series and cross-sectional data when applied independently of each other. A pool of 29 cross-sections with time-series data containing up to 480 observations would permit us to explore the existence of country-wise fixed effects. Further, the application of panel estimation techniques or fixed-effects models (i.e., least-squares dummy variable [LSDV] estimators) is an effective technique when applied to the time dimension of panels, which are larger than cross-section dimensions because the dynamic panel mitigates the bias in the coefficient of estimates (Judson & Owen, 1996). Five volatility variables have been derived using the most frequently tested GARCH-based specifications in terms of each currency for Pakistan's trading partners.[1]

Volatility emerges as a major issue when a flexible exchange rate regime replaces a fixed rate system.[2] The State Bank of Pakistan has adopted different strategies to control exchange rate variations over the last four decades. The nominal exchange rate was fixed at approximately PRs 9.9/$ from 1973 to 1981, but a 14.8 percent devaluation occurred in the real exchange rate in 1982 when a managed-float exchange rate regime was adopted. In 1999, the State Bank ceased to announce the official exchange rate and the PKR-USD rate jumped from PRs 46/$ to PRs 51.39/$ (an 11.7 percent devaluation).

---

[1] GARCH (1,1), EGARCH, TGARCH, PGARCH, and CGARCH because many studies have recurrently employed these models in various situations. See, for example, Floros (2008); Siddiqui (2009); Irfan, Irfan, and Awais (2010); Pattichis (2003); Crowley and Lee (2003); Kemal (2005); Qayyum and Kemal (2006); Hayakawa and Kimura (2008); Adjasi, Harvey, and Agyapong (2008).
[2] However, real exchange rate volatility was an important issue even before 1970 and onward.

In 2000, the rupee became fully flexible: as a result, the exchange rate rose once again from PRs 51.79/$ to PRs 58.44/$. In the last quarter of the year, rupee-dollar parity rose to PRs 64/$—a 12.84 and 9.51 percent devaluation, respectively (i.e., a 23.56 percent loss in the value of the rupee against the dollar). Finally, post-September 2001, the rupee showed some appreciation. The volatility of the nominal exchange rate increased with the rising exchange rate (depreciation), but remained low or declined when the exchange rate appreciated. This could imply that depreciation caused higher instability and appreciation stabilized the exchange rates (Azid et al., 2005). Pakistan's share in world imports has ranged from a minimum of 0.12 percent in 1980 to a maximum of 0.18 percent in 1992. In 2002/03, it was 0.17 percent, suggesting that Pakistan's export performance was influenced by the exchange rate volatility (Mustafa & Nishat, 2005).

2. Literature Review

In international transactions, a vehicle foreign currency (usually the US dollar) is used to quote exchange rates and conduct trade transactions, as evident from the fact that, till 1992, the recorded global currency turnover was 80 percent in dollar terms and exchange rates, among other currencies, were determined by their respective values against the dollar (Isard, 1995).

Some studies have attempted to explore the impact of volatility on imports. Since devaluation restricted aggregate supply because of increasingly expensive import production units, wage indexation programs, and high-cost working capital, the potential for trade has been lowered (see, for example, Bruno, 1979; Gylfason & Schmid, 1983; Hanson, 1983; Gylfason & Risager, 1984; Islam, 1984; Gylfason & Radetzki, 1985; Branson, 1986; Solimano, 1986; van Wijnbergen, 1986; Edwards, 1989).

Many studies have investigated the impact of volatility on exports: Franke (1991) and Sercu and Vanhulle (1992) find that an increase in exchange rate volatility increases the value of exporting firms and thus promotes export activities. Broll and Eckwert (1999) observe that exchange rate volatility increases the option to export to the world market because of the higher potential gains from international trade for risk seekers. Other studies show that higher volatility leads to more gains from international trade (see Brada & Méndez, 1988; Sercu & Vanhulle, 1992; De Grauwe, 1994).

Chowdhury (1993) investigates the impact of exchange rate volatility on the trade flows of the G-7 countries in the context of a multivariate error correction model. He observes a significant negative impact on export volume for each country. Prasad, Rogoff, Wei, and Kose (2004) find that "volatility has detrimental effects on international trade and thus has a negative economic impact, especially on emerging economies where underdeveloped capital markets and unstable economic policies exist."

Côté (1994) argues that exchange rate volatility has direct and indirect negative effects on international trade through uncertainty, adjustment costs, the allocation of resources, and government policies. A report by the Commission of the European Communities (1990) states that "the reduction of exchange rate uncertainty is necessary to promote intra-EU trade and investment." Dell'Ariccia (1999) finds that increased exchange rate volatility has had a small but significant impact on trading among 15 European Union members where the reduction in volatility to zero allowed them to expand their trade by 3–4 percent.

Rose (2000) also finds a significant but inverse relationship between trade and exchange rate volatility, with up to a 13 percent loss in trade in response to a one-standard deviation rise in volatility. Using a fixed-effects model, Clark, Tamirisa, and Wei (2004) produce the same evidence but find a 7 percent loss in trade consequent to increased volatility equal to one standard deviation. Tenreyro's (2007) results are in line with these studies but indicate a 2 percent rise in trade with the total elimination of volatility. The stability of exchange rates may be disturbed when the foreign currency-valued exchange rate is used: Cushman (1986) identifies the presence of a "third-country effect" and argues that the impact of exchange rate variability on bilateral trade flows is not only dependent on the exchange rate risk experienced by the country under consideration, but also on its correlation with exchange rate fluctuations in other countries.

As Table 1 shows, the literature on the impact of the exchange rate on trade can be categorized in terms of importance as follows:

- Pronounced negative effect (Debate 2)
- Absolutely no effect or, if it exists, not obviously significant (Debate 4)
- Pronounced positive effect on trade flows and volume (Debate 1)
- Pronounced mixed (both positive and negative) effect (Debate 3)

The most important consideration with regard to exchange rate volatility is the pronounced "negative" effect on trade because this can reduce the potential to expand trade. However, the existence of a significant "positive" effect would be surprising because, in such a situation, increased risk and variation in the exchange rate and other financial variables would ensure trade expansion.

In the literature on Pakistan, Amor and Sarkar (2008) find that openness helps reduce real exchange rate fluctuations. However, the framework of financial integration in South Asian and Southeast Asian countries does not favor the stability of the real exchange rate. Mustafa and Nishat (2004) analyze the effect of the exchange rate on export growth and find that volatility has a significantly negative effect with respect to major trading partners such as the UK and US. The volume of trade remains comparatively consistent and less volatile with respect to Australia, Bangladesh, and Singapore. There are long-run effects in the case of India but no empirical relationship with reference to New Zealand and Malaysia.

Table 1: Exchange rate volatility vs. trade: Conclusions based on empirical studies

Conclusion	Empirical studies with frequency of data and type of analysis
Debate 1 Significant positive impact on trade	**Studies**: Broll and Eckwert (1999); Brada and Méndez (1988); Asseery and Peel (1991); McKenzie and Brooks (1997); McKenzie (1998); Kasman and Kasman (2005); Hwang and Lee (2005). **Methods (data frequency)**: cross-sectional (A), OLS-ECM (Q), OLS (M), ARCH (Q), cointegration (Q), GARCH-M (M). *Cited in Kemal (2005, p. 3) and Ozturk (2006, table 1, p. 88).*
Debate 2 Significant negative impact on trade	**Studies**: Cushman (1983, 1986, 1988); Akhtar and Hilton (1984); Kenen and Rodrick (1986); Thursby and Thursby (1987); De Grauwe (1988); Peree and Steinherr (1986, 1989); Koray and Lastrapes (1989); Arize (1995); Kumar and Dhawan (1991); Pozo (1992); Persson and Svensson (1989); Lanyi and Suss (1986); Edwards (1987); Baldwin and Krugman (1989); Siddique and Salam (2000); Belenger et al. (1988); Caballero and Corbo (1989); Bini Smaghi (1991); Feenstra and Kendall (1991); Belenger et al. (1992); Savvides (1992); Chowdhury (1993); Caporale and Dorodian (1994); Hook and Boon (2000); Doganlar (2002); Vergil (2002); Das (2003); Baak (2004); Clark, Tamirisa, and Wei (2004); Arize et al. (2005); Lee and Saucier (2005). **Methods (data frequency)**: OLS (Q, A), IVE (Q), GIVE (Q), VAR (M, Q), ARCH-GARCH (Q), cross-sectional (A), joint estimation (M), EG cointegration (Q), SD (Q), ADF, ECM, cointegration (Q), gravity model (A). *Cited in Mustafa and Nishat (2004, p. 2), Kemal (2005, p. 2), and Ozturk (2006, table 1, p .88).*
Debate 3 Significant MIXED impact	**Studies**: Kumar (1992); Frenkel and Wei (1993); Kroner and Lastrapes (1993); Daly (1998). **Methods (data frequency)**: SD (A), OLS (A), IVE (A), GARCH-M (M). *Cited in Ozturk (2006, p. 90).*
Debate 4 NO or insignificant impact on trade	**Studies**: Hooper and Kohlhagen (1978); Gotur (1985); Bailey, Tavlas and Ulan (1986, 1987); Bailey and Tavlas (1988); Asseery and Peel (1991); Medhora (1990); Akhtar and Hilton (1991); Kumar and Dhawan (1991); Gagnon (1993); Aristotelous (2001); Tenreyro (2004); Bayoumi (1996); Bacchetta and van Wincoop (1998); Devereux and Engel (2002); Koray and Lastrapes (1989). **Methods (data frequency)**: OLS (Q, A), simulation analysis (Q), gravity model (A). *Cited in Ozturk (2006, p. 88) and Kemal (2005, p. 2).*

Note: A = annual, Q = quarterly, M = monthly data. Debates are numbered for authors' reference purpose only.

According to Kemal (2005), exchange rate instability affects exports positively and imports negatively, which improves the trade balance. Azid et al. (2005) obtain positive but insignificant results that do not support the position that excessive volatility has a pronounced effect on manufacturing production. Qayyum and Kemal (2006) show that returns in the foreign exchange market remain mean-reverting and are affected by the volatility of stock market returns in Pakistan's case. Arize, Malindretos, and Kasibhatla (2003) observe that exchange rate volatility has a significantly negative impact on exports, implying that risk-averse traders will contract their trade to minimize exposure to exchange rate risks.

The gaps in the literature are as follows. First, while imports and the trade balance have received little attention, they are often found to be pivotal to exchange rate markets in developing countries (which tend to be import-dependent). Second, in cases where the frequency of the time-series data used in time-series models is inconsistent with the latter's design, the estimation and consequent outcomes are subject to skepticism. Third, the "third-country effect" has been observed but not properly evaluated. Fourth, exchange rate values in terms of domestic and foreign currency have not been compared in the context of Pakistan or other developing countries and only marginally at the international level. This study is, therefore, an effort to address these issues and provide further evidence regarding the volatility impact on trade, especially for Pakistan.

Based on the discussion above, our objective of evaluating domestic and foreign currency-valued exchange rate volatilities for export and import demand functions can be hypothesized as follows:

- Hypothesis 1: Using an international (vehicle) currency to conduct international transactions can cause volatility in exchange rates.
- Hypothesis 2: The direction of the volatility impact depends on the nature of volatility measurement specifications.
- Hypothesis 3: Exchange rate volatility significantly discourages both exports and imports.

3. Methodology

This section describes the models and data used, as well as the estimation and verification procedures applied.

3.1. The Basic Models

The impact of exchange rate volatility on trade is measured using two functional forms: the real export demand function and the real import demand function. These models are determined using the following variables: domestic and international inflation, the consumer price index (CPI) (a proxy for the price of nontradable items), GDP (as a proxy for the manufacturing production index), foreign reserves, the shares price index as a proxy for business and consumer sentiments (Tang, 2012), domestic interest rates, interest rate differentials,[3] real exchange rates (measured in terms of both values), the per-unit US dollar as the foreign rate and the per-unit Pakistani rupee as the domestic rate, and GARCH-based exchange rate volatilities. Further, the corresponding autoregressive term allows us to capture the dynamic nature of these models and the speed at which they adjust toward long-run equilibrium in case a deviation occurs.

Since exports will decrease with an exchange rate appreciation while imports will rise, mathematically, this relation is given as

$$X = f\,[1/(ER \text{ per } \$)] \tag{1}$$

$$M = f\,(ER \text{ per } \$) \tag{2}$$

Real exports (RX) and real imports (RM) are calculated as follows, using data on the value of exports and imports in millions of domestic currency for each country and the price index:

$$RX_j = \left[\frac{\frac{X_j}{er^*}}{CPI^{US}}\right] = X_j^{USD}/CPI^{US} \text{ and } RM_j = \left[\frac{\frac{M_j}{er^*}}{CPI^{US}}\right] = M_j^{USD}/CPI^{US}$$

where RM_j= the real exports of the jth country in USD terms, X_j^{USD}= the real imports of the jth country in USD terms, = the nominal exports of the jth country in USD terms, M_j^{USD} = the nominal imports of the jth country in USD terms, CPI^{US} = the US Consumer Price Index (CPI), and er^* = monthly average exchange rates (domestic currency per unit of USD).

The real exchange rate in terms of the domestic currency per unit of foreign currency will be a function of the nominal exchange rate and the foreign-to-domestic price ratio (P^f/P^d) for each country:

$$RER = f\,(P^d, P^f, NER) \tag{3}$$

To calculate the real exchange rate in both USD and PKR terms, we use the methods below:

[3] The difference between the domestic interest rate and selected international interest rates.

$$RERD_j = \prod_{j=1}^{m} NER_j^{dcr/USD} \left[\frac{CPI^{US}}{CPI_j}\right] \text{ and}$$
$$RERR_j = \prod_{j=1}^{m} NER_j^{dcr/PKR} \left[\frac{CPI^{PK}}{CPI_j}\right]$$

where $RERD_j$ = the real exchange rate in foreign currency terms (USD) for country j, $RERR_j$ = the real exchange rate in domestic currency terms (PKR) for country j, CPI_j = the CPI of country j, CPI^{US} = the CPI of the US, CPI^{PK} = the CPI of Pakistan, m = the total number of countries in the sample, $NER_j^{dcr/USD}$ = the nominal exchange rate (monthly average) of country j in terms of domestic currency per unit USD, $NER_j^{dcr/PKR}$ = the nominal exchange rate (monthly average) of country j in terms of domestic currency per unit PKR.

3.2. Model Specification

GARCH models are assumed to be appropriate for capturing news elements[4] in time-series data. They also help us understand the dynamic behavior of exchange rate variables and derive variance series for volatility. The real exchange rate usually depends on its values in the recent past and on the nonconstant variance, hence:

$$RER = f\,[RER_{t-1}, u_t \sim N(0, h^2)] \tag{4}$$

Accordingly, the impact of autoregressive and autocorrelation elements to the exchange rate is accounted for through the first lag of the dependent variable and error terms, respectively. However, the conditional constraint u_t (h^2) indicates that any shock or noise that might exist in the error term (u_t) is normally distributed with a zero mean and nonconstant variance (h^2)′. The export and import demand functions are expressed below.

3.2.1. *Real Export Demand Function*

The real export demand function is

$$RX_{j,t} = f\begin{pmatrix} \overset{+}{RX_{j,t-1}}, \overset{+}{P_{j,t}}, \overset{+}{CPI_{j,t}}, \overset{+}{MP_{j,t}}, \overset{-}{RIR_{j.t}}, \overset{+}{RCF_{j.t}}, \overset{+}{SP_{j.t}}, \overset{-}{RFR_{j.t}}, \overset{-}{RERD_{j,t}}, \\ \overset{?}{VOLG_{j,t}}, \overset{?}{VOLC_{j,t}}, \overset{?}{VOLE_{j,t}}, \overset{?}{VOLP_{j,t}}, \overset{?}{VOLT_{j,t}} \end{pmatrix} \tag{5}$$

---

[4] For reference purposes, this is equivalent to innovation, noise, or shock.

3.2.2. Real Import Demand Function

The real import demand function is

$$RM_{j,t} = f\left(\begin{matrix} \overset{+}{RM_{j,t-1}}, \overset{+}{P_{j,t}}, \overset{+}{CPI_{j,t}}, \overset{+}{MP_{j,t}}, \overset{-}{RIR_{j.t}}, \overset{-}{RCF_{j.t}}, \overset{+}{SP_{j.t}}, \overset{-}{RFR_{j.t}}, \overset{-}{RER_{j,t}}, \\ \overset{?}{VOLG_{j,t}}, \overset{?}{VOLC_{j,t}}, \overset{?}{VOLE_{j,t}}, \overset{?}{VOLP_{j,t}}, \overset{?}{VOLT_{j,t}} \end{matrix}\right) \quad (6)$$

where $RX_{j,t}$ = the demand for real exports of country j at time t (current period), $RX_{j,t-1}$ = the demand for real exports of country j at time t–1 (previous period), $RM_{j,t}$ = the demand for real imports of country j at time t, $RM_{j,t-1}$ = the demand for real imports of country j at time t–1, $P_{j,t}$ = the inflation rate of country j at time t, $CPI_{j,t}$ = the CPI of country j at time t, $MP_{j,t}$ = the manufacturing production of country j at time t, $RFR_{j.t}$ = the real foreign reserves of country j at time t, $RIR_{j.t}$ = the real interest rate of country j at time t, $RCF_{j.t}$ = the real (net) capital (out)flows of country j at time t, $SP_{j.t}$ = the shares price index of country j at time t, $RER_{j,t}$ = the real exchange rate of country j at time t, $VOLG_{j,t}$ = the GARCH-based exchange rate volatility of country j at time t, $VOLC_{j,t}$ = the CGARCH-based exchange rate volatility of country j at time t, $VOLE_{j,t}$ = the EGARCH-based exchange rate volatility of country j at time t, $VOLP_{j,t}$ = the nonlinear GARCH-based exchange rate volatility of country j at time t, $VOLT_{j,t}$ = the TGARCH-based exchange rate volatility of country j at time t.

Theoretically, the income level has a positive and direct association with exports and imports while the inflation rate (*P*) has an inverse association with exports and imports through exchange rate adjustment. Real foreign reserves (*RFR*) are accumulated through the export of goods and services (possibly with some lag) but they deteriorate with imports. A rise in the shares price index encourages trading activities, while rising interest rates will discourage investment, exports, and imports. Real capital (out) flows will encourage exports and imports subject to some constraints. An appreciation (depreciation) in the real exchange (domestic) rate will increase (decrease) imports and reduce (raise) exports, with the reverse for the foreign rate. Exchange rate volatility may have a four-dimensional impact on exports and imports (see Table 1).

Table 2: List of relevant variables

Variables of interest	Real exports, real imports, first lag of real exports and imports, nominal and real exchange rate, various volatility specifications.
Control variables	Cross-country political and structural differences, inflation rate, prices of nontradable commodities, production level, real foreign reserves, real capital flows, real interest rates, shares price index.

3.2.3. *Real Export Demand Equation*

We employ double-log models in our estimation to overcome the problem of nonstationarity detected in some variables, which need to be dealt with cautiously:

$$LNRX_{j,t} = \beta_0 + \sum_{i=1}^{n} \beta_{1,i} LNRX_{j,t-1} + \sum_{i=0}^{n} \beta_{2,i}\, LNP_{j,t} + \sum_{i=0}^{n} \beta_{3,i}\, LNCPI_{j,t} + \sum_{i=0}^{n} \beta_{4,i}\, LNMP_{j,t} + \sum_{i=0}^{n} \beta_{5,i}\, LNRFR_{j,t} + \sum_{i=0}^{n} \beta_{6,i}\, LNRIR_{j,t} + \sum_{i=0}^{n} \beta_{7,i}\, LNSP_{j,t} + \sum_{i=0}^{n} \beta_{8,i}\, LNRCF_{j,t}^{2} + \sum_{i=0}^{n} \beta_{9,i}\, LNRER_{j,t} + \sum_{i=0}^{n} \beta_{10,i}\, LNVOLG_{j,t} + \sum_{i=0}^{n} \beta_{11,i}\, LNVOLE_{j,t} + \sum_{i=0}^{n} \beta_{12,i}\, LNVOLT_{j,t} + \sum_{i=0}^{n} \beta_{13,i}\, LNVOLP_{j,t} + \sum_{i=0}^{n} \beta_{14,i}\, LNVOLC_{j,t} + u_{j,t} + v_{j,t} \quad (7)$$

Taking the first difference of each variable in the suggested model allows us to make a short-run analysis as well:

$$\Delta RX_{j,t} = \beta_0 + \beta_1 \Delta RX_{j,t-1} + \beta_2\, \Delta P_{j,t} + \beta_3 \Delta CPI_{j,t} + \beta_4 \Delta MP_{j,t} + \beta_5 \Delta RFR_{j,t} + \beta_6 \Delta RIR_{j,t} + \beta_7 \Delta SP_{j,t} + \beta_8 \Delta RCF_{j,t} + \beta_9 \Delta RER_{j,t} + \beta_{10}\, \Delta VOLG_{j,t} + \beta_{11} \Delta VOLE_{j,t} + \beta_{12} \Delta VOLT_{j,t} + \beta_{13}\, \Delta VOLP_{j,t} + \beta_{14} \Delta VOLC_{j,t} + \Delta v_{j,t} \quad (8)$$

3.2.4. *Real Import Demand Equation*

Having considered all the factors that might determine the export demand for domestic output, it is equally important to determine the import demand for internationally available foreign output, although the nature of this relationship may vary:

$$LNRM_{j,t} = \beta_0 + \sum_{i=1}^{n} \beta_{1,i} LNRM_{j,t-1} + \sum_{i=0}^{n} \beta_{2,i}\, LNP_{j,t} + \sum_{i=0}^{n} \beta_{3,i}\, LNCPI_{j,t} + \sum_{i=0}^{n} \beta_{4,i}\, LNMP_{j,t} + \sum_{i=0}^{n} \beta_{5,i}\, LNRFR_{j,t} + \sum_{i=0}^{n} \beta_{6,i}\, LNRIR_{j,t} + \sum_{i=0}^{n} \beta_{7,i}\, LNSP_{j,t} + \sum_{i=0}^{n} \beta_{8,i}\, LNRCF_{j,t}^{2} + \sum_{i=0}^{n} \beta_{9,i}\, LNRER_{j,t} + \sum_{i=0}^{n} \beta_{10,i}\, LNVOLG_{j,t} + \sum_{i=0}^{n} \beta_{11,i}\, LNVOLE_{j,t} + \sum_{i=0}^{n} \beta_{12,i}\, LNVOLT_{j,t} + \sum_{i=0}^{n} \beta_{13,i}\, LNVOLP_{j,t} + \sum_{i=0}^{n} \beta_{14,i}\, LNVOLC_{j,t} + u_{j,t} + v_{j,t} \quad (9)$$

For a short-run analysis, the equation can be written as

$$\Delta RM_{j,t} = \beta_0 + \beta_1 \Delta RM_{j,t-1} + \beta_2 \Delta P_{j,t} + \beta_3 \Delta CPI_{j,t} + \beta_4 \Delta MP_{j,t} + \beta_5 \Delta RFR_{j,t} + \beta_6 \Delta RIR_{j,t} + \beta_7 \Delta SP_{j,t} + \beta_8 \Delta RCF_{j,t} + \beta_9 \Delta RER_{j,t} + \beta_{10} \Delta VOLG_{j,t} + \beta_{11} \Delta VOLE_{j,t} + \beta_{12} \Delta VOLT_{j,t} + \beta_{13} \Delta VOLP_{j,t} + \beta_{14} \Delta VOLC_{j,t} + \Delta v_{j,t} \quad (10)$$

The logarithmic transformation makes the series stationary in most cases (see Table A1 in the Appendix) and allows us to make a comparative analysis of functional relationships and the elasticities of the given variables. Differenced equations ensure the stationarity of each variable in the model but at the expense of dynamic long-run effects.

Table 3: Description of volatility specifications

Volatility proxy	Elements captured in 'news' component	Explanation
GARCH	Volatility clustering	Helps quantify impact of any shock on variance that continues to transmit itself during adjacent time interval, as a large shock is followed by a larger one and a small shock is followed by a smaller one. However, shock transmission process is captured by nonlinear specifications.[a]
EGARCH	Leverage effect, nature of dominant shock	Helps expose the shock, which may strongly influence the variance because a "negative shock" causes greater loss in returns than the gains from a "positive shock."
TGARCH	Asymmetries in news, impact of bad news	Measures the significance and proportional contribution of negative shock that destabilizes variance.
CGARCH	Long-run persistence (of news) in volatility patterns	Reflects the consistency of shock impact in variance series, which may not allow the variance to become stable over time.
NGARCH (PGARCH)	Nonlinearities and asymmetries	Allows us to capture the degree of correlation between current and lagged observations of the time series in absolute and squared terms; remains significantly positive for very long lags.[b]

Source: a = Clements (2005, p. 64) and Islam (2004, p. 133); b = Islam (2004, p. 133).

3.3. *Data Specification*

Our major source of data is the International Financial Statistics database. Data on bilateral exports is taken from the Direction of Trade Statistics database. We have selected monthly data series from January 1970 to December 2009, covering 40 years with up to 480 values for each time-series variable, especially in the case of all exchange rates. However, to account for any missing values, we have also consulted the Penn World Tables (Version 6.1; see Heston, Summers, & Aten, 2002) and the official websites of the sampled countries, especially in relation to their statistical bureaus and central banks.

3.4. Estimation Procedure

We capture the dynamic relationship in question by estimating LSDV fixed-effects models, using a panel data approach and a sample of 29 trading partners (of Pakistan) that hold significant trade shares (see Table C1 in the Appendix). Although various estimation techniques have been employed in similar studies (see Table 1), cross-sectional and time-series data can pose problems. As Dell'Ariccia (1999) points out, the unobservable cross-sectional-specific effects that usually influence trade flows (such as cross-country structural and policy differences) can only be captured through fixed-effects or random-effects specifications.

The dataset we have used has both a time-series (T) and cross-sectional (N) dimension (with the condition N > T where T is large). This is referred to as panel or longitudinal data. In comparing the asymptotic variances, it is obvious that, although less biased, simple instrumental variable estimators yield substantial efficiency losses compared to the LSDV (and GMM) techniques (Bun, 2001).

3.5. Panel Unit Root Tests

Our analysis employs monthly data series for 29 countries, ranging from 1970:01 to 2009:12. To avoid spurious estimates, we apply three different panel unit root tests (where the first two are given more weight than the third): (a) Levin, Lin, and Chu (LLC); (b) Im, Pesaran, and Shin (IPS); and (c) Hadri Lagrange multiplier (HLM).

The LLC and HLM tests both assume common transverse cross-sectional persistence parameters, i.e., identical autoregressive coefficients, while the IPS test allows these autoregressive coefficients to vary freely across cross-sections (Quantitative Micro Software, 2007). The LLC test evaluates the null hypothesis of a common unit root while the IPS test considers individual unit roots. The results (Table A1 in the Appendix) show that, according to both the LLC and IPS criteria, all variables at level remain stationary at a 1 percent level of significance except real exports, real imports, the inflation rate, consumer prices, productivity, the ordinary and log of the stock of real foreign reserves, and shares prices. However, the real capital flow variable is nonstationary at level based on the LLC criterion. These nonstationary variables became stationary either by transforming them into logarithmic form or taking their first difference.

