ISSN 1811-5438

# THE LAHORE JOURNAL OF ECONOMICS

## Lahore School of Economics

| | |
|---|---|
| *Muhammad Husnain, Arshad Hassan and Eric Lamarque* **Shrinking the Variance-Covariance Matrix: Simpler is Better** | *Karim Khan, Anwar Shah and Jaffar Khan* **Electricity Consumption Patterns: Comparative Evidence from Pakistan's Public and Private Sectors** |
| *Muhammad Zubair Mumtaz, Zachary A. Smith and Ather Maqsood Ahmed* **The Aftermarket Performance of Initial Public Offerings in Pakistan** | *Uzma Noreen and Shabbir Ahmad* **Cost Efficiency and Total Factor Productivity: An Empirical Analysis of Pakistan's Insurance Sector** |
| *Sami Ullah Khan and Muhammad Jehangir Khan* **The Impact of Remittances on Child Education in Pakistan** | *Namra Awais* **Was the SAFTA (Phase II) Revision Successful? A Case Study of Bangladesh's RMG Exports to India** |

Volume 21, No.1 Jan-June, 2016

# THE LAHORE JOURNAL OF ECONOMICS

**Editors**
Dr. Azam Chaudhry, Editor
Dr. Theresa Thompson Chaudhry, Editor
Ms. Nina Gera, Associate Editor
Ms. Ayesha Khanum, Assistant Editor



*Editorial Staff:* Tele. No: 0092 - 42 - 36560969
Telefax: 0092 - 42 - 36560905
E-mail: nina@lahoreschool.edu.pk, nina_lse@yahoo.com
*Publisher:* Lahore School of Economics, Lahore, Pakistan.

Correspondence relating to subscriptions and changes of address should be sent to *The Lahore Journal of Economics*, 104 -C-2, Gulberg-III, Lahore - 54660 – Pakistan.

Instructions to authors can be found at the end of this issue. No responsibility for the views expressed by authors and reviewers in *The Lahore Journal of Economics* is assumed by the Editors, the Associate Editor and the Publisher.



**21** 2016

# THE LAHORE JOURNAL OF ECONOMICS

Contents Vol. 21, No.1, 2016

*The Lahore Journal of Economics*
21 : 1 (Summer 2016): pp. 1–21

# Shrinking the Variance-Covariance Matrix: Simpler is Better

**Muhammad Husnain,[*] Arshad Hassan,[**] and Eric Lamarque[***]**

## Abstract

*This study focuses on the estimation of the covariance matrix as an input to portfolio optimization. We compare 12 covariance estimators across four categories – conventional methods, factor models, portfolios of estimators and the shrinkage approach – applied to five emerging Asian economies (India, Indonesia, Pakistan, the Philippines and Thailand). We find that, in terms of the root mean square error and risk profile of minimum variance portfolios, investors gain no additional benefit from using the more complex shrinkage covariance estimators over the simpler, equally weighted portfolio of estimators in the sample countries.*

**Keywords**: Variance-covariance matrix, mean-variance criteria, portfolio management.

**JEL classification**: C13, C51, C52, G11, G15.

## 1. Introduction

The concept of mean-variance optimization was introduced by Markowitz (1952). Although studies such as Jagannathan and Ma (2003) and Chan, Karceski and Lakonishok (1999) support the use of the standard mean-variance framework for optimal portfolio construction, it has been criticized on a number of fronts. Michaud (1989) terms the concept an "enigma" while Disatnik and Benninga (2007) argue that it yields questionable results. There are two main approaches to dealing with the problems presented by traditional mean-variance optimization. The theoretical approach focuses on the assumptions and notional aspects of the mean-variance framework, while the implementation approach looks at how investors can estimate the expected return vector and covariance matrix of asset classes in order to use the framework successfully.

---

[*] Department of Management Sciences, Capital University of Science and Technology, Islamabad; research fellow, IAE de Paris, Université Paris 1 Panthéon-Sorbonne.
[**] Associate Professor, Faculty of Management and Social Sciences, Capital University of Science and Technology, Islamabad.
[***] Professor, IAE de Paris, Université Paris 1 Panthéon-Sorbonne.

This study examines the literature on the implementation approach to mean-variance optimization and the estimation of the covariance matrix, which is seen as the most troubling aspect of the framework (Ledoit & Wolf, 2003). Elton and Gruber (1973) and DeMiguel, Garlappi and Uppal (2009) reinforce the importance of the covariance estimator in implementing mean-variance optimization successfully.

The sample covariance matrix is the conventional measure for estimating the pair-wise covariances of asset classes, based primarily on past covariances. Pafka and Kondor (2004), Michaud (1989), and Jobson and Korkie (1980) have criticized this method of estimating pair-wise covariances. Specifically, it is prone to errors when the number of underlying asset classes is larger than the sample. Michaud (1989) labels this phenomenon "error maximization." Sharpe (1963) proposes a relatively intuitive way of explaining covariances through a common factor – the market factor. Blume (1971), Vasicek (1973) and King (1966) try to improve the estimator by considering the mean-reverting tendency of betas, adjusting their variation and taking into account other factors beyond the single common factor, respectively.

Statistical and nontheory-based measures, such as principal component analysis (PCA), can also be used to identify factors relating to historical sample covariances. Elton and Gruber (1973) suggest using average correlation-based covariance estimators. While the literature on covariance estimators is too extensive to survey here, we agree that the standard method of estimating the covariance matrix is prone to either estimation or specification errors. Given the errors and numerical instability of estimators, DeMiguel et al. (2009) conclude empirically that nontheory-based diversification outperforms the more sophisticated asset allocation strategies.

The financial literature applies a fundamental principle of statistics to optimize between the estimation error and specification error. Bengtsson and Holst (2002), Chan et al. (1999), Jagannathan and Ma (2003), Ledoit and Wolf (2003, 2004) and Wolf (2004) show empirically that shrinkage estimators and a portfolio of estimators are best suited to covariance estimation. As per the decision theory in statistics, there is an optimal point between the specification error and estimation error. According to Stein (1956), this optimal point can be determined by a weighted average of both estimators.

Ledoit and Wolf (2003) suggest using the Bayesian shrinkage approach to optimization in relation to the single-index covariance estimator and sample covariance estimator. This process guarantees to reduce the estimation error in the sample covariance without producing much of a specification error. It results in a shrinkage matrix whereby all the covariances (off-diagonal elements) of the conventional sample matrix are shrunk without changing the diagonal elements. Ledoit and Wolf (2004) shrink the sample covariance toward a constant correlation covariance estimator. Jagannathan and Ma (2003) conceptualize a portfolio of covariance estimators, which challenges the more complex Ledoit and Wolf (2003) estimator, and involves using the equally weighted average of the sample covariance estimator and any other covariance estimator.

Both the shrinkage estimator and equally weighted estimator are supposed to be better than the sample covariance estimator. Of these approaches, shrinkage estimators are theoretically more complex than the simpler, equally weighted average of a portfolio of estimators. Disatnik and Benninga (2007) use data from the New York Stock Exchange to confirm that investors have no additional benefit to gain from using shrinkage estimators over an equally weighted portfolio of covariance estimators. However, the literature on covariance estimation offers no real consensus on the relative merits of sophisticated versus simple estimators in the context of equity markets in emerging Asian economies.

With this in mind, we compare 12 covariance estimators across four groups – conventional methods, factor models, a portfolio of estimators and the shrinkage approach – applied to five emerging Asian economies (India, Indonesia, Pakistan, the Philippines and Thailand). For this purpose, we use the equity classification from the Global Industry Classification Standard (GICS) developed by Morgan Stanley Capital International and Standard & Poor's. We use two different criteria to assess covariance estimators: the root mean square error (RMSE) and the risk associated with the minimum variance portfolio (MVP). The RMSE of a pair-wise covariance matrix focuses on accuracy, while the MVP risk measure gauges the effectiveness of estimators in selecting an MVP. We find that the sample covariance matrix remains a poor estimator in terms of the RMSE and MVP, while the equally weighted average of covariance estimators performs better than the shrinkage estimators proposed by Ledoit and Wolf (2003, 2004).

Section 2 describes the dataset and research methodology used, including our criteria for comparison. Section 3 presents the study's empirical findings, followed by a discussion of the results in Section 4. Section 5 concludes the paper.

## 2. Dataset and Research Methodology

We have used the Bloomberg database to collect data on the sample countries. The sample period spans 22 March 2002 to 30 October 2015 on a biweekly basis. This is divided into two subsamples: from 22 March 2002 to 2 January 2009 and from 16 January 2009 to 30 October 2015. The covariance matrices are estimated based on the first subsample. The second window is used to provide the ex-post accuracy of the covariance matrix.

This study develops equally weighted indices based on the GICS, which consists of ten sectors for each sample country: the consumer discretionary sector, consumer staples, energy, financials, healthcare, industrials, information technology, materials, telecommunication services and utilities. Table 1 gives details of the selected representative equity indices for the stock market of each country.

**Table 1: Summary of selected equity indices for sample countries**

| Country | Stock market | Representative index |
|---|---|---|
| India | Bombay Stock Exchange | S&P BSE Sensex (cap-weighted) |
| Indonesia | Indonesian Bursa Efek Jakarta | JCI index (mod cap-weighted) |
| Pakistan | Karachi Stock Exchange | KSE-100 index (cap-weighted) |
| Philippines | Philippine Stock Exchange | PSEi index (cap-weighted) |
| Thailand | Stock Exchange of Thailand | SET index (cap-weighted) |

The continuous compounded return ($R_{i,t}$) on each asset class is calculated by the formula $R_{i,t} = \ln(P_t/P_{t-1})$. Here, $P_t$ and $P_{t-1}$ are the returns in the current and previous period for the asset class, respectively.

### *2.1. Estimation of Variance-Covariance Matrix*

The variance-covariance matrix is a square matrix of the variances and covariances of the asset classes concerned. It contains the variances of each asset class as diagonal entries, while the off-diagonal entries comprise the covariances of all possible pairs of the asset classes. Simply put, the variance is the squared mean deviation while the covariance indicates how two asset classes change together. Mathematically, a variance-covariance matrix can be written as follows:

$$\Sigma = \begin{bmatrix} \sum x_1^2/n & \sum x_1x_2/n & \cdots & \sum x_1x_i/n \\ \sum x_2x_1/n & \sum x_2^2/n & \cdots & \sum x_2x_i/n \\ \cdots & \cdots & \cdots & \cdots \\ \sum x_ix_1/n & \sum x_ix_2/n & \cdots & \sum x_i^2/n \end{bmatrix}$$

Here, $\Sigma$ is the variance-covariance matrix $(i * i)$, $n$ is the number of data points in each asset class, $x_i$ represents the mean deviation, $\sum x_1^2/n$ is the variance of the *i*th asset class, and $\sum x_i x_j/n$ is the covariance between asset classes *i* and *j*. This study compares the performance of 12 covariance matrices across conventional methods, factor models, a portfolio of estimators and the shrinkage approach. The matrices are outlined below.

*2.1.1. Sample Covariance Matrix*

For any vector $l \in R^n$, where the sample variance is $\sigma^2$ and the sample average is $\hat{x}$, then:

$$\hat{l} = \frac{1}{n}(l_1 + l_2 + l_3 + \cdots + l_n), \sigma^2 = \frac{1}{n}((l_1 - \hat{l})^2 + (l_2 - \hat{l})^2 + \cdots + (l_n - \hat{l})^2)$$

Let $X = [x_1 + x_2 + x_3 + \cdots + x_n] \in R^{m*n}$ where every column $x_i$ represents an observation in $R^m$. For the variance, we have the values obtained from projecting the data along a line in the direction $\tau \in R^m$ such that:

$$l = (\tau^T x_1 + \tau^T x_2 + \tau^T x_3 + \cdots \tau^T x_n) = \tau^T X \in R^n$$

The corresponding sample variance and sample mean are:

$$\sigma^2(\tau) = \frac{1}{n}\sum_{k=1}^{n}(\tau^T x_k - \tau^T \hat{x})^2, \hat{l} = \tau^T \hat{x}$$

In this equation, the sample mean is $\hat{x} = \frac{1}{n}(x_1 + x_2 + x_3 + \cdots + x_n) \in R^m$ and the variance with direction $\tau$ in quadratic form is:

$$\sigma^2(\tau) = \frac{1}{m}\sum_{k=1}^{m}[\tau^T(x_k - \hat{x})]^2 = \tau^T \Sigma \tau$$

In the last expression, the sample variance-covariance is represented by $\Sigma$ and can be written as:

$$\Sigma_{sample} = \frac{1}{n}\sum_{k=1}^{n}(x_k - \hat{x})(x_k - \hat{x})^T \quad (1)$$

The covariance matrix in equation (1) is symmetrical, positive and semi-definite, and can be used to find the variance in any direction.

### *2.1.2. Constant Correlation (Overall Mean) Covariance Matrix*

Elton and Gruber (1973) estimate the covariance matrix on the assumption that the variance of the return on each asset class is the sample return and that the covariance is associated by the same coefficient of correlation. For this, we use the average correlation coefficient of all the asset classes in question. Chan et al. (1999) also claim that this covariance matrix is more appropriate than its alternatives. We know that $\sigma_{lm} = \rho_{l,m}\sigma_l\sigma_m$ and, therefore:

$$\sigma_{lm} = \begin{cases} \sigma_{lm} = \sigma_l^2 \; if \; l = m \\ \sigma_{lm} = \rho_{l,m}\sigma_l\sigma_m \; if \; l \neq m \end{cases} \quad (2)$$

### *2.1.3. Single-Index Covariance Matrix*

Sharpe (1963) presents the single-index formula and assumes that the return on any asset class can be written as a linear combination of the market portfolio. Hence, there is a significant, positive linear relationship between asset returns and market portfolios, which can be expressed as:

$$Y_{it} = \alpha_i + \gamma_i x_t + \varepsilon_t$$

where $x_t$ denotes the market portfolio, which is uncorrelated with the error term. Further, $E(\varepsilon_{it}\varepsilon_{jt}) = 0$. The variance ($var\ (\varepsilon_{it}) = \delta_{ii}$) within the asset classes is unchanged. The covariance matrix ($\sigma_{ij}$) is expressed as:

$$\sigma_{ij} = \beta\sigma^2\beta^T + \varphi$$

Here, $\beta$, $\sigma^2$ and $\varphi$ denote the vector of the slope, the variance of the market and the matrix of the variance of the error term, respectively. The covariance matrix under the single-index model takes this form:

$$\Sigma_{single\ index} = b\sigma^2\hat{b} + \omega \quad (3)$$

where $b$, $\sigma^2$ and $\omega$ are the vector of slope estimates, the sample variance of the market and the matrix of the variance of error term estimates, respectively.

### *2.1.4. Principal Component Model*

PCA is used to examine the underlying motives for co-movement among asset classes. It does so without any economic justification and transforms the vector space of *K* asset classes into *K* factors. PCA uses the singular value decomposition of the sample covariance. The *j*th factor out of *K* is the linear combination of *K* asset classes. We also assume that there is no correlation among the factors. Mathematically, asset returns and the sample covariance take the following form:

$$R_j^e = \sum_{j=1}^{k} \tau_{ij} F_j$$

$$\Sigma = \tau Z_F \acute{\tau}$$

Here, $\tau$ is a matrix of eigenvectors of order 1**N* and *Z* is a matrix of eigenvalues of order *N*N*. Since the objective of PCA is to cut dimensions, out of *K* factors we can select only the first *G* factors if $\sum_{a=0}^{G} \sigma_{F,a}^2 / \sum_{a=0}^{K} \sigma_{F,a}^2 \cong 1$. Therefore, the PCA-based covariance matrix of the first *G* factors is estimated as follows:

$$\Sigma = \tilde{\tau}\widetilde{Z_F}\tilde{\tau}' + Z_\varepsilon \quad (4)$$

Here, $\tau$ is a matrix of the first *G* eigenvectors and *Z* is a diagonal matrix of the first *G* eigenvalues. We use equation (4) to estimate the covariance matrix based on PCA.

### *2.1.5. Shrinkage Variance-Covariance Matrix*

The single-index covariance matrix and the sample covariance are two sides of the same coin in that the first is a one-factor model while the second is an *N*-factor model. Generally, a true estimator is held to be an *m*-factor model such that $N > m > 1$. Ledoit and Wolf (2003) suggest that the single-index covariance has a specification problem, but the sample matrix also has an inherent estimation problem.

Stein (1956) shows that an optimal point can be determined by taking the weighted average of both estimators. This method involves shrinking the sample matrix toward the fixed (diagonal) target. Jorion (1986) suggests that this shrinking plays a vital role in portfolio selection. Assuming $\psi$ and $\phi$ are the parameters of unrestricted high-dimension and restricted low-dimension sub-models, respectively, we can obtain the corresponding estimates $L = \hat{\psi}$ and $K = \hat{\phi}$ from the observed data. $L$ has a high variance as it requires more fitted parameters than $K$, but $K$ is theoretically biased. The estimator can be written as:

$$\Sigma = \theta * K + (1 - \theta) * L \tag{5}$$

Here, $L$ denotes the sample covariance, $K$ is the target matrix (highly structured estimator) and $\theta$ is the weight of $K$ in the convex linear combination between $K$ and $L$. The shrinkage intensity of $\theta$ ranges from 0 to 1. If the value of $\theta$ is 0, we return to the sample matrix and it implies no shrinkage. On the other hand, if $\theta = 1$, then there is complete shrinkage and the resulting covariance matrix is equal to the target $K$. The question is whether to fix the value of $\theta$ or let it be determined by minimizing the following loss function (mean square error):

$$R(\theta) = E(\textstyle\sum_{i=1}^{p}(l_i^* - \psi_i)^2) \tag{6}$$

Ledoit and Wolf's (2003) analytical formula for determining the optimal shrinkage intensity $(\theta)$ involves shrinking the sample covariance matrix toward the single-index covariance matrix. This ensures that the mean square error is minimized without any assumption about distribution. Given the first and second moments of $L$ and $K$, the squared error loss function from equation (6) is:

$$R(\theta) = \sum_{i=1}^{p} var(l_i^*) + [E(l_i^*) - \psi_i]^2$$

$$R(\theta) = \sum_{i=1}^{p} var(\theta t_i + (1 - \theta)l_i) + [E(\theta t_i + (1 - \theta)l_i) - \psi_i]^2$$

$$R(\theta) = \sum_{i=1}^{p} \theta^2 var(t_i) + (1 - \theta)^2 var(l_i) + 2\theta(1 - \theta)cov(l_i, t_i) + [\theta E(t_i - l_i) + bias(l_i)]^2$$

Minimizing this function with respect to $\theta$, we have:

$$\theta^* = \frac{\sum_{i=1}^{p} var(l_i) - cov(l_i, t_i) - bias(l_i)E(t_i - l_i)}{\sum_{i=1}^{p} E[(t_i - l_i)^2]}$$

If $L$ is an unbiased estimator of $\psi$, then the above expression can be written as:

$$\theta^* = \frac{\sum_{i=1}^{p} var(l_i) - cov(l_i, t_i)}{\sum_{i=1}^{p} E[(t_i - l_i)^2]} \tag{7}$$

We use expression (7) to compute the optimal shrinkage intensity $(\theta)$ (see Ledoit & Wolf, 2003). Ledoit and Wolf (2004) shrink the sample covariance matrix toward the constant correlation covariance estimator and propose a formula for computing the optimal shrinking intensity. Bengtsson and Holst (2002) shrink the sample covariance matrix to the $k$-factor principal component model, while Kwan (2011) shows how to shrink the sample covariance toward the diagonal matrix. Consistent with the literature, we use three types of targets: the diagonal target, the single-index covariance and the constant correlation covariance matrix. For further discussion of these shrinkage estimators, see Ledoit and Wolf (2003, 2004) and Kwan (2011).

### *2.1.6. Portfolio of Estimators*

Jagannathan and Ma (2003) criticize the concept of optimally weighted intensity presented by Ledoit and Wolf (2003), and introduce equally weighted covariance estimators instead. In line with Jagannathan and Ma (2003), Liu and Lin (2010), and Disatnik and Benninga (2007), we use the following five equally weighted portfolios of estimators:

- *Portfolio of sample matrix and diagonal matrix*. In equation (8), $\Sigma_{p1}$ is the equally weighted average of the sample covariance and diagonal covariance matrix. In the diagonal matrix, all the off-diagonal elements are equal to 0 while the variances of the asset classes are diagonal entries:

$$\Sigma_{p1} = \frac{1}{2}\Sigma_{sample} + \frac{1}{2}\Sigma_{diagonal} \tag{8}$$

- *Portfolio of sample matrix and single-index matrix*. In equation (9), $\Sigma_{p2}$ is the equally weighted average of the sample covariance and single-index covariance matrix:

$$\Sigma_{p2} = \frac{1}{2}\Sigma_{sample} + \frac{1}{2}\Sigma_{single\ index} \tag{9}$$

- *Portfolio of sample matrix and constant correlation covariance matrix*. In equation (10), $\Sigma_{p3}$ is the equally weighted average of the sample covariance and constant correlation (overall mean) covariance matrix:

$$\Sigma_{p3} = \frac{1}{2}\Sigma_{sample} + \frac{1}{2}\Sigma_{overall\ mean} \tag{10}$$

- *Portfolio of sample matrix, single-index and constant correlation matrix*. In equation (11), $\Sigma_{p4}$ is the equally weighted average of the sample covariance, the single-index covariance matrix and the constant correlation (overall mean) covariance matrix:

$$\Sigma_{p4} = \frac{1}{3}\Sigma_{sample} + \frac{1}{3}\Sigma_{single\ index} + \frac{1}{3}\Sigma_{overall\ mean} \tag{11}$$

- *Portfolio of sample matrix, single-index matrix, overall mean matrix and diagonal matrix*. In equation (12), $\Sigma_{p5}$ is the equally weighted average of the sample covariance, the single-index covariance matrix, constant correlation (overall mean) covariance matrix and diagonal matrix:

$$\Sigma_{p5} = \frac{1}{4}\Sigma_{sample} + \frac{1}{4}\Sigma_{single\ index} + \frac{1}{4}\Sigma_{overall\ mean} + \frac{1}{4}\Sigma_{diagonal} \tag{12}$$

#### 2.1.7. *Summary of Covariance Estimators*

We have shown that the structure of alternative covariance matrices can include conventional methods, factor models, a portfolio of estimators and the shrinkage approach (Table 2). The sample matrix is based on historical covariances, but has a lower structure than other covariance estimators. Elton and Gruber (1973) recommend using the historical degree of association to estimate covariance estimators. Similarly, Sharpe (1963) uses systemic risk factors to determine the covariance matrix, although this is criticized on the grounds that it relies on a single systematic risk factor. Arguably, the single-index covariance matrix is more appropriate than the sample covariance on the basis of estimation errors, but it can lead to specification errors.