The probable limitation of the HLM is "the over-rejection of the null hypothesis due to high autocorrelation," which can cause severe size distortions.[5] Accordingly, it is possible that those variables that proved to be stationary at level (based on the LLC and IPS tests) might not remain stationary on applying the HLM test. We therefore consider the LLC and IPS tests to be better in evaluating the stationarity of the relevant variables.

3.6. Hausman Test and Likelihood Ratio

The Hausman test is used to detect random effects while the likelihood ratio examines fixed effects in panel data models. Both tests are applied to evaluate our cross-sectional fixed- and random-effects models. All equations are estimated using LSDV pooled and panel estimation techniques. The fixed-effects likelihood ratio allows us to reject the null hypothesis of redundant fixed effects due to the large value of the chi-squared term. This implies that these models are best suited to fixed effects mainly when the cross-section weights limitation is imposed.[6]

3.7. The Case for Fixed-Effects Modeling

There are two types of variations: (i) inter-country (cross-sectional effects), which can be handled independently by cross-sectional models; and (ii) intra-country (period effects), which can be dealt with by time-series models (see Dranove, n.d.). Panel data helps us handle both dimensions simultaneously. The availability of a large number of observations in this study allows us to determine the effect of the volatility component within each country in a sample by using a fixed-effects model.

The main purpose of fixed-effects modeling is to remove any bias caused by omitted variables. In the case of exchange rate variations, the omitted variables include: the diversification of risk-related behavior of traders and investors, country-wise differences in exchange rate markets, and the pattern of relationships among countries in the context of bilateral

[5] As observed in the results obtained through the application of EViews.
[6] Random effects were tested but did not remain valid on application of the autoregressive term in the suggested models.

or multilateral trade arrangements. Fixed-effects models do this by exploiting temporal variations within groups.

3.7.1. Specifications and Limitations of Fixed-Effects Estimation

Each fixed-effects model was estimated using a pooled EGLS cross-section weights specification. The total number of unbalanced pool observations is more than 9,000. The specified limitation for obtaining the best-fit model includes cross-section weighted (PCSE) standard errors and covariance after correcting for the degree of freedom. First-differenced models effectively fit the limitation specified by cross-section SUR (PCSE) standard errors and covariance after degree of freedom correction.

However, the application of the short-run model reduces the sample, which started from 1992:01 to 2009:12. The values of the weighted adjusted R-squares range from 15 to 40 percent. Moreover, the square of real capital flows has to be taken in double-log models to allow all values of the series to remain intact (which might otherwise be lost in log transformations because of frequent negative values).

Technically, a bias may emerge when estimating fixed-effects panel models due to the presence of lag terms in the given equations. However, the fixed-effects $u_{j,t}$ is removed when variables are used by taking the first difference in the model.

4. Results, Analysis, and Discussion

This section describes the short- and long-run volatility impact on the trade functions.

4.1. Long-Run Volatility Impact

The results obtained from the fixed-effects log models show that exchange rate volatility has a highly significant impact on both the real import and export demand functions. While all the sampled countries were evaluated, the magnitude of the impact and the number of significant volatility variables are larger for the foreign currency rate than the domestic rate at a 5 percent level of significance. In particular, the impact of the GARCH-based volatility variables on trade depends on the nature of volatility in the exchange rate measured by each corresponding volatility variable.

Interestingly, no volatility variable is significant at the 5 percent level of significance—and very few at the 10 percent level—when developed countries are excluded from the sample and the domestic currency is taken as the mode of transaction. Moreover, the use of foreign currency-based exchange rates in this sub-sample ensures strictly that the volatility influence exists, which implies that trade among developing countries will be significantly affected by high margins of volatility when the foreign currency replaces the domestic currency as a base for measuring exchange rates and executing trade transactions.

The GARCH (1,1) model allows us to record volatility clustering: this is significant in both the export and import functions in terms of the domestic rate but only significant in the import function in terms of the foreign rate. All other volatility specifications are highly significant in terms of the foreign rate for the export demand function, except the CGARCH for imports.

Analyzing the full sample reveals that the impact of bad news is significant in the export function while a leverage effect is noted in the import function. The long-run persistence of news occurs in both functions. Remarkably, in the case of the developing countries sub-sample, all the volatility variables are insignificant except for nonlinearity in volatility, which is significant at the 10 percent level only in the import demand function. In both currency terms, the impact of bad news encourages exports in the long run when the sample countries' mutual trade links are accounted for. In the foreign currency rate, however, the same phenomenon discourages exports in the sub-sample and imports in both samples.

4.2. Short-Run Volatility Impact

The short-run analysis reveals that volatility has no significant effect on trade when Pakistan trades only with developing countries. The robustness of this finding is established when we evaluate the developed countries in the full sample as well as separately. Both results confirm the existence of a significant volatility effect. The direction of the volatility effect differs across volatility specifications.

4.3. Volatility Specification Impact

Having established that the exchange rate volatility impact is significant, each model, based on a particular volatility specification, behaves differently.

- GARCH (1,1) shows that shock disturbances continue to transmit their effect in subsequent periods and cause instability in trade flows and in the expected stream of returns. Therefore, volatility clustering depresses real exports persistently both in the long run[7] and the short run when we consider all Pakistan's trading partners by using the vehicle currency. In contrast, when using the PKR in trade with underdeveloped partners, there is no volatility impact in either the short or long run.[8] In the case of real imports, GARCH-based volatility significantly encourages imports in the short run when using a vehicle currency (foreign rate) and the domestic rate, but discourages imports in the long run (except, when among underdeveloped countries, imports are transacted using the domestic rate).
- The EGARCH-based leverage effect and dominant shocks lead to an increase in real exports when using the vehicle currency as a whole. However, in the short run, real exports decrease among underdeveloped partners and remain completely insignificant when using the domestic rate. In the short run, imports among all the sampled partners are encouraged in terms of both rates. However, among underdeveloped partners, we see no volatility effect on real imports when using the domestic rate; the effect significantly discourages imports in the short run and encourages them in the long run.
- TGARCH-based asymmetries and the impact of bad news discourage real exports among all partners when using the vehicle currency (foreign rate). This also applies in the long run to underdeveloped partners. Using the domestic rate encourages real exports in the long run only but with no effect otherwise. Real imports are discouraged among all partners but with no effect in the case of most underdeveloped partners when the domestic rate is considered.
- The CGARCH-based long-run persistence of news discourages real exports in both the long and short run when using the vehicle currency for all partners. However, when Pakistan trades with underdeveloped counterparts, real exports are encouraged in the short run but

[7] In line with the conclusions drawn by Arize et al. (2003).
[8] McKenzie (1999) reaches a similar conclusion.

discouraged in the long run. Underdeveloped partners remain immune in domestic rate terms. Real imports are discouraged irrespective of the partner in the short run. In the long run, we see no effect except when the domestic rate is used (for all partners).

- NGARCH-based nonlinearities generally encourage real exports except among underdeveloped partners in the short run, which remains unaffected alike domestic rate in all cases except in short run when it encouraged real exports for all partners in short run. Real imports increase in the short run for all the sampled countries as well as in the long run within the underdeveloped partner sample. Otherwise, there is no effect.

5. Conclusions and Policy Recommendations

Our results imply that dependence on a vehicle currency (USD) can become a serious issue for developing countries trading with each other. When Pakistan relies on a vehicle currency for trade with all its sampled partners (irrespective of the type of country), volatility has a significant effect on trade. Imports in particular are discouraged (see Arize, 1998) in both the short and long run, based on the vehicle currency. Real exports are adversely affected by volatility among developing trade partners, at least in the short run as evidenced by Hayakawa and Kimura (2008) and Chit et al. (2008) for East Asian countries[9] and earlier by Kumar and Dhawan (1991) for export demand in Pakistan.

Using the country's own currency to conduct trade transactions by excluding the developed trade partners helps avoid volatility distortions. This implies that the volatility impact may emerge when considering trade with developed trade partners and when the foreign currency is involved.[10] These results are in line with Esquivel and Larraín (2002) and Mustafa and Nishat (2004). We can conclude that volatility might not reside purely in the vehicle currency but can also be transmitted from developed countries' financial markets through trade links. Hence, we can justify the first hypothesis and provide evidence on the existence of Cushman's third-country effect.

On average, most exchange rate volatility variables remain significant when the vehicle currency is employed to conduct international

[9] This is because most of the developing countries in our selected sample belong to East Asia.
[10] Supported by the estimation results obtained for the sub-sample of developed trade partners (not reported here due to limited space but available on request).

transactions related to real exports among all the sampled partners. However, when only underdeveloped partners and the domestic rate are considered, volatility has no effect on real exports. Further, the magnitude and direction of the impact is volatility specification-dependent. Exchange rate volatility also affects real imports whether among all sampled partners or only among underdeveloped partners. However, volatility appears to have no impact when the domestic rate is employed for import transactions with underdeveloped partners. Hence, the first hypothesis holds.

Both real exports and real imports experience a mixed effect with respect to GARCH-based volatility: a continuing shock element encourages trade in the short run but can affect it adversely or not at all in the long run. EGARCH- and NGARCH-based volatilities (i.e., the leverage effect of a dominant shock as well as nonlinear patterns in volatility) have a positive and direct effect that encourages trade. The negative and inverse effect of TGARCH- and CGARCH-based volatilities implies that bad news and the persistence of a shock can both damage trade. Showing that the volatility impact depends on the nature of the volatility specification justifies the second hypothesis. The results also provide evidence in favor of the third hypothesis by showing that exchange rate volatility has a similar impact on both real exports and real imports.

On the whole, our results show that the adverse impact of volatility can be avoided by trading mainly with emerging and developing countries (middle-income and lower middle-income groups, respectively) and by conducting bilateral trade in their own currencies rather than using a vehicle currency. These results have important implications for Pakistan, where trade is concentrated in only a few countries. Policymakers need to explore potential opportunities that would increase trade openness by expanding Pakistan's trade with other countries.

The results deviate from Hayakawa and Kimura (2008) perhaps because we have used domestic currency-based exchange rates. However, like Pakistan, a large number of developing countries have trade concentrations with developed countries (see Table C1 in the Appendix). A recent economic survey suggests that the global economy is passing from a unipolar (US) economy toward multi-polar (emerging) economies (Pakistan Economic Survey, 2010–11). This means that, in the future, such structural changes in trade patterns may help avoid potential volatility distortions.

Finally, Pakistan clearly needs to revise its trade policy and expand trade with low- and middle-income developing and emerging economies, using its own domestic currency to avoid the uncertainties and related instability of exchange rates. These uncertainties can emerge through the use of international currency in bilateral trade transactions because a variety of latent patterns in exchange rate volatility are potentially channeled through the vehicle currency.

The same model could be re-estimated on a regional basis to explore the potential for regional integration. In addition, assessing the use of other developing countries' currencies as a base for executing international trade would not only help compare the volatility impact with that of the vehicle currency, but also allow developing countries to circumvent potential distortions that might be transmitted through the financial markets of developed countries.

References

Adjasi, C., Harvey, S. K., & Agyapong, D. (2008). Effect of exchange rate volatility on the Ghana Stock Exchange. *African Journal of Accounting, Economics, Finance and Banking Research*, *3*(3), 28–47.

Aliyu, S. U. R. (2008). *Exchange rate volatility and export trade in Nigeria: An empirical investigation* (MPRA Paper No. 13490). Munich: University Library of Munich.

Amor, T. H., & Sarkar, A. U. (2008). Financial integration and real exchange rate volatility: Evidences from South and South East Asia. *International Journal of Business and Management*, *3*(1), 112–124.

Andersen, T., Bollerslev, T., Diebold, F. X., & Labys, P. (2001). The distribution of realized exchange rate volatility. *Journal of the American Statistical Association*, *96*, 42–55.

Arize, C. A. (1998). The effect of exchange rate on US imports: An empirical investigation. *International Economic Journal*, *12*(3), 31–40.

Arize, C. A., Malindretos, J., & Kasibhatla, K. M. (2003). Does exchange-rate volatility depress export flows: The case of LDCs. *International Advances in Economic Research*, *9*(1), 7–19.

Azid, T., Jamil, M., & Kousar, A. (2005). Impact of exchange rate volatility on growth and economic performance: A case study of Pakistan, 1973–2003. *Pakistan Development Review*, *44*(4, Pt. II), 749–775.

Bahmani-Oskooee, M. (2002). Does black market exchange rate volatility deter the trade flows? Iranian experience. *Applied Economics*, *34*(18), 2249–2255.

Beine, M., Lahaye, J., Laurent, S., Neely, C. J., & Palm, F. C. (2006). *Central bank intervention and exchange rate volatility, its continuous and jump components* (Working Paper No. 2006-031B). St. Louis, MO: Federal Reserve Bank of St. Louis.

Bénassy-Quéré, A., Fontagné, L., & Lahrèche-Révil, A. (2001). Exchange-rate strategies in the competition for attracting foreign direct investment. *Journal of Japanese and International Economies*, *15*, 178–198.

Berger, H., Sturm, J.-E., & de Haan, J. (2000). *An empirical investigation into exchange rate regime choice and exchange rate volatility* (Working Paper No. 263). Munich: Center for Economic Studies, Ifo Institute.

Brada, J. C., & Méndez, J. A. (1988). Exchange rate risk, exchange rate regime, and the volume of international trade. *Kyklos*, *41*(2), 263–280.

Branson, W. H. (1986). Stabilization, stagflation, and investment incentives: The case of Kenya, 1979–1980. In S. Edwards & L. Ahamed (Eds.), *Economic adjustment and exchange rates in developing countries* (pp. 267–293). Chicago, IL: Chicago University Press.

Broll, U., & Eckwert, B. (1999). Exchange rate volatility and international trade. *Southern Economic Journal*, *66*(1), 178–185.

Brooks, C. (2008). *Introductory econometrics for finance* (2nd ed.). Cambridge: Cambridge University Press.

Bruno, M. (1979). Stabilization and stagflation in a semi-industrialized economy. In R. Dornbusch & J. Frenkel (Eds.), *International economic policy*. Baltimore, MD: Johns Hopkins University Press.

Buddelmeyer, H., Jensen, P. H., Oguzoglu, U. & Webster, E. (2008). *Fixed effects bias in panel data estimators* (Discussion Paper No. 3487). Bonn, Germany: Institute for the Study of Labor.

Bun, M. J. G. (2001). *Accurate statistical analysis in dynamic panel data models*. PhD thesis, Tinbergen Institute, Amsterdam.

Canales-Kriljenko, J., & Habermeier, K. (2004). *Structural factors affecting exchange rate volatility: A cross-section study* (Working Paper No. 04/147). Washington, DC: International Monetary Fund.

Chit, M. M., Rizov, M., & Willenbockel, D. (2008). *Exchange rate volatility and exports: New empirical evidence from the emerging East Asian economies* (Economics and Statistics Discussion Paper No. 127). London: Middlesex University.

Chowdhury, A. R. (1993). Does exchange rate volatility depress trade flows? Evidence from error-correction models. *Review of Economics and Statistics*, *75*(4), 700–706.

Clark, P., Tamirisa, N., & Wei, S.-J. (2004). *A new look at exchange rate volatility and trade flows* (Occasional Paper No. 235). Washington, DC: International Monetary Fund.

Clements, M. P. (2005). *Evaluating econometric forecasts of economic and financial variables*. Basingstoke: Palgrave Macmillan.

Commission of the European Communities. (1990). One market, one money: An evaluation of potential benefits and costs of forming an economic and monetary union (*European Economy* No. 44). Brussels: Author.

Côté, A. (1994). *Exchange rate volatility and trade: A survey* (Working Paper No. 94-5). Ottawa, ON: Bank of Canada.

Crowley, P., & Lee, J. (2003). Exchange rate volatility and foreign investment: International evidence. *International Trade Journal*, *17*(3), 227–252.

Cushman, D. O. (1986). Has exchange risk depressed international trade? The impact of third-country exchange risk. *Journal of International Money and Finance*, *5*(3), 361–379.

De Grauwe, P. (1994). *The economics of monetary integration*. New York, NY: Oxford University Press.

Dell'Ariccia, G. (1999). Exchange rate fluctuations and trade flows: Evidence from the European Union. *IMF Staff Papers*, *46*(3), 315–334.

Dranove, D. (n.d.). *Fixed effects models* [Lecture notes]. Kellogg School of Management, Northwestern University. Retrieved from www.kellogg.northwestern.edu/faculty/dranove/htm/dranove/coursepages/Mgmt%20469/Fixed%20Effects%20Models.pdf

Edwards, S. (1989). *Real exchange rates, devaluation, and adjustments*. Cambridge, MA: MIT Press.

Esquivel, G., & Larraín, B. F. (2002). *The impact of G-3 exchange rate volatility on developing countries* (G-24 Discussion Paper No. 16). Geneva: United Nations Conference on Trade and Development.

Floros, C. (2008). Modeling volatility using GARCH models: Evidence from Egypt and Israel. *Middle Eastern Finance and Economics*, *2*, 31–41.

Franke, G. (1991). Exchange rate volatility and international trading strategy. *Journal of International Money and Finance*, *10*(2), 292–307.

Gylfason, T., & Radetzki, M. (1985). *Does devaluation make sense in the least developed countries?* (Seminar Paper No. 314). Stockholm: Institute of International Economic Studies.

Gylfason, T., & Risager, O. (1984). Does devaluation improve the current account? *European Economic Review*, *25*(1), 37–64.

Gylfason, T., & Schmid, M. (1983). Does devaluation cause stagflation? *Canadian Journal of Economics*, *16*(4), 641–654.

Hanson, J. A. (1983). Contractionary devaluation, substitution in production and consumption, and the role of the labor market. *Journal of International Economics*, *14*, 179–189.

Hayakawa, K., & Kimura, F. (2008). *The effect of exchange rate volatility on international trade in East Asia* (Discussion Paper No. 2008-03). Jakarta: Economic Research Institute for ASEAN and East Asia.

Hernández, L., & Schmidt-Hebbel, K. (Eds.). (2002). *Banking, financial integration, and international crises*. Santiago: Central Bank of Chile.

Heston, A., Summers, R., & Aten, B. (2002). *Penn world table version 6.1*. Philadelphia, PA: Center for International Comparisons at the University of Pennsylvania.

Hondroyiannis, G., Swamy, P. A. V. B., Tavlas, G., & Ulan, M. (2005). *Some further evidence on exchange-rate volatility and exports* (Working Paper No. 28). Athens: Bank of Greece.

Irfan, M., Irfan, M., & Awais, M. (2010). Modeling volatility of short-term interest rates by ARCH family models: Evidence from Pakistan and India. *World Applied Sciences Journal*, *9*(10), 1089–2010.

Isard, P. (1995). *Exchange rate economics*. Cambridge, UK: Cambridge University Press.

Islam, S. (1984). Devaluation, stabilization policies, and the developing countries: A macroeconomic analysis. *Journal of Development Economics*, *14*, 37–60.

Jongwanich, J. (2010). *Capital flows and real exchange rates in emerging Asian countries* (Working Paper No. 210). Manila: Asian Development Bank.

Judson, R. A., & Owen, A. L. (1996). *Estimating dynamic panel data models: A practical guide for macroeconomists*. Washington, DC: Federal Reserve Board of Governors.

Kemal, M. A. (2005). *Exchange rate instability and trade: The case of Pakistan* (Research Report No. 186). Islamabad: Pakistan Institute of Development Economics.

Kumar, R., & Dhawan, R. (1991). Exchange rate volatility and Pakistan's exports to the developed world, 1974–1985. *World Development*, *19*(9), 1225–1240.

McKenzie, M. D. (1999). The impact of exchange rate volatility on international trade flows. *Journal of Economic Surveys*, *13*(1), 71–106.

Mustafa, K., & Nishat, M. (2004). Volatility of exchange rate and export growth in Pakistan: The structure and interdependence in regional markets. *Pakistan Development Review*, *43*(4), 813–828.

Ozturk, I. (2006). Exchange rate volatility and trade: A literature survey. *International Journal of Applied Econometrics and Quantitative Studies*, *3*(1), 85–102.

Pattichis, C. (2003). Conditional exchange rate volatility, unit roots, and international trade. *International Trade Journal*, *17*(1), 1–17.

Prasad, E., Rogoff, K., Wei, S.-J., & Kose, M. A. (2004). *Effects on financial globalization on developing countries: Some empirical evidence* (Occasional Paper No. 220). Washington, DC: International Monetary Fund.

Qayyum, A., & Kemal, A. R. (2006). *Volatility spillover between the stock market and the foreign exchange market in Pakistan* (Working Paper No. 2006-7). Islamabad: Pakistan Institute of Development Economics.

Quantitative Micro Software. (2007). *EViews 6 user's guide II*. Irvine, CA: Author.

Rose, A. K. (2000). One money, one market: The effect of common currencies on trade. *Economic Policy*, *15*(30), 7–46.

Sercu, P., & Vanhulle, C. (1992). Exchange rate volatility, international trade and the value of exporting firms. *Journal of Banking and Finance*, *16*(1), 155–182.

Siddiqui, M. A. (2009). Modeling Pak rupee volatility against five major currencies in the perspective of different exchange rate regimes. *European Journal of Economics, Finance and Administrative Sciences*, *17*, 81–96.

Solimano, A. (1986). Contractionary devaluation in the Southern Cone: The case of Chile. *Journal of Development Economics*, *23*, 135–151.

Tang, H. C. (2012). *Why do imports fall more than exports especially during crises? Evidence from selected Asian economies* (Working Paper on Regional Economic Integration No. 96). Manila: Asian Development Bank.

Tenreyro, S. (2007). On the trade impact of nominal exchange rate volatility. *Journal of Development Economics*, *82*, 485–508.

van Wijnbergen, S. (1986). Exchange rate management and stabilization policies in developing countries. *Journal of Development Economics*, *23*, 227–247.

Appendix

Comparative results for pooled series with three different unit root tests

Table A1: Results based on panel unit root tests

Variable	Levin, Lin, Chu (LLC) (2002) H_0: Common unit roots H_a: Stationarity		Im, Pesaran, Shin (IPS) (2003) H_0: Individual unit roots H_a: Stationarity		Hadri Lagrange multiplier (HLM) (2000) H_0: Stationarity H_a: Unit root (nonstationary)	
	Level	**Difference**	**Level**	**Difference**	**Level**	**Difference**
RX	7.95230^	-77.3146*	7.90569^	-44.9007*	69.1382^	0.39975*
LNRX	-5.64092*			-42.9672*		-.42814*
DRX	-68.5454*§		-44.9007*		0.39975*	
RM	7.74950^	-32.4105*	7.63314^	-51.9636*	65.8984^	-0.37937*
LNRM	-4.77200*			-58.3954*		-1.30924*
DRM	-15.3367*		-51.9636*		-0.37933*	
TB	-4.6229*		-10.8965*		30.4937^	-1.42482*
LNTB	-6.81063*		-14.1449*			-1.18560*
DTB	-156.041*		-126.591*		-0.05601*	
P	5.27950^	-39.7603*	-6.0097^	-41.8611*	26.7045^	-2.70667*
LNP	3.70968^	-8.79989*	-4.10158*		37.5834^	-1.782*
DP	-23.068*		-41.8601*		-2.70669*	
CPI	3.23042^	-39.7603*	12.5497^	-35.2565*	79.1358^	¬-0.53231*
LNCPI	-17.1407*		-6.14599*			¬-1.81521*
DCPI	-41.3232*		-38.7572*			-0.27555*
MP	4.86390^	-23.0747*	5.81468^	-32.6942*	67.2631^	¬-2.37179*
LNMP	-4.01874*			-37.5175*		¬-1.84560*
DMP	-37.1732*§		-33.0737*			-2.38453*
RFR	12.7778^	72.3515*	11.9783^	-37.7237*	25.8825^	0.54973*
LNRFR		-109.346*		-91.7945*		-2.91806*
DRFR	-34.9282*§		-37.7622*		0.55064*	
SP	4.59758^	-89.2916*	5.4888^	-75.2148*	55.4938^	-0.65032*
LNSP		-90.7385*		-80.1237*		-0.47421*
DSP	-84.6522*		-75.6219*		-0.80644*	
RCF	0.19575^	-94.0659*	-2.75244*		41.7357^	-0.14942*
DRCF	-53.6034*		-71.4790*		-0.14974*	
RIR	-3.1270*		-13.0244*		16.8158^	-3.07201*
DRIR	-106.746		-95.4949*		-3.35617*	
RERD	-2.81785*		-3.19496*	-92.7994*	33.0965^	-0.55557*
LNRERD	-2.98556*		-2.85995*			0.33884*
VOLG	-16.3071*		-36.1049*	-95.445*	4.87767^	-0.93286*
LNVOLG	-18.0385*		-30.3495*			-0.64995*
VOLE	-40.4186*		-57.5758*	-160.639*	10.0507^	¬0.76542*
LNVOLE	-41.8546*		-54.4244*			¬-1.68881*

Variable	Levin, Lin, Chu (LLC) (2002) H_0: Common unit roots H_a: Stationarity		Im, Pesaran, Shin (IPS) (2003) H_0: Individual unit roots H_a: Stationarity		Hadri Lagrange multiplier (HLM) (2000) H_0: Stationarity H_a: Unit root (nonstationary)	
	Level	**Difference**	**Level**	**Difference**	**Level**	**Difference**
VOLP	-9.31378*		-26.8833*	-128.434*	-7.90614^	-2.23928*
LNVOLP	-14.2295*		-29.4042*			0.62023*
VOLT	-24.0896*		-41.9023*	-110.135*	7.59183^	0.42357*
LNVOLT	-23.4530*		-36.3405*			˜-0.39917*
VOLC	-25.0956*		-29.1406*	-115.693*	6.98159^	0.35744*
LNVOLC	-11.4583*		-15.9807			0.71311*
RERR	-7.51395*		-8.28275*		49.5481^	-1.9174*
LNRERR	-4.46648*		-4.70145*			-2.40685*
VOLGR	-34.7379*		-64.3387*		5.00038^	1.96043^
LNVOLGR	-15.0746*		-38.9511*			-0.35630*
VOLER	-21.3477*		-56.6643*		7.15261^	-0.23498*
LNVOLER	-19.4552*		-53.0982*			-1.54498*
VOLPR	-35.4050*		-48.7782*		5.18746^	-2.00689*
LNVOLPR	-30.8714*		-55.2507*			-0.60690*
VOLTR	-33.8811*		-45.8619*		1.48524^	-2.65418*
LNVOLTR	-20.0706		-39.6877*			-1.95911*
VOLCR	-24.7446*		-27.5626*	-64.2608*	5.0314^	-0.88942*
LNVOLCR	-10.2033*		-16.7669*			-0.26952*
FRFGIRDF	-11.2279*		-22.2389*		12.6420^	-2.23543*
GDMGIRDF	-3.61924*		-12.1150*		14.7927^	-2.3137*
NLGGIRDF	-3.31749*		-14.4048*		-14.7948^	-2.02165*
JPYGIRDF	-4.03637*		-15.6493*		13.3510^	-1.9992*
UKPGIRDF	-4.24617*		-18.3488*		13.1149^	-2.02780*
USDGIRDF	-5.92308*		-16.5827*		16.368^	-3.72168*

Note: Stationarity established at * = 1% level of significance. ˜ = second difference, § = without exogenous variable (neither intercept nor trend), ^ = unit root (nonstationary) series.

Estimation results of exchange rate volatility impact on trade

Table B1: Exchange rate volatility in real exports equations: Full sample

[Pooled EGLS (cross-section weights) fixed-effects estimation]

	FULL SAMPLE – USD		FULL SAMPLE – PKR	
REAL EXPORT FUNCTIONS	**(1) Double log**	**(2) First difference**	**(3) Double log**	**(4) First difference**
Rate of inflation	-0.003752	0.070022	0.002077	
	(-2.06)*	(1.05)	(1.15)	
Nontradable commodity prices	0.006851	0.430305		0.507029
	(1.79)**	(2.81)*		(3.93)*
Production index	0.252128	0.860931	0.150485	0.798954
	(35.94)*	(54.92)*	(30.75)*	(55.85)*
Real foreign reserves	-0.005978	-3.10E-06	-0.005266	-4.37E-06
	(-5.02)*	(-2.52)*	(-4.50)*	(-3.61)*
Real interest rate	-0.002768	0.00516	-0.001744	-0.001399
	(-5.05)*	(0.59)	(-3.21)*	(-0.18)
Real capital flows			0.003038	0.450711
			(5.07)*	(41.67)*
Real exchange rate	-0.181819	-0.00194	-0.081019	-0.204441
	(-20.33)*	(-1.14)	(-12.12)*	(-2.16)*
GARCH volatility	0.003943	2.20E-05	-0.004545	0.06914
	(0.86)	(2.79)*	(-2.36)*	(2.15)*
EGARCH volatility	0.012818	1.98E-05	0.000264	6.15E-07
	(3.62)*	(1.96)*	(0.14)	(1.11)
TGARCH volatility	-0.008792	-7.62E-06	0.004521	-0.07016
	(-2.76)*	(-2.39)*	(1.70)**	(-2.18)*
CGARCH volatility	-0.008211	-9.18E-05	-0.006369	-0.117068
	(-2.82)*	(-2.84)*	(-3.26)*	(-1.67)**
Power GARCH volatility	0.012247	2.70E-05	0.002146	0.084626
	(2.72)*	(2.68)*	(0.81)	(1.78)**
Shares price index	0.025674	0.051527		
	(9.25)*	(3.17)*		
Common constant	0.268236	0.554318	-0.089916	0.490587
	(10.56)*	(5.96)*	(-4.73)*	(6.15)*
1st lagged real exports	0.763409	-0.256648	0.832503	-0.214491
(SPEED OF ADJUSTMENT)	(130.61)*	(-26.33)*	(170.24)*	(-24.29)
Adjusted R^2	0.992480	0.320821	0.993171	0.430063
DW statistics	2.362268	2.320321	2.482831	2.342896

Note: Significant at * 5% and ** 10%, respectively.

Table B2: Exchange rate volatility in real exports equations: Developing countries sub-sample

[Pooled EGLS (cross-section weights) fixed-effects estimation]

	LDC – SUB-SAMPLE – USD			LDC – SUB-SAMPLE – PKR		
	Unit change	**Elasticity**	**Growth rate**	**Unit change**	**Elasticity**	**Growth rate**
REAL EXPORT FUNCTIONS	(1) Level	(2) Double log	(3) First difference	(4) Level	(5) Double log	(6) First difference
Rate of inflation	-0.03194 (-3.89)*	-0.010254 (-3.27)*		-0.032332 (-3.94)*	-0.00669 (-2.07)*	0.094601 (2.04)*
Nontradable commodity prices	-0.009083 (-2.84)*	-0.025432 (-4.33)*		-0.009171 (-2.87)*	-0.02136 (-3.76)*	0.244857 (3.46)*
Production index	0.008733 (3.56)*	0.136881 (14.66)*	0.22105 (22.03)*	0.008721 (3.55)*	0.11774 (13.78)*	0.22412 (22.12)*
Real foreign reserves	-6.57E-06 (-4.10)*	-0.004166 (-1.44)	-4.90E-06 (-3.27)*	-6.57E-06 (-4.10)*	-0.00702 (-2.57)*	-4.90E-06 (-3.27)*
Real interest rate	-0.001129 (-0.15)	-0.001754 (-1.83)**	0.004019 (0.45)	-0.000981 (-0.13)	-0.001351 (-1.41)	0.003962 (0.45)
Real capital flows	0.047874 (5.63)*	0.002659 (2.44)*	0.241026 (16.20)*	0.048119 (5.66)*	0.003095 (2.84)*	0.240633 (16.16)*
Real exchange rate	-1.34E-05 (-0.04)	-0.06461 (-4.93)*	-0.000526 (-0.52)	-0.014894 (-0.44)	-0.033189 (-2.01)*	-0.029644 (-0.46)
GARCH volatility	9.42E-07 (1.37)	0.001599 (0.30)	-9.02E-06 (-1.94)*	-0.002274 (-0.49)	-0.003001 (-0.67)	0.029511 (1.33)
EGARCH volatility	-8.40E-06 (-1.48)	0.008615 (2.17)*	-1.56E-05 (-2.58)*	-5.11E-07 (-0.68)	-0.000841 (-0.27)	1.57E-07 (0.33)
TGARCH volatility	4.08E-07 (1.13)	-0.008893 (-2.44)*	-2.33E-07 (-0.12)	0.002809 (0.12)	0.002284 (0.45)	-0.010532 (-0.47)
CGARCH volatility	4.28E-07 (0.38)	-0.005963 (-1.57)	3.96E-05 (2.07)*	-0.005263 (-0.27)	0.00153 (0.37)	-0.065795 (-1.37)
Power GARCH volatility	-6.35E-09 (-0.15)	0.013315 (2.67)*	-4.41E-06 (-0.74)	0.006108 (0.34)	0.00623 (1.20)	-0.002186 (-0.07)
Shares price index	0.0129 (6.90)*	0.039854 (7.90)*	0.016558 (1.56)	0.012979 (6.97)*	0.0366 (7.54)*	0.017835 (1.67)**
Common constant	2.160674 (5.63)*	0.218122 (5.78)*	0.610631 (9.45)*	2.216188 (5.46)*	0.080553 (2.37)*	0.601433 (9.26)*
1st lagged real exports	0.972748 (210.09)*	0.832916 (92.64)*	-0.301646 (-17.65)*	0.972815 (210.33)*	0.845077 (97.13)*	-0.301887 (-17.66)*
1st lag of inflation rate			0.107645 (2.32)*			
2nd lag of tradable commodity prices			0.230301 (3.29)*			
Adjusted R^2	0.985346	0.989761	0.285506	0.985334	0.989712	0.284935
DW statistics	2.712008	2.566917	2.140201	2.711772	2.587099	2.140844

Note: Significant at * 5% and ** 10%, respectively.

Table B3: Exchange rate volatility in real imports equations: Full sample

[Pooled EGLS (cross-section weights) fixed-effects estimation]

	FULL SAMPLE - USD		FULL SAMPLE - PKR	
REAL IMPORT FUNCTIONS	**(1) Double log**	**(2) First difference**	**(4) Double log**	**(5) First difference**
Rate of inflation	0.005565		0.009225	
	(3.07)*		(4.90)*	
Nontradable commodity prices	0.010833	0.608685	0.013983	0.454847
	(2.75)*	(3.98)*	(3.63)*	(2.90)*
Production index	0.19767	0.882021	0.150482	0.879239
	(31.92)*	(53.93)*	(26.95)*	(53.88)*
Real foreign reserves	-0.003457	-2.81E-06	-0.009054	-2.86E-06
	(-2.94)*	(-2.29)*	(-7.60)*	(-2.33)*
Real interest rate	-0.002308	0.005502	-0.002043	0.003737
	(-4.36)*	(0.61)	(-3.84)*	(0.41)
Real capital flows	0.007009	-0.419409	0.006231	-0.420927
	(11.94)*	(-37.84)*	(10.43)*	(-38.02)*
Real exchange rate	-0.164068	-0.003114	-0.06582	-0.234609
	(-19.49)*	(-1.82)**	(-9.63)*	(-2.40)*
GARCH volatility	-0.01071	2.19E-05	-0.004463	0.083016
	(-2.28)*	(2.91)*	(-2.26)*	(2.50)*
EGARCH volatility	0.011266	1.37E-05	0.004092	5.83E-07
	(2.88)*	(1.39)	(2.18)*	(0.96)
TGARCH volatility	-0.00525	-1.03E-05	0.001409	-0.083946
	(-1.62)**	(-3.24)*	(0.52)	(-2.51)*
CGARCH volatility	-0.002904	-9.01E-05	-0.006873	-0.138623
	(-1.00)	(-2.92)*	(-3.43)*	(-1.93)*
Power GARCH volatility	0.008457	3.30E-05	-0.001041	0.098035
	(1.80)**	(3.36)*	(-0.37)	(1.98)*
Shares price index	0.026323	0.060489	0.012248	0.005675
	(9.47)*	(3.56)*	(4.28)*	(3.25)*
Common constant	0.259832	0.497037	-0.095355	0.208188
	(10.26)*	(5.29)*	(-4.06)*	(1.55)
1st lagged real imports	0.783819	-0.22437	0.817296	-0.224069
	(141.30)*	(-24.66)*	(155.86)*	(-24.66)*
1st lag of inflation rate		0.101585		0.100752
		(1.60)**		(1.61)**
Weighted adjusted R^2	0.991765	0.388641	0.991577	0.388936
Weighted DW statistics	2.464956	2.314511	2.520785	2.311633

Note: Significant at * 5% and ** 10%, respectively.

Table B4: Exchange rate volatility in real imports equations: Developing countries sub-sample

[Pooled EGLS (cross-section weights) fixed-effects estimation]

	LDC – SUB-SAMPLE – USD			LDC – SUB-SAMPLE – PKR		
	(1)	(2)	(3)	(4)	(5)	(6)
REAL IMPORT FUNCTIONS	**Level**	**Double log**	**First difference**	**Level**	**Double log**	**First difference**
Rate of inflation	-0.034172			-0.034475	0.000397	
	(-3.27)*			(-3.30)*	(0.11)	
Nontradable commodity prices	-0.015058	-0.036173	0.044009	-0.015088	-0.03177	0.039217
	(-3.98)*	(-5.47)*	(0.63)	(-4.00)*	(-4.98)*	(0.56)
Production index	0.011494	0.152506	0.220168	0.011362	0.104788	0.222932
	(4.46)*	(14.31)*	(22.05)*	(4.42)*	(11.88)*	(22.12)*
Real foreign reserves	-1.30E-05		-3.33E-06	-1.30E-05	-0.005814	-3.32E-06
	(-6.67)*		(-2.19)*	(-6.68)*	(-1.89)**	(-2.18)*
Real interest rate	-0.025685	-0.002909	0.010577	-0.025654	-0.002501	0.010436
	(-2.59)*	(-2.74)*	(1.07)	(-2.59)*	(-2.34)*	(1.06)
Real capital flows	-0.112213	0.008712	-0.656933	-0.11193	0.009613	-0.657638
	(-10.03)*	(7.14)*	(-42.01)*	(-10.01)*	(7.93)*	(-41.96)*
Real exchange rate	-0.000172	-0.145409	-0.000586	-0.021821	-0.103391	-0.037981
	(-0.38)	(-9.11)*	(-0.59)	(-0.50)	(-5.51)*	(-0.59)
GARCH volatility	4.71E-07	-0.012183	-1.13E-05	-0.000853	-0.001041	0.036114
	(0.52)	(-1.94)*	(-2.52)*	(-0.14)	(-0.20)	(1.65)**
EGARCH volatility	-5.68E-06	0.009577	-2.03E-05	4.14E-09	0.002632	4.88E-08
	(-0.77)	(1.99)*	(-3.49)*	(0.00)	(0.78)	(0.10)
TGARCH volatility	5.07E-07	-0.006813	-6.28E-07	0.007931	-0.004163	-0.008925
	(1.07)	(-1.75)**	(-0.34)	(0.26)	(-0.73)	(-0.40)
CGARCH volatility	9.42E-08	-0.003543	4.98E-05	-0.014439	-0.00507	-0.082781
	(0.06)	(-0.83)	(2.71)*	(-0.56)	(-1.05)	(-1.75)**
Power GARCH volatility	-2.29E-08	0.017655	-4.67E-06	0.001655	0.010276	-0.010807
	(-0.41)	(3.23)*	(-0.81)	(0.07)	(1.71)**	(-0.33)
Shares price index	0.010454	0.054818	0.020111	0.010565	0.047867	0.021476
	(4.70)*	(9.54)*	(1.97)*	(4.78)*	(8.75)*	(2.09)*
Common constant	4.200393	0.443988	0.621099	4.243242	0.083307	0.618115
	(9.84)*	(10.12)*	(9.61)*	(9.23)*	(2.05)*	(9.50)*
1st lagged real imports	0.954429	0.786846	-0.211206	0.95451	0.822151	-0.210327
	(186.89)*	(79.01)*	(-14.98)	(187.01)*	(89.81)*	(-14.89)*
1st lag of inflation rate			0.120238			0.101268
			(2.52)*			(2.12)*
2nd lag of inflation rate		-0.005952				
		(-1.74)**				
1st lag of real foreign reserves		0.005779				
		(1.80)**				
Adjusted R^2	0.981326	0.984058	0.497562	0.981335	0.983773	0.495748
DW statistics	2.650187	2.575752	2.299241	2.650121	2.629967	2.301654

Note: Significant at * 5% and ** 10%, respectively.

Table C1: List of countries selected for analysis

Sub-groups	**Countries (~ trade share) a**	**Currency**	**Abbreviations**
A) Developed countries High-income OECD and *NON-OECD* (15/66)	Australia	Dollar	ASD
	Belgium	Frank	BGF
	Canada (1.3%)	Dollar	CAD
	France (2.5%)	Franc	FRF
	Germany (4.9%)	Deutschmark (Euro)	GDM
	Hong Kong, China (3.1%)	Dollar	HKD
	Italy (2.6%)	Lira (Euro)	ITL
	Japan (4.4%)	Yen	JPY
	Korea (2.5%)	Won	KRW
	Kuwait	Dollar	KWD
	Netherland (1.8%)	Guilder	NLG
	Singapore (3.6%)	Dollar	SGD
	Spain (1.3%)	Peseta	SPP
	UK (5.2%)	Pound (sterling)	UKP
	USA (14.4%)	Dollar	USD
B) Developing countries Middle-income countries (5/46)	Malaysia	Ringgit	MLR
	Mexico	Pound	MXP
	Russia	Ruble	RUR
	South Africa	Rand	SAR
	Turkey	Lira	TRL
Lower middle-income countries (7/55)	China	Yuan	CHY
	Egypt	Pound	EGP
	India	Rupee	INR
	Indonesia	Rupiah	ISR
	Pakistan	Rupee	PKR
	Sri Lanka	Rupee	SLR
	Thailand	Baht	THB
Low-income countries (2/43)	Bangladesh	Taka	BDT
	Kenya	Shilling	KNS

Notes: * Sample of countries selected on the basis of our prime focus on Asian and Middle Eastern developing countries. However, according to the classification of the World Bank in October 2009, each group is represented on the basis of "country groups by income." Major criteria for sample countries include the relatively significant trade magnitude, i.e., exports are either higher than or equal to at least $10 million per month on average or imports are more than $20 million per month on average or both with Pakistan.

~ Values in braces show the share of major trading partners of Pakistan. Total is 47.6% (for 12 major trade partners). These are included to analyze in the context of trade and capital flows.

Some countries are excluded or partially analyzed due to short/nonavailability of relevant (frequency) data: Afghanistan, Iran, Oman, Qatar, Saudi Arabia and UAE.

a See Table 1, p. 3, in Z. Aftab & S. Khan. (2008). *Bilateral J-curves between Pakistan and her trading partners* (PIDE Working Paper No. 45).

Figure C1: Volatility and trade time-series in short run for Pakistan

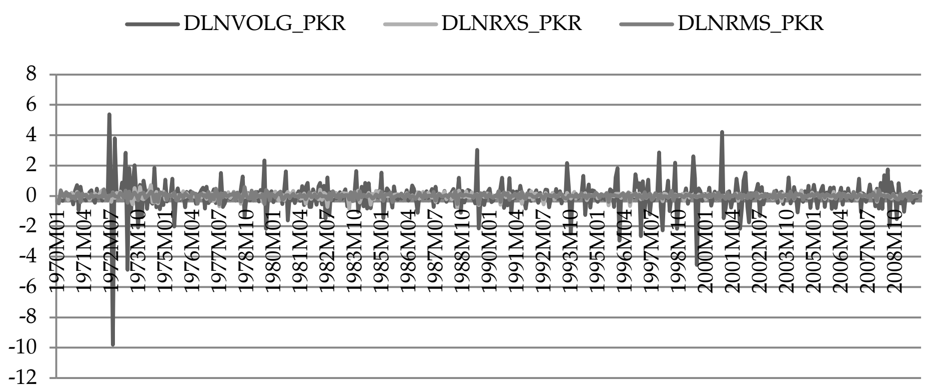
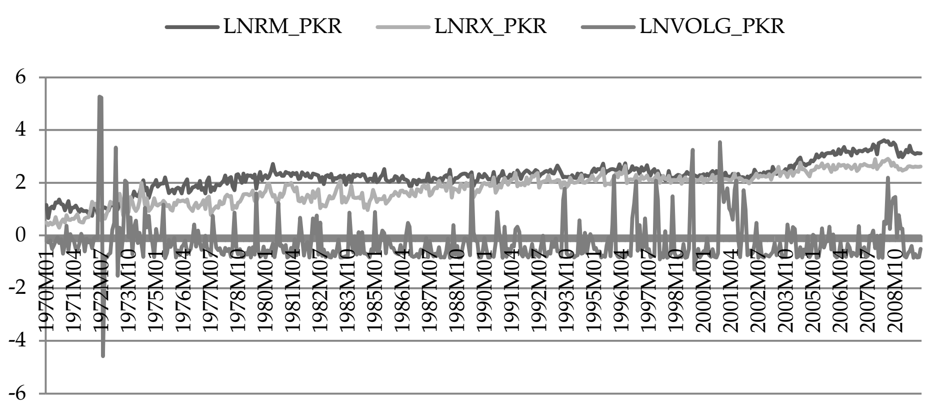


Figure C2: Volatility and trade time-series in long run for Pakistan



The Lahore Journal of Economics
19 : 1 (Summer 2014): pp. 67–89

The Effect of Trade Liberalization on Firm Entry and Exit in Punjab, Pakistan

Marjan Nasir*

Abstract

This study focuses on the impact of trade liberalization on firm entry and exit in Punjab's export manufacturing sector over the decade 2001–10. As far as the province's export industries are concerned, real exchange rate depreciation attracts new firms but also leads weaker firms to exit. A reduction in local or international tariffs, however, has no significant impact on firm entry or exit.

Keywords: trade liberalization, exchange rates, firm entry, Pakistan.

JEL classification: F41.

1. Introduction

The industrial organization literature has traditionally emphasized the role of new firms as stimulators of economic development. The entry of new firms is associated with employment changes, product and technological innovation, and other structural changes in that particular industry (Roberts & Thompson, 2003). Furthermore, as incumbent firms face growing competition from the new arrivals, their productivity is expected to improve.

Researchers have examined the relationship between trade liberalization and firm turnover to determine the extent to which international markets and policies influence regional industries and their development. Exchange rate depreciation and tariff reductions can lead to the expansion of exports as the output of existing firms increases or new firms enter the industry (Bernard and Jensen, 2004; Gu, Sawchuk, and Whewell, 2003). Domestic firms can face increased competition from abroad when domestic tariff rates fall or the domestic currency appreciates (Baggs, Beaulieu, & Fung, 2009; Fung, 2008; Head and Ries, 1999; Klein, Schuh, and Triest, 2000). The primary aim of this study is to analyze the impact of exchange rate depreciation and tariff reductions on the output resulting from the entry of new firms. However, it is pertinent to note that

* Teaching fellow, Lahore School of Economics, Lahore, Pakistan.

entry into the exports sector requires that firms are at least as productive as the incumbent firms in order to survive both local and foreign competition, which could otherwise lead them to exit if they do not deliver efficiently.

Over the last decade, Pakistan has experienced currency depreciations against the US dollar and the euro, together with an increase in export volume. In 2010, nearly 22 percent and 17 percent of its exports went to the European Union (EU) and the US, respectively; 48 other countries, each receiving a minimal share, accounted for the remaining volume. Accordingly, we look only at those sectors that export to the US and EU, while the depreciating rupee provides an opportunity to study its effects on firm turnover on the export industries in Punjab.

At the same time, the tariff rates of member countries of the World Trade Organization (WTO) have decreased since 2000, in an effort to boost world exports. Pakistan has also experienced this decline together with an increase in exports to the US and EU.

This study looks at the impact of spatial and industrial concentration, currency depreciation, and tariff reductions on the entry and exit rates of manufacturing firms in Punjab. Section 2 provides a literature review, Section 3 gives a theoretical background, and Section 4 describes the data used and descriptive statistics. Section 5 estimates the study's econometric model Section 6 analyzes firm entry, exit and trade liberalization in the context of the results while Section 7 concludes the study.

2. Literature Review

The literature on firm entry differentiates between new entrants—also referred to as greenfield firms—and existing or diversifying firms that have set up plants in different geographical areas and/or expanded their range of products. The importance of studying entry rates is associated positively with regional development. Whether the benefits are direct (in the form of job creation) or indirect (such as improvements in supply conditions), new establishments are known to stimulate economic development. They add to the resource flows of an industry (Roberts & Thompson, 2003), thus enhancing its productivity and contributing to product and technological innovation. According to Hopenhayn (1992), firms in the manufacturing sector tend to be replaced by new entrants over five-year periods, with a similar trend in job turnover. However, Fritsch and Mueller (2004) suggest that these benefits can take as long as eight years to occur.

Earlier studies have looked at the impact of macroeconomic shocks such as large exchange rate movements, changes in export and import duties, or international trade treaties that ease trade between the signatories. The empirical evidence shows that trade liberalization can affect the growth of exports by changing the entry, exit, and production decisions of heterogeneous firms that are major contributors to the economy's export sector. Trade liberalization in this context implies the depreciation or devaluation of the home currency, making home products relatively cheaper in the international market. However, it can also imply a reduction in tariffs by importing countries, which, again, influences the price of the final product sold to trading partners.

A currency appreciation is found to reduce sales and thus affect the survival of existing firms that might otherwise deter the entry of new firms (Baggs, Beaulieu, & Fung, 2009). However, the impact on firm survival is smaller for more productive firms, either because their technology is superior or their labor force more efficient. Domestic currency appreciation gives foreign firms a cost advantage and forces domestic firms or exporters to reduce their prices as a result of the rise in competition. This fall in price makes it difficult for some firms to maintain their mark-up and, as a result, compels them to exit the industry. On the other hand, currency depreciation tends to increase the number of establishments as well as the scale of production of existing firms (Head & Ries, 1999).

Klein, Schuh, and Triest (2000) have put forward similar findings on the significant role played by currency appreciation on job destruction. They show that job flows respond asymmetrically to changes in the real exchange rate, i.e., while job destruction is affected by the exchange rate, job creation is not. Moreover, how sensitive job destruction is to exchange rate fluctuations depends on the extent of the industry's exposure to trade. A contributing factor to this analysis is that workers can be laid off immediately once a firm finds it optimal to do so, while hiring new labor often requires screening and training. As a result of these delays, it may be difficult to identify the response of job creation to exchange rate changes, even if the response does exist.

Changes in the exchange rate influence an economy by affecting its exports and imports. Dominguez and Tesar (2006) find that these changes are also correlated with firm and industry characteristics such as firm size, multinational status, international sales, international assets, and competitiveness. A favorable exchange rate movement may result in a boom in the exports market either through an expansion in the output of existing producers or through the entry of new firms or both, depending on the barriers to entry that exist for that industry.

Bernard and Wagner (2001) assess firms' decision whether to enter the exports market and conclude that entry entails considerable sunk costs. Firm entry into the exports sector depends on firm size and productivity, which ultimately determines their level of success. Bernard and Jenson (2004) present a similar analysis for the US exports boom from 1987 to 1992. They argue that entry for firms in the exports sector is costly, even if there are favorable shocks in the international market. Using plant-level data, they find that a depreciating exchange rate and rising foreign income increases exports, while the existence of sunk costs increases the contribution of existing—as opposed to new—exporters.

So while exchange rate movements appear to have significant impacts, the evidence for tariff reductions, however, is weak. Head and Ries (1999) find that a decrease in home tariffs increases plant closure and reduces the scale of production of existing plants in the home country. However, a reduction in foreign tariffs increases the scale of production but does not induce the entry of new firms. After adding controls for exchange rate changes and fixed costs in terms of research and development, the authors find no significant change in the tariff coefficient.

Gu, Sawchuk, and Whewell (2003) use a panel dataset comprising 81 manufacturing firms over 14 years to determine the productivity (in the shape of firm size and turnover) caused by a reduction in tariffs under the free trade agreement between the US and Canada. The results suggest that less productive firms will exit after tariffs are reduced, while tariff reductions have no significant impact on the scale of production of existing firms.

In comparison to changes in tariffs, large fluctuations in exchange rates are considered to have greater consequences for firm performance and turnover. Fung (2008) uses data on a Taiwanese firm to study the impact of large fluctuations in the exchange rate on firm performance and turnover. By including an exchange rate variable in the firm's profit function, the study analyzes the impact of an appreciation of the New Taiwan dollar on the scale of production of existing firms and the exit rate in the industry. Intuitively, firm exit will rise as a result of currency appreciation because the costs of domestic firms will increase, forcing less productive firms to shut down. The results indicate that the relationship between currency appreciation and firm scale and productivity depends significantly on the magnitude and direction of changes in output and exports.

Given the temporary nature of changes in the exchange rate, however, firms are unlikely to change their production activities at all. Baggs et al. (2009) conducted a firm-level analysis of Canadian manufacturing firms for the period 1986 to 1997, incorporating exchange rate data with respect to the US dollar. This timeframe was divided naturally such that, during the first six years, the Canadian dollar appreciated by about 30 percent, after which it depreciated by 30 percent during the next six years. The model regressed three variables, i.e., firm survival, entry, and sales, individually on the trade-weighted exchange rate, the tariff rates of the two countries, and various control factors. The results suggested that the exchange rate had a stronger impact on firm survival, entry, and sales than tariff rates.

3. Theoretical Background

The study's theoretical background is based on Krugman's (1979) model, which looks at the effects of trade liberalization on the scale of production and the productivity of firms. Subsequently, Melitz (2003), Fung (2008), and Baggs et al. (2009) have extended this model in their analyses, particularly with the inclusion of an exchange rate variable to incorporate the effects of international trade on domestic industries.

These models assume that labor is the only factor of production and that a domestic currency appreciation gives foreign firms a cost advantage (in terms of the domestic currency). This increases the competition faced by domestic firms in the local and international markets, forcing them to decrease their own prices. The increase in competition and fall in prices charged will lead some firms to exit the industry. Accordingly, currency depreciation has the opposite effect and gives new firms an incentive to enter the industry.