**Table 2: Summary of variance-covariance methods**

| **Category** | | **Variance-covariance matrices** |
|---|---|---|
| Conventional methods | D | Diagonal method |
| | S | Sample matrix |
| | CC | Constant correlation model |
| Factor models | SI | Single-index matrix |
| | PCA | Principal component analysis-based model |
| Portfolio of estimators | P1 | Portfolio of sample matrix and diagonal matrix |
| | P2 | Portfolio of sample matrix and single-index matrix |
| | P3 | Portfolio of sample matrix and constant correlation matrix |
| | P4 | Portfolio of sample matrix, single-index matrix and constant correlation matrix |
| | P5 | Portfolio of sample matrix, single-index matrix, constant correlation matrix and diagonal |
| Shrinkage approaches | P6 | Shrinkage to diagonal matrix |
| | P7 | Shrinkage to single-index model |
| | P8 | Shrinkage to constant correlation model |

Ledoit and Wolf (2003, 2004) use an optimal combination of two covariance matrices to yield one covariance estimator by shrinking the sample covariances to the target matrix. Jagannathan and Ma (2003) challenge this approach and propose a simpler, equally weighted average of two or more covariance estimators. Ledoit and Wolf's (2003, 2004) method is theoretically more rigorous, but its empirical results are questionable (Disatnik & Benninga, 2007). Table 2 summarizes the alternative covariance matrices along with the abbreviations used hereon. It also includes the diagonal method of estimating covariances, which is the basis for other covariance estimators under the categories of "portfolio of estimators" and "shrinkage approaches" (P1, P5, P6).

### *2.2. Evaluation of Covariance Estimators*

As mentioned earlier, we use two different assessment criteria to compare the 12 covariance estimators: the RMSE and portfolio allocation. Most of the literature supports the use of these criteria: Liu and Lin (2010) use the RMSE to evaluate the performance of covariance estimators, while Chan et al. (1999), Jagannathan and Ma (2003), and Kyj, Ostdiek and Ensor (2010) use MVP output to gauge alternative covariance estimators.

We use the RMSE to compare the pair-wise accuracy of estimators, initially estimating covariance matrices based on the first subsample window (22 March 2002 to 2 January 2009). The second subsample window

(16 January 2009 to 30 October 2015) is used to determine the ex-post accuracy of the covariance matrix. This means looking at the difference between the covariance estimators obtained in the two subsample windows. The RMSE is calculated as follows:

$$RMSE = \sqrt{\frac{M(M-1)}{2} \sum_{j=1}^{M} \sum_{k=1, j \neq k}^{M} (\hat{\sigma}_{jk} - \sigma_{jk})^2} \quad (13)$$

Here, $\frac{M(M-1)}{2}$ represents the total pair-wise covariance estimators against the *M***M* covariance matrix, while $\sigma_{jk}$ and $\hat{\sigma}_{jk}$ are the actual and estimated covariances among $j$ and $k$, respectively. The RMSE is easy to interpret because it has no unit problem and a smaller value is better than a higher one.

Next, we use the MVP method to compare the performance of covariance estimators. An MVP is the only portfolio on the efficient frontier that depends on the covariance matrix, but not on the choice of the vector of returns on asset classes. Although Jagannathan and Ma (2003) argue that a constrained MVP provides better estimates, we use an unrestricted MVP for three reasons. First, our main focus is not the resulting performance of optimal portfolios, but the estimation error that arises when estimating the covariance matrix. Thus, to achieve the *maximum* estimation error, we use an unconstrained MVP. Second, a constrained MVP is preferable when investors rebalance their portfolios after every period in the out-of-sample window (Chan et al., 1999). However, we focus not on the efficiency of the resultant portfolios, but on estimating the covariance matrix, which is why we use a buy-and-hold MVP. Third, we are interested in the consistency of the RMSE and MVP risk profile as our assessment criteria. Accordingly, we employ an unrestricted MVP in line with Liu and Lin (2010).

The first step is to compute the weights using the MVP under an alternative covariance matrix for the first subsample period. Based on these weights, we note down the return on the MVP in the out-of-sample window (the second subsample) and then calculate the mean risk and mean return for this series. While calculating the RMSE of the pair-wise covariance matrix gauges accuracy, the MVP is a way of looking at the effectiveness of estimators in selecting an MVP. The weight of an MVP of $n$ risky assets is given by:

$$Min_w \, w^T \Sigma w \quad s.t. \; w^T e = 1$$

Using the Lagrangian multiplier $\lambda$, the problem is restated as:

$$Min_w \delta = w^T \Sigma w - 2\lambda(w^T e - 1)$$

The *n* first-order condition is:

$$\frac{\partial \delta}{\partial w} = 2\Sigma w - 2\lambda e = 0$$

Solving this expression for the weight *w*, we obtain:

$$w = \lambda \Sigma^{-1} e$$

Let $z$ be a $p$ x 1 column vector defined as $z = \frac{1}{\lambda} w$, which we can write as $z = \Sigma^{-1} e$. Since the sum of the total weights equals 1, $z^T e = \frac{1}{\lambda} w^T e = \frac{1}{\lambda}$. Therefore, the investment weight vector for the MVP is:[1]

$$w_{mvp} = \frac{z}{z^T e} \tag{14}$$

## 3. Empirical Findings

Table 3 gives the RMSE results for the 12 covariance estimators, indicating the pair-wise covariance estimation and corresponding out-of-sample values. A covariance estimator outperforms other estimators if it has a relatively low RMSE value. From the table, it is evident that the PCA-based covariance estimator consistently outperforms the others, but estimates the covariance matrix without any economic rationale. The sample covariance estimator proves to be a poor estimator of covariance, especially for the Philippines, Pakistan, Indonesia and India. Generally, the overall mean method yields a competitive RMSE using a single-index covariance estimator. By and large, the single-index covariance estimator outperforms the overall mean method for all five countries.

---

[1] The weight of the MVP for *N* asset classes can also be computed by minimizing the Lagrange function *C* for portfolio variance:

$Min\ var(R_p) = \sum_{i=1}^{N} \sum_{j=i+1}^{N} w_i w_j\, \sigma_{ij}$ subject to $\sum_{j=1}^{N} w_j = 1$

$$C = \sum_{i=1}^{N} \sum_{j=i+1}^{N} w_i w_j\, \sigma_{ij} + \lambda_1 \left(1 - \sum_{i=1}^{N} w_i\right)$$

Here $w_i$, $w_j$, $\sigma_{ij}$ and $\lambda_1$ are the weights, covariance and Lagrange multiplier, respectively.

**Table 3: Summary of RMSE under covariance estimators**

| Group | Covariance | India | Indonesia | Pakistan | Philippines | Thailand |
|---|---|---|---|---|---|---|
| Conventional methods | S | 0.0293 | 0.0592 | 0.0218 | 0.0461 | 0.0287 |
| | CC | 0.0254 | 0.0593 | 0.0170 | 0.0357 | 0.0239 |
| Factor models | SI | 0.0027 | 0.0570 | 0.0169 | 0.0322 | 0.0290 |
| | PCA | 0.0006 | 0.0013 | 0.0003 | 0.0008 | 0.0005 |
| Portfolio of estimators | P1 | 0.0147 | 0.0296 | 0.0109 | 0.0231 | 0.0143 |
| | P2 | 0.0160 | 0.0579 | 0.0175 | 0.0386 | 0.0288 |
| | P3 | 0.0271 | 0.0582 | 0.0156 | 0.0404 | 0.0262 |
| | P4 | 0.0190 | 0.0575 | 0.0148 | 0.0372 | 0.0271 |
| | P5 | 0.0142 | 0.0432 | 0.0111 | 0.0279 | 0.0203 |
| Shrinkage approaches | P6 | 0.0292 | 0.0588 | 0.0217 | 0.0458 | 0.0285 |
| | P7 | 0.0208 | 0.0587 | 0.0176 | 0.0435 | 0.0287 |
| | P8 | 0.0300 | 0.0584 | 0.0129 | 0.0437 | 0.0224 |

***Source***: Authors' calculations.

The most important result is the comparison between the complex covariance estimator introduced by Ledoit and Wolf (2003, 2004) and the equally weighted portfolio of estimators proposed by Jagannathan and Ma (2003). The results for the shrinkage covariance estimators show that P6 performs worse than P7 and P8 across the sample, barring Thailand. Moreover, P7 has a lower RMSE than P8 for India and the Philippines.

When we compare the RMSE across the equally weighted covariance estimators, then P1 outperforms the other equally weighted estimators for all sample countries except India. P2 and P3 yield comparable RMSE values, but P2 performs better for India, Indonesia and the Philippines. P4 (the equally weighted portfolio of the sample covariance, single-index covariance and constant correlation covariance) outperforms P2 (the equally weighted portfolio of the sample covariance and single-index covariance) and P3 (the equally weighted portfolio of the sample covariance and constant correlation covariance) for Indonesia, Pakistan and the Philippines. For Thailand, P3 performs better than P4, while P2 outperforms P4 for India.

The complex estimator P8 (Ledoit & Wolf, 2003) fares poorly against the equally weighted portfolio of the sample covariance and single-index covariance estimator (P2) for India, Indonesia, and the Philippines. P7 (Ledoit & Wolf, 2004) performs poorly against the equally weighted portfolio of the sample covariance and constant correlation covariance estimator P3 for Indonesia, Pakistan and Thailand. P4 has a lower RMSE than P7 and P8 for India, Indonesia and the Philippines. Overall, the results imply that investors have no additional benefit to gain from using a more complex estimator over a simpler, equally weighted portfolio of estimators.

Table 4 gives a risk profile in terms of the standard deviation (SD) of MVPs under the 12 covariance estimators for our sample. We find little variation in their performance under the RMSE and MVP criteria. Again, the sample covariance estimator is a poor estimator, especially for Indonesia, Pakistan and the Philippines. The SDs of the single-index and constant correlation covariance estimators are comparable, although the latter has a lower SD for India, Pakistan and the Philippines.

**Table 4: Risk associated with MVP under alternative covariance estimators**

| Group | Covariance | India | Indonesia | Pakistan | Philippines | Thailand |
|---|---|---|---|---|---|---|
| Conventional methods | S | 0.0212 | 0.0253 | 0.0256 | 0.0315 | 0.0149 |
| | CC | 0.0235 | 0.0244 | 0.0244 | 0.0222 | 0.0165 |
| Factor models | SI | 0.0287 | 0.0241 | 0.0249 | 0.0291 | 0.0163 |
| | PCA | 0.0730 | 0.1677 | 0.1442 | 0.0369 | 0.0971 |
| Portfolio of estimators | P1 | 0.0276 | 0.0225 | 0.0249 | 0.0268 | 0.0176 |
| | P2 | 0.0230 | 0.0234 | 0.0246 | 0.0275 | 0.0157 |
| | P3 | 0.0275 | 0.0241 | 0.0250 | 0.0303 | 0.0156 |
| | P4 | 0.0265 | 0.0235 | 0.0246 | 0.0281 | 0.0159 |
| | P5 | 0.0273 | 0.0228 | 0.0245 | 0.0263 | 0.0168 |
| Shrinkage approaches | P6 | 0.0212 | 0.0251 | 0.0256 | 0.0314 | 0.0149 |
| | P7 | 0.0246 | 0.0248 | 0.0249 | 0.0311 | 0.0152 |
| | P8 | 0.0224 | 0.0236 | 0.0244 | 0.0302 | 0.0165 |

***Source***: Authors' calculations.

P2 outperforms the shrinkage estimator P3 for India, Indonesia, Pakistan and the Philippines. For Indonesia, the equally weighted estimators P1, P2, P4 and P5 outperform the complex shrinkage estimators P6, P7 and P8. In Pakistan's case, P1, P2, P4 and P5 fare better than P6 and remain comparable with P7 and P8. In the case of the Philippines, the relatively simple portfolio of estimators P1, P2, P4 and P5 have a lower SD for the MVP than the shrinkage estimators P6, P7 and P8. P3 has an SD of 0.3033, which is almost equal to the SD of P8 (0.0302). P2, P3 and P4 outperform the shrinkage estimator P8 for Thailand.

In India's case, P2 outperforms the shrinkage estimator P8, but P7 has a lower SD than P3, P4 and P5. The equally weighted estimator P2 performs better than the shrinkage estimator P7 for India, Indonesia, Pakistan and the Philippines. As Table 4 shows, Ledoit and Wolf's (2003, 2004) complex estimator improves relative to the RMSE. On the whole, the equally weighted portfolio group performs better than the shrinkage estimators for this sample, reinforcing the argument that investors will not gain from using a more complex estimator over a portfolio of estimators. Table A1 in the Appendix reports the average mean of the MVP to compare levels of associated risk.

The Sharpe ratio is used to compare the resultant portfolios based on their MVP under alternative covariance estimators (Table 5). This ratio indicates the risk-adjusted return under various inputs to the MVP.

**Table 5: Sharpe ratio of resultant MVPs under alternative covariance matrices**

| Group | Covariance | India | Indonesia | Pakistan | Philippines | Thailand |
|---|---|---|---|---|---|---|
| Conventional methods | S | 0.0381 | 0.1728 | 0.0892 | -0.0100 | 0.2661 |
| | CC | 0.1054 | 0.1116 | 0.0971 | 0.1129 | 0.2224 |
| Factor models | SI | 0.0239 | 0.1339 | 0.0682 | 0.0159 | 0.2395 |
| | PCA | 0.1339 | 0.0403 | -0.0323 | 0.2071 | 0.0212 |
| Portfolio of estimators | P1 | 0.0240 | 0.1138 | 0.0666 | 0.0207 | 0.2218 |
| | P2 | 0.0542 | 0.1411 | 0.0926 | 0.0317 | 0.2447 |
| | P3 | 0.0233 | 0.1537 | 0.0792 | 0.0011 | 0.2538 |
| | P4 | 0.0365 | 0.1407 | 0.0852 | 0.0243 | 0.2433 |
| | P5 | 0.0323 | 0.1214 | 0.0755 | 0.0336 | 0.2300 |
| Shrinkage approaches | P6 | 0.0376 | 0.1716 | 0.0889 | -0.0097 | 0.2659 |
| | P7 | 0.0268 | 0.1685 | 0.0713 | -0.0069 | 0.2625 |
| | P8 | 0.0444 | 0.1557 | 0.0952 | 0.0037 | 0.2224 |

*Source*: Authors' calculations.

The table shows that the sample covariance performs better than the constant correlation covariance for Indonesia and Thailand. The single-index covariance outperforms the PCA estimators for Indonesia, Pakistan and Thailand. Among the portfolio of estimators, P2 and P3 outperform the other estimators for Indonesia and Thailand. P8 yields a higher Sharpe ratio than P6 and P7 in the case of India. The evidence is, therefore, mixed: no one estimator consistently outperforms the others, implying that investors gain no additional benefit from using complex estimators.

## 4. Discussion

Jagannathan and Ma (2003) argue that the equally weighted average of the sample covariance and single-index covariance estimator outperforms the weighted average of the covariance estimator based on optimal shrinkage intensity, as proposed by Ledoit and Wolf (2003). Our findings are consistent with this. Moreover, in line with Liu and Lin (2010), we find that the estimator proposed by Ledoit and Wolf (2003, 2004) is better than the equally weighted estimator when gauged by the MVP criterion compared to the RMSE. Jagannathan and Ma (2003) also suggest that constraints in any sense – right or wrong – decrease portfolio risk.

The sample covariance matrix remains a poor estimator based on the RMSE and MVP risk criteria. Given that Ledoit and Wolf's (2003, 2004) estimators both depend on the minimization of the quadratic loss function, they should, theoretically, outperform all other weighted estimators. However, consistent with Disatnik and Benninga (2007), we find that the portfolio of weighted estimators based on the optimal shrinkage intensity does not outperform the equally weighted portfolio of estimators for our sample of emerging Asian economies.

Our study reinforces Disatnik and Benninga's (2007) claim that the Ledoit and Wolf (2003, 2004) covariance estimator yields a new type of error, which eliminates the benefit of using a weighted portfolio of covariance estimators based on the optimal shrinkage intensity. Further, it offers no additional benefits over using the equally weighted average of covariance estimators in this case.

## 5. Conclusion

This study adopts the implementation approach to portfolio optimization. We compare 12 covariance estimators across four categories – conventional methods, factor models, portfolios of estimators and the shrinkage approach – applied to five emerging Asian economies (India, Indonesia, Pakistan, the Philippines and Thailand). The data used is drawn from ten sectors classified under the GICS. We use two different criteria to compare the covariance estimators: the RMSE to establish accuracy and portfolio allocation to gauge their effectiveness.

We find that the sample covariance matrix is a poor estimator in terms of the RMSE and MVP, while the equally weighted average of covariance estimators performs better than the more complex shrinkage estimators proposed by Ledoit and Wolf (2003, 2004). The covariance estimator also yields a different conclusion under both the RMSE and MVP criteria. In the context of our sample, simpler covariance estimators perform better under the RMSE than more complicated covariance estimators. The opposite holds when applying the MVP criterion.

This implies that, in general, investors gain no advantage in using more complex estimators over a simpler, equally weighted portfolio of estimators in emerging Asian countries. Both investors and portfolio managers should, therefore, consider the portfolio of estimators and factor models better benchmarks than other, more sophisticated estimators.

Subsequent research could take into account the impact of higher-order moments when formulating optimal portfolios. We also recommend that investors develop better comparison criteria for the variance-covariance matrix because the RMSE only considers individual differences in each element of the matrix, while a better gauge would look at its overall structure. Moreover, the MVP is only one portfolio on the efficient frontier in terms of asset allocation. This means that other criteria are needed to compare different covariance estimators for more satisfactory results.

**References**

Bengtsson, C., & Holst, J. (2002, November). *On portfolio selection: Improved covariance matrix estimation for Swedish asset returns*. Paper presented at the 31st Meeting of the EURO Working Group for Commodities and Financial Modeling, Cyprus.

Blume, M. E. (1971). On the assessment of risk. *The Journal of Finance*, *26*(1), 1–10.

Chan, L. K., Karceski, J., & Lakonishok, J. (1999). On portfolio optimization: Forecasting covariances and choosing the risk model. *Review of Financial Studies*, *12*(5), 937–974.

DeMiguel, V., Garlappi, L., & Uppal, R. (2009). Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy? *Review of Financial Studies*, *22*(5), 1915–1953.

Disatnik, D. J., & Benninga, S. (2007). Shrinking the covariance matrix. *Journal of Portfolio Management*, *33*(4), 55–63.

Elton, E. J., & Gruber, M. J. (1973). Estimating the dependence structure of share prices: Implications for portfolio selection. *The Journal of Finance*, *28*(5), 1203–1232.

Jagannathan, R., & Ma, T. (2003). Risk reduction in large portfolios: Why imposing the wrong constraints helps. *The Journal of Finance*, *58*(4), 1651–1684.

Jobson, J. D., & Korkie, B. (1980). Estimation for Markowitz efficient portfolios. *Journal of the American Statistical Association*, *75*(371), 544–554.

Jorion, P. (1986). Bayes–Stein estimation for portfolio analysis. *Journal of Financial and Quantitative Analysis*, *21*, 279–292.

King, B. F. (1966). Market and industry factors in stock price behavior. *The Journal of Business*, *39*(1, Pt. 2), 139–190.

Kwan, C. C. (2011). An introduction to shrinkage estimation of the covariance matrix: A pedagogic illustration. *Spreadsheets in Education*, *4*(3), art. 6.

Kyj, L., Ostdiek, B., & Ensor, K. (2010, January). *Covariance estimation in dynamic portfolio optimization: A realized single-factor model*. Paper presented at the Annual Meeting of the American Finance Association, Atlanta, GA.

Ledoit, O., & Wolf, M. (2003). Improved estimation of the covariance matrix of stock returns with an application to portfolio selection. *Journal of Empirical Finance*, *10*(5), 603–621.

Ledoit, O., & Wolf, M. (2004). Honey, I shrunk the sample covariance matrix. *Journal of Portfolio Management*, *30*(4), 110–119.

Liu, L., & Lin, H. (2010). Covariance estimation: Do new methods outperform old ones? *Journal of Economics and Finance*, *34*(2), 187–195.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, *7*(1), 77–91.

Markowitz, H. (1999). The early history of portfolio theory: 1600–1960. *Financial Analysts Journal*, *55*(4), 5–16.

Michaud, R. O. (1989). The Markowitz optimization enigma: Is 'optimized' optimal? *Financial Analysts Journal*, *45*(1), 31–42.

Pafka, S., & Kondor, I. (2004). Estimated correlation matrices and portfolio optimization. *Physica A: Statistical Mechanics and its Applications*, *343*, 623–634.

Sharpe, W. F. (1963). A simplified model for portfolio analysis. *Management Science*, *9*(2), 277–293.

Stein, C. (1956). Inadmissibility of the usual estimator for the mean of a multivariate normal distribution. In J. Neyman (Ed.), *Proceedings of the Third Berkeley Symposium on Mathematical and Statistical Probability* (pp. 197–206). Berkeley, CA: University of California.

Vasicek, O. A. (1973). A note on using cross-sectional information in Bayesian estimation of security betas. *The Journal of Finance*, *28*(5), 1233–1239.

Wolf, M. (2004). *Resampling vs. shrinkage for benchmarked managers* (Technical Article No. 4). Zurich: University of Zurich. Retrieved from http://www.econ.uzh.ch/dam/jcr:ffffffff-935a-b0d6-0000-0000487f72c5/wilmott2007.pdf

# *Appendix*

## Detailed results for MVPs

This study also uses the risk associated with MVPs as a criterion for comparison. We compute the weights by MVP under the alternative covariance matrix, based on which we record the return on the MVP in an out-of-sample window. Finally, we calculate the mean returns for this series (Table A1).

**Table A1: Average means for MVPs**

| Group | Covariance | India | Indonesia | Pakistan | Philippines | Thailand |
|---|---|---|---|---|---|---|
| Conventional methods | S | 0.0008 | 0.0044 | 0.0023 | -0.0003 | 0.0040 |
| | CC | 0.0025 | 0.0027 | 0.0024 | 0.0025 | 0.0037 |
| Factor models | SI | 0.0007 | 0.0032 | 0.0017 | 0.0005 | 0.0039 |
| | PCA | 0.0098 | 0.0068 | -0.0047 | 0.0076 | 0.0021 |
| Portfolio of estimators | P1 | 0.0007 | 0.0026 | 0.0017 | 0.0006 | 0.0039 |
| | P2 | 0.0012 | 0.0033 | 0.0023 | 0.0009 | 0.0038 |
| | P3 | 0.0006 | 0.0037 | 0.0020 | 0.0000 | 0.0040 |
| | P4 | 0.0010 | 0.0033 | 0.0021 | 0.0007 | 0.0039 |
| | P5 | 0.0009 | 0.0028 | 0.0019 | 0.0009 | 0.0039 |
| Shrinkage approaches | P6 | 0.0008 | 0.0043 | 0.0023 | -0.0003 | 0.0040 |
| | P7 | 0.0007 | 0.0042 | 0.0018 | -0.0002 | 0.0040 |
| | P8 | 0.0010 | 0.0037 | 0.0023 | 0.0001 | 0.0037 |

***Source***: Authors' calculations.

*The Lahore Journal of Economics*
21 : 1 (Summer 2016): pp. 23–68

# The Aftermarket Performance of Initial Public Offerings in Pakistan

**Muhammad Zubair Mumtaz,[*] Zachary A. Smith[**] and Ather Maqsood Ahmed[***]**

**Abstract**

*This paper estimates the aftermarket performance of initial public offerings (IPOs) listed on the Karachi Stock Exchange. The evidence confirms that IPOs generate statistically significant abnormal returns in the short run, which indicates that underwriters initially underprice IPOs when analyzed using a short time horizon. However, when using longer time horizons to estimate abnormal performance, the results indicate that IPOs underperform in the long-run. There is an apparent dislocation between the initial valuation set by underwriters and the premium paid by the market for these new issues. The market sentiment that causes this temporary disequilibrium eventually fades and the market reprices the newly issued shares. We conduct an extreme bounds analysis to test the sensitivity and robustness of 16 explanatory variables in determining the long-term performance of unseasoned newly issued shares. The results indicate that the long-term investment ratio, industry affiliation, market-adjusted abnormal returns, financial leverage, return on assets, IPO activity period, the aftermarket risk level of unseasoned issues, and the post-issue promoter's holdings variables significantly affect IPOs' aftermarket performance. Theoretically, the overreaction hypothesis, ex-ante uncertainty hypothesis and window-of-opportunity hypothesis best explain IPOs' aftermarket performance in this study.*

**Keywords**: Initial public offering, underpricing, underperformance, extreme bounds analysis.

**JEL classification**: G14, G23, G32.

## 1. Introduction

Questions pertaining to how initial public offerings (IPOs) behave over short and longer time horizons have generated considerable debate.