A brief overview of the mathematical specification of the model adopted by Fung (2006) starts with the expenditure function below:

$$ln\,E(p,u) = ln\,u + \sum_{i=1}^{\tilde{n}} \alpha_i lnP_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} lnP_i lnP_j \quad \text{with } \gamma_{ij=}\gamma_{ji}, \tag{1}$$

where ñ represents the sum of local and foreign varieties and P is the price charged by firm i. The demand function derived is represented by $C_i = s_i E/P_i$ where E is total expenditure and s_i is the share of expenditure of firm i denoted by:

$$s_i = \frac{P_i C_i}{E} = \frac{\partial lnE(P,u)}{\partial lnP_i} = \alpha_i + \sum_j \gamma_{ij} lnP_j \tag{2}$$

The use of a symmetric expenditure function in translog form to derive the demand curve leads to varying mark-ups and scales of production for the sample firms. This is different from Krugman's (1979) initial model where the assumption of a constant elasticity of scale meant that the elasticity and scale of production were held constant, i.e., unaffected by exogenous shocks.

We also assume that the expenditure function is homogenous of degree one, thus $\sum_i \alpha_i = 1$ and $\sum \gamma_{ij} = \sum \gamma_{ji} = 0$ and that the price elasticity of demand, which is positive, is represented by:

$$\varepsilon_i = 1 - \frac{\partial ln\, s_i}{\partial ln P_i} = 1 - \frac{\gamma_{ii}}{s_i} \tag{3}$$

where $\gamma_{ii} < 0$ for demand to be elastic. The assumption of symmetry is imposed on foreign (*f*) and domestic (*d*) goods indicated by: $P_{id} = P_d$, $C_{id} = C_d$ and $P_{if} = P_f$, $C_{if} = C_f$. Given this assumption, the following restrictions are applied:

$$\alpha_i = \frac{1}{\tilde{n}}, \gamma_{ii} = -\frac{\gamma}{\tilde{n}}, and\ \gamma_{ij} = \frac{\gamma}{\tilde{n}(\tilde{n}-1)} \quad \text{for } j \neq i, \quad \text{where } \gamma > 0 \tag{4}$$

Therefore, the demand elasticities (ε_i) are:

$$\varepsilon_d = 1 + \frac{\gamma}{\tilde{n} s_d} = 1 + \gamma \left[1 - \frac{n_f \gamma}{(\tilde{n} - 1)} \left(ln\, P_d - ln P_f\right)\right]^{-1}$$

$$\varepsilon_f = 1 + \frac{\gamma}{\tilde{n} s_f} = 1 + \gamma \left[1 - \frac{n_d \gamma}{(\tilde{n}-1)} \left(ln\, P_d - ln P_f\right)\right]^{-1} \tag{5}$$

Interpreting equation (5) above is necessary as it shows the relationship between the elasticity and price of one good relative to competing goods. The equation indicates a positive relationship, implying that an increase in the price of an imported or foreign good (*f*) will reduce the competition faced by domestic firms, resulting in a lower elasticity of demand for local firms (ε_d) and a higher elasticity for foreign firms (ε_f). This will eventually increase domestic firms' mark-up over cost, and attract other firms to enter the profit-making industry.

On the supply side, given that *n* is the number of firms producing in a monopolistically competitive industry, the total production of firm *i* is $(X_i + X_i^*)$ i.e., the sum of domestic sales and exports. The cost of the only input, labor, is $l_i = \alpha + \alpha_x + \beta(X_i + X_i^*)$, where α is the fixed cost, α_i is the fixed cost of exports, and β is the marginal cost. Given this cost information, the profit function of the exporting firm is:

$$\pi_i(X_i, X_i^*) = P_i X_i + eP_i^* X_i^* - w[\alpha + \alpha_x + \beta(X_i + X_i^*)] \quad (6)$$

where e is the exchange rate (the amount of domestic currency per unit of foreign currency), w is the wage level, and P_i^* is the price in foreign currency of firm i's exports.

In this partial equilibrium model, n_d, the number of domestic firms, is endogenous, keeping all other factors constant. The equilibrium quantity of domestic sales and exports is:

$$X_i = X_d = C_d = s_d \frac{wL}{P_d} = \frac{\gamma L}{\tilde{n}\varepsilon_d \beta} \quad (7)$$

$$X_i^* = X_d^* = C_d^* = s_d^* \frac{W^* L^*}{P_d^*} = \frac{\gamma^* w^* L^* e}{\tilde{n}\varepsilon_d^* \beta w} \quad (8)$$

where L and L^* are units of domestic and foreign labor, respectively, with the additional assumptions that $wL = E$ and $w^*L^* = E^*$. Given the above model and related assumptions, we can conclude that, in the case of currency depreciation (increase in e), domestic firms will have a cost advantage over foreign firms. This will, in turn, increase the number of domestic firms (n_d) as well as total firms ($\tilde{n}$) in the industry. Equation (8) shows that a rise in e leads to an expansion in exports, i.e., an increase in X^*.

$$\tilde{n} = \frac{\gamma^* e P_d^*}{\varepsilon_d^* \beta w s_d^*} \quad (9)$$

Equation (9) solves for the number of firms $\tilde{n}$, which establishes that a rise in e (depreciation) results in an increase in the total number of firms in the industry.

4. Data and Descriptive Statistics

We have used data from the Directory of Industries (compiled by the Punjab government) for 2002, 2006, and 2010. On average, the directory includes approximately 18,000 manufacturing firms. It also provides the names and addresses of all firms across nearly 180 industries in Punjab. Other information includes the year of establishment, the total number of employees, and each firm's initial investment. Table A1 in the Appendix gives the total number of firms in each industry for 2002 and 2006. In almost every industry, the number of firms has either increased or decreased, indicating the variability of firm turnover across sectors.

The employment information provided by the directory is used to calculate the agglomeration index and determine firm size, while initial investment is used as a control factor to proxy for sunk costs.

4.1. Descriptive Statistics

Table 1 gives industry and firm descriptive statistics. In 2006, there were 180 industries comprising 18,007 firms operating in Punjab. From 2002 to 2006, the mean firm entry rate was 10 percent while the exit rate was 25 percent. Output growth was high over the five-year period with firms undertaking an initial investment of approximately PRs 40 million on average (with a median value of USD 2,648,000).

Table 1: Descriptive statistics, 2006 (all industries)

Number of industries	180
Number of firms	18,007
Mean firm age	17
Mean number of employees	48
Mean industry entry rate	0.10
Mean industry exit rate	0.25
Mean industry E-G index (2002)	0.1554
Mean industry output growth (%)	86
Mean initial investment (PRs '000)	40,892

Source: Government of Punjab, Directory of Industries.

For the trade liberalization analysis, we have used annual exchange rate data from the Federal Bureau of Statistics and data on tariff rates from the WTO. The latter provides tariff averages for its member countries across a large range of goods for multiple years. These were used to calculate tariff changes in order to assess their impact on the entry and exit rates of new firms. The exchange rate data was used to construct a trade-weighted real exchange rate. Our analysis includes 25 industries in Punjab exporting to the US and EU.

Table 2 presents descriptive statistics for the industries exporting to the US and EU. Their average entry and exit rates are higher in the first five-year period than the second five-year period. In the latter half of the decade, industrial concentration fell, indicating that export firms faced higher competition from incumbent firms. Tariffs fell between 2001 and 2005, but from 2006 to 2010 the average rate increased for industries exporting to the EU. The trade-weighted real exchange rate appreciated slightly from 2006 to 2010.

Table 2: Descriptive statistics for export industries

	2001–05	**2006–10**
Number of export industries	25	25
Number of firms	11,620	7,600
Mean firm age	18	21
Mean number of employees	67	69
Mean industry entry rate	0.105	0.029
Mean industry exit rate	0.41	0.1
Mean industry concentration (Herfindahl index)	0.1365	0.0628
Mean industry output growth (%)	25	46
Mean initial investment (PRs '000)	137,403	150,415
Mean tariff change (Pakistan)	-7.187	0.164
Mean tariff change (EU)	-0.328	0.007
Mean tariff change (US)	-0.596	-0.131
Mean trade-weighted real exchange rate	0.012	0.0153

Source: Government of Punjab, Directory of Industries.

Table 3 lists the top 20 industries in Punjab in descending order of entry, while Table 4 lists the top 20 industries in descending order of exit. Table 5 shows industry concentration as measured by the E-G index of agglomeration.

Table 3: Top 20 industries in Punjab with highest entry rates, 2006

No.	Industry	Entry rate*
1	Gypsum	0.93
2	Mineral water	0.55
3	Firefighting equipment	0.50
4	Motorcycles/rickshaws	0.50
5	Radios/TVs	0.50
6	Welding electrodes	0.50
7	Zips	0.50
8	Knitted textiles	0.45
9	Embroidery	0.43
10	Cones	0.43
11	Yarn doubling	0.41
12	Powder coating	0.33
13	Pesticides and insecticides	0.32
14	Citrus grading	0.29
15	Fruit juices	0.29
16	Readymade garments	0.28
17	Gas appliances	0.28
18	Textile made-ups	0.28
19	Ceramics	0.28
20	Fertilizer	0.27

* Note: Entry rate in industry *i* = number of new firms in industry *i* in 2006 that did not exist in 2002, divided by the total number of firms in industry *i* in 2006.
Source: Government of Punjab, Directory of Industries.

Table 4: Top 20 industries in Punjab with highest exit rates, 2006

No.	Industry	Exit rate*
1	Bus bodies	0.99
2	Nuts and bolts	0.97
3	Spices	0.95
4	Electroplating	0.89
5	Electric furnaces	0.88
6	Bakery products	0.85
7	Photographic goods	0.83
8	Razors/safety razors/blades	0.83
9	Dyes and blocks	0.80
10	Knitted textiles	0.79
11	Ice cream	0.79
12	Zinc sulfate	0.75
13	Bicycles	0.75
14	Hand-powered tools	0.67
15	Bulbs and tubes	0.67
16	Refineries	0.67
17	*Unani* medicines	0.67
18	Weights and scales	0.66
19	Agricultural implements	0.64
20	Pins/clips	0.60

* Note: Exit rate in industry *i* = number of firms in industry *i* in 2002 that did not exist in 2006, divided by the total number of firms in industry *i* in 2002.
Source: Government of Punjab, Directory of Industries.

Table 5: Top 20 most agglomerated industries in Punjab, 2006

No.	Industry	E-G index*
1	Electroplating	1.5948
2	Citrus grading	1.1967
3	Wool scouring	1.1652
4	Powder coating	1.1072
5	Musical instruments	1.0586
6	Weights and scales	1.0529
7	Sports goods	1.0333
8	Leather garments	0.9820
9	Surgical instruments	0.9380
10	Utensils (all sorts)	0.9254
11	Belts	0.9214
12	Canvas shoes	0.8583
13	Raising cloth	0.8529
14	Cutlery	0.8209
15	Fiber tops	0.8169
16	Polyester yarn	0.8091
17	Crown corks	0.7284
18	Fiberglass	0.7151
19	Sanitary fittings	0.7131
20	Machine tools	0.7128

* Note: E-G index in 2002 measured using employment data.
Source: Government of Punjab, Directory of Industries.

5. Econometric Model and Estimation Technique

We have designed two separate models to determine the impact of agglomeration and trade liberalization on firm entry and exit, controlling for industry-level factors. Table 6 defines all the variables used.

Table 6: Variable names and definitions

Explanatory variable	Definition
E-G index	Constructed using firm employment; consists of the Gini coefficient and Herfindahl index.
ER	Trade-weighted real exchange rate with respect to the USD and EUR (increase = appreciation of PRe)
$\Delta tariff^{PK}$	Change in tariff rates in Pakistan from 2001 to 2010
$\Delta tariff^{US}$	Change in tariff rates in the US from 2001 to 2010
$\Delta tariff^{EU}$	Change in tariff rates in the EU from 2001 to 2010
Average firm age	Average age of a firm in an industry (since establishment)
Average firm size	Average size of a firm in an industry as measured by its number of employees
Output growth	Change in output during the time period
Sunk cost	Average initial investment of firms in an industry
Industry concentration	Herfindahl index measured using employment data

The model for trade liberalization draws on Baggs et al. (2009), where the entry and exit of firms is regressed on the real exchange rates of Pakistan's two major trading partners, the US and the EU, together with the tariff rates of the three regions under analysis. The model specification is given below:

$$Entry_{it} = E_{it} = \frac{N_{it}}{I_{it}} = \beta_0 + \beta_1 ER_{it} + \beta_2 \Delta tariff_{it}^{PK} + \beta_3 \Delta tariff_{it}^{US} + \beta_4 \Delta tariff_{it}^{EU} + \beta_5 X_{it} + \tau_t + I_i + \varepsilon_{it} \quad (10)$$

where E_{it} is the number of new firms in industry i in year t (N_{it}) divided by the total number of firms in industry i in year t (I_{it}). ER_{it} is the industry-specific trade-weighted real exchange rate. $\Delta tariff_{it}$ is the change in Pakistan, US, and EU tariff rates at the industry level. X is a vector of control factors (firm age, firm size, sunk costs, output growth, and concentration index). τ_t represents time fixed effects and I_i industry fixed effects.

The variable measuring entry is measured for 25 export industries and two periods, i.e., t = 1 (2002 to 2005) and t = 2 (2006 to 2010). The year of establishment is used to indicate that a firm is a new entrant. Thus, the entry rate of industry i in year t is the number of entrants in t as a fraction of the total number of firms in that industry for that period.

$$Exit_{it} = Z_{it} = \frac{M_{it}}{F_{it}} = \beta_0 + \beta_1 ER_{it} + \beta_2 \Delta tariff_{it}^{PK} + \beta_3 \Delta tariff_{it}^{US} + \beta_4 \Delta tariff_{it}^{EU} + \beta_5 X_{it} + \tau_t + I_i + \varepsilon_{it} \quad (11)$$

Z_{it} is the exit rate in industry i and equals the number of firms in industry i in year t that did not exist in $t + 1$ (M_i) divided by the total number of firms in industry i in year t (F_i). ER_{it} is the industry-specific trade-weighted real exchange rate. $\Delta tariff_{it}$ is the change in Pakistan, US, and EU tariff rates at the industry level. X is a vector of control factors (firm age, firm size, sunk costs, output growth, and concentration index). τ represents time fixed effects and I_i are industry fixed effects.

The exit variable is also measured for two periods, i.e., $t = 1$ and $t = 2$. The number of firms that were present in year t but not in $t + 1$ as a fraction of the total number of firms in industry i in year t gives us the exit rate. The trade-weighted real exchange rate variable (see Baggs et al., 2009, appendix) (ER) is constructed using the equation

$$ExchangeRate_{it} = ER_{it} = \sum_{j \in top2} TW_{ij} rer_{jt} \quad (12)$$

where i represents industry, j represents the top two trading partners of the industry (the US and EU in the case of Pakistan), and t represents the time period. TW_{ij} or the trade weight is estimated by taking the share of the industry's exports and imports with its trading partners as a proportion of the total exports and imports of all the manufacturing industries exposed to trade with the top two trading countries. The equation for the trade weight is shown below:

$$TW_{ij} = \frac{(X+M)_{ij}}{\sum_{j \in top\,2_i} \sum (X+M)_{ij}} \quad (13)$$

where $(X + M)$ is the sum of exports and imports for the two periods. The term rer_{jt} refers to the real exchange rate in terms of the two trading countries, which is normalized for each country using 2000 as the base year.[1]

The WTO tariff rates for 2002 and 2010 for the 25 export industries in our analysis are used to construct the variable $\Delta tariff_{it}$, which can be expressed as follows:

[1] This is done to avoid the unit problem, which occurs when bilateral exchange rates have different units.

$$\Delta tariff_{i1} = tariff_{i2006} - tariff_{i2002} \text{ for } t = 1 \tag{14}$$

$$\Delta tariff_{i2} = tariff_{i2010} - tariff_{i2006} \text{ for } t = 2 \tag{15}$$

where $tariff_i$ is the simple average rate for the different product categories provided by the WTO. It is also necessary to control for other factors that affect the entry and exit of firms in order to minimize omitted variable bias. Initial investment is used as a proxy for sunk costs. Other control variables include industry concentration (Herfindahl index), average firm size, age, and output growth in the industry.

We use ordinary least squares to estimate the models while accounting for time and industry fixed effects. Time fixed effects are observed to account for time-variant factors such as government policies. Similarly, industry fixed effects take into account the individual differences between industries, e.g., the nature of the product being produced.

6. Analysis of Estimates

The results of the regression analysis indicate that an appreciation of the trade-weighted real exchange rate lowers the rate of exit of existing firms and the rate of entry of new firms, while depreciation increases the rate of entry as well as rate of exit (see Table 7). Movements in the exchange rate force firms to adjust to new competitive conditions, affecting their entry and exit positions. Currency depreciation makes exports cheaper than imports, thus boosting the sales of export firms. Since these industries enjoy higher rents, they become attractive to potential exporters. The entry of new firms starts to take place, raising the level of competition. This, in turn, causes weaker firms to exit the industry.

Table 7: Entry and exit/trade liberalization regression results

	Entry		Exit	
	(1)	**(2)**	**(3)**	**(4)**
ER	-8.335**	-7.700	-31.568**	-61.991**
(Increase = appreciation of PRe)	(3.418)	(7.047)	(12.568)	(27.692)
Tariff PK	-0.0001	0.001	-0.011	-0.015
	(0.002)	(0.003)	(0.022)	(0.027)
Tariff EU	-0.011	-0.033	0.194	0.283*
	(0.014)	(0.020)	(0.123)	(0.145)
Tariff US	-0.001	-0.001	0.004	0.018
	(0.001)	(0.002)	(0.006)	(0.012)
Concentration index	-0.067***	-0.013	0.202	0.261
	(0.023)	(0.063)	(0.246)	(0.430)
Output growth	0.008	-0.013	0.086**	0.142*
	(0.014)	(0.030)	(0.040)	(0.074)
Firm age	-0.003	-0.004	-0.004	0.002
	(0.002)	(0.005)	(0.006)	(0.014)
Firm size (small; dummy = 1 if < 49 employees)	-0.060	-0.176***	0.209	0.655***
	(0.044)	(0.032)	(0.161)	(0.192)
Firm size (medium; dummy = 1 if ≥ 49 and < 100 employees)	-0.010	-0.167***	0.227*	0.575***
	(0.045)	(0.037)	(0.130)	(0.177)
Firm size (large; dummy = 1 if ≥ 100 employees)	-	-	-	-
High cost	-0.019	-0.157***	0.025	-0.455**
(Dummy = 1 if sunk cost > PRs 50 mn)	(0.031)	(0.052)	(0.130)	(0.214)
Cons.	0.269***	0.456*	0.513***	0.583*
Time and industry fixed effects	NO	YES	NO	YES
	N = 48	N = 48	N = 48	N = 48
	R2 = 0.38	R2 = 0.15	R2 = 0.12	R2 = 0.05

Note: *** = statistical significance at 1 percent level, ** = statistical significance at 5 percent level, and * = statistical significance at 10 percent level. Robust standard errors are given in parentheses.
Source: Author's calculations.

In terms of magnitude, the results show that an appreciation or depreciation of the trade-weighted real exchange rate seems to affect firm exit more than firm entry. The extent to which each industry is influenced by exchange rate fluctuations depends on its exposure to the export market. Greater exposure puts the firms in that industry at a higher risk of mortality, specifically if they do not have a competitive edge over foreign firms. Baggs et al. (2009), Fung (2008), and Head and Ries (1999) establish similar results for the US, Canada, and Taiwan: currency depreciation attracts entry or increases the scale of production, while the appreciation of the home currency deters the entry of new firms.

Gu et al. (2003) and Head and Ries (1999) show that a reduction in foreign rates in bilateral trade increases the rate of exit but has no significant impact on firms' entry or scale of production. On the other hand, a reduction in domestic rates leads to an increase in plant closure and a fall in the scale of production of existing plants in the home country. For Punjab's export industries—apart from the EU tariff variable, which only affects exit at a low significance level—neither of the other two tariff variables seem to have any significant impact on either entry or exit. This could be attributed to the low variation in the tariff rates, with small reductions observed from 2002 to 2006 and even smaller increases from 2006 to 2010.

The coefficient of industrial concentration (Herfindahl index) is negative and significant in our estimation for firm entry without fixed effects in place, indicating that new firms will avoid industries where the market share is concentrated in the hands of a few firms. However, the variable becomes insignificant once fixed effects are incorporated. Also, it has no significant impact on firm exit.

Industrial output growth varies positively with exit rates, again reinforcing the notion that competitive conditions influence firm turnover, specifically causing weaker firms to exit. Additionally, firm entry is lower and firm exit is higher in industries that comprise more small or medium firms, holding other factors constant. This depends on the competitiveness of the firms in that industry. Finally, firms avoid industries that require large sunk or irrecoverable costs; exit rates are also observed to be lower in such industries. Sunk costs are considered a barrier to entry and exit as new firms find it more difficult to raise large amounts. Existing firms that have already undertaken such high initial investment continue operating till they are at least able to cover these costs.

An important conclusion to draw from this analysis is that firm entry (E_{it}) and exit (Z_{it}) are positively affected by a depreciating real exchange rate (ER_{it}), while the tariff reduction and firm turnover relationship remains inconclusive.

7. Conclusion

This study has shown that a real exchange rate appreciation or depreciation is more likely to influence firm entry and exit than large tariff changes. Whether these changes in tariff rates take place in the domestic market or foreign market, they seem to have very little impact on firm turnover. Firm entry is lower and firm exit higher in industries comprising more smaller or medium firms, suggesting that they are more competitive and may pose a threat to new as well as existing firms. Finally, the results highlight the significant role of high initial investment in deterring firm entry and exit.

References

Baggs, J., Beaulieu, E., & Fung, L. (2009). Firm survival, performance, and the exchange rate. *Canadian Journal of Economics*, *42*(2), 393–421.

Bernard, A. B., & Jenson, J. B. (2004). Entry, expansion, and intensity in the US export boom, 1987–1992. *Review of International Economics*, *12*(4), 662–675.

Bernard, A. B., & Wagner, J. (2001). Export entry and exit by German firms. *Review of World Economics* (*Weltwirtschaftliches Archiv*), *137*(1), 105–123.

Carlton, D. W. (1983). The location and employment choices of new firms: An econometric model with discrete and continuous endogenous variables. *Review of Economics and Statistics*, *65*(3), 440–449.

Caves, R. E. (1998). Industrial organization and new findings on the turnover and mobility of firms. *Journal of Economic Literature*, *36*(4), 1947–1982.

Dominguez, K. M. E., & Tesar, L. L. (2006). Exchange rate exposure. *Journal of International Economics*, *68*(1), 188–218.

Fajnzylber, P., Maloney, W. F., & Ribeiro, E. (2001). *Firm entry and exit, labor demand, and trade reform: Evidence from Chile and Colombia* (Policy Research Working Paper No. 2659). Washington, DC: World Bank.

Fritsch, M., & Mueller, P. (2004). The effects of new business formation on regional development over time. *Regional Studies*, *38*(8), 961–976.

Fung, L. (2008). Large real exchange rate movements, firm dynamics, and productivity growth. *Canadian Journal of Economics*, *41*(2), 391–424.

Geroski, P. A. (1995). What do we know about entry? *International Journal of Industrial Organization*, *13*(4), 421–440.

Gu, W., Sawchuk, G., & Whewell, L. (2003). The effect of tariff reductions on firm size and firm turnover in Canadian manufacturing. *Review of World Economics* (*Weltwirtschaftliches Archiv*), *139*(3), 440–459.

Head, K., & Ries, J. (1999). Rationalization effects of tariff reductions. *Journal of International Economics*, *47*(2), 295–320.

Hopenhayn, H. A. (1992). Entry, exit, and firm dynamics in long-run equilibrium. *Econometrica*, *60*(5), 1127–1150.

Klein, M. W., Schuh, S., & Triest, R. K. (2000). *Job creation, job destruction and the real exchange rate* (Working Paper No. 7466). Cambridge, MA: National Bureau of Economic Research.

Krugman, P. R. (1979). Increasing returns, monopolistic competition, and international trade. *Journal of International Economics*, *9*(4), 469–479.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695–1725.

Roberts, B. M., & Thompson, S. (2003). Entry and exit in a transition economy: The case of Poland. *Review of Industrial Organization*, *22*(3), 225–243.

Soubeyran, A., & Thisse, J. F. (1998). Learning-by-doing and the development of industrial districts. *Journal of Urban Economics*, *45*(1), 156–176.

Appendix

Table A1: Number of firms in Punjab's manufacturing sector, 2002 and 2006

	Industry	2002	2006		Industry	2002	2006
1	Air conditioners/ refrigerators/ deep-freezers	10	15	91	Liquified petroleum gas (LPG)	0	6
2	Agricultural implements	751	419	92	Lubricants	21	10
3	Aluminum products	16	35	93	Machine tools	65	62
4	Arms and ammunition	12	9	94	Marble	222	6
5	Automobile parts	287	278	95	Matches	2	2
6	Bakery products	164	35	96	Melamine (plastic) utensils	76	65
7	Baby bicycles	5	3	97	Mineral water	0	11
8	Batteries	3	5	98	Motorcars	1	1
9	Belts	8	7	99	Motorcycles/ rickshaws	2	23
10	Beverages	20	22	100	Motors/pumps	193	170
11	Bicycles	102	40	101	Musical instruments	9	11
12	Biscuits	29	32	102	Nuts and bolts	216	112
13	Boilers	2	4	103	Oil stoves	2	1
14	Bulbs and tubes	3	3	104	Packages	93	187
15	Canvas shoes	1	1	105	Paints and varnishes	61	61
16	Carpets	67	50	106	Paper and paper board	83	110
17	Caustic soda	3	1	107	Paper cones	3	22
18	Cement	212	43	108	Parachute bags	1	1
19	Ceramics	23	111	109	Pencils/ ballpoint pens	4	6
20	Chalk	1	1	110	Pesticides and insecticides	12	25
21	Chemicals	41	85	111	Petroleum products	0	3
22	Chip/straw board	13	88	112	Photographic goods	6	1
23	Citrus grading	4	41	113	Pins and clips	5	2
24	Cold storage	442	633	114	Plaster of Paris	0	1
25	Cones	23	7	115	Plastic products	343	287

	Industry	2002	2006		Industry	2002	2006
26	Confectionery	69	89	116	Polypropylene bags	33	45
27	Cosmetics	5	7	117	Polyester yarn	4	9
28	Cotton ginning and pressing	1236	1358	118	Polythene bags	12	27
29	Cotton tape	2	1	119	Pottery	143	185
30	Cotton waste	66	56	120	Poultry feed	85	79
31	Crown corks	2	2	121	Powder coating	2	3
32	Cutlery	214	227	122	Power generation	43	46
33	Cycle tyres/tubes	17	21	123	PVC pipes	30	40
34	Dairy products	17	25	124	Radios/televisions	2	2
35	Diapers (baby)	2	1	125	Cloth raising	13	7
36	Dyes and blocks	94	18	126	Razors/blades	6	1
37	Diesel engines	62	70	127	Readymade garments	105	364
38	Domestic hardware	107	70	128	Refineries	3	2
39	Yarn doubling	16	39	129	Rice mills	1066	1717
40	Drugs and pharmaceuticals	114	151	130	Rubber products	67	64
41	Dyes	3	3	131	Sanitary fittings	218	252
42	Elastic	0	6	132	Seed processing	8	11
43	Electric furnaces	51	15	133	Sewing machines /parts	25	23
44	Electric goods	223	219	134	Shoe lasts	1	1
45	Electric meters	5	7	135	Yarn sizing	197	204
46	Electric poles	1	1	136	Soaps and detergents	412	188
47	Electric transformers	16	18	137	Sodium silicate	42	39
48	Electroplating	17	1	138	Solvent oil extraction	18	24
49	Embroidery	50	150	139	Specialized textiles	0	1
50	Essences	1	1	140	Spices	1	2
51	Explosives	1	1	141	Sports goods	500	564
52	Fans/coolers	510	536	142	Spray machines	2	2
53	Fertilizer	7	11	143	Springs	2	1
54	Fiberglass	5	6	144	Starch and products	5	4
55	Fiber tops	2	2	145	Sugar	39	41
56	Fire clay	1	1	146	Sulphuric acid	10	7
57	Fire-fighting equipment	1	2	147	Surgical cotton/ bandages	13	50
58	Flour mills	437	543	148	Surgical instruments	999	1298
59	Foam	8	6	149	Synthetic fiber	0	1

	Industry	2002	2006		Industry	2002	2006
60	Food products	39	47	150	Synthetic resins	4	5
61	Forging	3	17	151	Syringes	3	4
62	Foundry products	762	600	152	Tanneries	524	623
63	Fruit juices	22	28	153	Tents	12	26
64	Fruit preservation	2	1	154	Textile composite	23	28
65	GI/MS pipes	45	66	155	Textile made-ups	32	43
66	Gas appliances	29	45	156	Textile processing	355	483
67	Glass and glass products	29	42	157	Textile spinning	309	421
68	Glue	5	8	158	Textile weaving	188	219
69	Glycerin	1	1	159	Thermopore	6	8
70	Grinding wheels	1	1	160	Thread	11	9
71	Gypsum	14	1	161	Tobacco	3	5
72	Handheld tools	46	15	162	Towel	10	17
73	Hatcheries	23	21	163	Tractors and parts	158	158
74	Heavy engineering (bulldozers/cranes, etc.)	1	1	164	Trucks	1	1
75	Homeopathic medicines	2	2	165	Tyres and tubes	12	11
76	Hosepipes	1	1	166	Unani medicines	45	18
77	Hosiery	444	366	167	Utensils (all sorts)	534	488
78	Ice cream	14	11	168	Ghee and cooking oil	96	92
79	Industrial/burn gases	32	28	169	Velvet cloth	1	1
80	Industrial (textile) machinery	92	92	170	Vermicelli	5	10
81	Ink	6	6	171	Washing machines	94	105
82	Iron and steel rerolling	317	385	172	Weights and scales	41	14
83	Jute mills	13	22	173	Welding electrodes	2	2
84	Knitted textiles	95	91	174	Wire and cable	39	77
85	Leather footwear	96	100	175	Wooden products	6	6
86	Leather garments	201	392	176	Wool scouring	3	4
87	Leather products	51	64	177	Woolen textiles	125	132
88	Light engineering	198	233	178	Zinc sulphate	4	1
89	Locks and padlocks	32	27	179	Zari work	3	3
90	LPG (gas) cylinders	7	9	180	Zips	0	1

Source: Government of Punjab, Directory of Industries.