---

[*] School of Social Sciences and Humanities, National University of Sciences and Technology, Islamabad.
[**] Donald R. Tapia School of Business, Saint Leo University, United States.
[***] School of Social Sciences and Humanities, National University of Sciences and Technology, Islamabad.

The literature indicates that underwriters seem to underprice IPOs in the short run and that they underperform over longer time horizons. Researchers have constructed empirical as well as theoretical explanations to account for these anomalies. The consensus is that companies initially underprice their shares to promote goodwill for seasoned equity offers.

Ritter and Welch (2002) find that the results of empirical studies are extremely sensitive to the methodology used to identify abnormal performance and the time horizon examined. Therefore, a broadly accepted theory of longer-term underperformance remains elusive. Generally, investors experience short-term abnormally positive performance when participating in unseasoned equity issuance and are exposed to longer-term underperformance (Jenkinson & Ljungqvist, 2001). However, IPOs' short- and long-run performance can vary from country to country.

The underpricing of IPOs has been a pervasive phenomenon for decades. Banerjee, Dai and Shrestha (2011) find evidence of IPO underpricing in 36 countries; they report that underpricing is universal, but that the level of underpricing varies from country to country. Loughran, Ritter and Rydqvist (1994) give evidence of underpricing in 25 countries and argue that initial underpricing is lower in developed countries than in developing countries. This is particularly true for Asian markets (Moshirian, Ng & Wu, 2010).

Examining longer-term underperformance, Ritter (1991) argues that, on average, IPOs underperform over a three-year period following issuance. Some studies have questioned the methodological and conceptual frameworks used to identify abnormal performance. Ritter (1991) applies and consequently devises different methodological approaches to overcome these shortcomings.[1] Unfortunately, there is no consensus on which methodology provides the best estimate of longer-term underperformance (see Fama, 1998; Loughran & Ritter, 2000).

In terms of IPOs' longer-term performance in developing markets, Sohail and Nasr (2007) report significantly negative market-adjusted abnormal returns (MAAR) over the one-year period following the initial offering in the Pakistani market. Sahoo and Rajib (2010) find that Indian IPOs underperform over the one-year period following the issuance of unseasoned equity shares, although investors who purchase the shares on the offering date benefit from abnormally positive performance.

---

[1] See, for instance, Barber and Lyon (1997) and Lyon, Barber and Tsai (1999).

The performance of Pakistani IPOs over a longer time horizon is relatively unexplored. Accordingly, we examine the three-year performance-adjusted, size-based, matched-firm benchmark after listing, using a sample of 57 firms during the period 2000–10 to investigate whether IPOs generate abnormal performance over the short and long run.

To test the sensitivity and robustness of the explanatory variables used to determine IPOs' longer-term performance, we conduct an extreme bounds analysis (EBA). We find that the average initial underpricing of IPOs was 32 percent over this time horizon, which implies that investors earned abnormal excess returns by participating in the new issues at the offering price and selling them at the listing price. Explanations for underpricing include information asymmetry, ex-ante uncertainty, underwriters' prestige, and signaling, but there is little agreement on whether a single hypothesis properly explains this phenomenon (Ritter & Welch, 2002).

The study uses four different methods to test the robustness of IPOs' longer-term performance: (i) buy-and-hold abnormal returns (BHAR), (ii) cumulative abnormal returns (CAR), (iii) the Fama and French (1993) model, and (iv) the Carhart (1997) model using a size-based, matched-firm benchmark index. We find that newly issued shares underperform against their respective benchmarks over the three-year period post-listing. However, the observed pattern of underperformance is not always statistically significant and the results are susceptible to the methodology used to identify abnormal performance (Fama, 1998). A comprehensive analysis of longer-term IPO performance would also examine the factors used to explain the underperformance.

This study, therefore, applies the EBA technique to identify robust predictors of longer-term performance. The variables selected as indicators of longer-term performance include (i) long-term investment, (ii) industry effects, (iii) financial leverage, (iv) MAAR, (v) the IPO activity period, (vi) the rate of return on total assets (ROA), (vii) the aftermarket risk level of the IPO, and (viii) post-issue promoters' holding (PIPH).

The remaining paper is structured as follows. Section 2 provides an overview of the IPO literature. Section 3 describes the IPO market in Pakistan. Section 4 discusses the research methodology and Section 5 describes the data and variables used. Section 6 examines the empirical results. Section 7 concludes the study with some policy implications.

## 2. Overview of the IPO Literature

This section outlines the theoretical, empirical and Pakistan-specific literature on IPOs.

### *2.1. Theoretical Aspects*

The current literature on IPO pricing and performance focuses on two broad themes: short-run and long-run abnormal performance. A number of theories account for short-term performance. Rock (1986) presents the "winner's curse" hypothesis, which assumes that asymmetric information causes underpricing. The study segregates investors into informed and uninformed cohorts. To determine the appropriate value to place on an individual firm as well as a potential offer price, informed investors attempt to obtain information on the new issue and are cognizant of the cost of that information. In comparison, uninformed investors estimate firm value without the information available to informed investors because they lack the resources to obtain this information. Informed investors participate only in those issues that underwriters tend to underprice, which creates the impression that attractive IPO stocks may be oversubscribed.

The information asymmetry hypothesis, in relation to investors in newly issued IPOs, suggests that uninformed investors may invest in overpriced issues and obtain negative returns (Ritter & Welch, 2002) – referred to as the "winner's curse." The signaling hypothesis (Welch, 1989) indicates that firms deliberately underprice their issues against the value of the company to "leave a good taste in investors' mouths" (Ibbotson, 1975). Subsequently, these firms issue seasoned equity offerings at higher prices.

The ex-ante uncertainty hypothesis is related to information asymmetry and emphasizes the investment risk faced by prospective investors. In the presence of ex-ante uncertainty, the offering price will be too low, thereby increasing the level of oversubscription. IPO stocks are intentionally underpriced to reduce the possibility that the underwriter might fail to allocate the entire issue. Moreover, underpricing correlates positively with the ex-ante uncertainty. The ownership dispersion hypothesis posits that issuers deliberately underprice securities to generate more demand and attract a large number of small shareholders (Ritter, 1991). This dispersed ownership may increase the liquidity of the firm. Prior studies have documented a negative relationship between promoters' holding and underpricing.

This study also examines longer-term post-IPO pricing behavior to gauge whether investors are better off holding onto IPOs over a longer time horizon. In this context, Jenkinson and Ljungqvist (2001) argue that investors' returns deteriorate the longer they hold onto IPO stocks. There is evidence supporting the idea that IPOs underperform over longer time horizons when measured against standard benchmarks (see Ritter, 1991; Loughran & Ritter, 1995). Conversely, Brav and Gompers (1997) and Smith (2008) have developed matched-firm techniques based on size, industry affiliation and book-to-market ratios to reduce the potential bias inherent in gauging abnormal performance.

Most studies argue that IPOs suffer from longer-term price underperformance and that the magnitude of underperformance decreases if researchers use standard benchmarks to estimate abnormal performance. The results of longer-term performance depend on the methodology used to gauge abnormal performance (see Eckbo, Masulis & Norli, 2000; Loughran & Ritter, 1995; Gompers & Lerner, 2003). Jenkinson and Ljungqvist (2001) point out that the evidence for longer-term performance is controversial and inconclusive.

Longer-term IPO performance is explained by different hypotheses. The impresario or fads hypothesis states that the process of IPO issuance does not instantly determine the value of new stocks. The overvaluation of shares, therefore, implies abnormal excess returns earned by investors at the start of market trading (Aggarwal & Rivoli, 1990). When investors earn excess returns on the listing day, this consequently corrects the overpricing and results in lower returns over the longer term.

The divergence-of-opinion hypothesis argues that optimistic and pessimistic investors evaluate newly issued shares differently. Given the surge of information that occurs when newly issued shares enter the market, investors' expectations will diverge to the extent of generating a price correction (Miller, 1977).

Under the window-of-opportunity hypothesis, investors will expect IPOs issued during a period of high trading volume to be overvalued compared to other IPOs because young firms without adequate growth prospects are more likely to issue shares. This overvaluation fails to justify the valuation, and stock prices adjust quickly to their fundamental value. Further, this theory indicates that periods of high issuance may be correlated with the lowest subsequent returns in the longer run (Loughran & Ritter, 1995).

Finally, the entrenchment theory describes the relationship between who controls the company and its long-term underperformance. Morck, Shleifer and Vishny (1988) argue that ownership control of a firm influences the risk associated with management entrenchment. If this risk is high, then it is likely that the new issues will underperform significantly in the long term (Mazzola & Marchisio, 2003).

### *2.2. Empirical Evidence*

There has been a great deal of academic interest in identifying the magnitude of underpricing experienced by firms that initially offer their shares to the public. The absolute levels of the average discrepancy between what firms receive for their newly issued shares and what they end up trading on the first day warrants further exploration of this phenomenon. We provide some examples from the literature below.

Reilly and Hatfield (1969) report underpricing of 11 percent in the US. Liu and Ritter (2010) find that the level of underpricing in the US was 12 percent during 2001–08. Data from the UK yields an underpricing level of 19 percent from 1989 to 2007 (Chambers & Dimson, 2009). Banerjee et al. (2011) find that the average underpricing in 11 Asian countries ranged from 12.94 percent in Singapore to 57.14 percent in China.[2] Hahl, Vahamaa and Aijo (2014) report average underpricing of 15.62 percent for a sample of 67 Finnish IPOs for the period 1994 to 2006. Jewartowski and Lizinska (2012) find an average underpricing level of 13.95 percent in a study of 186 Polish IPOs from 1998 to 2008. Agathee, Sannassee and Brooks (2012) document underpricing of 13.14 percent for 44 Mauritian IPOs for 1989–2005. Abu Bakar and Uzaki (2012) find an underpricing level of 35.87 percent in a study of 476 Malaysian IPOs. Adjasi, Osei and Fiawoyife (2011) report underpricing of 43.10 percent for a sample of 77 Nigerian IPOs. Samarakoon (2010) finds underpricing of 33.50 percent for 105 Sri Lankan IPOs, and Sahoo and Rajib (2010) report underpricing of 46.55 percent in a study of 92 Indian IPOs.

Empirical studies of longer-term performance attempt to model price behavior after listing (see Table 1). The question typically proffered by researchers is whether it is beneficial for investors to hold onto IPOs for longer periods after their initial offering. Empirical studies show that

[2] They find the following levels of underpricing: 12.94 percent in Singapore, 17.25 percent in Taiwan, 19.15 percent in Thailand, 22.21 percent in Hong Kong, 25.01 percent in India, 31.18 percent in Malaysia, 45.14 percent in Japan, 45.50 percent in the Philippines, 52.25 percent in Indonesia, 54.57 percent in the Republic of Korea and 57.14 percent in China.

abnormal performance depends on the methodology employed (see Jenkinson & Ljungqvist, 2001). Using 1,526 US IPOs during 1975–84, Ritter (1991) shows that they significantly underperformed against their matched-firm benchmark based on size and industry affiliation in the three-year period following the listing. Levis (1993) finds that IPOs in the UK underperformed against a number of relevant benchmarks in the three-year period following their listing.

**Table 1: Longer-term IPO performance in the literature**

| Study | Period | Sample size | Country | Abnormal returns (%) | Underperformance up to |
|---|---|---|---|---|---|
| Thomadakis, Nounis and Gounopoulos (2012) | 1994–2002 | 254 | Greece | -16.12 | 36 months |
| Belghitar and Dixon (2012) | 1992–96 | 335 | UK | -14.00 | 36 months |
| Jewartowski and Lizinska (2012) | 1998–2008 | 142 | Poland | -22.62 | 36 months |
| Sahoo and Rajib (2010) | 2002–06 | 92 | India | 41.91 | 36 months |
| Chi, McWha and Young (2010) | 1991–2005 | 114 | New Zealand | -27.81 | 36 months |
| Chorruk and Worthington (2010) | 1997–2008 | 141 | Thailand | -25.39 | 36 months |
| Chi, Wang and Young (2010) | 1996–2002 | 897 | China | 9.60 | 36 months |
| Sohail and Nasr (2007) | 2000–05 | 36 | Pakistan | -38.10 | 12 months |
| Rizwan and Khan (2007) | 2000–06 | 35 | Pakistan | -23.70 | 24 months |
| Goergen, Khurshed and Mudambi (2007) | 1991–95 | 240 | UK | -21.98 | 36 months |
| Ahmad-Zaluki, Campbell and Goodacre (2007) | 1990–2000 | 454 | Malaysia | -2.01 | 36 months |
| Drobetz, Kammermann and Wälchli (2005) | 1983–2000 | 53 | Switzerland | -173.46 | 120 months |
| Kooli and Suret (2004) | 1991–98 | 445 | Canada | -20.70 | 60 months |
| Gompers and Lerner (2003) | 1935–1972 | 3,661 | US | -33.40 | 60 months |
| Ritter and Welch (2002) | 1980–2001 | 6,249 | US | -23.40 | 36 months |
| Espenlaub, Gregory and Tonks (2000) | 1985–92 | 588 | UK | -21.30 | 60 months |
| Allen, Morkel-Kingsbury and Piboonthanakiat (1999) | 1985–92 | 143 | Thailand | 10.02 | 36 months |
| Ritter (1991) | 1975–84 | 1,526 | US | -29.10 | 36 months |
| Levis (1993) | 1980–88 | 712 | UK | -22.96 | 36 months |

Hwang and Jayaraman (1995) measure the performance of 182 Japanese IPOs over a three-year period and conclude that the value-weighted CAR is significantly positive (16.44 percent) while the equal-weighted CAR is significantly negative (–14.98 percent). Lyon et al. (1999) argue that researchers could remove biases by developing a matched-firm benchmark based on size and/or the book-to-market ratio. Gompers and Lerner (2003) examine the five-year performance (post-listing) of 3,661 US IPOs from 1935 to 1972. They argue that underperformance persists when using event-time BHAR, but disappears when using CAR and calendar time analysis (i.e., the capital asset pricing and Fama–French models); they report no abnormal performance in longer-term studies. Kooli and Suret (2004) investigate the five-year post-IPO performance of 445 Canadian IPOs during 1991–98 and find evidence of underperformance in the long run. They argue that this longer-term behavior can be explained by "hot markets" and the fads hypothesis.

### *2.3. Prior Studies in the Pakistani Context*

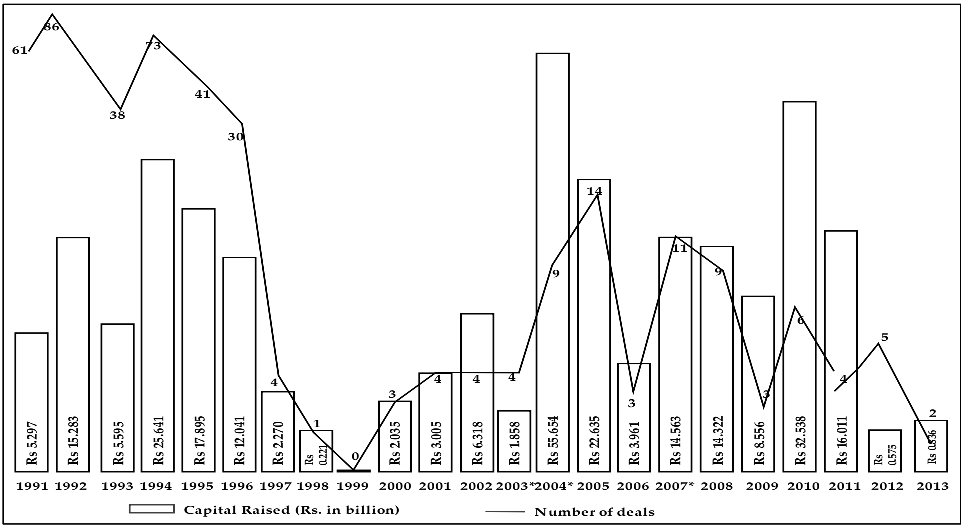
A handful of studies have examined the short-run underpricing of IPOs. Sohail and Nasr (2007) document an average underpricing of 35.66 percent, using 50 IPOs listed on the Karachi Stock Exchange (KSE) from 2000 to 2005. Rizwan and Khan (2007) analyze 35 IPOs from 2000 to 2006 and find an underpricing level of 36.48 percent. Kayani and Amjad (2011) examine 59 IPOs and report an average initial underpricing of 39.87 percent from 2000 to 2010. In another study, Afza, Yousaf and Alam (2013) report underpricing of 28.03 percent after analyzing 55 IPOs from 2000 to 2011. Mumtaz and Ahmed (2014) study short-run underpricing using 75 IPOs from 2000 to 2011, and find that they exhibit initial underpricing of 30.30 percent, on average.

To gauge longer-term performance, Sohail and Nasr (2007) study the one-year performance of 36 IPOs from 2000 to 2005, and report the average market-adjusted CARs and BHARs at –19.67 and –38.10 percent, respectively. In another study, Rizwan and Khan (2007) analyze the two-year performance of 35 IPOs using the BHAR methodology and document negative returns of –23.68 percent.

## 3. Pakistan's IPO Market

While the market for IPOs in Pakistan is limited, companies find it more appropriate to issue their shares through the IPO process and generate funds from the public. Over the last 15 years, Asian markets have been more likely to access the IPO market to raise capital. China is considered the leading country in which investors attract funds by issuing unseasoned equity shares, followed by India. However, Pakistan is also an emerging country in this context. Figure 1 illustrates annual IPO activity in Pakistan during the period 1991 to 2013.

**Figure 1: Annual IPO activity in Pakistan, 1991 to 2013**




* excluding 3rd offer for Sale of shares of National Bank of Pakistan in 2003, Offer for Sale of shares of (i) M/s Sui Southern Gas Co. Ltd. & (ii) M/s Pakistan international Airlines Corp. Ltd. In 2004 and 2nd Offer of Shared of OGDCL shares in 2007 which were already listed.
*Source:* Securities and Exchange Commission of Pakistan

With the advent of liberalization in 1991, a number of reforms were introduced in Pakistan's capital market. At this stage, IPO issuance increased and privately held companies issued shares to diversify ownership, raise funds for investment and create an exit strategy for mature firms. Earlier, the Corporate Law Authority (CLA) had been set up in 1986 with the objective of monitoring the corporate sector to ensure transparency and compliance with laws. To make the IPO process rigorous and competitive, the CLA was abolished and an independent commission set up. The Securities and Exchange Commission of Pakistan (SECP) was established in 1997 through the Securities and Exchange Commission of Pakistan Act. The SECP began its operational functions on 1 January 1999 with the objective of carrying out the reform program envisaged for Pakistan's capital market. After this, the process of issuing IPOs became more rigorous and efficient as companies were allowed to float their shares and raise funds from the public.

During 2000–11, 79 IPOs took place with paid-up capital of PRs 181.456 billion. In Pakistan, companies use two methods to issue shares to the public: (i) the fixed price method and (ii) the book-building process. Under the fixed price method, the offer price is set at par or at a premium by the issuer on the basis of a valuation of companies' financials. Under the book-building mechanism, the issuer gathers pricing information from institutional investors and individual investors with a high net worth through a bidding process in order to build interest in investment in the company's shares. In Pakistan, IPOs are normally issued under the fixed price method whereas only five IPOs have been issued through the book-building mechanism.

## 4. Research Methodology

The literature shows that most studies have used different benchmarks to measure abnormal returns (see Lyon et al., 1999; Drobetz et al., 2005). The results of studies of longer-term abnormal returns as they relate to IPO performance are extremely susceptible to the methodology used to identify abnormal performance. There is little consistency in terms of the methodology applied to measure abnormal returns and, therefore, no consensus on the magnitude of long-term underperformance. Fama (1998) postulates that anomalies in abnormal performance as portrayed in earlier studies do not clearly establish that the anomalous behavior found in event studies is valid. He suggests that a theory that explains both over-reaction and under-reaction does not exist.

The extensive debate on evaluating longer-term abnormal performance in event studies has led to three important critiques: (i) the use of biased benchmarks, (ii) the selection of the time period for which researchers evaluate IPO stocks and benchmark returns, and (iii) issues pertaining to the rationality of statistical inferences when significance levels may be biased.

Event studies (see Ball & Brown, 1968; Fama, Fisher, Jensen & Roll, 1969) and calendar time studies (see Mitchell & Stafford, 2000; Hou, Olsson & Robinson, 2001) were developed to examine market efficiency. The event study methodology is the most popular method for measuring the short-term and long-term performance of IPOs using different time horizons and event windows (see Ritter, 1991; Bradley, Jordan & Ritter, 2003). Lyon et al. (1999) argue that researchers should apply the calendar time approach to projects that experience correlation of their sample returns because there is an overlap in the estimation period.

Researchers have used both methods to analyze IPO performance in empirical studies, and determine whether there is evidence of positive or negative returns over specific time horizons. Moreover, academics have rigorously debated whether the methodologies used over the last decade to conduct event studies and identify abnormal performance have improved.

This study examines the short-run and longer-term performance of IPOs. Where most other studies have examined long-term performance over a two-year period, using the benchmark index as a proxy for normal performance, we test for longer-term abnormal performance using four different methods to capture how IPOs behave over a three-year time horizon. We apply both the event and calendar time approaches to analyze and compare abnormal returns. In addition, we determine the robust predictors that affect longer-term IPO performance using EBA.

To construct a proxy for normal performance, we matched each issuing firm to a nonissuing firm, based on a list of all firms listed on the KSE each December that had not issued any stock within the last three years. These firms were then ranked by their market value (see Loughran & Ritter, 1995). To select the matched-firm benchmark, we chose the firm with a market value closest to, but higher than, that of the issuing firm as its matched firm. Firms that delisted their shares during the three-year period were not selected as matched firms. We also chose not to match firms by industry affiliation because some industries did not have enough firms to apply the industry and market capitalization filter and to avoid industry-wide misevaluation.

### *4.1. Estimation of Underpricing*

Following other studies (e.g., Berk & Peterle, 2015; Laokulrach, 2015), the underpricing of unseasoned new issues is measured through the initial return on stock *i* at the close of the first trading day. The MAAR is computed for stock *i* using the benchmark index (KSE)[3] at the first closing market price as follows:

---

[3] The raw return $R_{i,1}$ for stock *i* at the close of the first trading day is calculated as $R_{i,1} = \left( {P_{i,1}}/{P_{i,0}} \right) - 1$ where $R_{i,1}$ is the return on stock *i* at the close of the first trading day, $P_{i,1}$ is the price of stock *i* at the end of the first closing market price and $P_{i,0}$ is the offer price of stock *i*. The market return is obtained from the benchmark index and computed as $R_{m,1} = \left( {I_{m,1}}/{I_{m,0}} \right) - 1$ where $R_{m,1}$ is the market return on the first trading day, $I_{m,1}$ is the value of the market index at the close of the first trading day for stock *i* and $I_{m,0}$ is the value of the market index on the offering date for stock *i*.

$$MAAR_{i,1} = 100 \times \left\{\left[\frac{(1+R_{i1})}{(1+R_{m1})} - 1\right]\right\} \quad (1)$$

The sample mean $MAAR_{i,1}$ at the end of the first trading day is measured as $MAAR_{i,1} = \frac{1}{n}\sum_{i=1}^{n} MAAR_{i,1}$. We test the null hypothesis that the mean MAAR ($MAAR_{i,1}$) is equal to 0. To test the hypothesis, the t-statistic is computed as $t = \frac{(MAAR_{i,1})}{s/\sqrt{n}}$ where $s$ is the standard deviation of $MAAR_{i,1}$ for $n$ number of firms.

### *4.2. Buy-and-Hold Abnormal Returns*

Lyon et al. (1999) argue that BHAR measures investors' experience precisely. This makes it one of the preferred methods in the literature to gauge abnormal performance during a specific period (Mitchell & Stafford, 2000). We measure abnormal returns over a period of 36 months starting from the closing price on the first day of trading. Following Berk and Peterle (2015) and Barber and Lyon (1997), the BHAR for firm *i* at time *t* adjusted by size, based on the matched-firm benchmark index is computed as follows:

$$BHAR_t = \left[\prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{mf,t})\right] \quad (2)$$

where $R_{i,t}$ is the monthly return of the event firm *i* at time *t* and $R_{mf,t}$ is the return of the size-based matched-firm benchmark over the corresponding period. *T* is the time period for which we calculate the BHAR, that is, the return an investor would have obtained using a buy-and-hold strategy, purchasing the stock on the listing day and holding it until the stock's three-year anniversary.[4] The mean BHAR[5] for period *t* is defined as:

$$Mean\ BHAR_T = \sum_{i=1}^{n} w_i BHAR_{i,t} \quad (3)$$

To test the statistical significance of whether the mean BHAR is equal to 0, Lyon et al. (1999) suggest using skewness-adjusted t-statistics, which we calculate as follows:

$$t = \sqrt{n} \times \left(S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n}\hat{\gamma}\right) \quad (4)$$

[4] Firms delisted during the return estimation period are not included in the sample.

[5] In the case of equal-weighted, $w_i = {}^{1}/_{n}$ and in the case of value-weighted, $w_i = {}^{MV_i}/_{\sum_i MV_i}$, where $MV_i$ is the market value of IPO firm $i$ (the number of shares outstanding multiplied by the closing market price on the first day of trading).

where

$$S = \frac{BHAR_t}{\sigma(BHAR_t)} \text{ and } \hat{\gamma} = \frac{\sum_{i=1}^{n}(BHAR_i - BHAR)^3}{n\sigma(BHAR_t)^3} \quad (5)$$

where $BHAR_t$ is the sample mean BHAR, $\sigma(BHAR_t)$ is the cross-sectional sample standard deviation of abnormal returns and $n$ is the number of sample firms. $\hat{\gamma}$ is an estimate of the coefficient of skewness. We use skewness-adjusted t-statistics to cope with the problem of skewness as the critical values of conventional t-statistics are inappropriate in this case.

### *4.3. Cumulative Abnormal Returns*

The abnormal returns ($AR_{i,\tau}$) for firm $i$ starting in period $s$ are computed as:

$$AR_{i,\tau} = \left[R_{i,t} - \frac{1}{n_t}\sum_{t=s}^{s+\tau} R_{mf,t}\right] \quad (6)$$

where $R_{i,t}$ is the monthly return of event firm $i$ at time $t$ and $R_{mf,t}$ is the return of the size-based matched-firm benchmark for the corresponding period. The $\tau$-period CAR ($CAR_{i\tau}$) for firm $i$ beginning in period $s$ is calculated as follows (Lyon et al., 1999):

$$CAR_{i\tau} = \sum_{t=s}^{s+\tau}\left[R_{i,t} - \frac{1}{n_t}\sum_{t=s}^{s+\tau} R_{mf,t}\right] \quad (7)$$

We calculate the CAR based on the newly issued IPOs' performance from the first closing market price and compared against the cumulative mean benchmark-adjusted matched-firm return[6] for months 1 to 36. Since the CAR is less skewed than the BHAR, conventional t-statistics yield well-specified test statistics. To test the statistical significance of the CAR, Ritter (1991) defines the t-statistics for the CAR in month $t$, $CAR_{1,t}$ as follows:

$$t_{CAR_{1,t}} = CAR_{1,t} \times \sqrt{\frac{n_t}{t \times var + 2(t-1) \times cov}} \quad (8)$$

[6] The mean-adjusted return through the benchmark on a portfolio of $n$ stocks for the event month is measured on the basis of equal-weighted and value-weighted. In the case of equal-weighted, $w_i = {}^{1}/_{n}$ while for value-weighted, $w_i = {}^{MV_i}/_{\sum_i MV_i}$ where $MV_i$ is the market value of IPO firm $i$ (the number of shares outstanding multiplied by the closing market price on the first day of trading).

where $n_t$ is the number of IPO firms trading in each month, *var* is the average of the cross-sectional variation over 36 months of the $AR_{i,\tau}$ and *cov* is the first-order auto-covariance of the $AR_t$ series.

### 4.4. Calendar Time Approach

The calendar time approach is carried out using the Fama–French (1993) three-factor model and the Carhart (1997) four-factor model. The return on a portfolio comprises the IPO firms issued within the last three years from the first closing market price. Applying Fama and French (1993), the return on this portfolio is used to estimate the following regression:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + \epsilon_{it} \tag{9}$$

where $R_{pt}$ is the equal-weighted or value-weighted return on the IPO portfolio in month $t$, $R_{ft}$ is the three-month treasury bill rate in month $t$, $R_{mt}$ is the return on the value-weighted index (KSE-100) in month $t$, $SMB_t$ is the return on a value-weighted portfolio of small stocks minus large stocks in month $t$ and $HML_t$ is the return on a value-weighted portfolio of high book-to-market stocks minus low book-to-market stocks in month $t$. $\beta_i$, $s_i$ and $h_i$ stand for the loadings of the portfolio on each factor: the market, SMB (size) and HML (book-to-market) ratio. The term $\alpha_i$ is an intercept, which we use to investigate the null hypothesis that the mean monthly excess return is equal to 0.

The Carhart (1997) model extends the Fama–French model to strengthen portfolio returns as well as the risk-adjusted abnormal return earned on the portfolio. The model is written as:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + w_i WML_t + \epsilon_{it} \tag{10}$$

where $SMB_t$ and $HML_t$ are defined above and the winner-minus-loser term ($WML_t$) is the momentum factor added by the Carhart model. WML is calculated by ranking all the firms by their 11-month stock returns and subsequently taking the average return of the top third (high past returns) minus the average return of the bottom third (low past returns). The intercept of the model reflects the average monthly abnormal return.

The regressions are estimated using Newey–West heteroskedasticity and autocorrelation standard errors to calculate the t-statistics for the regression coefficients. To estimate the parameters of the calendar time approach, we gather data on 80 non-IPO firms listed on the stock market and divide them into three groups. We segregate the first and last third of this sample, covering 27 firms each and their returns based on the SMB, HML and WML criteria.

### *4.5. Extreme Bounds Analysis*

The EBA technique is used to determine the robust predictors that affect longer-term IPO performance. This method reduces the ambiguity in selecting and determining only those variables that affect longer-term performance. These determinants are typically based on the following regression:

$$BHAR_i \text{ or } CAR_i = \alpha_0 + \sum_{j=1}^{n} \alpha_j X_{ji} + \varepsilon_i \quad (11)$$

where $BHAR_i$ and $CAR_i$ are the equal-weighted BHAR and CAR, respectively, of firm $i$ over the period of 36 months, and $X_{ji}$ is the $j$th explanatory variable of firm $i$. EBA is applied to a linear regression that explains longer-term performance. The model is described as follows:

$$BHAR_i \text{ or } CAR_i = \alpha_0 + \sum_{j=1}^{n} \delta_i X_{ji} + \beta Q_i + \sum_{j=1}^{m} \gamma_i Z_{ji} + \varepsilon_i \quad (12)$$

where X is an important explanatory variable(s), as identified by prior studies, that is included in every regression (also known as a free variable). Q is the variable of interest whose robustness we test, and Z is a potentially important variable.

The purpose of the EBA is to examine the robustness of the value of the coefficient of the variable of interest, Q. A large number of regressions are required to run an EBA and the free variables are included in every regression, whereas we select the variable of interest Q and the set of Z variables from a predetermined pool. This exercise of conducting exhaustive regressions for each variable of interest gives us the highest and lowest values of $\beta$that cannot be rejected at a particular significance level. In a set of regressions, if the value of the coefficient has the same sign and its extreme value remains statistically significant, then it is called a "robust" variable, otherwise the variable is treated as "fragile."

Researchers have applied the EBA technique to a diverse set of projects to test the robustness and sensitivity of the explanatory variables that truly influence the dependent variable. The empirical literature indicates that EBA can be used to identify the determinants of: (i) IPO underpricing (see Mumtaz & Ahmed, 2014), (ii) the emergence and survival of democracy (see Gassebner, Lamla & Vreeland, 2013), (iii) R&D investment (see Wang, 2010), (iv) foreign direct investment (see Moosa & Cardak, 2006), (v) corruption (see Seldadyo & de Haan, 2006), (vi) stock prices in the Kuwait Stock Exchange (see Al-Deehani, 2005), (vii) regional trading arrangements (see Ghosh & Yamarik, 2004) and (viii) productivity growth (see Hwang & Wang, 2004).

### 4.6. Determinants of IPOs' Longer-Term Performance

While the empirical literature identifies the explanatory variables that influence longer-term IPO performance, what is important is to select only the robust variables. Therefore, we use the EBA technique to find the true determinants of longer-term IPO performance. More importantly, this technique has not been used in empirical studies to do so. The possible explanatory variables that determine longer-term performance can be written as follows:

$$BHAR_i \text{ or } CAR_i = \alpha_0 + \beta_1 LT_i + \beta_2 INDUSTRY_i + \beta_3 LDel_i + \beta_4 FinLev_i + \beta_5 FSize_i + \beta_6 Risk_i + \beta_7 MAAR_i + \beta_8 Time + \beta_9 PIPH_i + \beta_{10} MktRet + \beta_{11} OSize_i + \beta_{12} Sub_i + \beta_{13} EPS_i + \beta_{14} Age_i + \beta_{15} ROA_i + \beta_{16} MktVol + \epsilon_i \quad (13)$$

where $BHAR_i$ and $CAR_i$ represent the 36-month equal-weighted BHAR and CAR, respectively, based on the size-based matched-firm benchmark. *LT* is the long-term investment ratio, *INDUSTRY* is a dummy variable equal to 1 for the financial sector and 0 otherwise, and *LDel* is the listing delay between the offering and listing dates. *FinLev* is the firm's financial leverage prior to the IPO, *FSize* is firm size measured by the firm's total assets, *Risk* is the aftermarket risk level of the IPO and *MAAR* represents the MAAR on the first day of listing. *Time* is a dummy variable: if the IPO is issued during a hot period, it is equal to 1 and 0 otherwise. The remaining variables include the PIPH (post-issue promoters holding), *MktRet* (the market return measured on the KSE-100 value-weighted index over the three-month period prior to the IPO), *OSize* (issue proceeds), *Sub* (oversubscription), earnings per share (EPS), *Age* (the firm's age prior to the IPO), *ROA* (the rate of return on total assets) and *MktVol* (market volatility).

## 5. Data and Description of Variables

During the sample period of January 2000 to December 2010, 73 Pakistani IPOs listed their shares on the KSE. Of these, four IPOs were delisted and 12 had to be dropped from the sample for lack of data. The final sample comprised 57 IPOs (78 percent of the total). We collected statistics pertaining to these IPOs from their prospectuses as well as the opening and closing prices for the newly issued companies. Data on the KSE-100 index was collected from the KSE website and T-bill rates from the State Bank of Pakistan website.

The Appendix gives a detailed description of the variables used in this study. When employing the EBA technique, the goal is to choose the X, Q and Z variables mentioned in equation 13 that can cause longer-term performance. We have identified the X variables as fixed variables; these are used in every regression and considered important determinants of longer-term IPO performance, based on the theoretical and empirical literature.

Out of 16 variables, two X variables – the long-term investment ratio and industry effects – are selected as fixed variables and used to estimate long-run performance under the buy-and-hold strategy. The MAAR and IPO activity period are selected as X variables when using the CAR method. We select the Q and Z variables from the remaining 14 variables. Each of these 14 variables is a variable of interest Q whose robustness is tested. For a given Q variable, three Z variables are selected from the other 13, yielding 4,004 regressions (286 regressions for each variable of interest). In total, we run 16,016 regressions to determine the explanatory variables of IPO underperformance with regard to BHAR and CAR.

Table 2 gives the descriptive statistics for the sample 57 IPOs. The two dependent variables include the BHAR and CAR. The independent variables include the long-term investment ratio (*LT*), financial leverage (*FinLev*), the MAAR, market return (*MktRet*), PIPH, ROA and market volatility (*MktVol*), denoted in percentage terms. Firm size (*FSize*) and offer size (*OSize*) are estimated in PRs million. The listing delay (*LDel*) is scaled in days and the age of the firm (*Age*) in years. Risk is measured by the standard deviation of post-listing price behavior. EPS is measured in PRs per share and the oversubscription ratio (*SUB*) is represented by the number of times.

**Table 2: Descriptive statistics for 57 KSE-listed IPOs, 2000–10**

| Variable | Mean | Median | Min. value | Max. value | SD |
|---|---|---|---|---|---|
| BHAR | -32.73 | -22.56 | -289.85 | 349.57 | 105.32 |
| CAR | -17.91 | -15.43 | -239.07 | 208.85 | 103.28 |
| LT | 5.85 | 0.00 | 0.00 | 78.89 | 14.51 |
| LDel | 42.44 | 39.00 | 9.00 | 87.00 | 12.76 |
| FinLev | 22.66 | 16.32 | 0.00 | 77.08 | 22.60 |
| FSize | 29,452.14 | 1,416.47 | 10.06 | 562,915.76 | 94,373.54 |
| Risk | 8.80 | 3.22 | 0.57 | 85.61 | 15.83 |
| MAAR | 31.96 | 12.54 | -34.59 | 315.88 | 63.49 |
| PIPH | 65.34 | 73.79 | 16.70 | 95.00 | 19.39 |
| MktRet | 0.06 | 0.11 | -0.64 | 0.72 | 0.26 |
| OSize | 711.21 | 250.00 | 40.00 | 8,107.50 | 1,243.47 |
| Sub | 2.88 | 1.21 | 0.01 | 18.69 | 3.97 |
| EPS | 0.87 | 0.05 | 0.00 | 5.79 | 1.78 |
| Age | 11.21 | 6.00 | 0.00 | 66.00 | 14.12 |
| ROA | 8.95 | 5.07 | 0.00 | 72.60 | 12.09 |
| MktVol | 1.46 | 1.30 | 0.78 | 2.89 | 0.77 |

***Source***: Authors' calculations.

The data for the dependent variables consists of the 36-month equal-weighted BHAR and CAR. The average BHAR and CAR are –32.73 percent and –17.91 percent, respectively. The median BHAR and CAR are –22.56 percent and –15.43 percent, respectively. We can see that the level of underperformance is higher when using the BHAR method.

Among the independent variables, the mean value of the long-term investment ratio is 5.9 percent with a maximum value of 78.9 percent and a standard deviation of 14.5 percent. The mean listing delay is 42.4 days and the median delay is 39 days. The mean value of financial leverage is 22.7 percent, with a median of 16.3 percent and a maximum of 77.1 percent, which implies that the average IPO firm does not have a high debt burden before going public. The mean value of firm size is PRs 29,452 million, ranging from PRs 10 million to PRs 562,916 million. By eliminating the three largest firms, the average firm size decreases to PRs 8,750 million with a standard deviation of PRs 17,057 million. The mean value of aftermarket risk is 8.8, with a maximum value of 85.6 and a median of 3.2.

The average MAAR on the first day of trading is 32.0 percent with a median abnormal return of 12.5 percent. Overpricing and underpricing range from 34.6 to 315.9 percent, showing a large fluctuation in the performance of the sample IPOs. The average market return is 0.1 percent with a median return of 0.1 percent, indicating a nominal market return prior to the IPO. The mean offer size is PRs 711.2 million. The lowest and highest offer sizes are PRs 40 million and PRs 8,107 million, respectively. The large variation in offer size indicates diversification among the IPOs in this sample in terms of market capitalization. The average PIPH is 65.3 percent with a median value of 73.8 percent.

By holding a high percentage of equity in the post-IPO period, promoters illustrate their confidence in the IPO firms. The IPOs are subscribed by a factor of 2.9 on average, and the median value suggests that the oversubscription rate is more than 1, with a standard deviation of 3.9, showing negligible oversubscription. The average EPS ratio is PRs 0.9, that is, every share of the IPO firms earns PRs 0.9. This ratio is low, indicating that firms prior to IPO were unable to earn a profit. On average, the age of the firm is 11.2 years with a median age of 6.0 years. The mean ROA is 8.9 percent with a maximum value of 72.6 percent and a median value of 5.1 percent. This indicates that, prior to the IPO, firms' ROA was very low. Market volatility seems very low – just 1.5 percent on average – showing a small variation in market returns.

## 6. Empirical Results

This section examines IPO underpricing, firms' BHAR and CAR, and their issue proceeds and initial returns in the context of longer-term performance.

### *6.1. Underpricing of IPOs*

We examine the underpricing of IPOs to evaluate the abnormal excess returns obtained by investors if they participate at the offering price and sell the newly issued shares on the first day of trading after listing. Table 3 summarizes the initial returns of 57 IPOs during the sample period 2000–10. The analysis shows that the average raw return was 36.7 percent and the average market return (KSE-100 index) was 4.7 percent on the first day of trading after listing. This reflects that, on average, Pakistani IPOs are underpriced by 32.0 percent. This is statistically significant using an $\alpha$ of 1 percent, which implies that abnormal excess returns are earned on the first day of trading.

This study, therefore, rejects the null hypothesis that the average initial MAAR is equal to 0. This finding is consistent with prior studies, for example, Sohail and Nasr (2007), Sahoo and Rajib (2010), Samarakoon (2010) and Otchere, Owusu-Antwi and Mohsni (2013). Firms dealing in financial services are underpriced by 31.7 percent (t-statistic = 2.66) relative to 32.1 percent (t-statistic = 2.80) for nonfinancial firms.

The median underpricing is reported at 12.5 percent on the first day of listing, which is significant at the 1 percent level. The standard deviation of the sample IPOs is 63.5 percent. The MAAR variable ranged from –34.6 to 315.9 percent. The considerable spread between the maximum and minimum values confirms that there are large fluctuations in initial performance and hence the perceived underpricing. The skewness value shows that the mean is greater than the median, which indicates that returns are positively skewed. The excess kurtosis variable is different from 0, which suggests that stock price returns are not normally distributed.

Of the sample of 57 IPOs, 22 (39 percent) produced short-term negative returns when compared against the market, which indicates that the listing price is below the offer price. If we exclude the IPOs that produced negative MAARs, the average underpricing or initial MAAR reaches 60.0 percent on the first day of trading, which is higher than what international evidence has suggested (see Adjasi et al., 2011). The observed underpricing may be a short-term effect: eventually, the market "takes back" this initial premium it pays for the unseasoned IPO (Ritter and Welch, 2002).

**Table 3: Underpricing of sample IPOs**

| | |
|---|---|
| Average raw return | 36.7% |
| Average market return | 4.8% |
| Mean | 32.0% |
| t-statistic | 3.801*** |
| Median | 12.5% |
| z-statistic | 4.107*** |
| Minimum value | -34.6% |
| Maximum value | 315.9% |
| Standard deviation | 63.5% |
| Skewness | 2.318 |
| Kurtosis | 6.893 |

Note: The underpricing is measured from the first closing market price over the sample period. For stock *i* at the close of the first trading day, this is computed as $MAAR_{i,t} = 100 \times \left\{\left[\frac{(1+R_{i,t})}{(1+R_{m,t})} - 1\right]\right\}$ where $R_{i,t}$ denotes the raw return and $R_{m,t}$ the market return.
The z-statistics for the median are for the Wilcoxon rank-sum test. *** = significant at 1% level.
***Source***: Authors' calculations.

### *6.2. Buy-and-Hold Abnormal Returns*

The BHAR evaluates the change in wealth that investors experience by passively investing on the initial day, holding their newly issued shares for a specified period. A positive BHAR indicates outperformance and a negative BHAR indicates underperformance relative to the chosen proxy. Table 4 presents the equally weighted and value-weighted BHAR for the 57 IPOs included in this study over months 1 through 36, following the listing of the unseasoned equity shares, using the size-based matched-firm benchmark.

The results for the equal-weighted BHAR reveal significant IPO underperformance. From this, it appears that IPOs underperform relative to their size-based matched-firm benchmark. An initial investment in the new issues would have resulted in a loss of 26.3 percent (t-statistic = –4.08) by the end of month 12, and 23.0 percent (t-statistic = –2.39) and 32.7 percent (t-statistic = –2.31) by the end of months 24 and 36, respectively.

The underperformance of IPO firms relative to the matched firms based on market capitalization is statistically significant in all 36 months except for the sixth month of trading, where the BHAR was -7.8 percent (t-statistic = –1.41). This indicates that, if investors bought the IPOs on the first trading day and held them for up to three years, they would have incurred significant underperformance relative to the benchmark. This result is consistent with those found in Chi, Wang and Young (2010) and Boissin and Sentis (2014).