The Lahore Journal of Economics
19 : 1 (Summer 2014): pp. 91–109

Can Analysts Really Forecast? Evidence from the Karachi Stock Exchange

Haris Bin Jamil,[*] Aisha Ghazi Aurakzai,[**] and Muhammad Subayyal[***]

Abstract

This study examines the impact of analysts' recommendations on stock prices listed on the Karachi Stock Exchange for the period 2006–12. The recommendations are extracted from the daily Morning Shout report published by Khadim Ali Shah Bukhari Securities Ltd (KASB), which provides buy and sell recommendations for different stocks. We use the market model to estimate the abnormal returns around the recommendation dates for these securities. The study also investigates whether the abnormal returns are due to price pressure or information content. We find that investors earn abnormal returns on the basis of analysts' recommendations for these securities. The results are robust in considering only the sub-sample subsequent to 2008's global financial crisis, and are also consistent with the information content hypothesis and price pressure hypothesis.

Keywords: Analysts' recommendations, information content, price pressure, abnormal returns, market efficiency, Pakistan.

JEL classification: G14, G24.

1. Introduction

What gives an investor an advantage over others in the market? How does an inexperienced investor compete in a market filled with experts? The answer lies in the work of analysts who study the health of companies and make investment recommendations based on their performance. Brokerage firms invest millions of dollars employing qualified analysts to issue recommendations that are, in turn, published or sold to investors. Each recommendation is based on careful analysis and market surveys, given that the reputation of the analyst as well as the firm he/she represents is at stake. The question that arises is whether such recommendations really benefit investors in terms of excess returns.

---

[*] BBA student at FAST National University, Peshawar, Pakistan.
[**] BBA student at FAST National University, Peshawar, Pakistan.
[***] PhD scholar and assistant professor at FAST National University, Peshawar, Pakistan.

The impact of analysts' recommendations on stock prices has been clearly established in the literature. What is lacking, however, is relevant research on whether this impact emanates from the information contained in the recommendations or whether it is simply a result of price pressure. This forms the focus of our study. Additionally, we test the impact of information leaked prior to the publication of the recommendations. This will enable us to establish the form of market efficiency prevalent in the market under observation.

The market under observation is the Karachi Stock Exchange (KSE)—Pakistan's largest and most liquid stock exchange. The KSE serves the interest of individual as well as institutional investors, the trading community, and listed companies. Established in 1949, it now comprises four indices and 590 listed companies, and has a market capitalization of PRs 4.59 trillion.[1] Authorized by the Securities and Exchange Commission of Pakistan (SECP), Khadim Ali Shah Bukhari (KASB) Securities is one of the country's largest pure agency brokerage firms and publishes its recommendations online in a daily web-post titled *Morning Shout*, with options to "buy," "sell," or "hold."

2. Literature Review

Cowles' (1933) study set in motion a vast body of research on the impact of analysts' recommendations. He concluded that such recommendations were not generally important to investors as they did not create any value. A wide range of studies followed, some denied the phenomenon while others agreed with it. Studies conducted by Bidwell (1977), Diefenbach (1972), and Logue and Tuttle (1973) on the role of security analysts supported Cowles' conclusion. His position was also strengthened by research conducted on investment managers by Jensen (1978), Fama (1991) and by Colker (1963).

Other researchers, however, have observed the existence of abnormal returns following such recommendations. Ball, Brown and Finn (1978) confirm that the analysts' recommendations lead to additional returns, but point out that these returns are greater during the months the recommendations are published. Once the publication is phased out, investors earn lower returns. They conclude that the share prices have a small impact on recommendations since the information provided is collected before publication.

[1] http://www.thenews.com.pk/Todays-News-3-173250-KSE-index-rises-on-institutional-buying (accessed 18 June 2013).

Bjerring, Lakonishok and Vermaelen (1983) look at the recommendations issued by a leading Canadian brokerage firm and find that, after deducting transaction costs, the recommended securities show positive abnormal returns. Groth, Lewellen, Schlarbaum, and Lease (1979) reach a similar conclusion based on their study of the investment advice issued by a US brokerage house. Studying an entire set of the firm's recommendations for the period 1964–74, the authors conclude that returns tend to increase before, rather than after, a positive recommendation is issued. Elton, Gruber, and Grossman (1986) also note positive abnormal returns that remain in excess (3.43 percent) during the month of publication and two months after a change in brokerage recommendations. Downgraded recommendations, on the other hand, result in a 2.26 percent loss.

Copeland and Mayers (1982) conclude that the returns that result from analysts' recommendations are low, and the expected revenue is lower than the cost. According to Lynch (1989), analysts publish buy recommendations after a stock price rises, hence losing any investment opportunity. He attributes this to their preference for those stocks that attract the attention of institutional investors. Dorfman (1993) studies a set of recommendations concerning the 12 most popular shares on the NYSE; he shows that the price of nine shares fell in the 12 months after the recommendation date. Liu, Smith, and Syed (1990) also show that positive returns accrue nearer to the date the recommendations are issued.

Barber and Loeffler (1993) record abnormal returns of over 4 percent—nearly twice the amount calculated by previous studies. Their study is based on a column in the *Wall Street Journal* that compares analysts' recommendations with those of randomly selected securities via a "dartboard." The authors link these substantial excess returns to the high availability and circulation of the journal (which doubled between 1970/71 and 1988–90) compared to other methods used by previous studies. Higher circulation and availability mean that more investors have access to information in time, leading to greater demand for these securities. The study documents abnormal returns of –4.61 percent from day 2 through 25 (t = –2.03). This mean reversion reflects the price pressure phenomenon, which is a result of the high visibility of information.

Whether recommendations have greater influence depends on their relation to the environment of the company being recommended. Recommendations are also temporarily affected by announced revised profits (Stickel, 1995). On the other hand, Walker and Hatfield (1996) find that investors do not earn significant profits by following analysts' recommendations. Womack (1996) finds that buy and sell recommendations can impinge on stock prices and influence these for weeks or months at a time.

Francis and Soffer (1997) introduce the qualitative aspect of trust, arguing that investors will not trust an analyst's recommendation, particularly if it is positive. However, they show that recommendations contain information, and that investors display more confidence in revised estimates, specifically when combined with favorable recommendations to buy or hold. Stickle (1995) reaches a similar conclusion regarding revised estimates.

Jaffe and Mahoney (1999) find that, even if recommendations do lead to excess returns, these are insignificant if one includes the cost of collecting information. Juergens (1999) argues that recommendations published together with an announcement of important information lead to significant additional returns. Moreover, investors tend to follow recommendations that are accompanied by basic economic data on the company in question (Ho & Harris, 2000).

Some studies have focused on the stock exchange as a whole. Looking at the Australian stock exchange market over 1992–98, researchers observe that real estate agents' recommendations have had a significant impact on not only prices but also commercial activity—particularly on the date of publication. The impact is permanent for sell recommendations, but the buy side shows a temporary effect (Aitken et al., 2001).

Research on the London Stock Exchange comes to a similar conclusion regarding investors' profits, which increase with changes in recommendations. The impact on new "sell" recommendations is much stronger than on "buy" recommendations, which are rather weak (more so for smaller companies). Studies on the Asian market (Australia, Singapore, Korea, and Hong Kong) show that the latest recommendations affect share returns more so when given by reputed international financial companies (Lim & Kim, 2004). Jegadeesh, Kim, Krische, and Lee (2004) argue that analysts neglect companies that are not known widely by focusing on "famous" shares.

Fang and Yasuda (2007) find that the analysts' recommendations do result in excess returns. Mokoaleli-Mokoteli (2005) reveal that investors react to changes in recommendations, with buy recommendations affecting investment decisions longer than sell recommendations. In a study on the

G7 countries' stock exchanges, Jegadeesh and Kim (2006) find that sell recommendations are not as frequent as buy recommendations.

In 2000, the US Securities and Exchange Commission (SEC) issued Regulation Fair Disclosure (Reg FD), which denied legal access to any material information about a company before it was disclosed to the public. This was done because companies had been found revealing material nonpublic information before it was released to the public. It meant that analysts now had to use their own insight rather than rely on material nonpublic information. Goff and Keasler (2008) study the post-Reg FD recommendations for the S&P 500, 600 and 400 indices, and conclude that upgrades are linked to positive abnormal returns while downgrades are associated with negative abnormal returns. Their study also reveals that recommendations that are accompanied by news lead to significantly larger reactions. Even those recommendations that are not accompanied by news, however, are significantly different from zero, implying that analysts' recommendations are informative per se.

Schlumpf, Schmid and Zimmermann's (2008) empirical study on buy recommendations are consistent with the notion that analysts' recommendations contain information that is quickly added to stock prices. Looking at the first and second release of information, the authors find that information is incorporated quickly following the first release. However, when the same information is released to a larger group of investors, the price change is not permanent. The study thus attributes the change in price on second release exclusively to price pressure.

Barber, Lehavy, and Trueman (2010) observe abnormal returns resulting from rating levels and rating changes. They show that recommendation upgrades based on the rating level earn the highest returns as opposed to downgrades, which show the lowest. When based on the sign and magnitude of a change in ratings, the more favorable the level of recommendation, the greater will be the return. The study also implies that a strategy based on both the recommendation level and change has the potential to outperform a strategy based exclusively on one or the other (5.2 compared to 3.5 basis points for a recommendation level-based strategy and 3.8 basis points for a recommendation change-based strategy). Interestingly, these levels and changes can be used to forecast future unexpected earnings as well as related market reactions.

Given that brokerage houses appear to spend a fortune on convincing investors to buy or sell certain securities, gives rise to an important question: What do these firms stand to gain? Grossman and Stiglitz (1980) make an interesting observation in stating that prices in the market cannot be based perfectly on all the available information because if this were true, then information seekers would be unable to earn any reward for their high-cost activities. Womack (1996) argues that the rational and competitive world seeks to compensate such costly activities with equivalent or higher-than-expected profits by underwriting the fees, profits, and commissions earned from trading securities. On the other side of the coin, investors should also be willing to pay only when the cost of obtaining such information is at least equal to the expected benefit.

We generally assume that the release of new earnings reports by companies is an important information resource for security recommendations, yet only 9 percent of new buy recommendations coincide with the issue of quarterly earnings reports. Womack (1996) observes that every calendar quarter of a firm equals approximately 63 trading days. This means that an earnings report date will fall 4.8 percent of the time as a matter of chance. Changes are thus not driven primarily by "information", or based on reactions to the latest market news or the release of earnings reports. What induces an analyst to recommend a security, is driven by "price," i.e., it relates to the price of the stock according to market and industry valuation models.

Holloway (1981) looks at strategies based on "value-line" recommendations (not taking any transaction costs into account), which can help achieve additional returns in relation to market value. Dimson and Marsh (1984) conclude that brokers are able to predict correctly the rise/fall of stock prices, but tend to exaggerate the extent of the variation: they may overestimate a rise and underestimate a fall.

In determining whether investor behavior is influenced by market behavior, DeBondt and Thaler (1985) find that investors who follow standard methods based on their experience tend to be overambitious or under-pessimistic with regard to winners or losers. This bias can cause deviations from the basic price level; hence, investors' decisions are affected by the near past. Finn (1988) studies the Australian stock market, and concludes that additional returns can be achieved within the first month of the publication of recommendations related to the market.

Subayyal and Shah (2011) are the first to test this phenomenon in Pakistan's context. They apply an event-study methodology to 277 recommendations taken from KASB's *Morning Shout*. The event window is 21 days long with a collection period of 141 days prior to the recommendation. The study finds evidence of abnormal returns: the cumulative abnormal return (CAR) on $t - 8$ is 1.24 percent, indicating information content; the CAR on $t - 9$ is 1.21 percent, implying that information was leaked prior to the announcement.

The evidence thus far suggests that analysts issue buy recommendations when the price is relatively low and sell recommendations when the price is relatively high: this is in accordance with traditional financial ratios.

Seyhun (1986) refers to the e*fficient market hypothesis* (EMH) as the central focus of financial economics, supported by a large body of evidence beginning with Fama (1970). Although we are not concerned with determining the level of market efficiency, it is worth mentioning since our results will indirectly reflect the level of efficiency for the market in question. The EMH suggests that stock prices fully reflect all available information in the market. There is, however, a precondition for this extreme version of the hypothesis: the cost of ensuring that the price reflects the information on the security (information and trading cost) should always be zero (Grossman & Stiglitz, 1980). A more economical, albeit weaker, form of this hypothesis states that security prices reflect information up to the point that the marginal benefit (expected profit) does not exceed the marginal cost (Jensen, 1978).

When the capital market is perfect, the stock's excess demand curves are seen to be perfectly elastic. This means that investors can sell or buy an unlimited amount of securities at a market price that reflects all the relevant information on that particular security. In the real world capital market, however, market inefficiencies will limit market forces from keeping the excess demand curves perfectly elastic. The following are alternatives to perfect capital markets.

The *price pressure hypothesis* states that prices will shift temporarily from their information-efficient values due to upward or downward pressure on the demand side. This implies that the demand curve for securities is not perfectly elastic. Temporary buying pressure on a recommended security by naïve investors will result in positive abnormal returns after a buy recommendation has been given as second-hand information.

Barber and Loeffler (1993) find evidence that is consistent with the price pressure hypothesis. Analysts' recommendations do result in significant abnormal returns, but these are reversed partially in the short term. Harris and Gruel (1986) argue that no new information on return distributions is conveyed when a firm is included in the S&P 500 index, although they estimate abnormal returns of 3 percent for firms added to the index. They observe a complete price reversal over a two-week interval and interpret their results as supporting the price pressure hypothesis.

The *information content hypothesis* states that analysts' recommendations reveal relevant information on a security to the market, thereby resulting in abnormal returns that do not revert. The new information contained in the recommendation will result in a permanent price change as the market adjusts to the value of the new information.

Barber and Loeffler (1993) find evidence that is also consistent with the information hypothesis. Analysts' recommendations are seen as second-hand information in the market. The resulting abnormal returns are significant and do not fully revert in the short run. Trahan and Bolster (1995) relate the size of the firm to the information content hypothesis: analysts are likely to neglect smaller firms, which means that, as the firm's size decreases, its information content should increase in terms of published recommendations. This inverse relation leads to predictions regarding small firms being associated with larger abnormal returns.

3. Data and Methodology

This section describes our sample data and methodology.

3.1. Sampling

The study is divided into two parts: study A spans January 2006 to December 2012 and consists of 1,127 recommendations; study B spans January 2009 to December 2012 and includes 723 recommendations. This division allows us to check for any abnormalities that may have resulted from the crash that occurred in the KSE during the global financial crisis (August to December 2008)—the KSE witnessed an all-time low in June 2008.[2] Hence, study B will exclude the impact of the financial crisis (an abnormal event) from the sample.

Our sampling method draws on other, similar studies. Analysts' buy recommendations are taken from the daily *Morning Shout*, which is published by KASB under license by the SECP.[3] The post also provides in-

[2] http://www.geo.tv/6-21-2008/19613.htm (accessed 18 June 2013)
[3] http://www.kasb.com/securities/ (accessed 18 June 2013)

depth coverage of 14 key listed sectors that account for 73 percent of the KSE 100 index.[4] Although the post provides buy, sell, and hold recommendations, we focus solely on buy recommendations for a number of reasons. Short selling is forbidden by the KSE;[5] the ban is still in effect despite a plan to have it relaxed after February 2012,[6] making it irrelevant for this study. Moreover, Barber et al. (2010) argue that buy recommendations have greater returns than sell recommendations, which analysts take into consideration when making recommendations.

3.2. Event Study

Our aim is to find which abnormal returns are attributable to the event in question. This is done by adjusting for returns that result from price fluctuations in the market as a whole. The event study assumes that the market information being processed about the event in question is unbiased as well as efficient. Event studies provide important information on the reaction of securities to a given event. In this manner, they can also help predict the reaction of securities to various events

3.3. The Market Model

We take 161 days' prices for each security to calculate the parameters of the market model. Of these, a 21-day period that spans 10 days before and after the event date $T = 0$ is utilized as the event window to capture the effect of abnormal returns. We also take 141 days' share prices and market index data prior to the event window.

This brings the total number of observations to 362,894 for study A, i.e., 1,127 (recommended securities for the period) x 161 (the number of days under consideration) x 2 (security prices and market index). Similarly, study B includes 232,806 observations (723 x 161 x 2). A two-tailed T-test is applied to check the significance of abnormal returns during the event window (21 days centered on the event date).

3.4. Parameters

We calculate a set of parameters to determine which abnormal returns occurred due to analysts' recommendations. First, the individual

[4] http://www.kasb.com/securities/equity_and_economic_research.aspx (accessed 18 June 2013)
[5] http://dailytimes.com.pk/default.asp?page=2006%5C06%5C24%5Cstory_24-6-2006_pg5_11 (accessed 18 June 2013)
[6] http://dailytimes.com.pk/default.asp?page=2006%5C06%5C24%5Cstory_24-6-2006_pg5_11 (accessed 18 June 2013)

security returns suggested by analysts are calculated using the formula *ln(current security price)/ln(previous security price)*. Next, the parameters ($\boldsymbol{\alpha_i}$ and $\boldsymbol{\beta_i}$) are estimated to calculate abnormal returns.

A market model with linear parameters and linear variables is used to calculate the expected returns, using the following equation. All these parameters are used to calculate abnormal returns.

$$R_{it} = \alpha_i + \beta_i R_{mt} \tag{1}$$

R_{it} is the expected return on security i at time t. This equation is used just to calculate expected returns while we are interested in abnormal returns. Accordingly, rearranging equation (1), we get

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \tag{2}$$

Here, AR_{it} calculates the abnormal returns on security i at time t. $\beta_i$is the sensitivity of the stock return compared with changes in the market return (R_{mt}) and is computed as

$$\beta_i = \frac{cov(Rit: Rmt}{varRmt}$$

α_i is the excess estimated return. In the case of no abnormal returns, both sides of equation (3) will be equal:

$$\alpha_i = R_{it} - \beta_i R_{mt} \tag{3}$$

3.5. Research Hypotheses

We present the following hypotheses:

- H_0: Analysts' recommendations have no impact on share prices.
- $H_\alpha{}^1$: Analysts' recommendations have an impact on share prices.
- $H_\alpha{}^2$: Analysts' recommendations have an impact on share prices due to price pressure.
- $H_\alpha{}^3$: Analysts' recommendations have an impact on share prices due to information content.
- $H_\alpha{}^4$: Analysts' recommendations have an impact on share prices due to information leaks.

4. Data Analysis and Discussion

We compare the results for the period 2006–12 and 2009–12. The event window consists of 21 days and a simple t-test has been applied to test the statistical significance of the returns generated. The results reveal that analysts' recommendations do generate abnormal returns. The presence of information content is also tested and proves to be significant. The price pressure alternative, however, is refuted by the results.

4.1. Analysis of Study A

This analysis covers a period of seven years, from 2006 to 2012. Table 1 gives the results of the event window: on days $t - 10$, $t - 9$, $t - 3$, $t - 2$, $t = 0$, and $t + 6$, the securities recommended by analysts earned statistically significant abnormal returns. These results are statistically different from zero at 10 percent and 5 percent significance levels.

On $t - 10$ (ten days before the recommendations were published), the recommended securities earned 0.087 percent in abnormal returns on average. Similarly, on $t - 9$ (nine days before the recommendations were published), the recommended securities earned 0.087 percent in abnormal returns on average. On day $t - 3$, investors earned average abnormal returns of –0.011 percent. On day $t - 2$, the recommended securities generated an average return of –0.018 percent. On the event day $t = 0$ (the day the recommendations were published), the average abnormal returns were 0.014 percent. On day $t + 6$ (six days after publication), the average investor earned abnormal returns of –0.096 percent.

As we can see, the average return becomes positive at 0.014 percent on the event day, implying that the analysts' recommendations did have an impact on security prices. We can also see that the average return becomes negative on day $t + 6$, indicating the presence of price pressure.

Table 1: Average abnormal returns on recommended securities (A)

	Test value = 0					
					95% confidence interval of the difference	
Day	**t-stat**	**Df**	**Sig. (2-tailed)**	**Mean difference**	**Lower**	**Upper**
t-10	1.616*	1126	0.106	0.000875684	-0.00018725	0.00193862
t-9	1.533*	1126	0.126	0.000873083	-0.00024467	0.00199084
t-8	-1.185	1126	0.236	-0.000723098	-0.00192069	0.00047449
t-7	1.076	1126	0.282	0.000692639	-0.00057079	0.00195607
t-6	0.690	1126	0.491	0.000393039	-0.00072536	0.00151144
t-5	-0.689	1126	0.491	-0.000456385	-0.00175613	0.00084336
t-4	0.662	1125	0.508	0.000376977	-0.00074009	0.00149404
t-3	-1.536*	1125	0.125	-0.001106446	-0.00252002	0.00030713
t-2	-2.308**	1126	0.021	-0.001823887	-0.00337410	-0.00027368
t-1	0.906	1126	0.365	0.000692608	-0.00080683	0.00219205
t 0	**2.363****	**1126**	**0.018**	**0.001432665**	**0.00024307**	**0.00262226**
t+1	1.051	1126	0.293	0.000794437	-0.00068850	0.00227737
t+2	1.225	1126	0.221	0.000675698	-0.00040658	0.00175797
t+3	-0.747	1126	0.455	-0.000455678	-0.00165215	0.00074079
t+4	-1.155	1126	0.248	-0.000612237	-0.00165256	0.00042808
t+5	0.486	1126	0.627	0.000325313	-0.00098831	0.00163893
t+6	-1.699*	1126	0.090	-0.000964331	-0.00207792	0.00014926
t+7	-0.827	1126	0.408	-0.000734652	-0.00247773	0.00100843
t+8	-1.131	1126	0.258	-0.000641325	-0.00175409	0.00047144
t+9	-0.287	1126	0.774	-0.000199161	-0.00156264	0.00116432
t+10	-1.258	1126	0.209	-0.001007210	-0.00257809	0.00056367

Note: Abnormal returns are calculated as actual returns minus expected returns (using the market model). *, **, and *** indicate 10%, 5%, & 1% significance levels.
Source: Authors' calculations.

4.2. Analysis of Study B

Table 2 gives the results for the 2009–12 period. As mentioned earlier, the global financial crisis event is excluded from this segment. Instead, we focus on the post-crisis period. There are a total of 723 recommended securities with an event window of 21 days. Applying the t-test produces statistically significant abnormal returns for days $t-10$, $t-3$, $t-2$, $t=0$, $t+1$, $t+2$, $t+4$, and $t+10$.

Ten days before the recommendations were published ($t-10$), the recommended securities generated average abnormal returns of 0.012 percent. The following day, $t-9$, the recommended securities earned investors an average abnormal return of –0.013 percent. On $t - 2$, the average abnormal return was –0.026 percent. On the event day $t = 0$, the day the recommendations were published, the recommended securities earned average abnormal returns of 0.016 percent. On day $t + 1$, the day following publication, the recommended securities earned 0.016 percent in average abnormal returns. On day $t + 2$, the average abnormal return was 0.015 percent. Four days after publication, on $t + 4$, the average abnormal return was 0.013 percent. On $t + 10$, the average abnormal return was 0.013 percent.

Table 2: Average abnormal returns on recommended securities (B)

	One-sample test					
	Test value = 0					
					95% confidence interval of the difference	
Day	**t-stat**	**df**	**Sig. (2-tailed)**	**Mean difference**	**Lower**	**Upper**
t-10	1.848*	722	0.065	0.001276892	-0.00007934	0.00263312
t-9	0.715	722	0.475	0.000542230	-0.00094736	0.00203182
t-8	-0.255	722	0.799	-0.000195172	-0.00170011	0.00130977
t-7	1.119	722	0.264	0.000809421	-0.00061067	0.00222951
t-6	0.578	722	0.563	0.000444884	-0.00106614	0.00195591
t-5	-0.432	722	0.666	-0.000390013	-0.00216081	0.00138078
t-4	0.372	722	0.710	0.000275800	-0.00118101	0.00173261
t-3	-1.342*	722	0.180	-0.001337419	-0.00329336	0.00061853
t-2	-2.398*	722	0.017	-0.002658668	-0.00483546	-0.00048188
t-1	-0.458	722	0.647	-0.000487513	-0.00257517	0.00160014
t 0	2.132**	722	0.033	0.001643838	0.00013032	0.00315735
t+1	2.535**	722	0.011	0.001649561	0.00037198	0.00292714
t+2	2.502**	722	0.013	0.001546085	0.00033315	0.00275902
t+3	0.180	722	0.857	0.000119709	-0.00118358	0.00142300
t+4	-1.916**	722	0.056	-0.001309458	-0.00265090	0.00003198
t+5	0.689	722	0.491	0.000467363	-0.00086343	0.00179816
t+6	0.254	722	0.800	0.000158450	-0.00106786	0.00138476
t+7	-0.106	722	0.916	-0.000132248	-0.00258093	0.00231644
t+8	-0.981	722	0.327	-0.000696344	-0.00209040	0.00069771
t+9	-0.136	722	0.892	-0.000091303	-0.00140544	0.00122284
t+10	-1.603**	722	0.109	-0.001315979	-0.00292797	0.00029601

Note: Abnormal returns are calculated as actual returns minus expected returns (using the market model). *, **, and *** indicate 10%, 5%, & 1% significance levels.
Source: Authors' calculations.