On a value-weighted basis, the BHAR results reflected significant underperformance in the first two months, which illustrates that IPOs underperform in the short run. For example, their performance relative to the size-based matched-firm benchmark was -11 percent (t-statistic = –0.98) after 12 months. However, in the long run, IPOs actually outperformed their benchmark by 7.7 percent each in month 24 (t-statistic = 0.40) and month 36 (t-statistic = 0.42). Hence, there is no statistically significant evidence of underperformance or over-performance in the long run when using value-weighted benchmarks. Even without a significant result, we believe that this finding is consistent with earlier findings such as Kooli and Suret (2004) and Chen, Bangassa and Brookfield (2011).

**Table 4: Aftermarket BHAR for sample IPOs**

| Month | Equal-weighted | | | | Value-weighted | | | |
|---|---|---|---|---|---|---|---|---|
| | $BHAR_{i,t}$ | $BHAR_{mf,t}$ | $BHAR_T$ | $t(BHAR_T)$ | $BHAR_{i,t}$ | $BHAR_{mf,t}$ | $BHAR_T$ | $t(BHAR_T)$ |
| 1 | -4.8% | 1.8% | -6.7% | (-2.75)** | -5.7% | 5.8% | -11.2% | (-2.02)* |
| 2 | -8.8% | 2.3% | -11.1% | (-3.44)*** | -9.5% | 1.8% | -11.3% | (-1.77)* |
| 3 | -8.9% | 1.9% | -10.8% | (-3.54)*** | -6.7% | 5.9% | -12.6% | (-1.23) |
| 4 | -7.3% | 1.8% | -9.1% | (-2.55)** | -4.6% | 3.2% | -7.7% | (-0.91) |
| 5 | -5.6% | 5.5% | -11.1% | (-2.74)** | 3.3% | 16.1% | -12.8% | (-1.00) |
| 6 | -1.5% | 6.4% | -7.8% | (-1.41) | 14.6% | 8.5% | 6.1% | (0.38) |
| 7 | -7.7% | 7.1% | -14.9% | (-1.97)* | 6.6% | 10.6% | -4.0% | (-0.31) |
| 8 | -9.4% | 6.9% | -16.2% | (-2.05)* | -1.3% | 1.8% | -3.1% | (-0.26) |
| 9 | -9.2% | 12.3% | -21.5% | (-2.80)** | 0.1% | -2.0% | 2.1% | (0.21) |
| 10 | -7.3% | 15.5% | -22.8% | (-3.10)*** | -2.9% | -0.4% | -2.5% | (-0.16) |
| 11 | -7.5% | 17.7% | -25.2% | (-3.50)*** | -11.5% | 4.0% | -15.5% | (-1.40) |
| 12 | -5.5% | 20.8% | -26.3% | (-4.08)*** | -10.5% | 0.6% | -11.0% | (-0.98) |
| 13 | -4.5% | 20.8% | -25.3% | (-3.39)*** | -6.9% | -2.1% | -4.7% | (-0.38) |
| 14 | -5.6% | 20.7% | -26.3% | (-3.90)*** | -5.9% | -2.0% | -3.9% | (-0.31) |
| 15 | -8.2% | 17.0% | -25.2% | (-3.55)*** | -8.2% | -8.3% | 0.1% | (0.04) |
| 16 | -11.8% | 18.3% | -30.1% | (-4.16)*** | -12.0% | -16.5% | 4.5% | (0.46) |
| 17 | -8.7% | 22.8% | -31.5% | (-3.72)*** | -3.7% | -8.0% | 4.3% | (0.37) |
| 18 | -6.6% | 26.2% | -32.8% | (-3.92)*** | -0.9% | -3.4% | 2.5% | (0.21) |
| 19 | -7.7% | 27.5% | -35.2% | (-4.51)*** | 9.6% | 7.4% | 2.2% | (0.14) |
| 20 | -4.8% | 26.7% | -31.4% | (-3.78)*** | 5.6% | 0.9% | 4.6% | (0.27) |
| 21 | -5.9% | 25.8% | -31.7% | (-3.87)*** | -6.1% | -5.1% | -0.9% | (-0.05) |

| | Equal-weighted | | | | Value-weighted | | | |
|---|---|---|---|---|---|---|---|---|
| Month | $BHAR_{i,t}$ | $BHAR_{mf,t}$ | $BHAR_T$ | $t(BHAR_T)$ | $BHAR_{i,t}$ | $BHAR_{mf,t}$ | $BHAR_T$ | $t(BHAR_T)$ |
| 22 | -2.7% | 26.3% | -28.9% | (-3.37)*** | 4.4% | -4.0% | 8.4% | (0.50) |
| 23 | 1.5% | 25.3% | -23.8% | (-2.75)** | 9.9% | -3.8% | 13.6% | (0.77) |
| 24 | 1.7% | 24.6% | -22.9% | (-2.39)** | 10.6% | 2.9% | 7.7% | (0.40) |
| 25 | -0.4% | 24.3% | -24.7% | (-2.63)** | 8.9% | 0.0% | 8.9% | (0.49) |
| 26 | 4.3% | 26.4% | -22.1% | (-2.12)** | 10.8% | 0.2% | 10.6% | (0.56) |
| 27 | 4.7% | 26.9% | -22.2% | (-2.38)** | 12.2% | 0.4% | 11.8% | (0.56) |
| 28 | 4.5% | 28.4% | -23.9% | (-2.56)** | 11.9% | 0.7% | 11.2% | (0.53) |
| 29 | 6.0% | 30.0% | -23.9% | (-2.33)** | 13.3% | -1.0% | 14.2% | (0.71) |
| 30 | 6.7% | 32.1% | -25.3% | (-2.41)** | 8.2% | -3.2% | 11.3% | (0.57) |
| 31 | 8.5% | 39.1% | -30.5% | (-2.69)** | 11.9% | -0.2% | 12.2% | (0.55) |
| 32 | 11.3% | 42.1% | -30.8% | (-2.74)** | 8.7% | -1.2% | 9.9% | (0.48) |
| 33 | 14.0% | 42.4% | -28.4% | (-2.52)** | 9.5% | -4.24% | 13.7% | (0.68) |
| 34 | 15.2% | 48.5% | -33.3% | (-2.73)** | 9.1% | -2.6% | 11.7% | (0.56) |
| 35 | 13.3% | 44.2% | -30.9% | (-2.39)** | 2.1% | -6.1% | 8.2% | (0.43) |
| 36 | 16.4% | 49.1% | -32.7% | (-2.31)** | 2.5% | -5.2% | 7.7% | (0.42) |

Note: $BHAR_t$ is computed as $BHAR_t = \left[\prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{mf,t})\right]$ where $R_{i,t}$ and $R_{mf,t}$ are the returns of IPO firm $i$ and its matching firm respectively.
To test the null hypothesis that the BHAR is significantly different from 0, we employ skewness-adjusted t-statistics (Lyon et al., 1999). The t-statistics are given in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.
***Source***: Authors' calculations.

### *6.3. Cumulative Abnormal Returns*

Table 5 gives the equal- and value-weighted CAR for the 36-month period after listing for the 57 IPOs issued between 2000 and 2010, based on the size matched-firm benchmark. The results of the equal-weighted CARs reveal that IPOs underperformed against their benchmark over the sample period. The level of underperformance is significant in most cases, but this significance deteriorates at the end of month 23. For instance, CAR is -27.4 percent (t-statistic = –1.82) after 12 months, and -16.3 percent (t-statistic = –1.15) and -17.6 percent (t-statistic: = –1.67) after months 24 and 36, respectively (see Chen et al., 2011).

The value-weighted CAR illustrates that IPOs underperform over the sample period; however, this underperformance is rarely statistically significant. The value-weighted CAR is -22.8 percent (t-statistic = –1.52) after 12 months and -19.3 percent (t-statistic = –1.37) after 24 months. The value-weighted CAR in month 36 is –22.5 percent, which is significant at a 5 percent level, illustrating that Pakistani IPOs incur negative abnormal returns if the new issues are held over a period of three years.

In conclusion, the BHAR and CAR results on the basis of the equal- and value-weighted benchmarks demonstrate that evidence of longer-term performance depends on the method used to measure abnormal returns. The equal-weighted BHAR values suggest that IPOs underperform significantly as do the equal-weighted CAR values, but these are rarely significant over the 36-month period. The value-weighted BHAR shows that IPOs underperform up to month 13, but not thereafter. In addition, the results of the value-weighted CAR explain that IPOs underperform in the long run.

**Table 5: Aftermarket CAR for sample IPOs**

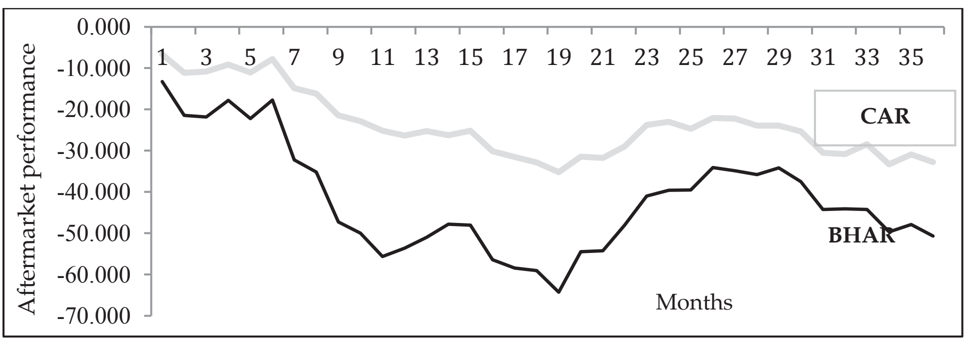
| | Equal-weighted | | | | Value-weighted | | | |
|---|---|---|---|---|---|---|---|---|
| Month | $AR_t$ | $t(AR_T)$ | $CAR_T$ | $t(CAR_T)$ | $AR_t$ | $t(AR_T)$ | $CAR_T$ | $t(CAR_T)$ |
| 1 | -6.6% | (-2.39)** | -6.6% | (-2.39)** | -11.2% | (-3.20)*** | -11.2% | (-4.07)*** |
| 2 | -3.8% | (-1.79)* | -10.3% | (-3.49)*** | -0.4% | (-0.14) | -11.7% | (-3.94)*** |
| 3 | -0.7% | (-0.30) | -11.0% | (-2.73)** | -0.2% | (-0.06) | -11.8% | (-2.93)*** |
| 4 | 2.4% | (1.21) | -8.7% | (-2.22)** | 4.2% | (2.21)** | -7.6% | (-1.96)* |
| 5 | -2.4% | (-1.04) | -11.1% | (-2.11)** | -2.8% | (-0.54) | -10.4% | (-1.99)* |
| 6 | 1.2% | (0.45) | -9.9% | (-1.52) | 6.7% | (1.05) | -3.7% | (-0.58) |
| 7 | -7.5% | (-2.99)*** | -17.4% | (-2.62)** | -6.0% | (-1.15) | -9.8% | (-1.48) |
| 8 | -1.6% | (-0.80) | -19.0% | (-3.33)*** | 0.9% | (0.12) | -8.8% | (-1.56) |
| 9 | -6.8% | (-2.85)** | -25.8% | (-3.59)*** | -0.1% | (-0.02) | -8.9% | (-1.25) |
| 10 | -1.3% | (-0.72) | -27.1% | (-4.63)*** | -2.6% | (-1.09) | -11.5% | (-1.99)* |
| 11 | -3.4% | (-1.87)* | -30.5% | (-5.07)*** | -13.9% | (-2.37)** | -25.5% | (-4.29)*** |
| 12 | 3.1% | (0.72) | -27.4% | (-1.82)* | 2.7% | (0.79) | -22.8% | (-1.52) |
| 13 | 1.7% | (0.82) | -25.7% | (-3.49)*** | 7.9% | (3.49)*** | -14.9% | (-2.05)* |
| 14 | 4.2% | (1.53) | -21.5% | (-2.09)** | 4.5% | (2.43)** | -10.4% | (-1.02) |
| 15 | -1.4% | (-0.68) | -22.9% | (-2.89)** | -0.7% | (-0.07) | -11.2% | (-1.42) |
| 16 | -3.5% | (-2.17)** | -26.3% | (-4.11)*** | 4.8% | (0.31) | -6.4% | (-1.01) |
| 17 | -0.6% | (-0.13) | -26.9% | (-3.76)*** | -3.0% | (-0.21) | -9.5% | (-1.34) |
| 18 | 0.6% | (0.37) | -26.3% | (-3.56)*** | -5.4% | (-1.97)* | -14.9% | (-2.05)* |
| 19 | -2.8% | (-1.27) | -29.1% | (-3.00)*** | -6.7% | (-1.92)* | -21.6% | (-2.25)** |
| 20 | 6.0% | (1.80)* | -23.0% | (-1.53) | 1.2% | (0.31) | -20.4% | (-1.36) |
| 21 | 0.6% | (0.34) | -22.5% | (-2.72)** | -2.9% | (-0.49) | -23.3% | (-2.96)*** |
| 22 | 3.4% | (1.12) | -19.0% | (-1.32) | 6.6% | (0.75) | -16.7% | (-1.16) |
| 23 | 1.8% | (0.91) | -17.2% | (-1.78)* | 4.7% | (1.21) | -11.9% | (-1.25) |
| 24 | 0.6% | (0.21) | -16.6% | (-1.18) | -7.4% | (-1.62) | -19.3% | (-1.37) |
| 25 | 1.8% | (0.83) | -14.8% | (-1.39) | 4.5% | (2.24)** | -14.8% | (-1.40) |
| 26 | 2.8% | (1.14) | -12.0% | (-0.95) | 0.5% | (0.25) | -14.3% | (-1.13) |
| 27 | -0.7% | (-0.38) | -12.7% | (-1.37) | 2.1% | (1.77)* | -12.1% | (-1.33) |
| 28 | 0.8% | (0.52) | -11.9% | (-1.45) | 1.6% | (1.52) | -10.5% | (-1.31) |
| 29 | 1.7% | (0.72) | -10.2% | (-0.80) | 2.1% | (1.12) | -8.4% | (-0.67) |
| 30 | -1.9% | (-1.11) | -12.1% | (-1.27) | -4.6% | (-1.05) | -13.0% | (-1.38) |
| 31 | -1.6% | (-1.00) | -13.7% | (-1.53) | -1.9% | (-1.34) | -14.9% | (-1.68) |
| 32 | 0.4% | (0.20) | -13.3% | (-1.06) | -2.9% | (-0.79) | -17.8% | (-1.43) |
| 33 | -2.5% | (-1.37) | -15.8% | (-1.48) | 2.2% | (2.77)** | -15.6% | (-1.47) |

| | Equal-weighted | | | | Value-weighted | | | |
|---|---|---|---|---|---|---|---|---|
| **Month** | $AR_t$ | $t(AR_T)$ | $CAR_T$ | $t(CAR_T)$ | $AR_t$ | $t(AR_T)$ | $CAR_T$ | $t(CAR_T)$ |
| 34 | -0.6% | (-0.27) | -16.4% | (-1.29) | 0.5% | (0.17) | -15.1% | (-1.20) |
| 35 | -0.6% | (-0.26) | -16.9% | (-1.30) | -3.6% | (-0.98) | -18.7% | (-1.45) |
| 36 | -0.9% | (-0.54) | -17.9% | (-1.70) | -3.8% | (-2.87)** | -22.5% | (-2.16)** |

Note: The $\tau$-period CAR for IPO firm $i$ beginning in period $s$ is calculated as $CAR_{i\tau} = \sum_{t=s}^{s+\tau}\left[R_{i,t} - \frac{1}{n_t}\sum_{t=s}^{s+\tau} R_{mf,t}\right]$ where $R_{i,t}$ is the return of event firm $i$ and $R_{mf,t}$ is the benchmark return of size-based matching firms. $n$ is the number of observations.
To test the null hypothesis that the CAR is significantly different from 0, we employ $t_{CAR_{1,t}} = CAR_{1,t} \times \sqrt{\frac{n_t}{t \times var + 2(t-1) \times cov}}$ (Ritter, 1991). The t-statistics are given in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.
***Source***: Authors' calculations.

Figure 2 represents the equal-weighted BHAR and CAR values (for size-matched firms), which underperform their matched-firm benchmark over the 36-month period. The level of underperformance is estimated to be greater when researchers use the BHAR methodology, illustrating significantly negative abnormal returns.

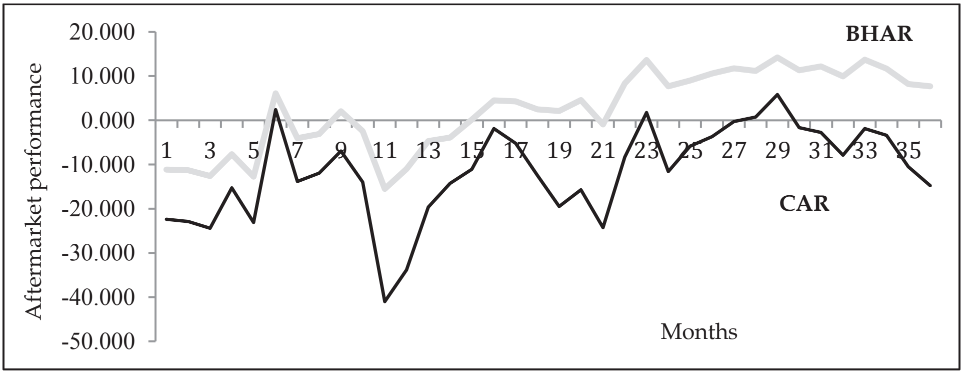
**Figure 2: Equal-weighted aftermarket performance of IPOs measured using the BHAR and CAR methods**




Note: The figure depicts the benchmark-adjusted mean BHAR and CAR, starting from the first day and ending with the third anniversary.

Figure 3 presents the performance of the value-weighted BHAR and CAR (for size-matched firms) using different event windows. The results provide evidence that when using the CAR methodology IPOs underperform a value-weighted matched-firm benchmark; when using the value weighted BHAR methodology, we obtained a statistically insignificant performance result. Again, the results imply that long-run performance depends on the method used to measure abnormal returns.

**Figure 3: Value-weighted aftermarket performance of IPOs measured using BHAR and CAR methods**




Note: The figure depicts the benchmark-adjusted BHAR and CAR, starting from the first day and ending with the third anniversary.

### *6.4. Issue Proceeds and Longer-Term Performance*

To investigate the effect of issuer proceeds on longer-term performance, we classify all 57 IPOs into size quartiles based on gross proceeds. The equal-weighted BHAR is presented in Table 6, showing that the IPOs in three of the four groups exhibit longer-term underperformance over three years.

**Table 6: Issue proceeds and longer-term performance**

| Gross proceeds (quartiles) | N | $BHAR_T$ | $t(BHAR_T)$ | $CAR_T$ | $t(CAR_T)$ |
|---|---|---|---|---|---|
| < PRs 150 mn | 14 | -79.2% | (-3.65)*** | -66.5% | (-2.59)** |
| PRs 151 mn–250 mn | 15 | 10.4% | (0.37) | 20.3% | (0.82) |
| PRs 251 mn–675 mn | 14 | -46.0% | (-1.92)* | -0.9% | (-0.05) |
| > PRs 675 mn | 14 | -19.1% | (-0.84) | -27.4% | (-2.00)* |
| Small size | 29 | -32.9% | (-1.43) | -21.6% | (-1.21) |
| Large size | 28 | -32.6% | (-1.99)* | -14.1% | (-1.22) |

Note: The table gives the equal-weighted BHAR and CAR over 36 months after listing based on the size-matched firm benchmark. All IPOs are distributed into size quartiles by market capitalization. PRs 150 million, PRs 250 million and PRs 675 million are used as cut-offs closest to the first, median and third quartile values, respectively. The small group pertains to firms with a market capitalization value of less than PRs 250 million.
***, ** and * = significant at the 1, 5 and 10% level, respectively.
*Source*: Authors' calculations.

The BHAR increases as the gross proceeds are increased. Firms that have the highest gross proceeds (> PRs 675 million) generate a BHAR of –19.1 percent (t-statistic = –0.84); those with the lowest gross proceeds (< PRs 150 million) generate a BHAR of –79.2 percent (t-statistic = –3.65). This evidence supports the ex-ante uncertainty hypothesis because issues yielding the lowest gross proceeds underperform significantly. Table 6 also documents the equal-weighted CAR for each size group, illustrating that IPOs underperform over the sample period with the exception of issue proceeds ranging from PRs 151 million to PRs 250 million, which seems to be an exception to the more general trend.

### *6.5. Initial Returns and Longer-Term Performance*

It is vital to mention that the longer-term performance of IPOs is influenced by the magnitude of the initial returns. Generally, it is argued that the highest initial-day returns may have the lowest aftermarket performance. From Table 7, when reviewing the results of the BHAR calculation it seems as though IPOs that are underpriced (i.e. IPOs that produce higher MAARs over the short-run) underperform less over the long-run (Ritter, 1991) when compared against overpriced IPOs (i.e. IPOs that produce lower MAARs over the short-run). The CAR results with respect to initial returns seem to be the opposite of the BHAR results. Specifically, IPOs that initially generated lower short-run MAARs obtained a CAR of –22.1 percent and IPOs that initially generated higher short-run MAARs obtained an average long-run CAR of –52.0 percent by not fully exploiting the market's over-optimism at the time of the offering (see Ibbotson (1975); Tinic (1988); Ritter (1991)).

**Table 7: Initial returns and longer-term performance**

| Initial returns | N | $BHAR_T$ | $t(BHAR_T)$ | $CAR_T$ | $t(CAR_T)$ |
|---|---|---|---|---|---|
| IR < 0% | 22 | -69.6% | (-3.02)** | -22.1% | (-2.03)* |
| 1% < IR < 25% | 12 | 18.5% | (1.61) | 29.8% | (0.86) |
| 26% < IR < 55% | 11 | -23.9% | (-0.44) | -24.4% | (-0.87) |
| IR > 56% | 12 | -24.5% | (-1.23) | -52.0% | (-3.73)*** |

Note: The table gives the equal-weighted BHAR and CAR over 36 months after listing based on the size-matched firm benchmark. IR = initial MAAR.
***, ** and * = significant at the 1, 5 and 10% level, respectively.
*Source*: Authors' calculations.

### *6.6. Calendar Time Approach*

Table 8 gives the regression results for the Fama–French three-factor model (Panel A) and the Carhart four-factor model (Panel B). The dependent variables are the equal- and value-weighted monthly excess returns of the IPO portfolio. The independent variables are market excess returns, size, the book-to-market ratio and the momentum factor.