The CAR values in Table 3 reveal that there was no information leak prior to publication, as the average abnormal returns are negative. Subayyal and Shah (2011) investigate analysts' recommendations and show a CAR of 1.21 percent. We can conclude that the market no longer supports information leaks; even if a leak did occur, increased efficiency in the market cleared any arbitrage opportunity prior to the day the recommendations were issued.

Table 3: Statistically significant pre-announcement CAR for recommended KSE securities

Day		CAR
t-10	0.0012	0.12%
t-3	-0.0013	-0.01%
t-2	-0.0026	-0.27%

Source: Authors' calculations.

The CAR values in Table 4 increase up to day *t* + 2 but then decrease due to the negative values for *t* + 4 and *t* + 10. This indicates an aspect of price pressure as the CAR has fallen by 26 percent by *t* + 10. Since there is no complete mean reversion, we conclude that the recommendations incorporated some information content.

Table 4: Statistically significant post-announcement CAR for recommended KSE securities

Day		CAR
t=0	0.0016	0.16%
t+1	0.0016	0.32%
t+2	0.0015	0.47%
t+4	-0.0013	0.34%
t+10	-0.0013	0.21%

Source: Authors' calculations.

5. Conclusion

We have derived two types of results from this study: one incorporates the effects of the global financial crisis of 2008—an abnormal event—up to the event study (study A); the other covers the post-financial crisis period (study B). Both studies reject the null hypothesis and confirm that investor analyses do have an impact on security prices. However, the results of study A cannot be seen in isolation since the financial crisis had a significant impact on the market during this period. Thus, the stock prices do not exclusively portray the impact of analysts' recommendations.

For this reason, we focus more on study B, the results of which do not incorporate any abnormal events. As mentioned above, we have found that analysts' recommendations have a substantial impact on stock prices. These prices report significant abnormal returns on the day the recommendations were published, thus refuting the first alternative hypothesis. Moreover, the CAR display an increase followed by a decrease, implying significant partial mean reversion four and ten days after the event. The reversion reflects the impact of price pressure but as the mean does not revert completely, it shows that the recommendations had some information content. This refutes the second alternative hypothesis as well.

Since the analysts' recommendations contain information, the market undertakes an increase in prices. However, a sudden surge in demand moves prices well above their worth. Three days after the event, as the market fully absorbs the information, prices move back to their correct level. Investors seeking short-term profits should, therefore, sell their securities two days after the relevant recommendation is issued; long-term investors would benefit by waiting for the price pressure to ease on the fourth day to avoid losses to their capital investment.

Although previous studies conducted on the KSE market reveal the presence of information leaks (see Subayyal & Shah, 2011), we find no evidence of such behavior in the pre-recommendation frame. The CAR are not positively significant before the event, implying that the market has largely incorporated and eliminated the effects of arbitrage. Investors can no longer take advantage of any such leak even if present. This shows that the market's degree of efficiency has improved, but is still not very strong, given the presence of price pressure and information content that affects the price of the securities.

References

Barber, B. M., Lehavy, R., & Trueman, B. (2010). Ratings changes, ratings levels, and the predictive value of analysts' recommendations. *Financial Management*, *39*(2), 533–553.

Ball, R. (1978). Anomalies in relationships between securities' yields and yield-surrogates. *Journal of Financial Economics*, *6*(2), 103–126.

Ball, R., Brown, P., & Finn, F. J. (1978). Published investment recommendations and share prices: Are there free lunches in security analysis? *JASSA*, *2*, 5–10.

Barber, B. M., & Loeffler, D. (1993). The "dartboard" column: Second-hand information and price pressure. *Journal of Financial and Quantitative Analysis*, 28(2), 273–284.

Bidwell, C. M. (1977). How good is institutional brokerage research? *Journal of Portfolio Management*, *3*(2), 26–31.

Bjerring, J. H., Lakonishok, J., & Vermaelen, T. (1983). Stock prices and financial analysts' recommendations. *Journal of Finance*, *38*(1), 187–204.

Colker, S. (1963). An analysis of security recommendations by brokerage houses. *Quarterly Review of Economics and Business*, *3*, 19–28.

Copeland, T., & Mayers, D. (1982). The value line enigma (1965–1978): A case study of performance evaluation issues. *Journal of Financial Economics*, *10*, 289–321.

Cowles, A. (1933). Can stock market forecasters forecast? *Econometrica*, *1*(3), 309–324.

DeBondt, W. F., & Thaler, R. (1985). Does the stock market overreact? *Journal of Finance*, *40*(3), 793–805.

DeBondt, W. F., & Thaler, R. H. (1990). Do security analysts overreact? *American Economic Review*, *80*(2), 52–57.

Diefenbach, R. E. (1972). How good is institutional brokerage research? *Financial Analysts Journal*, *28*(1), 54–60.

Dimson, E., & Marsh, P. (1984). An analysis of brokers' and analysts' unpublished forecasts of UK stock returns. *Journal of Finance*, *39*(5), 1257–1292.

Elton, E. J., Gruber, M. J., & Grossman, S. (1986). Discrete expectational data and portfolio performance. *Journal of Finance*, *41*(3), 699–713.

Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance*, *25*(2), 383–417.

Fama, E. (1991). Efficient capital markets II. *Journal of Finance*, *46*, 1575–617.

Fang, L. H., & Yasuda, A. (2007). *Are stars' opinions worth more? The relation between analyst reputation and recommendation values* (Working Paper No. 2007-12). Fontainebleau, France: INSEAD.

Francis, J., & Soffer, L. (1997). The relative informativeness of analysts' stock recommendations and earnings forecast revisions. *Journal of Accounting Research*, *35*(2), 193–211.

Goff, D., & Keasler, T. (2008). Market reactions to analysts' initiations of coverage, post-Reg FD. *Financial Decisions*, *20*(2), 1–18.

Grossman, S. J., & Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets. *American Economic Review*, *70*(3), 393–408.

Groth, J. C., Lewellen, W. G., Schlarbaum, G. G., & Lease, R. C. (1979). An analysis of brokerage house securities recommendations. *Financial Analysts Journal*, *35*, 32–40.

Harris, L., & Gruel, E. (1986). Price and volume effects associated with changes in the S&P500 list: New evidence for the existence of price pressures. *Journal of Finance*, *41*(4), 815–829.

Ho, M. J., & Harris, R. S. (2000). Brokerage analysts' rationale for investment recommendations: Market responses to different types of information. *Journal of Financial Research*, *23*(4), 449–468.

Holloway, C. (1981). A note on testing an aggressive investment strategy using value line ranks. *Journal of Finance*, *36*, 711–719.

Jaffe, J. F., & Mahoney, J. M. (1999). The performance of investment newsletters. *Journal of Financial Economics*, *53*(2), 289–307.

Jegadeesh, N., Kim, J., Krische, S., & Lee, C. (2004). Analyzing the analysts: When do recommendations add value? *Journal of Finance*, *59*, 1083–1124.

Jegadeesh, N., & Kim, W. (2006). Value of analyst recommendations: International evidence. *Journal of Financial Markets*, *9*(3), 274–309.

Jensen, M. (1978). Some anomalous evidence regarding market efficiency. *Journal of Financial Economics*, *6*(2–3), 95–101.

Juergens, J. L. (1999). *How do stock markets process analysts' recommendations? An intra-daily analysis* (Working paper). Phoenix, AZ: Arizona State University.

Lim, K.-P., Brooks, R. D., & Kim, J. H. (2008). Financial crisis and stock market efficiency: Empirical evidence from Asian countries. *International Review of Financial Analysis*, *17*(3), 571–591.

Liu, P., Smith, S. D., & Syed, A. A. (1990). Stock price reactions to the Wall Street Journal's securities recommendations. *Journal of Financial and Quantitative Analysis*, *25*(3), 399–410.

Logue, D. E., & Tuttle, D. L. (1973). Brokerage house investment advice. *Financial Review*, *8*(1), 38–54.

Mokoaleli-Mokoteli, T. (2005). *Are analysts biased? An analysis of analysts' stock recommendations for stocks that perform contrary to expectations*. Unpublished PhD thesis. Cranfield University, Bedford, UK. Retrieved from https://dspace.lib.cranfield.ac.uk/bitstream/1826/934/2/mokoteli.pdf?origin=publication_detail

Schlumpf, P. M., Schmid, M. M., & Zimmermann, H. (2008). The first- and second-hand effect of analysts' stock recommendations: Evidence from the Swiss stock market. *European Financial Management*, *14*(5), 962–988.

Seyhun, H. N. (1986). Insiders' profits, costs of trading, and market efficiency. *Journal of Financial Economics*, *16*(2), 189–212.

Stickel, S. E. (1995). The anatomy of the performance of buy and sell recommendations. *Financial Analysts Journal*, *51*(2), 25–39.

Subayyal, M., & Shah, A. (2011). *Impact of analysts' recommendations on stock prices: Evidence from the Karachi Stock Exchange* (Mimeo). Retrieved from http://saicon2011.ciitlahore.edu.pk/Economics/1216.pdf

Trahan, E. A., & Bolster, P. J. (1995). The impact of Barron's recommendations on stock prices. *Quarterly Journal of Business and Economics*, *34*, 3–15.

Walker, M. M., & Hatfield, G. B. (1996). Professional stock analysts' recommendations: Implications for individual investors. *Financial Services Review*, *5*(1), 13–29.

Womack, K. L. (1996). Do brokerage analysts' recommendations have investment value? *Journal of Finance*, *51*(1), 137–167.

The Lahore Journal of Economics
19 : 1 (Summer 2014): pp. 111–132

Terms-of-Trade Volatility and Inflation in Pakistan

Kiran Ijaz,* Muhammad Zakaria, and Bashir A. Fida*****

Abstract

This empirical study examines the effects of terms-of-trade (TOT) volatility on inflation in Pakistan, using annual data for the period 1972 to 2012. The results show that TOT volatility has a significant negative effect on inflation in Pakistan. This result is robust to alternative equation specifications and TOT volatility measures. Output growth has a negative effect on inflation while foreign export prices have a positive effect on inflation. Both the depreciation of the nominal exchange rate and money supply increase the inflation rate. The fiscal deficit and world oil prices are also found to increase domestic inflation.

Keywords: Terms of trade, inflation, Pakistan.

JEL classification: E31, F41.

1. Introduction

The price of exports relative to the price of imports is called the terms of trade (TOT), which indicates a quantitative relationship between two products traded between two countries. An increase in the price of exports relative to that of imports indicates an improvement in the country's TOT. This means that more foreign exchange is coming into the country than going out, which has a favorable impact on the balance of payments (BOP), foreign investment, and economic growth (see Mendoza, 1995; Bleaney & Greenway, 2001; Blattman, Hwang, & Williamson, 2003). Conversely, a larger increase in the price of imports than that of exports indicates a deterioration in the TOT, which adversely affects the BOP and output growth of the country.

Any volatility in the TOT also has adverse effects on economic growth because an increase in volatility increases risk, which discourages investment by making current investment unprofitable. The TOT is more volatile in developing countries (such as Pakistan), whose exports are

* Graduate student, Allama Iqbal Open University, Islamabad, Pakistan.
** Assistant Professor, COMSATS Institute of Information Technology, Islamabad, Pakistan.
*** Assistant Professor, Modern College of Business and Science, Muscat, Oman.

likely to be concentrated in primary commodities with fluctuating prices. This can, potentially, seriously disrupt the output growth of these countries (Broda & Tille, 2003). Mendoza (1995), for instance, shows that TOT volatility accounts for up to half of the output volatility in developing countries.

Other than output, TOT volatility is also considered a major source of inflation fluctuations (volatility) in developing countries. Theoretically, the TOT can affect inflation both positively and negatively. Under a fixed exchange rate system, the literature posits a positive relationship between TOT shocks and inflation; under a flexible exchange rate system, this relationship is reversed, at least in the short run (Gruen & Shuetrim, 1994; Gruen & Dwyer, 1995; Andrews & Rees, 2009).

Under a floating exchange rate system, a rise in the TOT leads to nominal and real exchange rate appreciation, which have a favorable impact on inflation. Gruen and Shuetrim (1994) have established a "threshold" exchange rate response: if the rise in the real exchange rate is less than this threshold, then the rise in TOT will increase inflation. Conversely, if the currency appreciates more than this threshold, an increase in TOT will decrease domestic inflation. Further, high volatility in the TOT increases uncertainty, which causes investment and thereby aggregate demand to fall. This, in turn, reduces domestic inflation (Desormeaux, García, & Soto, 2010). A decrease in investment will also reduce the demand for and hence wages of labor. It will decrease the cost of production, leading to lower price levels, i.e., domestic inflation will fall.

As in the theoretical literature, empirical studies also present contradictory views on the effect of TOT shocks on the inflation rate. Some show that a rise in TOT is inflationary (see Durevall & Ndung'u, 1999; Hove, Mama, & Tchana, 2012). Most studies, however, conclude that, under a fixed exchange rate, a rise in TOT is inflationary whereas a fall in TOT reduces inflation; under a floating exchange rate, this effect is reversed (see Gruen & Shuetrim, 1994; Jääskelä & Smith, 2011).

Broda (2004) also concludes that negative TOT shocks are deflationary under a peg and inflationary under a floating rate. In the first case, the observed real depreciation is small and slow in response to a fall in TOT; consequently, domestic inflation falls. Under a floating rate, the real depreciation is large in response to a fall in TOT; consequently, domestic inflation rises. The results confirm a negative relationship between TOT shocks and the inflation rate under a flexible exchange rate system.

Other studies, however, show that TOT volatility has a negative effect on inflation and that a higher TOT is not always inflationary (Gruen & Dwyer, 1995). This implies that the situation is still unclear. The relevant literature on Pakistan is limited: although studies such as Khan, Bukhari, and Ahmed (2007) and Abdullah and Kalim (2012) have tried to identify the determinants of inflation in this context, they do not consider TOT volatility as an inflation determinant. Our aim is to fill this gap by evaluating the effect of TOT volatility on inflation in Pakistan, using annual data for the period 1972 to 2012.

The rest of the paper is organized as follows. Section 2 provides a brief background to TOT and inflation in Pakistan. Section 3 presents our analytical framework. Section 4 provides an overview of the data, and estimates and interprets the model. Section 5 concludes the paper.

2. TOT and Inflation in Pakistan

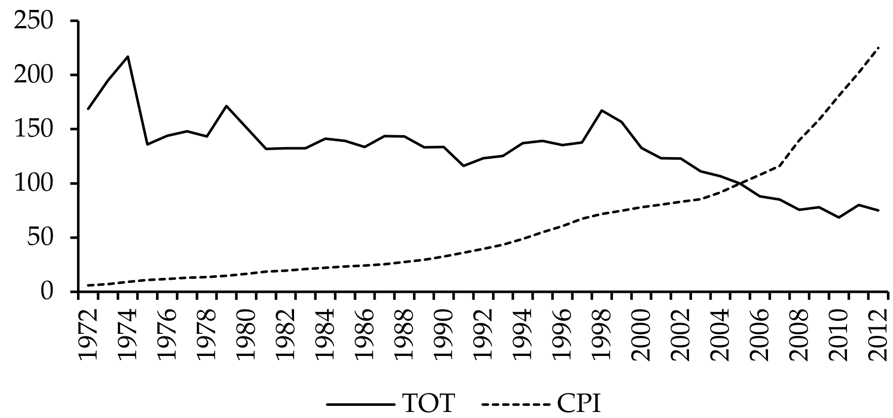
Pakistan's TOT has worsened continuously over the years because its main exports comprise agricultural products whose prices are relatively low and tend to fluctuate over time. The country also depends heavily on imported machinery, the price of which has increased over time. Other key reasons for the high fluctuation in TOT include the oscillating world demand for domestic exports, domestic political instability, and local drought/flood conditions (Fatima, 2010; Baxter & Kouparitsas, 2000).

Figure 1 illustrates Pakistan's TOT and inflation rate—measured by the consumer price index (CPI)—from 1972 to 2012. While the TOT has declined over time, the inflation rate has increased exponentially. In other words, we see a negative association between TOT and inflation, both of which have moved in opposite directions throughout this period. The TOT and inflation rate are negatively correlated both during Pakistan's fixed exchange rate period (1972–81) and flexible exchange rate period (1982–2012). This is because the TOT has deteriorated under the flexible regime, causing both the nominal and real exchange rates to depreciate. As a result, inflation has increased.

The data for the 1970s exhibit more volatility in TOT than in inflation. The TOT improved in the fiscal year (FY) 1974 as a result of an increase in the value of exports. However, by FY1975, the situation had reversed and the TOT had deteriorated. The 1980s indicate a mixed trend, with the TOT improving as well as deteriorating. This pattern continued through the 1990s but improved in FY1998 when export values rose.

The subsequent deterioration in FY2000 occurred due to a large increase in the price of imports. During the 2000s, the TOT deteriorated considerably due to a sharp increase in the price of petroleum products. In FY2011, the TOT improved slightly as oil prices fell and the price of manufactured exports improved.

Figure 1: TOT and inflation (1972–2012)



Inflation remained relatively low during the 1970s and 1980s as a result of a strict monetary policy, among other factors. High inflation during the 1990s was associated with the depreciation of the domestic currency and political instability. After remaining comparatively low during the early 2000s, it escalated in 2005 primarily due to low export growth compared to imports, high oil prices, the insufficient supply of food and nonfood items, and cutbacks in foreign capital inflows. Together, food and nonfood inflation account for the bulk of double-digit inflation during 2005–12. The main sources of high inflation in Pakistan include international inflation, monetary expansion, the deterioration in the BOP, the depreciation of the domestic currency, political instability, the fiscal deficit, and high oil prices (Hasan, Khan, Pasha, & Rasheed, 1995).

3. The Model

We employ a modified version of the small open economy model developed by Ball (1998), Cavoli and Rajan (2006), and Hove et al. (2012). The model assumes that the small market economy has exports, imports, and nontraded goods. TOT is defined as the ratio of the price of exports to the price of imports. Mathematically,

$$TOT_t = \frac{P_t^X}{P_t^M} \tag{1}$$

The log of this equation is

$$\log(TOT_t) = \log(P_t^X) - \log(P_t^M)$$

which, can be written as

$$tot_t = p_t^X - p_t^M \tag{2}$$

where $tot_t = \log(TOT_t)$, $p_t^X = \log(P_t^X)$, and $p_t^M = \log(P_t^M)$.

Taking the first difference, we obtain

$$\Delta tot_t = \Delta p_t^X - \Delta p_t^M$$

where Δtot_t is the growth in TOT and Δp_t^X (Δp_t^M) is the growth rate of the domestic price of exports (imports). This equation can also be written as

$$\Delta tot_t = \pi_t^X - \pi_t^M \tag{3}$$

where $\pi_t^X (= \Delta p_t^X)$ is domestic exports inflation and $\pi_t^M (= \Delta p_t^M)$ is domestic imports inflation.

We assume that the law of one price holds for both exports and imports. In the case of exports, this yields

$$NER_t = \frac{P_t^X}{P_t^{X*}}$$

where NER is the nominal exchange rate.

Taking the log, we obtain

$$\log(NER_t) = \log(P_t^X) - \log(P_t^{X*})$$

which, is written as

$$ner_t = p_t^X - p_t^{X*}$$

where $ner_t = \log(NER_t)$, $p_t^X = \log(P_t^X)$, and $p_t^{X*} = \log(P_t^{X*})$. Taking the first difference, we obtain

$$\Delta ner_t = \Delta p_t^X - \Delta p_t^{X*}$$

where Δner_t is the growth in the nominal exchange rate and $\Delta p_t^X (\Delta p_t^{X*})$ is the growth in the domestic (foreign) price of exports. Simple manipulation yields

$$\Delta p_t^X = \Delta p_t^{X*} + \Delta ner_t$$

which can also be written as

$$\pi_t^X = \pi_t^{X*} + \Delta ner_t \quad (4)$$

where $\pi_t^X (= \Delta p_t^X)$ is domestic exports inflation (the change in the domestic price of exports) and $\pi_t^{X*} (= \Delta p_t^{X*})$ is foreign exports inflation (the change in the foreign price of exports), which we assume to be exogenous. Similarly, if the law of one price holds for imports, then

$$\pi_t^M = \pi_t^{M*} + \Delta ner_t \quad (5)$$

where π_t^M is domestic imports inflation (the change in the domestic price of imports) and π_t^{M*} is foreign imports inflation (the change in the foreign price of imports). Substituting equations (4) and (5) into equation (3), we obtain

$$\Delta tot_t = \pi_t^{X*} + \Delta ner_t - (\pi_t^{M*} + \Delta ner_t)$$

A simple computation yields

$$\Delta tot_t = \pi_t^{X*} - \pi_t^{M*} \quad (6)$$

If the foreign price of imported goods is assumed to be related to the (general) foreign inflation rate, then the foreign price of imports will grow at the rate of foreign inflation, i.e.,

$$\pi_t^{M*} = \pi_t^* \quad (7)$$

where π_t^{M*} is foreign imports inflation and π_t^* is the foreign inflation rate. Substituting equation (7) into equation (6), we obtain

$$\Delta tot_t = \pi_t^{X*} - \pi_t^* \tag{8}$$

Rearranging the terms yields

$$\pi_t^* = \pi_t^{X*} - \Delta tot_t \tag{9}$$

The real exchange rate is the nominal exchange rate adjusted for domestic and foreign price levels. Mathematically,

$$RER_t = NER_t . \frac{P_t^*}{P_t}$$

where RER_t is the real exchange rate and $P_t(P_t^*)$ is the domestic (foreign) inflation rate. Taking the log, we obtain

$$\log(RER_t) = \log(NER_t) + \log(P_t^*) - \log(P_t)$$

which, in lowercase letters, is written as

$$rer_t = ner_t + p_t^* - p_t$$

where $rer_t = \log(RER_t)$, $ner_t = \log(NER_t)$, $p_t^* = \log(P_t^*)$, and $p_t = \log(P_t)$. Taking the first difference, we obtain

$$\Delta rer_t = \Delta ner_t + \Delta p_t^* - \Delta p_t$$

A notational change yields

$$\Delta rer_t = \Delta ner_t + \pi_t^* - \pi_t \tag{10}$$

where Δrer_t is the growth in the real exchange rate, Δner_t is the growth in the nominal exchange rate, $\pi_t^*(= \Delta p_t^*)$ is the foreign inflation rate, and $\pi_t(= \Delta p_t)$ is the domestic inflation rate. Substituting equation (9) into equation (10) yields

$$\Delta rer_t = \Delta ner_t + \pi_t^{X*} - \pi_t - \Delta tot_t \tag{11}$$

After simple modification, this equation becomes

$$rer_t = rer_{t-1} + ner_t - ner_{t-1} + \pi_t^{X*} - \pi_t - \Delta tot_t$$

If we assume that $rer_{t-1} = \theta\, ner_{t-1}$, then rearranging the equation above will yield

$$rer_t = ner_t + (\theta - 1)ner_{t-1} + \pi_t^{X*} - \pi_t - \Delta tot_t \tag{12}$$

This equation indicates that the real exchange rate is affected by the change in the nominal exchange rate, the change in price of foreign exported goods, domestic inflation, and the change in TOT.

The evolution of inflation takes the form of a Phillips curve as follows:

$$\pi_t = \gamma_1 y_t + \gamma_2 y_{t-1} + \gamma_3 rer_t + \gamma_4 \pi_{t-1} + \mu_t \tag{13}$$

where $\gamma_1, \gamma_2, \gamma_3$ and γ_4 are parameters while μ_t is the disturbance term. In this specification, the lagged inflation term captures inflation inertia, while the current and lagged output gap captures the contemporaneous as well as lagged transmission of output shocks to inflation. The real exchange rate affects inflation through import prices. Substituting equation (12) into equation (13), the above Phillips curve can be written as

$$\pi_t = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 totv_t + \beta_4 \pi_t^{X*} + \beta_5 ner_t + \beta_6 ner_{t-1} + \beta_7 \pi_{t-1} + \upsilon_t \tag{14}$$

where $totv_t = \Delta tot_t$ is TOT volatility and the βs are parameters to be estimated where $\beta_1 = [\gamma_1/(1+\gamma_3)]$, $\beta_2 = [\gamma_2/(1+\gamma_3)]$, $\beta_3 = [-\gamma_3/(1+\gamma_3)]$, $\beta_4 = [\gamma_3/(1+\gamma_3)]$, $\beta_5 = [\gamma_3/(1+\gamma_3)]$, $\beta_6 = [\gamma_3(\theta+1)/(1+\gamma_3)]$, $\beta_7 = [\gamma_4/(1+\gamma_3)]$, and $\upsilon_t = [\mu_t/(1+\gamma_3)]$.

We also estimate the following augmented version of our model:

$$\begin{aligned} \pi_t = {} & \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 totv_t + \beta_4 \pi_t^{X*} + \beta_5 ner_t + \beta_6 ner_{t-1} \\ & + \beta_7 \pi_{t-1} + \beta_8 ms_t + \beta_9 fd_t + \beta_{10} oil_t + \upsilon_t \end{aligned} \tag{15}$$

where ms_t is money supply, fd_t is the fiscal deficit, and oil_t represents oil prices. The theoretical justification for including these variables in the inflation equation is as follows:

- **Output growth (y_t):** Output growth can have both positive and negative effects on inflation. According to the quantity theory of money, as output increases, inflation decreases and vice versa. This implies that income affects inflation negatively. On the other hand, when income rises, the demand for money will also increase. As a result, the interest rate will rise, thereby increasing inflation (Fisher hypothesis). This indicates that income affects inflation positively. Some empirical studies show a negative relationship between income and inflation (see Ahmed & Murtaza, 2005; Ayyoub, Chaudhry, & Farooq, 2011); others show a positive relationship between income and inflation (see Malik & Chowdhury, 2001; Patra & Sahu, 2012).

- **TOT volatility ($totv_t$):** TOT volatility is expected to decrease inflation under a flexible exchange rate system by adjusting the real exchange rate. Further, high volatility in the TOT reduces investment by creating uncertainty. This will cause aggregate demand to fall, which will reduce inflation (Desormeaux et al., 2009). Some empirical studies find that TOT volatility has a negative effect on inflation (see Gruen & Shuetrim, 1994; Broda, 2004). Others have documented the positive effects of TOT volatility on inflation (see Andrews & Rees, 2009; Hove et al., 2012). This positive relationship between inflation and TOT volatility can be explained thus: when TOT volatility increases, exchange rate volatility will also rise. This will decrease foreign investment and trade, thereby reducing production and increasing inflation.