**Table 8: Long-run calendar time portfolio regressions**

**Panel A: Fama and French (1993) three-factor model**

| | Dependent variable: equal-weighted IPO portfolio returns | | Dependent variable: value-weighted IPO portfolio returns | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **t-test** | **Coefficient** | **t-test** |
| Intercept | -0.068 | -1.90* | -0.105 | -14.25*** |
| $R_m - R_f$ | 0.366 | 0.90 | 0.139 | 2.01* |
| SMB | -0.177 | -3.12*** | -1.015 | -47.11*** |
| HML | 0.044 | 0.45 | 0.011 | 0.25 |
| Adj. $R^2$ | 0.124 | | 0.982 | |
| F-stat. | 12.49*** | | 1,941.70*** | |

**Panel B: Carhart (1997) four-factor model**

| | Dependent variable: equal-weighted IPO portfolio returns | | Dependent variable: value-weighted IPO portfolio returns | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **t-test** | **Coefficient** | **t-test** |
| Intercept | -0.034 | -0.85 | -0.118 | -12.44*** |
| $R_m - R_f$ | 0.579 | 1.39 | 0.096 | 1.19 |
| SMB | -0.135 | -2.82*** | -1.031 | -41.97*** |
| HML | 0.010 | 0.10 | 0.018 | 0.50 |
| WML | -0.389 | -2.09** | 0.213 | 3.78*** |
| Adj. $R^2$ | 0.170 | | 0.985 | |
| F-stat. | 11.29*** | | 1,688.78*** | |

Note: The Fama-French three-factor model is estimated as $R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + \epsilon_{it}$ and the Carhart four-factor model is defined as $R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + w_i WML_t + \epsilon_{it}$ where $R_{pt}$ is the equal- or value-weighted return of the IPO portfolio in month $t$, $R_{ft}$ is the three-month treasury bill rate in month $t$, $R_{mt}$ is the return on the value-weighted market index (KSE-100) in month $t$, $SMB_t$ is the return on a value-weighted portfolio of small minus large stocks in month $t$, $HML_t$ is the return on a value-weighted portfolio of high minus low book-to-market stocks in month $t$, and $WML_t$ is the average return on a value-weighted portfolio of winner minus loser stock for the past 11 months in month $t$.

Large and small stocks = the top 30 and bottom 30 percent of market capitalization, respectively. High and low book-to-market ratios = top and bottom 30 percent, respectively. Winners and losers = top and bottom one-third average return over the past 11 months, respectively.

The t-statistics are based on Newey–West heteroskedasticity and autocorrelation consistent standard errors. *, ** and *** = significant at the 1, 5 and 10% level, respectively.

***Source***: Authors' calculations.

Panel A presents the negative coefficients of the intercepts in both regressions, which are significant at the 10 and 1 percent levels, respectively. These results indicate that IPOs underperform over the three-year period subsequent to issuing unseasoned equity shares and after controlling for market, size, book-to-market and momentum factors. The excess market return $(R_m - R_f)$ in both regressions illustrates that IPO stocks are subject to a much lower level of systematic risk, while in the value-weighted three-factor regression, $R_m - R_f$ is marginally significant at the 10 percent level; however, the economic significance of this coefficient shrinks from 0.336 to 0.139 indicating that the systemic component of IPO returns is modest. Both models indicate a stronger negative association with the size (SMB) factor, which suggests that large firms experience greater returns than small firms. The coefficient of HML is positive but insignificant. An interesting element of the results from panel A and warrants further consideration is the idea that the patterns of returns generated from the IPOs do not seem to adhere to modern portfolio theory and they seem to have very small levels of systemic risk associated with those return series. Therefore, further analysis is required to attempt to determine the true determinates of IPO performance and in the next section we will examine this issue.

Panel B reports that the coefficients of abnormal returns (the intercepts) are negative in both the regressions, and that the IPOs underperform significantly at the 1 percent level when using value-weighted returns over a period of three years. Again, the systematic risk in both regressions is very small, but has an insignificant effect. The coefficient of SMB is significantly negative in both regressions, which illustrates that firms with a large market capitalization earn higher returns than small firms. As far as HML is concerned, high B/M firms yield better returns than small B/M firms. In addition, WML is significant in both regressions. The value-weighted Carhart model shows that winners obtain higher returns than losers.

### *6.7. Determinants of IPOs' Longer-Term Performance*

To identify the determinants of longer-term performance, the EBA technique is used to test the robustness and sensitivity of the explanatory variables. The sensitivity results are summarized below.

### 6.7.1. Some Preliminary Results

In estimating the X variables for BHAR, the preliminary regression includes the long-term investment ratio (*LT*) and industry effects (*INDUSTRY*). The regression indicates the importance of the X variables' influence over long-term underperformance in the sample period. The dependent variable is the 36-month equal-weighted BHAR. The regression is presented as:

$$\underset{}{BHAR} = \underset{(2.13)^{**}}{-\,0.0099} \quad \underset{(2.68)^{***}}{-\,0.0708\,LT} \quad \underset{(1.74)^{*}}{+\,0.0137\,INDUSTRY} \qquad (14)$$

Equation (14) is estimated using ordinary least squares (OLS). The adjusted $R^2$ term is 0.1015, the number of observations is 57 and the t-values are presented in parentheses. The results of the equation reveal that the long-term investment ratio and industry effects are significant at the 1 and 10 percent levels, respectively.

The preliminary CAR regression comprises MAAR and the IPO activity period (*Time*) as X variables. The dependent variable is the 36-month equal-weighted CAR. The regression is specified as:

$$CAR = \underset{(-2.26)^{**}}{-\,0.5542} \quad \underset{(-1.61)}{-\,0.3229\,MAAR} \quad \underset{(-2.98)^{***}}{-\,0.8552\,Time} \qquad (15)$$

The adjusted $R^2$ is 0.1670, the number of observations is 57 and the t-values are presented in parentheses. Equation (15) explains the significance of *Time* at the 1 percent level, showing that it is an important determinant of longer-term underperformance. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

### 6.7.2. Results of Basic Model Without Z Variables

Two regressions excluding the Z variables are tested to examine long-term IPO performance. In both regressions, two different variables are considered X variables. Regression I includes the long-term investment ratio (*LT*) and industry effects (*INDUSTRY*) and regression II includes the MAAR and the IPO activity period (*Time*) as X variables. The listing delay (*LDel*), financial leverage (*FinLev*), size of the firm (*FSize*) and aftermarket risk level (*Risk*) are used in regression I, whereas ROA, *Risk*, *LT* and PIPH are included in regression II as Q variables.

Table 9 estimates the basic models for regressions I and II. First, the adjusted $R^2$ of regressions I and II were 0.1858 and 0.3593, respectively, which indicates that they explain some of the variation in the BHAR. Second, the X variables in both regressions are statistically significant, showing that the variables are important determinants of IPO performance.

**Table 9: Estimation results for benchmark models without Z variables**

| **Regression I** | | **Regression II** | |
|---|---|---|---|
| Constant | -0.1206 (-1.51) | Constant | -0.0013 (-0.22) |
| *X variables* | | *X variables* | |
| LT | -0.0794 (-3.83)*** | MAAR | -0.0095 (-2.17)** |
| INDUSTRY | 0.0174 (2.03)** | Time | -0.0273 (-2.34)** |
| *Q variables* | | *Q variables* | |
| LDel | 0.0063 (0.54) | ROA | -0.1109 (-4.31)*** |
| FinLev | 0.0231 (1.75)* | Risk | 0.0008 (6.45)*** |
| FSize | 0.0037 (1.50) | PIPH | 0.0373 (2.60)** |
| Risk | 0.0002 (0.91) | LT | -0.0348 (-1.46) |
| Adj. $R^2$ | 0.1858 | Adj. $R^2$ | 0.3593 |
| F-value | 5.37*** | F-value | 14.61*** |

Note: The two cross-sectional OLS regressions are $BHAR_i = \alpha_0 + \beta_1 LT_i + \beta_2 INDUSTRY_i + \beta_3 LDel_i + \beta_4 FinLev_i + \beta_5 FSize_i + \beta_6 Risk_i + \epsilon_i$ and $CAR_i = \alpha_0 + \beta_1 MAAR_i + \beta_2 Time_i + \beta_3 ROA_i + \beta_4 Risk_i + \beta_5 PIPH_i + \beta_6 LT_i + \epsilon_i$ where the dependent variables are the three-year equal-weighted BHAR (regression I) and CAR (regression II) based on the size-matched firm benchmark.
The independent variables include *LT* (long-term investment ratio), *INDUSTRY* (dummy variable = 1 for firms in the financial sector and 0 otherwise), *LDel* (listing delay), *FinLev* (financial leverage), *FSize* (size of the firm), *Risk* (aftermarket risk level of the IPO), MAAR (on the first trading day), *Time* (dummy variable = 1 for firms issued an IPO in a high-activity period and 0 otherwise), ROA and PIPH.
The t-values are shown in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.
***Source***: Authors' calculations.

In regression I, the long-term investment ratio at the time of issuance has a negative and statistically significant relationship with the long-term BHAR, which is in line with the previous studies (e.g. Cai, Liu & Mase (2008). In addition, we document a positive relationship between the industry variable which is coded as a binary variable taking on a '0' if the IPO is in an industry other than finance and a '1' if it is associated with the finance industry. The results of this study provide conflicting evidence in relation to the finance industry's impact on IPO performance and find a positive and statistically significant relationship between an affiliation in the finance industry and longer-term performance.

Continuing the analysis of the results presented in regression I, we find that the only Q variable that has a statistically significant impact on long-run IPO performance is the firm's use of financial leverage. Therefore, the listing delay, offer size, and after market risk variables have an insignificant effect on long-run IPO performance when using the BHAR methodology. The financial leverage variable (*FinLev*) has a positive and statistically significant relationship with the long-run BHAR. This indicates that firms with higher financial leverage will have more resources to expand their business activities, which increases the performance of IPO firms; firms with lower financial leverage prior to listing may limit their resources and this eventually reduces their performance over the long-run (Eckbo & Naroli, 2005; Hoechle & Schmid, 2007). This finding supports the ex-ante uncertainty hypothesis.

Turning to the results presented in Table 9, regression II, we find that both of the *X* variables have a statistically significant impact on long-run IPO performance. The MAAR and Time variables have negative relationships with the long-run CAR. We will explain these effects in the subsequent paragraphs.

In section 6.1, we examined whether IPOs were underpriced using the MAAR or market adjusted abnormal return method, a methodology that is used to detect whether the aggregate IPOs' returns were significantly different from the market's returns. The raw returns for the IPOs were 36.7 percent and the average return on the market was 4.7 percent; therefore, we estimated that IPOs were initially underpriced by 32.0 percent. The level of perceived underpricing increases as the MAAR increases because researchers, companies, and markets question why the underwriters and the company would accept an offer for their company at a 32 percent discount to what the company is actually worth on the next day. This is what has been referred to as leaving money on the table (Loughran & Ritter, 2002).

As indicated in regression II in Table 9, the relationship between the MAAR variable and the long-term CARs is both negative and statistically significant. As the initial MAAR increases the results indicate that three years later the CAR decreases all other things constant. Therefore, as the initial MAAR decreases the researchers expect that the CAR will increase. This finding supports empirical evidence and is somewhat intuitive. It is hard for companies that initially achieve significantly positive returns to sustain those valuations and they retreat over the long run to the initial value set by the company and the underwriters. This reversion to the initial price level or the negative relationship between initially positive MAARs and longer-term negative CARs leads some investors to question whether these issues are actually underpriced or if investors overreact to the hype created by these IPOs or the fads that might generate unwarranted public interest, which eventually diminishes as the excitement over the IPO fades.

The second X variable was the IPO activity period (*Time*) which has a negative and significant effect on the long-run CAR. This illustrates that when firms go public during a high-activity period their long-term CAR is lower when compared against firms that issue their shares in low-activity periods. This result makes practical sense and is in line with empirical research on IPO pricing and performance. There is a growing body of IPO literature that indicates that firms attempt to time their IPOs and issue their company's shares when the valuations of IPOs are elevated. If a company issues shares when markets are willing to pay a premium for their company they will likely experience difficultly maintaining that valuation when the market reverts to valuations that are in line with historic norms. This result is in line with the window-of-opportunity hypothesis (Helwege & Liang, 2004; Kooli, L'Her & Suret, 2006; Sahoo & Rajib, 2010).

In Table 9, among the Q variables, the significant determinants are ROA, aftermarket risk level, and PIPH. There is a negative relationship between the ROA prior to listing and IPO performance. This implies that as the IPO firm's ROA prior to issuance increases, their long-run performance decreases. The aftermarket risk level of the IPOs positively affects the aftermarket performance. This implies that there is a positive relationship between the post issuance volatility experienced in a newly issued IPO and the performance of the IPO (Sahoo & Rajib, 2010). The higher post-issue pricing behavior leads to higher volatility thereby increasing the CAR. Post issue promoters' holding (PIPH) significantly affects aftermarket performance, which suggests that as the promoters hold a higher proportion of shares the performance of IPOs increases (Thomadakis et al., 2012; Brau, Couch & Sutton, 2012). Finally, in Table 9, the listing delay, the size of the firm and the aftermarket risk level in regression I, and the long-term investment ratio in regression II are insignificant. In summary, financial leverage in regression I and ROA, aftermarket risk level and PIPH in regression II are considered as important determinants of IPO performance from the Q variables.

### *6.7.3. Results of Basic Model with All Z Variables*

Table 10 reports the results of the basic model with all Z variables included. The results can be described in regard to the basic model without the Z variables: both the X variables in regression I (long-term investment ratio and industry effects) and one of the X variables in regression II (IPO activity period) are significant. In terms of the Q variables the ROA, Risk and the Long-Term investment variables have a statistically significant effect on long-run performance when we use the CAR methodology. Among the Z variables, the age of the firm is the only significant variable that affects aftermarket performance (see regression II). This finding is contrary to earlier evidence. No other variable has a significant effect on the level of IPO performance in regressions I and II.

**Table 10: Estimation results for benchmark models with all Z variables**

| **Regression I** | | **Regression II** | |
|---|---|---|---|
| Constant | -0.1303 (-1.54) | Constant | 0.0573 (0.82) |
| X variables | | X variables | |
| LT | -0.1001 (-3.22)*** | MAAR | -0.0096 (-1.32) |
| INDUSTRY | 0.0194 (2.09)** | Time | -0.0274 (-3.17)*** |
| Q variables | | Q variables | |
| LDel | 0.0093 (0.73) | ROA | -0.1161 (-3.16)*** |
| FinLev | 0.0267 (1.33) | Risk | 0.0009 (3.08)*** |
| FSize | 0.0186 (1.06) | PIPH | 0.0250 (0.93) |
| Risk | 0.0002 (0.67) | LT | -0.0471 (-1.84)* |
| Z variables | | Z variables | |
| MAAR | -0.0022 (-0.45) | FinLev | 0.0064 (0.39) |
| Time | -0.0079 (-0.76) | FSize | -0.0006 (-0.18) |
| PIPH | 0.0344 (1.06) | INDUSTRY | -0.0027 (-0.36) |
| MktRet | 0.4059 (0.21) | MktRet | 0.1725 (0.11) |
| OSize | 0.0032 (0.52) | OSize | -0.0057 (-1.14) |
| Sub | 0.0008 (0.54) | Sub | -0.0003 (-0.28) |
| EPS | -0.0015 (-0.34) | EPS | 0.0016 (0.44) |
| ROA | -0.0415 (-0.93) | LDel | 0.0138 (1.31) |
| Age | 0.0088 (1.51) | Age | 0.0106 (2.22)** |
| MktVol | -0.0067 (-0.01) | MktVol | 0.0786 (0.11) |
| Adj. $R^2$ | 0.0902 | Adj. $R^2$ | 0.3535 |
| F-value | 1.43 | F-value | 2.91*** |

Note: The dependent variables are the three-year equal-weighted BHAR (regression I) and CAR (regression II) based on the size-matched firm benchmark.
The independent variables include *LT* (long-term investment ratio), *INDUSTRY* (dummy variable = 1 for firms in the financial sector and 0 otherwise), *LDel* (listing delay), *FinLev* (financial leverage), *FSize* (size of the firm), *Risk* (aftermarket risk level of the IPO), MAAR (on the first trading day), *Time* (dummy variable = 1 for firms issued an IPO in a high-activity period and 0 otherwise), ROA, PIPH, *MktRet* (market return measured through KSE-100 index over three months prior to the IPO date), *OSize* (offer size of issue), *Sub* (oversubscription ratio), EPS, *Age* (firm age), and *MktVol* (volatility of market returns).
The t-values are shown in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.
***Source***: Authors' calculations.

Regression I found in Table 10 provides empirical evidence of an insignificant relationship between the MAARs and the IPO activity periods (*Time*) with the BHARs. In regression II, all the variables are insignificant except for the age of the firm variable. Regressions I and II include other Z variables, such as market returns, offer size, oversubscription, EPS, ROA, and market volatility. We observe that offer size, EPS, ROA, age and market volatility are seen to have no significant effect on IPO performance.

In comparing the results of the regressions with and without the Z variables, we conclude that economic theory does not produce a complete specification of which variables researchers should hold constant when performing statistical tests. EBA, as the more useful approach, explains that a sensitivity analysis provides more authentic results in terms of the significance of the explanatory variables.

*6.7.4. Results of Sensitivity Analysis*

We test the sensitivity of the X and Q variables to examine whether they are robust or fragile. In each regression, three of 13 Z variables are chosen as regressors. For each regression, a total of 286 forms are tested. The purpose of this is to identify which variables are significant at the 10 percent level. Table 11 gives the results of the sensitivity test under the EBA method. The results show that, in regression I, the long-term investment ratio, industry effects, and financial leverage are the robust variables in determining IPO underperformance. Regression II shows that the initial MAAR variable, IPO activity period, ROA, PIPH and aftermarket risk level are the robust predictors that influence longer-term underperformance.

**Table 11: Summary of EBA tests**

| Variable | Sign | Regression I | Regression II |
|---|---|---|---|
| X variables | | | |
| Long-term investment ratio | – | Robust | NA |
| Industry effects | + | Robust | NA |
| MAAR | – | NA | Robust |
| Time | – | NA | Robust |
| Q variables | | | |
| Listing delay | + | Fragile | NA |
| Financial leverage | + | Robust | NA |
| Firm size | – | Fragile | NA |
| Aftermarket risk level of IPO | + | Fragile | Robust |
| ROA (total assets) | – | NA | Robust |
| Long-term investment ratio | – | NA | Fragile |
| PIPH | + | NA | Robust |

Note: We test the robustness of the variables based on a significance level of 10%. Significant variables are termed "robust" while the others are classified as "fragile." NA = not applicable in the regression.
***Source***: Authors' calculations.

## 7. Conclusion and Policy Implications

This study investigates the short-run and longer-term performance of unseasoned issues using 57 event firms listed on the KSE during the period lasting from 2000–10. We find that, at least initially, companies seem to underprice their IPOs – on average by 32.0 percent – which we attribute to the uncertainty attached to the sample IPOs. The degree of underpricing between financial and nonfinancial firms is initially almost the same. A comparison of the magnitude of the underpricing of Pakistani IPOs in comparison to international markets indicates that Pakistani issuers of unseasoned equity shares seem to leave too much money on the table (Loughran & Ritter, 2002).

To gauge the level of long-run abnormal performance, this study documents how IPOs underperform against their respective benchmarks over a three-year period following the issuance of unseasoned equity shares. The results are highly sensitive to the methodology used to identify abnormal performance. Interestingly, IPOs underperform significantly over the three years, but the pattern of underperformance is not always the same. The results of the calendar time analysis suggest that IPOs underperform significantly in the long run.

To identify the robust predictors of long-run performance, this study uses the EBA technique and reports the following: (i) long-term investment ratio has a negative effect on aftermarket performance, (ii) financial firms seem to produce better returns when compared against nonfinancial firms over the long run, which is contrary to empirical evidence, (iii) firms that use more leverage seem to generate better performance when compared against firms that use less leverage, (iv) there is a negative relationship between the short-term MAAR and longer-term performance, (v) IPOs issued during high-activity periods seem to generate lower returns in long-run studies of IPO performance, (vi) as the aftermarket risk of the new issues increases, the long-run performance increases, (vii) when the promoters hold a higher proportion of the shares, this adds value to the firms which eventually increases the IPO performance, and (viii) firms that initially have a higher return on assets produce lower returns over the long-run. These results are consistent with both the fads and window-of-opportunity hypotheses, which imply that the enthusiasm surrounding IPO stocks decreases over time and that prices are eventually corrected, which affects the longer-term performance.

In summary, IPOs outperformed over the short run and underperformed over longer-term time horizons. However, the results of longer-term performance may vary, depending on the choice of model used to gauge abnormal performance. It is, therefore, argued that the level of performance is improved by controlling for the timing of the new issue, the level of initial underpricing, the long-term investment, financial leverage, aftermarket risk level, return on assets, post-issue promoters' holding, and IPO activity period. It is important to improve IPO performance through the determination of the true offer price, which may help to reduce the deterioration in IPOs' aftermarket performance. It is, thus, appropriate for the underwriters to use the book-building mechanism to determine the appropriate offer price – this may reduce the chances of longer-term underperformance.

**References**

Abu Bakar, N. B., & Uzaki, K. (2012, November). *A test of initial public offerings (IPOs) underpricing performance in Malaysian stock exchange (MSE)*. Paper presented at the Third Asian Business and Management Conference, Osaka, Japan.

Adjasi, C. K. D., Osei, K. A., & Fiawoyife, E. U. (2011). Explaining underpricing of IPOs in frontier markets: Evidence from the Nigeria stock exchange. *Research in International Business and Finance*, *25*(3), 255–265.

Afza, T., Yousaf, H., & Alam, A. (2013). Information asymmetry, corporate governance and IPO underpricing. *Science International (Lahore)*, *25*(4), 989–997.

Agathee, U. S., Sannassee, R. V., & Brooks, C. (2012). The underpricing of IPOs on the stock exchange of Mauritius. *Research in International Business and Finance*, *26*(2), 281–303.

Aggarwal, R., & Rivoli, P. (1990). Fads in the initial public offering market? *Financial Management*, *19*(4), 45–57.

Ahmad-Zaluki, N. A., Campbell, K., & Goodacre, A. (2007). The long-run share price performance of Malaysian initial public offerings (IPOs). *Journal of Business Finance and Accounting*, *34*(1–2), 78–110.

Al-Deehani, T. M. (2005). The determinants of stock prices in the Kuwait stock exchange: An extreme bound analysis. *Investment Management and Financial Innovations*, *3*, 16–24.

Allen, D. E., Morkel-Kingsbury, N. J., & Piboonthanakiat, W. (1999). The long-run performance of initial public offerings in Thailand. *Applied Financial Economics*, *9*(3), 215–232.

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research*, *6*(2), 159–178.

Banerjee, S., Dai, L., & Shrestha, K. (2011). Cross-country IPOs: What explains differences in underpricing? *Journal of Corporate Finance*, *17*(5), 1289–1305.

Barber, B., & Lyon, J. (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics*, *43*(3), 341–372.

Belghitar, Y., & Dixon, R. (2012). Do venture capitalists reduce underpricing and underperformance of IPOs? *Applied Financial Economics*, *22*(1), 33–44.

Berk, A., & Peterle, P. (2015). Initial and long-run IPO returns in Central and Eastern Europe. *Emerging Markets Finance and Trade*, *51*, 42–60.

Boissin, R., & Sentis, P. (2014). Long-run performance of IPOs and the role of financial analysts: Some French evidence. *European Journal of Finance*, *20*(2), 125–149.

Bradley, D., Jordan, B., & Ritter, J. (2003). The quiet period goes out with a bang. *Journal of Finance*, *58*, 1–36.

Brau, J. C., Couch, R. B., & Sutton, N. K. (2012). The desire to acquire and IPO long-run underperformance. *Journal of Financial and Quantitative Analysis*, *47*(3), 493–510.

Brav, A., & Gompers, P. A. (1997). Myth or reality? The long-run underperformance of initial public offerings: Evidence from venture and nonventure capital-backed companies. *Journal of Finance*, *52*(5), 1791–1821.

Cai, X., Liu, G. S., & Mase, B. (2008). The long-run performance of initial public offerings and its determinants: The case of China. *Review of Quantitative Finance and Accounting*, *30*(4), 419–432.

Carhart, M. (1997). On persistence in mutual fund performance. *Journal of Finance*, *52*(1), 57–82.

Chambers, D., & Dimson, E. (2009). IPO underpricing over the very long run. *Journal of Finance*, *64*(3), 1407–1443.

Chen, S., Bangassa, K., & Brookfield, D. (2011). Long-run performance of Chinese initial public offerings: Further evidence. *Asia-Pacific Journal of Financial Studies*, *40*, 285–316.

Chi, J., McWha, M., & Young, M. (2010). The performance and the survivorship of New Zealand IPOs. *International Review of Financial Analysis*, *19*(3), 172–180.

Chi, J., Wang, C., & Young, M. (2010). Long-run outperformance of Chinese initial public offerings. *The Chinese Economy*, *43*(5), 62–88.

Chorruk, J., & Worthington, A. (2010). New evidence on the pricing and performance of initial public offerings in Thailand, 1997–2008. *Emerging Markets Review*, *11*(3), 285–299.

Drobetz, W., Kammermann, M., & Wälchli, U. (2005). Long-run performance of initial public offerings: The evidence for Switzerland. *Schmalenbach Business Review*, *57*(3), 253–275.

Eckbo, B. E., Masulis, R., & Norli, O. (2000). Seasoned public offerings: Resolution of the 'new issues puzzle'. *Journal of Financial Economics*, *56*(2), 251–291.

Eckbo, B. E., & Norli, O. (2005). Liquidity risk, leverage and long-run IPO returns. *Journal of Corporate Finance*, *11*(1–2), 1–35.

Espenlaub, S., Gregory, A., & Tonks, I. (2000). Reassessing the long-term underperformance of UK initial public offerings. *European Financial Management*, *6*(3), 319–342.

Fama, E. F. (1998). Market efficiency, long-term returns and behavioral finance. *Journal of Financial Economics*, *49*(3), 283–306.

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review*, *10*(1), 1–21.

Fama, E. F., & French, K. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56.

Gassebner, M., Lamla, M. J., & Vreeland, J. R. (2013). Extreme bounds of democracy. *Journal of Conflict Resolution*, *57*(2), 171–197.

Ghosh, S., & Yamarik, S. (2004). Are regional trading arrangements trade-creating? An application of extreme bounds analysis. *Journal of International Economics*, *63*(2), 369–395.

Goergen, M., Khurshed, A., & Mudambi, R. (2007). The long-run performance of UK IPOs: Can it be predicted? *Managerial Finance*, *33*(6), 401–419.

Gompers, P. A., & Lerner, J. (2003). The really long-run performance of initial public offerings: The pre-NASDAQ evidence. *Journal of Finance*, *58*(4), 1355–1392.

Hahl, T., Vahamaa, S., & Aijo, J. (2014) Value versus growth in IPOs: New evidence from Finland. *Research in International Business and Finance*, *31*, 17–31.

Helwege, J., & Liang, N. (2004). Initial public offerings in hot and cold markets. *Journal of Financial and Quantitative Analysis*, *39*(3), 541–569.

Hoechle, D., & Schmid, M. (2007). *Which, why and for how long do IPOs underperform?* Unpublished working paper. Retrieved from http://www.efmaefm.org/0EFMSYMPOSIUM/2008-Oxford/papers/markus.pdf.

Hou, K., Olsson, P., & Robinson, D. (2001). *Does takeover increase stockholder value?* Unpublished manuscript, Duke University, NC.

Hwang, C. Y., & Jayaraman, N. (1995). Long-term performance of IPOs and non-IPOs: Japanese evidence. *Advances in Pacific Basin Financial Markets*, *1*, 317–337.

Hwang, I., & Wang, E. C. (2004). Does openness to trade affect total factor productivity growth? Evidence from 45 Japanese manufacturing industries. *Journal of Economic Research*, *9*, 147–173.

Ibbotson, R. G. (1975). Price performance of common stock new issues. *Journal of Financial Economics*, *2*(3), 235–272.

Ibbotson, R.G., Sindelar, J.L. & Ritter, J.R. (1988). Initial public offerings. *Journal of Applied Corporate Finance*, 1, 37-45.Jain, B. A., & Kini, O. (1994). The post-issue operating performance of IPO firms. *Journal of Finance*, *49*(5), 1699–1726.

Jenkinson, T. J., & Ljungqvist, A. P. (2001). *Going public: The theory and evidence on how companies raise equity finance* (2nd ed.). Oxford: Oxford University Press.

Jewartowski, T., & Lizinska, J. (2012). Short- and long-term performance of Polish IPOs. *Emerging Markets Finance and Trade*, *48*(2), 59–75.

Kayani, S., & Amjad, S. (2011). Investor interest, underpricing and trading volume in Pakistan secondary market. *Business and Economics Journal*, *39*, 1–15.

Kooli, M., L'Her, J.-F., & Suret, J.-M. (2006). Do IPOs really underperform in the long run? New evidence from the Canadian market. *Journal of Private Equity*, *9*(4), 48–58.

Kooli, M., & Suret, J.-M. (2004). The aftermarket performance of initial public offerings in Canada. *Journal of Multinational Financial Management*, *14*, 47–66.

Laokulrach, M. (2015). Short-term IPO returns in stock exchange of Thailand: The study in 2003–2013. *International Journal of Trade, Economics and Finance*, *6*(2), 106–111.

Levis, M. (1993). The long-run performance of initial public offerings: The UK experience 1980–1988. *Financial Management*, *22*(1), 28–41.

Liu, X., & Ritter, J. R. (2010). The economic consequences of IPO spinning. *Review of Financial Studies*, *23*(5), 2024–2059.

Loughran, T., & Ritter, J. R. (1995). The new issues puzzle. *Journal of Finance*, *50*(1), 23–51.

Loughran, T., & Ritter, J. R. (2000). Uniformly least powerful tests of market efficiency. *Journal of Financial Economics*, *55*(3), 361–389.

Loughran, T., & Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies*, *15*(2), 413–443.

Loughran, T., Ritter, J. R., & Rydqvist, K. (1994). Initial public offerings: International insights. *Pacific-Basin Finance Journal*, *2*(2–3), 165–199.

Lyon, J. D., Barber, B. M., & Tsai, C.-L. (1999). Improved methods for tests of long-run abnormal stock returns. *Journal of Finance*, *54*(1), 165–201.

Mazzola, P., & Marchisio, G. (2003, September). *The strategic role of going public in family businesses' long-lasting growth: A study of Italian IPOs*.

Paper presented at the 14th FBN World Conference on New Frontiers in Family Business Research: The Leadership Challenge, Lausanne, Switzerland.

Miller, E. M. (1977). Risk, uncertainty and divergence of opinion. *Journal of Finance*, *32*(4), 1151–1168.

Mitchell, M., & Stafford, E. (2000). Managerial decisions and long-term stock price performance. *Journal of Business*, *73*(3), 287–329.

Moosa, I. A., & Cardak, B. A. (2006). The determinants of foreign direct investment: An extreme bounds analysis. *Journal of Multinational Financial Management*, *16*(2), 199–211.

Morck, R., Shleifer, A., & Vishny, R. (1988). Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics*, *20*(1–2), 293–315.

Moshirian, F., Ng, D., & Wu, E. (2010). Model specification and IPO performance: New insights from Asia. *Research in International Business and Finance*, *24*(1), 62–74.

Mumtaz, M. Z., & Ahmed, A. M. (2014). Determinants of underpricing of initial public offerings: Evidence from Pakistan. *Journal of Business and Economics*, *6*(1), 47–80.

Otchere, I., Owusu-Antwi, G., & Mohsni, S. (2013). Why are stock exchange IPOs so underpriced and yet outperform in the long run? *Journal of International Financial Markets, Institutions and Money*, *27*, 76–98.

Reilly, F. K., & Hatfield, K. (1969). Investor experience with new stock issues. *Financial Analysts Journal*, *25*(5), 73–80.

Ritter, J. R. (1991). The long-run performance of initial public offerings. *Journal of Finance*, *46*(1), 3–27.

Ritter, J. R., & Welch, I. (2002). A review of IPO activity, pricing and allocations. *Journal of Finance*, *57*(4), 1795–1828.

Rizwan, M. F., & Khan, S. (2007). Long-term performance of public vs. private sector initial public offerings in Pakistan. *Pakistan Development Review*, *46*(4), 421–433.

Rock, K. (1986). Why new issues are underpriced. *Journal of Financial Economics*, *15*(1–2), 187–212.

Sahoo, S., & Rajib, P. (2010). Aftermarket pricing performance of initial public offerings (IPOs): Indian IPO market 2002–2006. *Vikalpa*, *35*(4), 27–43.

Samarakoon, L. P. (2010). The short-run underpricing of initial public offerings in the Sri Lankan stock market. *Journal of Multinational Financial Management*, *20*(4–5), 197–213.

Seldadyo, H., & de Haan, J. (2006, April). *The determinants of corruption: A literature survey and new evidence*. Paper presented at the EPCS conference, Turku, Finland.

Smith, Z. A. (2008). *An empirical investigation of initial public offering (IPO) performance*. Unpublished PhD thesis, Walden University, Minneapolis, MN.

Sohail, M. K., & Nasr, M. (2007). Performance of initial public offerings in Pakistan. *International Review of Business Research Papers*, *3*(2), 420–441.

Sohail, M. K., & Raheman, A. (2010). Examining the short-run IPOs performance in state of economy: Normal, boom and recession. *International Research Journal of Finance and Economics*, *35*, 173–186.

Thomadakis, S., Nounis, C., & Gounopoulos, D. (2012). Long-term performance of Greek IPOs. *European Financial Management*, *18*(1), 117–141.

Tinic, S. (1988). Anatomy of initial public offerings of common stock. *Journal of Finance*, 43, 789-822.

Wang, E. C. (2010). Determinants of R&D investment: The extreme bounds analysis approach applied to 26 OECD countries. *Research Policy*, *39*(1), 103–116.Welch, I. (1989). Seasoned offerings, imitation costs, and the underpricing of initial public offerings. *Journal of Finance*, *44*(2), 421–449.

# *Appendix*

## Description and computation of explanatory variables used to measure longer-term performance

| Explanatory variables | Expected sign | Calculation |
|---|---|---|
| LT = long-term investment ratio | – | Long-term investments divided by total assets. |
| INDUSTRY = industry effects | – | Sample IPOs are segregated into two categories: financial and nonfinancial. The dummy variable = 1 if firms are in the financial sector and 0 otherwise. |
| LDel = listing delay | + | Natural logarithm of the number of days separating the closing of subscription and the first day of trading. |
| FinLev = financial leverage | + | Financial risk of the firm. Calculated as the book value of long-term debt to total assets. |
| FSize = size of the firm | – | Natural logarithm of the firm's total assets prior to IPO. |
| Risk = aftermarket risk level of the IPO | + | Standard deviation of the post-issue pricing of the first 245 trading days. |
| MAAR = short-run underpricing | – | Market-adjusted abnormal returns on the first day of trading earned by IPO investors. |
| Time = IPO activity period | – | Dummy variable = 1 for firms that are listed during the hot period and 0 otherwise. A hot period is one in which at least five IPOs took place in a year. |
| PIPH = post-issue promoters' holding | + | Number of shares owned and retained by the promoters and the promoter group, divided by total number of issued shares. |
| MktRet = market return | + | Measured through KSE-100 value-weighted index over three months prior to IPO. |
| OSize = issue proceeds | – | The number of shares issued multiplied by offer price: the amount a firm wants to issue through IPO. |
| Sub = oversubscription ratio | + | The number of shares demanded by the number of shares offered. |
| EPS = earnings per share | – | Total income divided by outstanding shares prior to IPO. |
| ROA = return on assets | – | Net income by total assets. |
| Age = age of the firm prior to IPO | – | Scaled as the difference between year of establishment and going public. |
| MktVol | + | Standard deviation of market return over three months prior to IPO. |

*The Lahore Journal of Economics*
21 : 1 (Summer 2016): pp. 69–98

# The Impact of Remittances on Child Education in Pakistan

**Sami Ullah Khan*[*] and Muhammad Jehangir Khan[**]**

## Abstract

*This study examines the impact of remittances on school enrollment and the level of education attained among children aged 4–15 years in Pakistan. It uses a nationally representative survey, the Pakistan Social and Living Standards Measurement Survey for 2010/11. The migrant network variable at the village level interacting with the number of adults at the household level is used as an instrument for remittances. The results of the IV probit model show that children from remittance-receiving households are more likely to enroll in school. The marginal impact of remittances on school enrollment is larger for girls and for rural households. Hence, remittances help reduce regional and gender disparities in child school enrollment in Pakistan. The IV censored ordered probit model is used to investigate the impact of remittances on children's grade attainment. The estimated impact is negative and significant, except for urban children, lowering the probability that a child will move to a higher grade.*

**Keywords**: Child education, school enrollment, educational attainment, remittances.

**JEL classification**: I25, O15.

## 1. Introduction

Globalization has opened up the labor market, enabling workers to move temporarily across boundaries, seeking better opportunities outside their home country. As a consequence, migration has increased rapidly, especially from developing countries in recent years. The substantial inflow of remittances to workers' home countries has proven one of the most important sources of external financing for these countries. At the macro-level, remittances help to maintain a stable balance of payments; at the micro-level (household level), they help raise private consumption, promote business investment, reduce poverty, increase health facilities and

[*] Ph.D Scholar at Institute of Management Sciences, Peshawar.
[**] Assistant Professor at Pakistan Institute of Development Economics (PIDE), Islamabad.

encourage human capital investment in workers' country of origin (Ahmed, Sugiyarto & Jha, 2010).

According to the International Organization for Migration, in 2013 3.2 percent of the world's total population were migrants. The number of world migrants increased from 154 million in 1991 to 231.5 million in 2013. From 2000 to 2010, the world migration growth rate was 2.2 million annually, which was twice that of the previous decade. Most migrants live in developed countries. Like other developing countries, migration from Pakistan has also increased in recent years. According to the United Nations, in 2013, more than 4 million Pakistanis (2.3 percent of the total population) were outside the country. World remittances have also increased with the rise in international migration. In 2012, world remittances were an estimated US$ 529 billion. The total flow to developing countries was US$ 401 billion in 2012, representing a 5.3 percent growth rate from the previous year. Pakistan was also one of the top ten remittance recipient countries, receiving US$ 14 billion in remittances in 2012 (World Bank, 2013).

The role of remittances has been investigated widely at the macro and micro levels. An important question to consider is how remittances affect children's education in workers' home countries. Studies examining the impact of migrant remittances on child education include Hanson and Woodruff (2003), Edwards and Ureta (2003), Arif (2004), Acosta (2006), Amuedo-Dorantes and Pozo (2010), Sherpa (2011), Chaaban and Mansour (2012), Mara et al. (2012) and Arif and Chaudhry (2015).

The evidence is mixed: it shows that remittances can have either positive or negative impacts on education. On the positive side, migrants who send remittances to their families help ease the household's credit constraint and thus encourage investment in their children's education. Remittances not only help children already enrolled to stay in school longer, but also enable out-of-school children to enroll as a result of the household's lowered credit constraint. Moreover, when there are good migration prospects for highly educated and skilled labor, the returns on education are higher for individuals moving abroad. In this sense, remittances affect child school attainment positively (McKenzie & Rapoport, 2006; Chaaban & Mansour, 2012).

On the negative side, the migration of a family member can also create constraints to education in the following ways. First, when an older member(s) of the household move(s) abroad, children's social and economic responsibilities may increase in his/her absence. They may have to spend more time on household chores to bridge the labor gap. Migration may also create an income gap, compelling the migrant's children to undertake labor (Hanson & Woodruff, 2003; Mansuri, 2006; McKenzie & Rapoport, 2006). Second, parental absence can have a negative effect on the child's schooling, given the lack of a role model or guardian and the supervision he/she would normally provide. Third, migration might also affect child schooling through the wage effect. When people migrate on a large scale, then the ensuing fall in labor supply may cause labor wages to increase in the home country. As a result, child work may become economically more rewarding, thus decreasing the value of schooling (Elbadawy & Roushdy, 2009; Nasir, Tariq & Rehman, 2011).

A number of studies have investigated the phenomenon of migration and the impact of migration and remittances on child education in Pakistan (see, for example: Arif, 2004; Mansuri, 2006; Nasir et al., 2011; Hassan, Mehmood & Hassan, 2013; Arif & Chaudhry, 2015). However, the evidence from these studies is not uniform: some report a positive impact on child schooling while others document a negative effect. The main focus of these studies is child school enrollment. Some have a limited scope in terms of time span, sample size or region (being confined to rural areas or to a specific locality in a rural area). Other constraints include econometric issues or the empirical models used.

Keeping in view these gaps, the main objective of this study is to examine the impact of remittances on child education in Pakistan through two channels: child school enrollment and educational attainment. We use the latter (along with school enrollment) in order to isolate the impact of remittances on child school progression. Children may be enrolled in school at a particular level, but might not complete that level if they drop out. In Pakistan, the school dropout rate is very high, both at the primary and secondary levels. According to Farooq (2013), the primary dropout rate is about 31 percent.

We also test for the exogeneity of remittances and account for censored child attainment for currently enrolled children. Previous studies on Pakistan have tended to overlook this issue, treating the educational attainment of those children who are still in school identically to those who have completed their schooling. Not accounting for censoring usually yields biased regression estimates (see Zhao & Glewwe, 2010). Therefore, the data needs to be censored for children currently attending school.

The study uses nationally representative data from the Pakistan Social and Living Standards Measurement Survey (PSLMS) for 2010/11, which covers both rural and urban areas of Pakistan. We analyze the overall sample as well as separately for both gender and region, which provides a clearer insight into the gender and regional disparity in child education between remittance recipient and nonrecipient households.

The study is organized as follows. The literature on remittances, migration and child education is outlined in Section 2. The data and methodology are described in Sections 3 and 4, followed by the study's empirical results in Section 5. Section 6 concludes the study and discusses policy implications based on our findings.

## 2. Literature Review

This section reviews the literature on the impact of remittances on child education. This includes empirical work on remittances and child education, other important correlates of child schooling, and methodological issues in modelling and identifying school attainment.

Numerous studies have investigated the effect of remittances on child education in developing countries. Hanson and Woodruff (2003) report that children in remittance-receiving households in Mexico complete more years of schooling. The estimated effect is positive and significant only for those girls with uneducated mothers. The authors argue that remittances ease the otherwise binding credit constraint on these households, which encourages investment in child education. In another study on Mexico, Borraz (2005) finds that remittances have a positive and significant impact only for children whose maternal level of education is low and who live in small cities.

Chaaban and Mansour (2012) examine the impact of migrant remittances on education for three countries – Jordan, Lebanon and Syria – dividing their sample into two age groups, 15–17 and 18–24. Their findings show that remittances have a significant, positive impact on school attendance for the 15–17-year age group in Syria. The impact is larger for men than women in Syria and Jordan, but smaller in Lebanon for the 18–24-year age group. Their results for school attainment are the same. In Egypt, Elbadawy and Roushdy (2009) find a strong, positive impact for migration and remittances on school attendance. Lu and Treiman (2007) examine the impact of remittances on children's education among blacks in South Africa.

Remittances also help reduce the gender gap in education (see Morooka, 2004). Sherpa (2011) concludes that the positive impact of remittances is larger for girls, which decreases the gender disparity in primary enrolment in Nepal. Similarly, Calero, Bedi and Sparrow (2009) suggest that remittances enhance education outcomes in Ecuador, especially for girls, in turn reducing the gender gap in education.

The negative impact of migration/remittances arises in a number of studies. When a family member moves abroad, this may affect child education adversely (Lucas, 2005). The negative impact can take the form of a social effect (parental absence) and a labor market effect. Parental absence may be detrimental to a child's schooling, given the lack of a role model or guardian to provide supervision. The absence of a working adult in the household may also increase the need for children to bridge the short-term gap in labor demand and supply (Booth & Tamura, 2009). Lucas (2005) indicates that remittances increase parental support for children's education, but also have a negative impact in terms of parental absence. Acosta, Fajnzylber, and Lopez (2008) examines the impact of remittances, using data for Latin America, and finds they have a negative effect on child school attainment for some countries.

Methodological issues, such as the problem of endogeneity, have also been the focus of many studies on remittances. The explanatory variable (remittances) may be correlated with the error term for two reasons: (i) unobserved omitted variables and (ii) the joint determination of remittances and schooling. Different instruments are used for remittances in order to tackle the problem of endogeneity. Acosta (2006) and Elbadawy and Roushdy (2009) use village-level migrant networks as an instrument for remittances. In the case of Pakistan, Mansuri (2006) uses the proportion of migrant households at the village level interacted with the number of male adults in each household. Sherpa (2011) uses migrant networks and the age of the migrant as an instrument for remittances. Historical migration rates at the state level interacting with household variables are used as an instrument for current migration by McKenzie and Rapoport (2006), Hanson and Woodruff (2003) for Mexico, and Arif and Chaudhry (2015) for Pakistan.

While it is important to isolate the impact of remittances on child education, it is also necessary to identify suitable controls for other key influences in the regression analysis. These controls include individual characteristics (age, gender), household characteristics (household structure, socioeconomic background), labor market conditions and structure, state policies, and the availability and quality of schools (Wolfe & Behrman, 1984; Holmes, 2003; Sherpa, 2011).

Parental education is one of the main determinants of child education: educated parents are more likely to place a higher value on their children's education (Tansel, 2002; Holmes, 2003; Emerson & Souza, 2007; Chaaban & Mansour, 2012). Glick and Sahn (2000) suggest that the father's education has a positive impact on children's education, but the impact is greater for girls. The mother's education has a significant, positive impact, but only for girls. Household wealth and income also have a significant effect on child schooling. Glick and Sahn (2000) find that the household's permanent income level increases school attendance and grade attainment among girls and lowers their probability of leaving school early. Holmes (2003) and Sánchez and Sbrana (2009) also suggest that wealth and high per capita income increase the likelihood of attending school for girls in the case of Pakistan and Yemen, respectively.

Other variables – the number of siblings, household size, the gender of the household head, the age and gender of the individual, and the quality of education – also determine schooling outcomes (see Wolfe & Behrman, 1984; Deolalikar, 1997; De Serf, 2002; Curran, Chung, Cadge & Varangrat, 2003; Sherpa, 2011). Ersado (2005) finds that younger siblings (under five years of age) have no impact on children's schooling in rural Nepal and Peru and in urban Zimbabwe, but report a significantly negative impact on schooling for urban Peru.