- **Foreign export prices ($\pi_t^{X^*}$):** Theoretically, we expect foreign export prices to have a positive effect on domestic inflation. Intuitively, foreign exports are domestic imports. As the price of foreign exports (domestic imports) increases, domestic inflation will rise and vice versa.

- **Nominal exchange rate (ner_t):** Under purchasing power parity, the exchange rate and inflation are positively correlated. A depreciation of the domestic currency will increase inflation while an appreciation will decrease inflation. Theoretically, the nominal exchange rate is expected to have a positive effect on inflation (see Ahmad & Ali, 1999; Ito & Sato, 2006).

- **Money supply (ms_t):** According to the quantity theory of money, when the money supply increases, inflation will also rise. Similarly, the monetarist view posits that inflation is a monetary phenomenon. Therefore, we expect the money supply to have a positive effect on inflation (in Pakistan's context, see, for instance, Qayyum, 2006; Kemal, 2006).

- **Fiscal deficit (fd_t):** In Pakistan, the government either prints or borrows money to finance its fiscal deficit. These policies increase the money supply, ultimately causing inflation to rise in the country. Theoretically, the fiscal deficit should have a positive impact on inflation. Empirical studies on Pakistan also show this to be the case. A fiscal deficit indicates an excess of government spending over government revenues: this increases aggregate demand, thereby causing demand-pull inflation in the country (see Chaudhary & Ahmad, 1995; Agha & Khan, 2006; Fayyaz, Mughal, & Khan, 2011).
- **Oil prices (oil_t):** Pakistan depends heavily on imported oil to meet its energy needs. Therefore, an increase in the price of imported oil will increase the cost of production, in turn increasing domestic inflation. A number of studies reflect the positive effect of international oil prices on domestic inflation (see Kiani, 2008; O'Brien & Weymes, 2010; Khan & Ahmed, 2011).

The theoretical expected effects of these variables on inflation are shown in Table 1.

Table 1: Effects of different variables on inflation

Parameter	Theoretically expected effect	Parameter	Theoretically expected effect
β_1	+/-	β_6	+
β_2	+/-	β_7	+
β_3	+/-	β_8	+
β_4	+	β_9	+
β_5	+	β_{10}	+

Source: Authors' calculations.

4. Data Overview and Interpretation of Results

This section describes the variables and data sources used, and estimates the model.

4.1. Data Overview

We have compiled annual time-series data for Pakistan for the period 1972 to 2012. Inflation is measured by the growth rate of the CPI.

Output growth is the real GDP growth rate. TOT volatility is measured using the autoregressive conditional heteroskedastic (ARCH) variance of TOT.[1] Foreign exports inflation is calculated as the growth rate of the unit value index of exports of a foreign country (the US, in our study). The nominal exchange rate is expressed as the domestic currency per unit of foreign currency. Thus, an increase (decrease) in the the exchange rate implies a depreciation (appreciation) of the domestic currency. The money supply is the growth rate of broad money (M2). The fiscal deficit is taken as a percentage of GDP. The world oil price index acts as a proxy for international oil prices.

The data has been collected from the International Financial Statistics database, the State Bank of Pakistan's (2010) *Handbook of Statistics on Pakistan Economy*, and the World Development Indicators database. Real variables and indices are calculated taking 2005 as the base year.

Table 2 gives the descriptive statistics for these variables. The value of the standard deviation (SD) for each variable indicates the degree of dispersion in the data from the mean value. The data confirm a high level of variation in the TOT index, foreign export price index, and world oil price index. The other variables show relatively less variation. The SD values will help us interpret the coefficient estimates.

Table 2: Descriptive statistics for variables

Variable	Mean	Median	Max.	Min.	SD	Count
Inflation	9.7	9.0	27.0	3.0	5.42	40
Income growth (%)	5.3	5.2	9.0	1.7	1.9	40
TOT index	129.9	133.6	217.1	68.5	31.7	41
Foreign export price index	84.2	83.0	171.8	26.9	31.6	41
Exchange rate	36.2	25.7	88.3	9.9	26.1	41
Money supply (% of GDP)	40.1	40.1	46.9	29.7	3.9	41
Fiscal deficit (% of GDP)	6.4	6.5	9.6	2.3	1.8	41
World oil price index	59.7	50.9	131.5	5.3	34.8	41

Source: Authors' calculations.

[1] Most studies use the standard deviation of the TOT to measure TOT volatility (see, for example, Blattman et al., 2003). Others use moving averages to measure volatility (Goel & Ram, 2001). Both methods give equal weight to each observation and do not take into account the dynamic properties of the variables, such as autocorrelation. ARCH models, on the other hand, give more weight to recent observations and also take into account the dynamic properties of variables. Therefore, an ARCH variance series is considered a better measure of volatility than standard deviations and moving averages. The Appendix provides a brief description of the ARCH model we have used.

Table 3 presents a correlation matrix for the variables used. The first column correlates inflation with all the independent variables. The value of the correlation coefficient –0.79 indicates that inflation is negatively correlated with the TOT index. The value of the correlation coefficient –0.25 indicates that inflation is also negatively correlated with income growth. The other correlation coefficients show that all the other variables are positively correlated with the inflation rate.

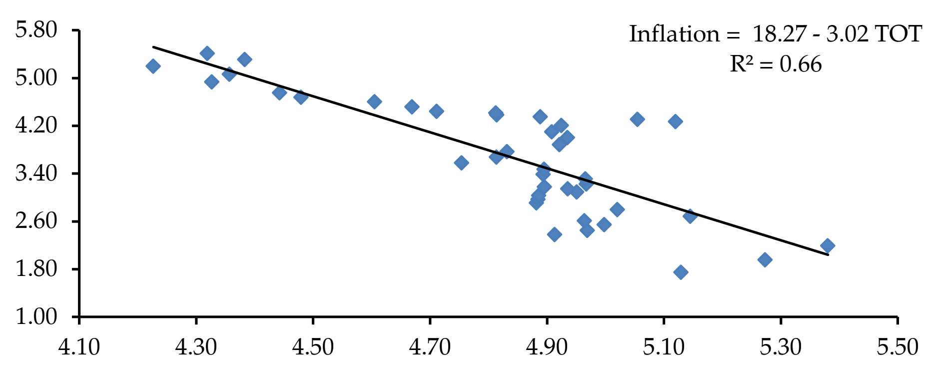
Figure 2 plots the correlation between inflation and TOT, indicating a negative relationship between inflation and TOT volatility for Pakistan. However, this correlation exercise is essentially bivariate and simplistic, and calls for exploration within a more rigorous framework. This is what the next section attempts to do.

Table 3: Correlation matrix for variables

	Inflation	Income growth	TOT index	Foreign export price index	Exchange rate	Money supply (% of GDP)	Fiscal deficit (% of GDP)	World oil price
Inflation	1							
Income growth	-0.25	1						
TOT index	-0.79	0.11	1					
Foreign export price index	0.93	-0.15	-0.84	1				
Exchange rate	0.96	-0.28	-0.77	0.87	1			
Money supply (% of GDP)	0.22	0.18	-0.21	0.33	0.33	1		
Fiscal deficit (% of GDP)	0.51	-0.06	0.47	-0.44	-0.59	-0.35	1	
World oil price index	0.78	0.12	-0.78	0.81	0.72	0.24	-0.53	1

Source: Authors' calculations.

Figure 2: Scatter diagram for TOT and inflation



4.2. Estimation and Interpretation of Model

Before estimating the model, we test the stationarity properties of the variables using the augmented Dickey-Fuller (ADF) unit root test (see Table 4 for ADF t-statistics). All variables expressed as growth rates are integrated of order zero [*I* (0)], i.e., they are stationary at level. These include domestic inflation, income growth, foreign exports inflation, and money supply growth. All nongrowth variables are stationary at first difference and nonstationary at level. Accordingly, they are integrated of order one, i.e., *I* (1). These include the TOT index, nominal exchange rate, fiscal deficit, and international oil prices. This indicates that there is no possibility of full cointegration among the variables, which specifies the existence of a degenerated case.

Table 4: Stationarity of variables

Variable	**ADF t-value (level)**	**ADF t-value (first difference)**	**Null order**
Inflation	-3.25*		*I* (0)
Income growth	-4.79*		*I* (0)
Terms of trade	-0.93	-7.56*	*I* (1)
Foreign inflation	-5.18*		*I* (0)
Nominal exchange rate	0.50	-5.85*	*I* (1)
Money supply growth	-4.41*		*I* (0)
Fiscal deficit	-2.16	-7.11*	*I* (1)
Oil prices	-2.46	-3.39*	*I* (1)

Note: The null hypothesis is that the series contains a unit root. The critical values at 1%, 5%, and 10% are –3.61045, –2.93899, and –2.60793, respectively. The asterisks * indicates the rejection of the null hypothesis at a 5% critical value.
Source: Authors' calculations.

Since reverse causality is likely to pose the problem of endogeneity between the variables, we cannot use the autoregressive distributed lag technique to estimate the model. Further, we cannot use least squares because, in the presence of endogeneity, least squares estimates become biased as well as inconsistent. We therefore apply the generalized method of moments (GMM) (Arellano & Bond, 1991; Arellano, 1993; Arellano & Bover, 1995). GMM estimators are able to account for the possible endogeneity of the lagged dependent variable and additional explanatory variables (Judson & Owen, 1999). The lagged values of the variables will be used as instruments as they are less likely to be influenced by current shocks (Holtz-Eakin, Newey, & Rosen, 1988).

Table 5 gives the estimated results of equation (15). In column (1), the estimated coefficient on TOT volatility, measured by the growth rate of TOT, has a significant negative effect on inflation. Since the TOT growth rate is a weak proxy for TOT volatility, we have also used an ARCH variance series to measure volatility.

Table 5: Effect of TOT volatility on inflation: Empirical estimates

Variable	TOT growth (1)	ARCH variance (2)	ARCH variance (3)	ARCH variance (4)	Variance (5)
Intercept	0.047	-0.030	-0.010	0.051	-0.031
	(0.956)	(-0.519)	(-0.182)	(6.237)*	(-0.763)
y_t	-0.046	-0.139	-0.666		-0.540
	(-0.133)	(-0.463)	(-1.775)**		(-2.095)*
y_{t-1}	0.446	-0.217			0.020
	(2.585)*	(-0.925)			(0.102)
$totv_t$	-0.177	-1.215	-2.220	-1.882	-7.259
	(-3.193)*	(-2.580)*	(-4.792)*	(-2.365)*	(-4.223)*
π_t^{X*}	-0.013	0.149	0.127		0.131
	(-0.232)	(2.059)*	(1.920)**		(2.992)*
ner_t	-0.173	0.343	-0.004		0.087
	(-1.851)**	(2.173)*	(-0.476)		(0.806)
ner_{t-1}	0.191	-0.344			-0.090
	(2.020)*	(-2.061)**			(-0.838)
π_{t-1}	0.374	0.452	0.488	0.670	0.518
	(3.957)*	(4.736)*	(5.783)*	(8.854)*	(7.116)*
ms_t	0.200	0.114	0.248		0.147
	(1.714)**	(1.738)**	(2.803)*		(1.668)**
fd_t	0.071	0.021	0.034		0.010
	(2.110)*	(0.861)	(1.214)		(0.698)
oil_t	0.025	0.031	0.045		0.028
	(2.274)*	(1.661)**	(3.345)*		(2.361)*
R-sq.	0.464	0.469	0.434	0.517	0.585
Adj. R-sq.	0.266	0.264	0.272	0.489	0.425
DW	1.974	2.037	1.807	2.114	1.905
Durbin *h*	0.099	-0.137	0.682	-0.399	0.324
J-statistic	6.696	7.094	7.607	2.527	5.708
Prob. (J-stat.)	0.570	0.627	0.667	0.640	0.769

Note: Values in parentheses denote the underlying student t-values. The t-statistics significant at 5% and 10% are indicated by * and **, respectively.
Source: Authors' calculations.

Column (2) gives the results of the ARCH variance series. The coefficient on TOT volatility is, again, statistically significant and negative.

The estimated value of the coefficient indicates that a one-percent increase in TOT volatility will decrease inflation by 1.215 percent. This implies that TOT volatility had a deflationary effect in Pakistan during the study period. One possible reason for this is that the volatile TOT adversely affected external trade and foreign investment, creating the deflationary impact. Further, Pakistan exports mainly agricultural products and imports capital goods: the price of the former fluctuates more than that of the latter, creating high volatility in TOT and discouraging agricultural good exports. This has a deflationary effect by decreasing aggregate demand.

Column (3) gives the results we obtain when the lagged terms of output growth and nominal exchange rate are excluded from the model to remove the possibility of multicollinearity. In this case, the coefficient on TOT volatility remains negative and statistically significant. Column (4) gives the results estimated exclusively for TOT volatility. The effect of TOT volatility on inflation is negative and statistically significant as the estimated value of the coefficient indicates (–1.882). Column (5) gives the results we obtain when TOT volatility is calculated by the simple variance of TOT. Here, again, the effect of TOT volatility on inflation is not only negative but also statistically significant. This indicates that the effect of TOT volatility on inflation is robust to alternative equation specifications and different measures of TOT volatility.

As far as the impact of the other control variables on inflation is concerned, output growth has a negative but statistically insignificant effect as shown in column (2).[2] Conversely, this result is significant both in columns (3) and (5). This result supports the quantity theory of money hypothesis, which posits that, as income increases, inflation decreases. The effect of previous-period output growth on inflation is statistically insignificant both in columns (2) and (5).

As expected in theory, the effect of foreign export prices on domestic inflation is positive and statistically significant. The estimated value of the coefficient indicates that a one-percent rise in foreign export prices will increase domestic inflation by 0.149 percent as shown in column (2). Alternatively, a one-SD rise in foreign exports inflation (31.6) will increase domestic inflation by 4.708 points. This result is robust to alternative equation specifications as shown in the other columns.

A depreciation of the domestic currency increases inflation as the significant positive value of the coefficient on the nominal exchange rate

---

[2] All interpretations refer to columns (2) to (5) only.

indicates in column (2). Thus, if the Pakistan rupee depreciates by 1 percent, domestic inflation will increase by 0.343 percent. However, this result is statistically insignificant in columns (3) and (5). Conversely, the lagged value of the nominal exchange rate has a significant negative effect on inflation. Again, this result is not, however, robust to alternative equation specifications.

Inflation is statistically positively correlated with its lagged value. Further, as theoretically expected, inflation increases with a rise in money supply. The estimated value of the coefficient indicates that a one-percent rise in money supply will increase inflation by 0.114 percent. Alternatively, a one-SD increase in money supply (3.9) will increase inflation by 0.445 units. This result is not only significant but also robust to alternative equation specifications, and implies that the quantity theory of money hypothesis holds for Pakistan, i.e., inflation increases with an increase in money supply.

As discussed earlier, there may be differential effects under fixed and flexible exchange rates. Pakistan followed a fixed rate regime till 1981 and then moved to a flexible system. The dummy incorporated to account for this was statistically insignificant and thus removed from the model. Further, we have only 10 observations for the fixed exchange rate (1972–1981) and 31 observations for the flexible regime (1982–2012).

The fiscal deficit has a positive effect on inflation: a one-percent increase in the fiscal deficit will increase inflation by 0.021 percent. However, this result is statistically insignificant and remains so in the other specifications as well. Finally, the international oil price has a significant positive effect on inflation: if oil prices increase by 1 percent in the international market, domestic inflation will rise by 0.031 percent. This result is robust to alternative equation specifications.

The high values of R^2 and the adjusted R^2 indicate that the model fits the data well. The Durbin Watson statistic values are close to the desired value of 2, which indicates the absence of autocorrelation. Since the lagged value of the dependent variable is included as an independent variable, we have also calculated Durbin *h* statistics, the values of which are less than 1.96 in absolute terms. Again, this indicates a lack of autocorrelation in the model. We check the validity of the instruments using the J-test: the high p-values of the J-statistics indicate that the instruments are valid. Further, the high value of the F-statistic indicates that the model fits the data well.

5. Conclusion

This study has empirically examined the effect of TOT volatility on inflation in Pakistan using annual data for the period 1972 to 2012. To control for potential endogeneity, we have employed the GMM technique. The estimated results show that TOT volatility has a significant negative effect on inflation in Pakistan. The estimated value of the coefficient on TOT volatility indicates that a one-percent increase in TOT volatility will reduce inflation by 1.215 percent. This result is robust to alternative equation specifications and TOT volatility measures.

The control variables used have the theoretical impact we expect. Output growth has a significant negative effect while the foreign exports price has a significant positive effect on domestic inflation. A depreciation of the nominal exchange rate or money supply increases the inflation rate. The positive significant influence of the money supply on domestic inflation corresponds somewhat to the monetarist view that money is the most important variable affecting the inflationary process. The fiscal deficit and world oil prices are also found to increase inflation in the country.

This study has some important policy implications. Inflation in Pakistan can be cured by maintaining a stable TOT. Foreign export prices (or domestic import prices) increase inflation, which implies that decreasing Pakistan's dependency on foreign imports would help reduce inflation. Further, appreciating the nominal exchange rate, tightening monetary policy, curtailing the fiscal deficit, and reducing oil prices would help curb inflation. Although the government has taken some recent steps to appreciate the domestic currency, much more needs to be done.

References

Abdullah, M., & Kalim, R. (2012). Empirical analysis of food price inflation in Pakistan. *World Applied Sciences Journal*, *16*(7), 933–939.

Agha, A. I., & Khan, M. S. (2006). An empirical analysis of fiscal imbalances and inflation in Pakistan. *SBP Research Bulletin*, *2*(2), 343–362.

Ahmad, E., & Ali, S. A. (1999). Exchange rate and inflation dynamics. *Pakistan Development Review*, *38*(3), 235–251.

Ahmed, S., & Murtaza, M. G. (2005). *Inflation and economic growth in Bangladesh: 1981–2005* (Working Paper No. 0604). Dhaka: Bangladesh Bank, Policy Analysis Unit.

Andrews, D., & Rees, D. (2009). *Macroeconomic volatility and terms of trade shocks* (Research Discussion Paper No. 2009-05). Sydney: Reserve Bank of Australia.

Arellano, M. (1993). On the testing of correlated effects with panel data. *Journal of Econometrics*, *59*(1–2), 87–97.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, *58*(2), 277–297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51.

Ayyoub, A., Chaudhry, I. S., & Farooq, F. (2011). Does inflation affect economic growth? *Pakistan Journal of Social Sciences*, *31*(1), 51–64.

Ball, L. M. (1998). *Policy rules for open economies* (Working Paper No. 6760). Cambridge, MA: NBER.

Baxter, M., & Kouparitsas, M. A. (2000). *What causes fluctuations in the terms of trade?* (Working Paper No. 7462). Cambridge, MA: National Bureau of Economic Research.

Blattman, C., Hwang, J., & Williamson, J. G. (2003). *The terms of trade and economic growth in the periphery 1870–1983* (Working Paper No. 9940). Cambridge, MA: National Bureau of Economic Research.

Bleaney, M., & Greenway, D. (2001). The impact of terms of trade and real exchange volatility on investment and growth in sub-Saharan Africa. *Journal of Development Economics*, *65*(2), 491–500.

Broda, C. (2004). Terms of trade and exchange rate regimes in developing countries. *Journal of International Economics*, *63*(1), 31–58.

Broda, C., & Tille, C. (2003). Coping with terms-of-trade shocks in developing countries. *Current Issues in Economics and Finance*, *9*(11), 1–7.

Cavoli, T., & Rajan, R. S. (2006). Monetary policy rules for small and open developing economies: A counterfactual policy analysis. *Journal of Economic Development*, *31*(1), 89–11.

Chaudhary, M. A., & Ahmad, N. (1995). Money supply, deficit, and inflation in Pakistan. *Pakistan Development Review*, *34*(4), 945–956.

Desormeaux, J., García, P., & Soto, C. (2010). Terms of trade, commodity prices and inflation dynamics in Chile. In Bank for International Settlements (Ed.), *Monetary policy and the measurement of inflation: Prices, wages and expectations* (vol. 49). Basel, Switzerland: Bank for International Settlements.

Durevall, D., & Ndung'u, N. S. (1999). *A dynamic model of inflation for Kenya: 1974–1996* (Working Paper No. 99/97). Washington, DC: International Monetary Fund.

Fatima, N. (2010). *Analyzing the terms of trade effect for Pakistan* (Working Paper No. 2010-59). Islamabad: Pakistan Institute of Development Economics.

Fayyaz, A., Mughal, K., & Khan, M. A. (2011). Fiscal deficit and its impact on inflation, causality and cointegration: The experience of Pakistan (1960–2010). *Far East Journal of Psychology and Business*, *5*(3), 51–62.

Goel, R. K., & Ram, R. (2001). Irreversibility of R&D investment and the adverse effect of uncertainty: Evidence from the OECD countries. *Economics Letters*, *71*, 287–291.

Gruen, D., & Dwyer, J. (1995). *Are terms of trade rises inflationary?* (Research Discussion Paper No. 9508). Sydney: Reserve Bank of Australia.

Gruen, D., & Shuetrim, G. (1994). Internationalization and the macro-economy. In P. Lowe & J. Dwyer (Eds.), *International integration of the Australian economy: Proceedings of a conference* (pp. 309–363). Sydney: Reserve Bank of Australia.

Hasan, M. A., Khan, A. H., Pasha, H. A., & Rasheed, M. A. (1995). What explains the current high rate of inflation in Pakistan? *Pakistan Development Review*, *34*(4), 927–943.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating vector autoregressions with panel data. *Econometrica*, *56*(6), 1371–1395.

Hove, S., Mama, A. T., & Tchana, F. T. (2012). *Terms of trade shocks and inflation targeting in emerging market economies* (Working Paper No. 273). Cape Town: Economic Research Southern Africa.

Ito, T., & Sato, K. (2006). *Exchange rate changes and inflation in post-crisis Asian economies: VAR analysis of the exchange rate pass-through* (Working Paper No. 12395). Cambridge, MA: National Bureau of Economic Research.

Jääskelä, J., & Smith, P. (2011). *Terms of trade shocks: What are they and what do they do?* (Research Discussion Paper No. 2011-5). Sydney: Reserve Bank of Australia.

Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: A guide for macroeconomists. *Economics Letters*, *65*(1), 9–15.

Kemal, M. A. (2006). Is inflation in Pakistan a monetary phenomenon? *Pakistan Development Review*, *45*(2), 213–220.

Khan, A. R., & Ahmed, A. (2011). Macroeconomic effects of global food and oil price shocks to the Pakistan economy: A structural vector autoregressive analysis. *Pakistan Development Review*, *50*(4), 491–511.

Khan, A., Bukhari, S., & Ahmed, Q. (2007). *Determinants of recent inflation in Pakistan* (Research Report No. 66). Karachi, Pakistan: Social Policy and Development Center.

Kiani, A. (2008). Impact of high oil prices on Pakistan's economic growth. *International Journal of Business and Social Science*, *2*(17), 209–216.

Malik, G., & Chowdhury, A. (2001). Inflation and economic growth: Evidence from four South Asian countries. *Asia-Pacific Development Journal*, *8*(1), 123–135.

Mendoza, E. G. (1995). The terms of trade, the real exchange rate, and economic fluctuations. *International Economic Review*, *36*(1), 101–137.

O'Brien, D., & Weymes, L. (2010, July). The impact of oil prices on Irish inflation. *Quarterly Bulletin* (Central Bank of Ireland), *3*, 66–82.

Patra, S., & Sahu, K. K. (2012). Inflation in South Asia and its macroeconomic linkages. *Journal of Arts, Science and Commerce*, *3*(2), 10–15.

Qayyum, A. (2006). Money, inflation, and growth in Pakistan. *Pakistan Development Review*, *45*(2), 203–212.

Appendix

An ARCH model simultaneously examines the mean and variance of a series according to the following specification:

$$Y_t = \alpha + \beta' X_t + \upsilon_t$$

$$\upsilon_t | \Omega_t \sim iid\ N(0, \sigma^2)$$

$$\sigma_t^2 = \gamma_0 + \sum_{j=1}^{q} \gamma_j \upsilon_{t-j}^2$$

where X_t is a $k \times 1$ vector of explanatory variables and β' is a $k \times 1$ vector of coefficients. Normally, we assume that υ_t is independently distributed with a zero mean and a constant variance σ^2, where Ω_t is the information set. In an ARCH model, the variance of the residual (σ^2) depends on history or is heteroskedastic because it changes over time. One way to take this into account is to have the variance depend on the lagged period of the squared error terms, where $j(=1 \ldots q)$ is the lag length of the error term. The estimated coefficients of the γ terms have to be positive for a positive variance. The ARCH model postulates that, when a large shock occurs in period $t-1$, the value of υ_t (in absolute terms because of the squares) is more likely to be higher, i.e., when υ_{t-1}^2 is large/small, the variance of the next innovation υ_t is also large/small.

The Lahore Journal of Economics
19 : 1 (Summer 2014): pp. 133–149

The Efficiency of Foreign Exchange Markets in Pakistan: An Empirical Analysis

Rizwana Bashir[*], Rabia Shakir[**], Badar Ashfaq[***], and Atif Hassan[****]

Abstract

This study investigates the empirical relationship between spot and forward exchange rate efficiency with reference to Pakistan and the efficiency of its foreign exchange market. We use monthly data from the State Bank of Pakistan and KIBOR rates for the period July 2006 to December 2013. Our results indicate that the forward exchange rate does not fully reflect all the information available. Market players may gain the benefits of volatility speculation due to market inefficiency. Pakistan's foreign exchange market is still small compared to those of other emerging economies, implying that substantial policy work is required.

Keywords: Foreign exchange markets, forward exchange rate efficiency, efficient market hypothesis, emerging economy, real effective exchange rate, Pakistan.

JEL classification: F30, F31, G10.

1. Introduction

The importance of the foreign exchange market is fairly evident in today's globalized world, and the exchange rate literature has produced a rich body of empirical research that addresses three key questions:

1. How efficient is the foreign exchange market?
2. Which is the most suitable model for exchange rate movements?
3. How can we model the expectations of foreign exchange market participants?

[*] Assistant Professor, Bahria University, Karachi, Pakistan.
[**] Lecturer, University of Karachi, Pakistan.
[***] MS scholar, Institute of Business and Technology, Karachi, Pakistan.
[****] Assistant professor, DHA Suffa University, Karachi, Pakistan.

The objective of this study is to answer these questions empirically by establishing the relationship between the spot exchange rate and forward exchange rate based on the regression analyses put forward by Frenkel (1980) and Levich (1979). Our study is with reference to Pakistan and also investigates the efficiency of its foreign exchange market. In this context, "efficiency" means that the market's players have processed all the available information at the time of determining the forward exchange rate. The forward exchange rate should then be able to predict the future spot rate with reasonable accuracy. On the other hand, if the future spot rate deviates from the forward rate, this will lead to inefficiency or imperfection.

In Pakistan's case, the most significant issue is to determine whether or not the financial markets can efficiently allocate economic resources based on the information available. The exchange rate of the Pakistani rupee (PKR) is influenced chiefly by the market mechanism and the forward exchange rate is determined by the interaction of demand and supply. The intercession of the State Bank of Pakistan (SBP) in the currency market does not have a significant impact on the determination of the forward exchange rate. Its only role is to smooth out any foreign exchange market shakiness.

The determinants of the forward exchange rate include the interest rate differential of the two economies in the interbank market, the current account surplus of imports in relation to exports, and capital receipts. When determining the forward exchange rate, market players are assumed to have complete information on these factors and to consider all the available information at that time. Thus, the forward exchange rate encompasses all the available information relating to these factors.

A number of tests help determine the efficiency of the foreign exchange market, of which the efficient market hypothesis (EMH) is the most useful (Roberts, 1967). The EMH is considered the cornerstone of modern foreign exchange theory, and it takes into account both the rational expectations hypothesis and the risk-neutral behavior of investing agents. The EMH holds that, in an efficient market, price will reflect the available information fully (Fama, 1984). It also considers issues related to reliability, variance, seasonality, volatility, and market instability. Studying all these issues enables market analysts to gauge the efficiency of a country's financial market.

Market efficiency with respect to the EMH is classified as weak, semi-strong, or strong. In its weak form, efficiency implies that the information available reflects only the history of prices or returns. Semi-strong efficiency suggests that prices reflect the information available to all market individuals. In its strong form, efficiency means that prices reflect inside information in addition to past prices and publicly available information (Fama, 1970, 1991).

Sections 2 and 3 review the theoretical and empirical aspects of the efficiency of the foreign exchange market. Sections 4 and 5 present the model and variables used. Section 6 provides a detailed empirical analysis. Sections 7 and 8 conclude the study and point out some research limitations.

2. Review of the Literature

Earlier studies on the EMH involved conducting regression analyses by taking the logs of the future spot exchange rate and current forward exchange rate. Their results suggested that the forward exchange rate was an unbiased predictor of the future spot exchange rate (Frenkel, 1980; Levich 1979). The efficiency of the foreign exchange market for different currencies against the US dollar was examined using ordinary least squares (OLS); these studies rejected the EMH because of a deviation from unity in both forward and level specifications. The deviation was a result of the risk premium factor involved in the forward exchange rate market (Fama, 1984).

The EMH became the hypothetical basis for most subsequent research during the 1980s, and was used to forecast the forward rate from historical data and stock variables such as P/E ratios, term structure variables, and dividends yield (Campbell & Shiller, 1987). The EMH can also be applied to the foreign exchange market to determine whether prices are independent of each other or if they follow a random walk. The weak form of efficiency exists because of the random walk but the random walk does not determine weak efficiency (Cuthbertson & Nitzsche, 2005). Time series financial market data can also be used to examine the relative efficiency of foreign exchange markets. Furthermore, an approximate entropy method can be applied to quantify foreign exchange market efficiency (Oh, Kim, & Eom, 2007).

In Pakistan, the empirical research shows that stock market prices are manipulated by market players, which increases the volatility of the financial market (Khawaja and & Mian, 2005). In India, which follows a floating exchange rate, the intervention of the Reserve Bank of India does not affect the determination of the forward exchange rate. The main determinant is the interest rate differential of the two countries in the inter-bank market (Sharma & Mitra, 2006). Another study shows that the foreign exchange market for the Indian rupee against the US dollar is efficient as the current forward rate predicts the future spot rate (Kumar & Mukherjee, 2007). The foreign exchange market in Sri Lanka shows weak efficiency, i.e., the forward rate reflects only the history of prices or returns (Wickremasinghe, 2004).

The markets for the euro, Japanese yen, and pound sterling are volatile as market players obtain higher returns through buying and selling without considering the transaction costs involved—although this would be more efficient (Lee & Khatanbaatar, 2012). Conjectures regarding volatility, speculation, and predictability also relate to the efficiency of foreign exchange markets; these are all interdependent issues (Cuthbertson, 1996). Various empirical models have been used to determine volatility, speculation, and certainty in foreign exchange markets, which either support or reject the market's efficiency (Bollerslev & Hodrick, 1992).

Empirical studies show that, in competitive markets, rational investors, returns, and prices are interdependent and follow a sequence of random variables (Mandelbrot, 1963). Due to volatility, speculation, and uncertainty in the financial market following the Asian economic crisis, the Thai baht was devalued and most currency markets in Southeast Asia suffered depreciating exchange rates with respect to their most important foreign currencies (Titman & Wei, 1999).

3. An Overview of Pakistan's Foreign Exchange Market

Pakistan's foreign exchange market is smaller than those of other emerging economies. The exchange rate policy is, by definition and in practice, part of the monetary policy and has undergone several changes since 1949. The country's exchange rate was originally pegged to the pound sterling up to September 1971 and subsequently to the US dollar. Since January 1982, the exchange rate regime has followed a managed float system pegged to a basket of currencies. Under the financial reforms initiated in 1991, a free float was proposed and finally achieved in 2000/01. Pakistan uses the US dollar as its reserve currency.

The Pakistani rupee has undergone various changes in nominal value. In September 1949, the government decided not to devalue the rupee (48 other currencies in the sterling area had been devalued) in spite of the fact that the current account deficit in 1948/49 was around 2.5 percent of GDP. The Korean War, however, helped Pakistan emerge from the crisis and in 1950/51 the country recorded a surplus in its current account. Once the Korean boom ended, the current account fell into deficit once again. On 31 July 1955, the Pakistan rupee was devalued for the first time.

By 1956/57, the balance of payments position had worsened to such an extent that the SBP governor singled out the balance of payments and inflation as the two main culprits in the economy. Since then, Pakistan has experienced a similar pattern. The nominal exchange rate had been fixed at PRs 4.76 per US dollar in 1955, but since the export bonus scheme was in vogue at the time, it was effectively a multiple exchange rate. In 1971, it depreciated to PRs 7.76 for exports. However, in 1972 it was unified at PRs 11 per US dollar.

Another issue confronting Pakistan at the time was the significant overvaluation of the real effective exchange rate (REER), which appreciated by 56 percent in 1972 and 25 percent in 1973. To adjust this and in order to make exports more competitive, the rupee was devalued by 56.73 percent. The main feature of adjustment in feeding current account deficits has been the external aid received from donor agencies (mainly from the US). This feature has continued to hold back the economy.

The foreign exchange market in Pakistan receives inflows through export proceeds, remittances, and foreign direct investment. The amount received from the IMF is to meet the current account deficit and does not translate into forex market activities. The SBP occasionally intervenes to smooth out the market, which can come under pressure on account of lumpy payments or plunge on receipt of a large amount. Under the financial reforms that started in 1991, the current account was made completely convertible in 1993 such that any foreign account holder (FE-25) could send money abroad unrestricted. Likewise, the account could receive amounts in cash or from abroad without any restrictions. In capital market investments, amounts could be sent in or out through special convertible rupee accounts that banks maintained on behalf of their investors. Capital account convertibility is not yet allowed in Pakistan.

FY2008 was a volatile year for the forex market: net foreign assets contracted by around PRs 375 billion, coinciding with an equivalent depletion in bank deposits. The outflow went mainly to the Gulf states, which offered better investment opportunities. This trend has now been reversed on account of the recessionary mood in these countries. At the time, the rupee had depreciated by more than 18 percent, although the situation improved with the receipt of IMF aid. These are, however, short-term arrangements. Opportunities exist to encash them on the back of declining inflation and a world emerging from the recession.

Forward points, an indicator of future trends in the forex market, had risen as high as PRs 3.72 per US dollar in June 2008. These are now softening out and forex reserves have also improved. This is needed mainly to meet import obligations and to help the forex market avoid dire undue fluctuations in the nominal exchange rate. In the wake of these changes, the SBP has succeeded in shifting oil payments to the interbank market. Furthermore, the kerb market is also showing some degree of discipline, resulting in a smaller spread between the interbank and kerb markets.

Another corrective measure is the foreign exchange exposure limit (FEEL) implemented by the SBP after replacing NOSTRO[1] limits had made the market more flexible and disciplined enough to move within some range of banks' paid-up capital. Previously, this range was 10 percent and recently, it has been relaxed to 20 percent. This has helped the forex market arrange its funds in a wider space.

Other factors that dictate exchange rate parity include (i) the difference in the interest rate on other currencies, specifically the US Dollar, with respect to the rupee; (ii) the difference between the forward exchange rate and the spot rate; (iii) how expected spot rates for the US dollar and rupee might be determined the following year; and (iv) the relationship foreseen between inflation in Pakistan with respect to other countries. The paramount factor is the demand and supply position of the US dollar with respect to the rupee, which can alter as a result of government and central bank policies. The kerb market plays a role here as well as in shifting market flows and creating market sentiments.

At present, the most important step in developing the forex market will be the introduction of hedging products. The SBP initiated a

[1] A bank account held in a foreign country by a domestic bank, denominated in the currency of that country. It is commonly used for currency settlement, where a bank or other financial institution needs to hold balances in a currency other than its home accounting unit.

derivatives market in 2004 with the introduction of forex options and other interest rate derivatives. Forwards and currency swaps already existed. Sensing the huge differential between the LIBOR and KIBOR, the market opted for cross-currency swaps in FY2007 and FY2008. However, a significant depreciation of the rupee affected corporate investors negatively. Since most of them had naturally hedged against their export proceeds, they were left where they started. This experience and others in the use of forwards reveals that most corporate players are not aware of the risks involved in cross-currency swaps and other derivatives. Forwards are mostly demand-driven and operate in an environment where no price discovery mechanism exists; ultimately, they also fail to provide prudent future prices.

These constraints to the forex market in Pakistan can be streamlined with the SBP's initiatives in collaboration with market players. However, the market side lacks capable staff, which places an extra burden on banks and other financial or corporate institutions in building the capacity of their treasury staff.

4. Methodology

As mentioned earlier, our methodology is based on the regression analyses conducted by Frenkel (1980) and Levich (1979), who take the logs of the future spot exchange rate and current forward exchange rate. Their results suggest that the forward exchange rate is an unbiased predictor of the future spot exchange rate. We establish the following relationship between the logs of the actual spot exchange rate and forward exchange rate at time *t*.

$$SR_{t+1} = ER_{t+1} + U_t \quad (1)$$

where SR_{t+1} is the log of the actual spot exchange rate in terms of the domestic currency unit per unit of foreign currency in $t + 1$ period, ER_{t+1} is the log of the expected exchange rate in $t + 1$ period, and U_t is the normally distributed random error term with mean equal to 0. Investors are assumed to be risk neutral and can set the forward exchange rate at a point that matches the expected future spot exchange rate. The forward exchange rate at time t is thus equal to the expected exchange rate in $t + 1$. Therefore,

$$f_t = ER_{t+1} \quad (2)$$

Putting this value in the above equation, we get

$$SR_{t+1} = f_t + U_t \quad (3)$$

Equation (3) constitutes a dual test of foreign exchange market efficiency and no risk premium. In other words, the forward exchange rate is, on average, an unbiased predictor of future spot exchange rates. The estimated equation used for empirical analysis is

$$SR_{t+1} = \alpha_1 + \alpha_2 f_t + U_t \quad (4)$$

where SR_{t+1} and f_{t+1} are stationary time series and the level of significance is 5 percent (see Levich, 1979, and Frenkel, 1980, who test the hypothesis based on this equation). The purpose of the empirical analysis is to examine the efficiency of the market. In order to obtain unbiased regression results, it is necessary to de-trend the data, for which purpose we re-estimate the results using the following regression equation:

$$(SR_{t+1} - S_t) = \alpha_1 + \alpha_2 (f_t - S_t) + U_{t+1} \quad (5)$$

where S_t is the log of the spot exchange rate. This is the more significant test of the EMH, according to which a currency that is at a forward discount rate $(f_t - S_t)$ of x percent should, on average, depreciate by x percent, whereas a currency that is at a forward rate premium $(SR_{t+1} - S_t)$ of x percent should, on average, appreciate by x percent.

5. Data and Estimation

We have used monthly data compiled from the State Bank of Pakistan and KIBOR rates. These include the spot exchange rate and one-month forward rates of the Australian dollar (AUD) to the rupee, Swiss franc (CHF) to the rupee, euro (EUR) to the rupee, yen (JPY) to the rupee, and US dollar (USD) to the rupee. The data span the period 3 July 2006 to 2 December 2013. The sample comprises a total of 90 observations.

The OLS regression we have carried out uses the log of the actual spot rate as the dependent variable and the log of the forward rate at time t as the independent variable. Durban Watson d statistics are used to detect the presence of autocorrelation in the residuals from the analysis. The model is then de-trended in order to obtain unbiased regression estimates.

According to this test, the foreign exchange market is deemed efficient if the forward exchange rate incorporates all currently accessible information without any risk premium. The estimation is based on the following assumptions:

- α_1 should be 0. The forward exchange rate may over- or under-predict the future spot exchange rate and rational market players will use this information to make a profit.
- α_2 should be equal to unity, indicating that, on average, the forward exchange rate exactly predicts the future spot exchange rate.
- The error term U_t should possess OLS properties.

If all three conditions are met, we can conclude that the foreign exchange market is efficient.

6. Empirical Analysis

All tests are conducted over the full sample of 90 observations. Both the actual spot rates and one-month forward rates are taken as units of the domestic currency per unit of foreign currency. The data refer to the end of every month. For dates for which both the spot and forward exchange rates were not available, we have taken the data available for the nearest date of the same month.

Tables 1 to 5 give the currency-wise summary statistics of the data, which are also illustrated in Figures 1 to 5.

Table 1: Summary statistics for AUD–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	74.74304	75.0088
Median	76.27265	76.71795
Maximum	102.5093	102.9738
Minimum	44.8437	44.9201
SD	19.24307	19.3462
Skewness	-0.09345	-0.0975
Kurtosis	1.514534	1.515461
Jarque-Bera	8.405787	8.407049
Probability	0.014952	0.014943
Sum	6726.874	6750.792
Sum sq. dev.	32956.33	33310.51

Source: Authors' calculations.

Table 2: Summary statistics for CHF–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	80.52053	81.09155
Median	80.58735	81.2523
Maximum	119.4341	119.529
Minimum	48.6839	48.9594
SD	21.21715	21.37859
Skewness	-0.08412	-0.09846
Kurtosis	1.770334	1.758107
Jarque-Bera	5.776448	5.929014
Probability	0.055675	0.051586
Sum	7246.848	7298.239
Sum sq. dev.	40064.92	40676.92

Source: Authors' calculations.

Table 3: Summary statistics for EUR–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	109.9209	110.6129
Median	115.2609	116.2247
Maximum	147.0172	147.0811
Minimum	51.7029	51.8355
SD	18.65862	18.85561
Skewness	-0.63731	-0.65589
Kurtosis	2.97792	2.945412
Jarque-Bera	6.094346	6.464133
Probability	0.047493	0.039476
Sum	9892.883	9955.16
Sum sq. dev.	30984.84	31642.51

Source: Authors' calculations.

Table 4: Summary statistics for JPY–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	0.8792	0.885709
Median	0.93605	0.9436
Maximum	1.2173	1.226
Minimum	0.4932	0.4968
SD	0.238556	0.240442
Skewness	-0.40491	-0.40747
Kurtosis	1.7363	1.739174
Jarque-Bera	8.447777	8.451761
Probability	0.014642	0.014612
Sum	79.128	79.7138
Sum sq. dev.	5.064878	5.14529

Source: Authors' calculations.

Table 5: Summary statistics for USD–PKR

Descriptive statistics	Spot rate	Forward rate
Mean	81.14992	81.58305
Median	84.5132	84.92615
Maximum	108.5238	108.5718
Minimum	60.2455	60.374
SD	13.86169	14.01576
Skewness	-0.22449	-0.24049
Kurtosis	2.030534	2.011453
Jarque-Bera	4.280435	4.5321
Probability	0.117629	0.103721
Sum	7303.493	7342.475
Sum sq. dev.	17101.04	17483.3

Source: Authors' calculations.

Figure 1: AUD–PKR

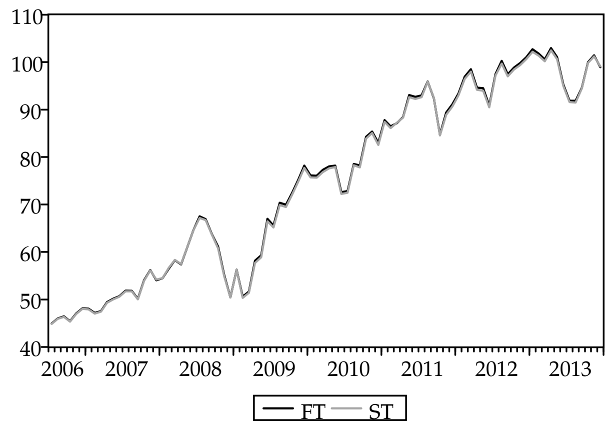


Figure 2: CHF–PKR

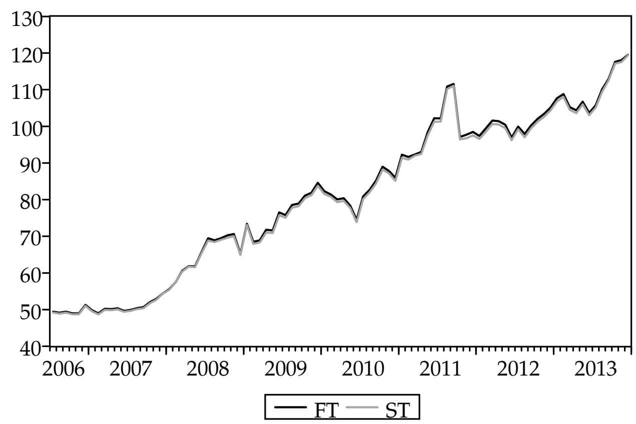


Figure 3: EUR–PKR

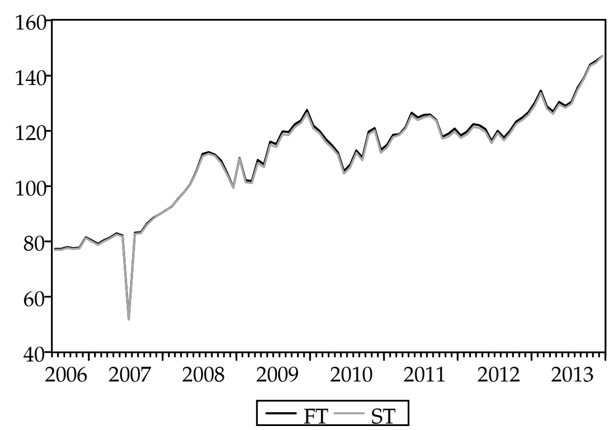


Figure 4: JPY–PKR

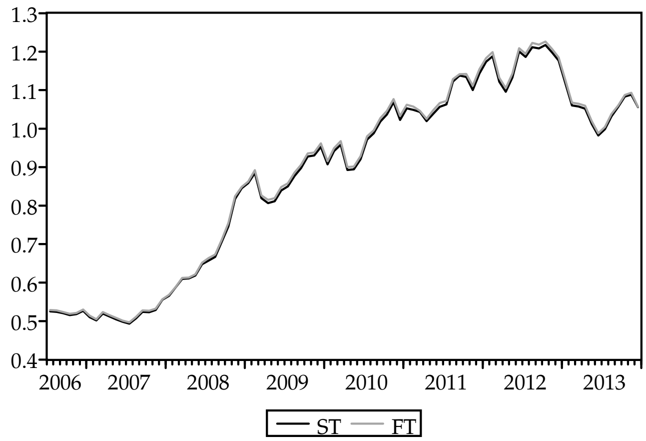
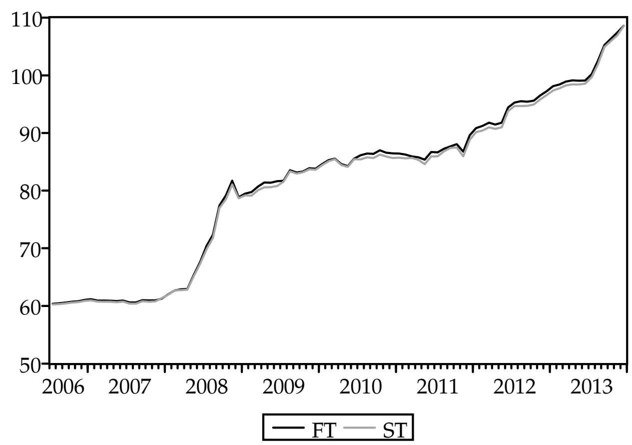


Figure 5: USD–PKR



Tables 6 and 7 give the country-wise regression statistics for the models. Overall, the model is found to be significant because α_1 and α_2 do not differ significantly from their hypothesized values at a 5 percent significance level. R^2 also indicates that the regression results are significant. The results suggest, therefore, that the market is efficient without a risk premium. However, the Durbin-Watson statistics show that there is serial positive correlation between the error terms. Since this renders the values of the t-statistics and R^2 less reliable, it becomes necessary to run the regression after correcting for serial correlation.

Table 6: Market efficiency test (A)

Estimated equation $SR_{t+1} = \alpha_1 + \alpha_2 f_t + U_t$

Currency rate	Period	α_1	α_2	DW	R^2
Australian dollar (AUD)	06M7-10M6	0.475*	0.989*	0.54	0.99
		(2.731)	(637.83)		
Swiss franc (CHF)	06M7-10M6	0.001	0.997*	0.58	0.99
		(0.800)	(1185.99)		
Euro (EUR)	06M7-10M6	0.009*	0.994*	0.55	0.99
		(3.39)	(727.59)		
Japanese yen (JPY)	06M7-10M6	-0.003*	0.99*	0.74	1.00
		(-29.73)	(1361.34)		
US dollar (USD)	06M7-10M6	0.012*	0.992*	0.64	0.99
		(4.027)	(646.09)		

* Reject the null hypothesis at 5 percent significance level; t-statistics given in parentheses.
Source: Authors' calculations.

Table 7: Market efficiency test (B)

Estimated equation: $(SR_{t+1} - S_t) = \alpha_1 + \alpha_2 (f_t - S_t) + U_{t+1}$

Currency rate	Period	α_1	α_2
Australian dollar (AUD)	06M7-10M6	-0.0014*	0.993*
		(-12.44)	(167.30)
Swiss franc (CHF)	06M7-10M6	-0.0030*	1.001*
		(-25.41)	(140.65)
Euro (EUR)	06M7-10M6	-0.0026*	0.999*
		(-21.20)	(269.04)
Japanese yen (JPY)	06M7-10M6	-0.0031*	0.99*
		(-28.80)	(134.78)
US dollar (USD)	06M7-10M6	-0.002*	0.942*
		(-11.296)	(42.606)

* Reject the null hypothesis at 5 percent significance level; t-statistics given in parentheses.
Source: Authors' calculations.

The purpose of the empirical analysis is to examine the efficiency of the market. To obtain unbiased regression results for this purpose, we re-estimate equation (5). The results indicate that the estimated coefficient of the one-period lagged forward rate does not differ significantly from 1, which is the condition for the EMH to hold true. However, α_1 differs significantly from 0 even after correcting for serial correlation, indicating that α_1 incorporates information that is not absorbed fully in the forward rate. In other words, the forward exchange rate does not fully reflect all the information available.

7. Conclusion

The forex market is clearly important to any economy. Pakistan's foreign exchange market is still small compared to those of other emerging economies, implying that substantial policy work is required to expand it.

We have empirically investigated the efficiency of the market for the Pakistani rupee against the US dollar-rupee, Swiss franc-rupee, Australian dollar-rupee, yen-rupee, and euro-rupee, using monthly data on spot and forward rates for the period July 2006 to December 2013. Our results indicate that, on average, the forward exchange rate closely predicts the future spot exchange rate. After correcting for serial correlation, the estimated coefficient of the one-period lagged forward rate does not differ significantly from 1. However, α_1 differs significantly from 0, indicating that it incorporates information that is not absorbed fully by the forward rate, i.e., the forward exchange rate does not fully reflect all information available. We can thus conclude that the EMH does not hold completely in the case of Pakistan's foreign exchange market, where market players can still benefit from speculation due to market inefficiency.

8. Research Limitations

We have not made any assumptions about the source of the variation between the forward rate and future spot rate, or taken into account structural changes over time in Pakistan's foreign exchange market. This provides further scope for analysis in this area. Moreover, for exchange rate market efficiency, the one-period lagged forward rate should reflect all the available information. This is not the case in our study, which implies that other hidden factors may be at play. Future research could follow the factors that determine the future spot rate in Pakistan.

References

Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy Modeling*, *26*, 627–639.

Bollerslev, T., & Hodrick, R. J. (1992). *Financial market efficiency tests* (Working Paper No. 4108). Cambridge, MA: National Bureau of Economic Research.

Campbell, J. Y., & Shiller, R. J. (1987). Cointegration and tests of present value models. *Journal of Political Economy*, *95*, 1062–1088.

Cuthbertson, K. (1996). *Quantitative financial economics: Stocks, bonds, and foreign exchange*. Chichester, UK: John Wiley.

Cuthbertson, K., & Nitzsche, D. (2005). *Quantitative financial economics: Stocks, bonds and foreign exchange* (3rd ed.; chaps. 2 and 8). Chichester, UK: John Wiley.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance*, *25*(2), 387–417.

Fama, E. F. (1984). Forward and spot exchange rates. *Journal of Monetary Economics*, *14*, 319–338.

Fama, E. F. (1991). Efficient capital markets: II. *Journal of Finance*, *46*(5), 1575–1617.

Frenkel, J. A. (1980). Exchange rates, prices and money: Lessons from the 1920s. *American Economic Review*, *70*, 235–242.

Khwaja, A. I., & Mian, A. (2005). Unchecked intermediaries: Price manipulation in an emerging stock market. *Journal of Financial Economics*, *78*(1), 203–241.

Kumar, R. V., & Mukherjee, S. (2007). Testing forward rate unbiasedness in India: An econometric analysis of Indo-US forex market. *International Research Journal of Finance and Economics*, *12*, 56–66.

Lee, Y.-H., & Khatanbaatar, S. (2012). Efficiency tests in foreign exchange market. *International Journal of Economics and Financial Issues*, *2*(2), 216–224.

Levich, R. M. (1979). On the efficiency of markets for foreign exchange. In R. Dornbusch & J. Frenkel (Eds.), *International economic policy: An assessment of theory and evidence*. Baltimore, MD: Johns Hopkins University Press.

Mandelbrot, B. (1963). The variation of certain speculative prices. *Journal of Business*, *36*(4), 394–419.

Oh, G., Kim, S., & Eom, C. (2007). Market efficiency in foreign exchange markets. *Physica A: Statistical Mechanics and its Applications*, *382*(1), 209–212.

Roberts, H. (1967). *Statistical versus clinical prediction of the stock market*. Unpublished manuscript, Center for Research in Security Prices, University of Chicago, IL.

Sharma, A. K., & Mitra, A. (2006). What drives forward premia in Indian forex market? *Reserve Bank of India Occasional Papers*, *27*(1–2), 119–139.

Titman, S., & Wei, K. C. J. (1999). Understanding stock market volatility: The case of Korea and Taiwan. *Pacific-Basin Finance Journal*, *7*, 41–66.

Wickremasinghe, G. B. (2004). *Efficiency of foreign exchange markets: A developing country perspective* (Discussion Paper No. 3). Melbourne, Australia: Monash University, Asian Business and Economics Research Unit.