Arif (2004) uses data from the Pakistan Socioeconomic Survey for 2001 to analyze the impact of migration on household consumption, education, health and labor supply in Pakistan. Households with at least one member abroad are considered migrant households. Using the logistic regression technique, he finds that migration has a positive impact on child enrollment. However, the author uses school enrollment as a binary variable and does not consider school attainment. Similarly, he does not test for the possible endogeneity of the migration variable.

Mansuri (2006) examines the impact of migration on school attainment and child labor in Pakistan, using data from the Pakistan Rural Household Survey for 2001/02. She uses the instrumental variable (IV) technique to gauge the impact of migration on child education and child labor. The migration network at the village level interacting with the number of adult males in the household is used as an instrument to isolate the impact of migration on child schooling. Her findings show that temporary migration has a positive and significant impact on child education. Children from migrant households have a better chance of attending school, a lower dropout rate, higher grade attainment and reduced labor market activities. This impact is higher for girls, decreasing the gender disparity in school enrollment. However, Mansuri ignores the censoring of data for currently enrolled children: educational attainment is measured as a categorical variable for the level of education completed by an individual child. Those children who are currently enrolled at a particular level of schooling and those who have completed a specific level but are not currently enrolled are treated identically.

Arif and Chaudhry (2015) examine the impact of migration on school enrollment, accumulated years of schooling and dropout rates in Punjab, Pakistan. The study uses a probit model and ordinary least squares. It accounts for the problem of endogeneity by using the IV technique and the historical migration rate as an instrument for migration. The results suggest that migration has a positive effect on child school enrollment. Children from migrant households accumulate more years of schooling and have a lower dropout rate. However, the study is limited to Punjab, and treats currently school-going children and currently out-of-school children identically. Not accounting for censoring may bias the regression estimates (Zhao & Glewwe, 2010).

The reviewed literature shows that remittances can have both a positive and negative effect on child education. If the income effect of remittances is greater than the other effects of migration (parental absence), then the overall impact will be positive and vice versa. In the case of Pakistan, the studies reviewed are either based on old data or small samples. Most of them have focused on the impact of migration and remittances on child school enrollment, while ignoring child grade attainment. Barring Mansuri (2006) and Arif and Chaudhry (2015), these studies have also overlooked the problem of endogeneity. Finally, none of them have considered censoring the data for currently enrolled children. This study tries to rectify these issues, using a recent, nationally representative dataset from Pakistan.

## 3. Data

This study uses data from the PSLMS for 2010/11 to investigate the impact of remittances on child education in Pakistan. The survey dataset consists of 76,546 households (50,128 rural and 27,360 urban households), spread across 5,413 primary sampling units (PSUs) in the four provinces and the capital. The PSLMS is a multidimensional district-level survey that provides detailed information on individual and household characteristics, including household expenditure, assets, income sources, employment, demographics, health and education. In this study, we focus on children aged 4–15 years, which shrinks the sample size to 31,392 children from 10,750 households.

According to the PSLMS data, out of 10,750 households, 288 reported receiving remittances (about 3 percent of the total sample). Of these, 204 households were rural, constituting 70 percent of the total recipients. Table 1 gives descriptive statistics for the overall sample as well as for remittance recipient and nonrecipient households. For those families receiving remittances, the mean value of remittances is PRs 160,485.53 and the per capita amount received by each household is PRs 16,596.85.

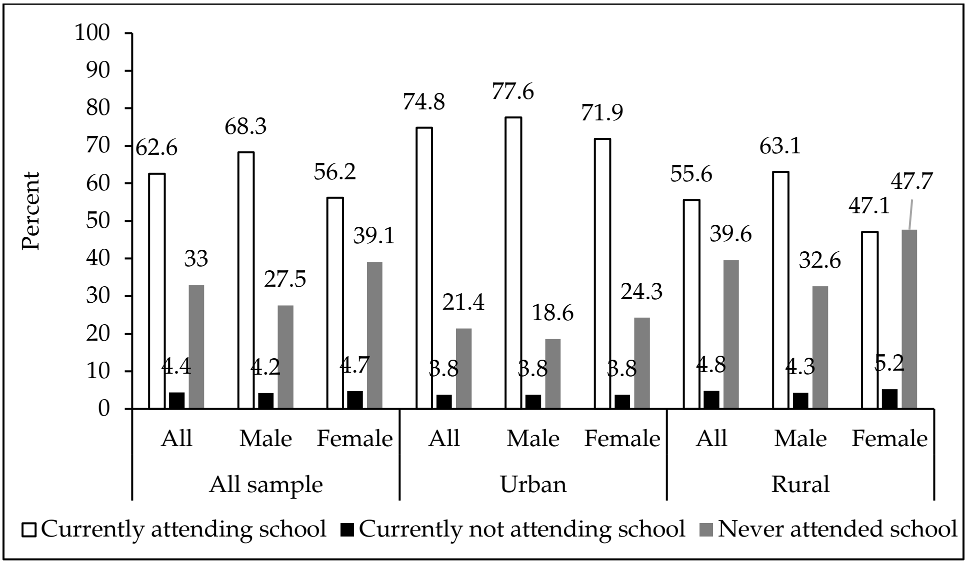
**Table 1: Descriptive statistics**

| Variable | Overall | | Remittance recipient households | | Nonrecipient households | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| *Household characteristics* | | | | | | |
| Remittances received by household | 4,352.74 | 32,452.84 | 160,485.53 | 115,832.740 | – | – |
| Per capita remittances | 497.54 | 3,823.48 | 16,596.85 | 13,790.090 | – | – |
| Remittances (binary) (= 1 if household reports remittances) | 0.03 | 0.16 | 1.00 | 0.000 | – | – |
| Proportion of households receiving remittances at the village level | 0.05 | 0.09 | – | – | – | – |
| Per capita expenditure | 26,917.12 | 19,794.45 | 29,221.19 | 18,024.260 | 24,297.52 | 16,453.120 |
| Father's education | 1.65 | 1.82 | 1.70 | 1.806 | 1.58 | 1.794 |
| Mother's education | 0.69 | 1.36 | 0.85 | 1.460 | 0.57 | 1.241 |
| Household head's education | 2.09 | 1.60 | 2.33 | 1.367 | 2.06 | 1.569 |
| Family size | 7.61 | 2.95 | 11.07 | 4.662 | 8.48 | 3.384 |
| *Child characteristics* | | | | | | |
| Child's age | 9.18 | 3.39 | 9.56 | 3.409 | 9.17 | 3.389 |
| Child's gender (= 1 for male) | 0.53 | 0.45 | 0.54 | 0.499 | 0.53 | 0.499 |
| Enrollment: children aged 4–15 (= 1 if enrolled) | 0.63 | 0.48 | 0.74 | 0.439 | 0.62 | 0.484 |
| Years of schooling: children aged 4–15 | 2.00 | 2.95 | 2.38 | 2.883 | 2.00 | 2.955 |
| Enrollment: boys aged 4–15 (= 1 if enrolled) | 0.68 | 0.46 | 0.81 | 0.396 | 0.68 | 0.466 |
| Enrollment: girls aged 4–15 (= 1 if enrolled) | 0.56 | 0.49 | 0.66 | 0.470 | 0.56 | 0.496 |
| Years of schooling: boys aged 4–15 | 2.17 | 2.98 | 2.70 | 3.133 | 2.16 | 2.980 |
| Years of schooling: girls aged 4–15 | 1.82 | 2.91 | 2.01 | 2.510 | 1.81 | 2.917 |
| Region (= 1 for urban) | 0.36 | 0.48 | 0.32 | 0.465 | 0.37 | 0.482 |
| Sample size | 31,392 | | 738 | | 30,654 | |

***Source***: Authors' calculations.

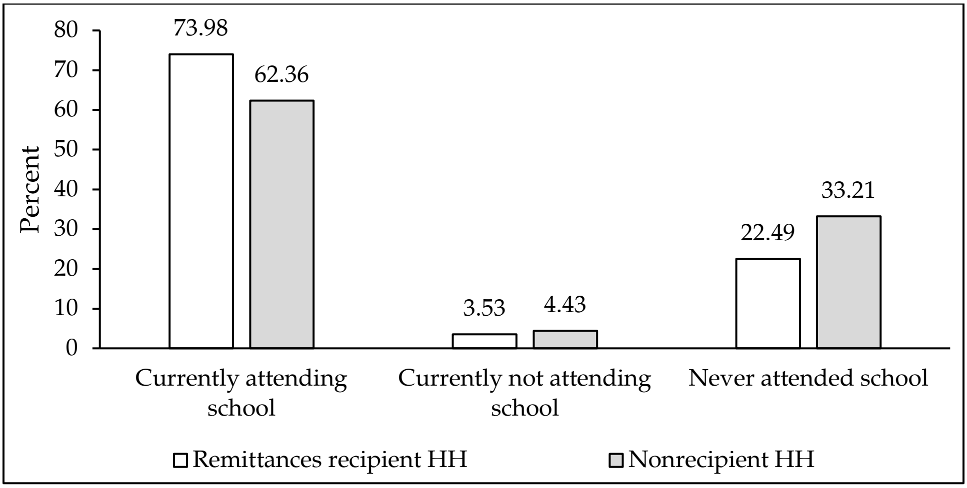
We have data on 31,392 school-going children aged 4–15, of which 738 children belong to remittance-receiving households. The PSLMS 2010/11 provides information on education variables such as enrollment, current level of education and dropout rates. Figure 1 illustrates school enrollment disaggregated by gender and region. Overall, 62.4 percent of children are currently enrolled. The enrollment rate is higher in urban regions and among boys. The dropout rate for girls is 4.7 percent, which is higher than that for boys.

**Figure 1: Child enrollment by region and gender**




There is also a large variation in school enrollment across remittance recipient and nonrecipient households (Figure 2). Among remittance-receiving households, the enrollment rate is about 74 percent, which is about 12 percentage points higher than for children from nonrecipient households. Similarly, the dropout rate is 10 percent higher for nonrecipient households.

**Figure 2: Child enrollment across households**




## 4. Methodology

In order to isolate the impact of remittances on child education, we develop two different econometric models: one for child enrollment and the second for child grade attainment.

### *4.1. Model for Child Enrollment*

The probit model for child enrollment is given as:

$$Y_{ih} = \alpha_0 + \alpha_1 R_{ih} + \alpha_2 C_{ih} + \alpha_3 H_h + \alpha_4 U_{ih} + \varepsilon_{ih} \quad (1)$$

In equation (1), $Y_{ih}$ is the dependent variable, which shows the schooling outcome of child $i$ in household $h$. $R_{ih}$ indicates whether the household receives remittances. $C_{ih}$ is a vector of child characteristics (age, age-squared and gender). $H_h$ is a vector of household characteristics (age and gender of the household head, the mother's education level, the father's education level, the number of school-going children, the number of earners in the household and total monthly household expenditure). $U_{ih}$ is a dummy variable used to capture regional disparities, equal to 1 for urban households and 0 otherwise; $\varepsilon_{ih}$ is the error term (see Section 4.3).

Child enrollment is a binary variable equal to 1 if the child is currently enrolled in any educational institution and 0 otherwise. Hence, we use a probit model to estimate equation (1) (see Holmes, 2003; Mansuri, 2006; Sherpa, 2011; Chaaban & Mansour, 2012).

$$P\left(Y_{ih}=1 / R_{ih}, C_{ih}, H_h, U_{ih}\right) = \phi(\alpha_0 + \alpha_1 R_{ih} + \alpha_2 C_{ih} + \alpha_3 H_h + \alpha_4 U_{ih} + \varepsilon_{ih}) \quad (2)$$

$\phi$ is the cumulative standard normal distribution function.

Econometric problems such as endogeneity can arise when estimating equation (2) above. Excluded, unobserved variables at the community and household level – for example, labor market shocks, school quality, access to credit market and other costs of schooling – that affect both remittances and child education simultaneously can give rise to the problem of endogeneity. We use the IV technique to tackle this as follows:

$$Y_{ih} = \alpha_0 + \alpha_1 R_{ih} + \alpha_2 C_{ih} + \alpha_3 H_h + \alpha_4 U_{ih} + \varepsilon_{ih} \quad (3)$$

$$R_{ih} = \beta_0 + \beta_1 Z_h + \beta_2 C_{ih} + \beta_3 H_h + \beta_4 U_{ih} + \nu_{ih} \quad (4)$$

where the $\alpha_i$ terms represent structural parameters and the $\beta_i$ terms are reduced-form vectors. $Z_h$ is a vector of IVs (see Section 4.3).

Since we are using school enrollment to measure education, which is a binary variable, we apply an IV probit model to estimate equations (3) and (4). Using the maximum likelihood method, the IV probit model jointly estimates these equations on the assumption that ($\varepsilon_{ih}$,$\nu_{ih}$) are identically and independently distributed. The endogenous variable is treated as a linear function of the instrument(s) and certain other control variables (see Miluka & Dabalen, 2008).

### *4.2. Model for Grade Attainment*

In order to examine the impact of remittances on children's grade progression, we use educational attainment (measured by the number of grade-years of schooling completed) as the dependent variable. In doing so, we use the two-stage least squares (2SLS) technique, which means taking the following issues into account.

First, we are interested in the final year of schooling completed in relation to the household's remittance-receiving status. Since we cannot observe the final year of schooling for children who are currently enrolled, we need to censor the data for children currently attending school. Neither 2SLS nor OLS take this censoring into account, and treat the educational attainment of children who are still in school as identical to that of children who have completed their schooling. This yields biased estimates of the impact of migration on educational attainment (see McKenzie & Rapoport, 2006).

Second, OLS and 2SLS assume a continuous distribution for the dependent variable, the years of schooling completed. However, this is a series of ordered discrete choices. To progress from one level of education to the next (primary to middle) and to continue for an extra year once the child has entered a certain level of education (secondary) are two different choices and should be modeled differently.

Accordingly, we follow the literature[1] and use a censored ordered probit model, which is an extended form of the ordered probit model. The reduced linear model of educational attainment is the same as equation (1):

$$Y_{ih} = \alpha_0 + \alpha_1 R_{ih} + \alpha_2 C_{ih} + \alpha_3 H_h + \alpha_4 U_{ih} + \varepsilon_{ih} \quad (5)$$

Here, we define $Y_{ih}$ as the number of completed grade-years of schooling and $Y^*$ as the latent desired level of schooling, which depends on the explanatory variables ($X$) and the error term ($\varepsilon$).

The latent desired level of schooling function is:

$$Y^* = \beta X + \epsilon \quad (6)$$

Although the survey does not provide data on the latent desired level of schooling, we do have data on the number of completed grade-years of schooling. Thus:

$Y = 0$ if $Y^* \leq \mu_0$

$Y = 0$ if $\mu_0 < Y^* \leq \mu_1$

$Y = 1$ if $\mu_0 < Y^* \leq \mu_1$

$Y = 2$ if $\mu_1 < Y^* \leq \mu_2$

$Y = n$ if $\mu_{j-1} \leq Y^*$

The $\mu_i$ terms are the cut-off points indicating the transition from one education level to the next. For those children who have completed their schooling, we observe a lower value of $Y$ that falls between two cut-off points. For those children with no schooling, the value of $Y$ will normalize at 0. The data for children who are currently enrolled will be

---

[1] See King and Lillard (1987), Glick and Sahn (2000), Maitra (2001), Holmes (2003), McKenzie and Rapoport (2006), Miluka and Dabalen (2008), Zhao and Glewwe (2010), and Chaaban and Mansour (2012).

censored with an unknown desired schooling level; we know they will have at least completed their current level of schooling. For these individuals, the desired latent level $Y^*$ is at least equal to the observed level of schooling ($Y$), $Y^* \geq \mu_{max}$.

The variable educational attainment is classified into five different categories:

$$S = \begin{cases} 0\ if\ no\ schooling \\ 1\ if\ highest\ educational\ attainment\ is > 0\ but \leq 5 \\ 2\ if\ highest\ educational\ attainment\ is > 5\ but \leq 8 \\ 3\ if\ highest\ educational\ attainment\ is > 8\ but \leq 10 \\ 4\ if\ highest\ educational\ attainment\ is > 10 \end{cases} \quad (7)$$

In order to consider the potential endogeneity of remittances, a two-step maximum likelihood estimation is implemented. In the first stage, the remittances variable is regressed on the instrumental and control variables. In the second stage, the fitted values and residuals from the first stage are used in the censored ordered probit model (see Rivers & Vuong, 1988; Miluka & Dabalen, 2008; Zhao & Glewwe, 2010).

### *4.3. Variables*

School enrollment is a dummy variable equal to 1 if the child is currently attending school and 0 otherwise. To capture the difference in school enrollment by gender and region, we also take into account enrollment data by gender and region. The sample of children comprises those aged 4–15 years.

In order to capture the completed level of education and the transition from one level to the next, an ordered discrete variable for schooling has be used. The variable (educational attainment) is classified into five different groups: (i) no schooling, (ii) 1–5 years of schooling (primary), (iii) 6–8 years of schooling (middle), (iv) 9–10 years of schooling (secondary) and (v) 11 years of schooling or more (higher secondary or above). For educational attainment, we consider only those children who are currently enrolled or have ever enrolled in the past.

Remittances are the main explanatory variable, taken as a dummy variable equal to 1 if the household receives remittances and 0 otherwise.

Different studies have used migrant networks, historical migration rates and distances to the border as an instrument for remittances and current migration.[2] Here, we use the proportion of migrant households in the village (the migrant network) interacted with the number of male adult members as our instrument for remittances.

Numerous studies have used migrant networks at a community or PSU level as an instrument for remittances/migration. Migrant networks provide information on conditions in the host country and the costs of migration. They also help reduce the costs related to migration and remittances. Therefore, the probability of migrating and the volume of remittances will be higher in those areas with larger, stronger migrant networks. In Pakistan, especially in rural regions, the opportunity to migrate also depends heavily on the presence of adult males in the household, given women's restricted mobility. Hence, the rate of migration and the remittances inflow are likely to be higher in those households that have more than one adult male. We therefore interact the migrant network with the number of male adults at the household level. This creates household-level variation in the opportunity to migrate or receive remittances.

By itself, the migrant network is unlikely to be correlated with household-level unobservables, but it may be correlated with community-level unobservables and average child outcomes (Mansuri, 2006). The identification argument is that the migrant network interacted with the number of male adults in the household must affect the family's opportunity to send a migrant abroad or receive remittances, but is unlikely to be correlated with household or child-level unobservables. It is possible for the male adult members of the household to affect child schooling outcomes through household income or through the supervision or guardianship of the household's children. However, as Mansuri (2006) shows, conditional on the demographic characteristics of the household and other appropriate controls, the variable for male adult members of the household has no impact on child schooling outcomes in Pakistan. The instrument therefore satisfies the exclusion restriction.

In summary, the IV should fulfill three conditions: (i) it must be uncorrelated with the error term, (ii) it must be strongly correlated with the endogenous variable, and (iii) it must not be correlated with the dependent variable:

$$Cov\,(Z_h\,, \varepsilon_{ih}\,) = 0$$

---

[2] See Hanson and Woodruff (2003); Alcaraz, Chiquiar and Salcedo (2010); Mansuri (2006); Acosta (2006); Lokshin, Bontch-Osmolovski and Glinskaya (2010); Sherpa (2011).

$$Cov\ (Z_h\, , M_h\,) \neq 0$$

However, in some cases, even a valid instrument may not be strongly correlated with the variable being instrumented. To address this, we determine the relevance of the instruments in the first stage by testing their overall significance. Section 5 reports the results for the Wald test of exogeneity and the p-value and F-statistics from the first stage.

The vector of child-specific characteristics includes all the relevant control variables: the child's age (*Age_child*), age-squared (*Age2_child*) and gender (*gender_child*). As the child grows older, the opportunity cost of education is expected to increase because labor productivity increases and work becomes less harmful and more socially acceptable. For girls, both school and market-based work become less acceptable and decline in favor of home-based work as they grow older (Bhalotra, 2003).

In order to control for the gender effect, some studies have used a separate model for boys and girls, allowing the intercept and slope coefficient to be gender-specific (see Ilahi & Jafarey, 1999; Bhalotra, 2003. In these studies, most variables show a significant difference in results by gender. In most cases, a dummy is used to control for gender effects, with mixed results (see Mansuri, 2006; McKenzie & Rapoport, 2006; Hanson & Woodruff, 2003; Sherpa, 2011).

The vector of household characteristics comprises control variables including the number of school-going children (*No_child*), the number of earners in the household (*No_b.earners*), the mother's education level (*Mothedu*), the father's education level (*Fathedu*), and the gender (*Head gender*) and age of the household head (*Head age*).

We would expect households with more school-going children to have a lower level of child schooling since the available resources have to be divided among more individuals (Sherpa, 2011).

The gender of the household head is also an important control variable. Bhalotra and Tzannatos (2003) expect women-headed households to have fewer economic resources because, on average, the education level of women is lower than that of men and because women are more likely to face wage discrimination: on average, women are paid less in the labor market. Also, we would like to capture the role of women's decision-making in their children's education.

The age of the household head is used as an indicator of the household's lifecycle stage. For example, in some cases, the head of the household may be a grandparent and older household heads may have different attitudes toward education.

Parental education levels are expected to have a positive effect on child schooling. Educated parents are more likely to want schooling for their children, are more aware of the returns on education, and place more value on their children's schooling (Bhalotra, 2003; Miluka & Dabalen, 2008). Finally, educated household heads or parents may have higher incomes and be in a better position to devote more resources to their children's education.

In order to control for the wealth effect, we include monthly per capita consumption expenditure (*lnpcexp*). Household per capita expenditure is used in this case because it is less volatile than income. Using expenditure as a proxy for income implies that, over time, household expenditure is smoother than household income and reflects its permanent income (Bhalotra & Heady, 2003). Households with a higher monthly expenditure are expected to value child education more because they have greater resources available for schooling and attach less value to the child income foregone from being in school (Miluka & Dabalen, 2008).

The model also includes dummies for rural and urban regions. In most developing countries, the level of education is lower in rural areas, given the relative underdevelopment of market, social, economic and school infrastructure (Bhalotra, 2003). To capture these regional disparities, $U_{ih}$ (*Region*) is used as a dummy variable equal to 1 if the household is in an urban area and 0 otherwise.

## 5. Results and Discussion

Section 5.1 discusses the results of the IV probit model examining the impact of remittances on child school enrollment. Section 5.2 presents the results of the IV censored ordered probit model for the impact of remittances on child school attainment.

### *5.1. Impact of Remittances on Child School Enrollment*

In the first stage of the IV probit model, we regress remittances on the instrument and control variables. In the second stage, the predicted value of the dependent variable and the residuals are used as independent variables. The results of the first-stage regression are given in Table 2. The impact of the IV (the migrant network interacting with the number of adults in the household) has a significant, positive impact on remittances. The positive impact is significant for the overall sample and for the subsamples across region and gender.

**Table 2: First-stage regression results for IV probit model**

| Variable | 1 | All | Male | Female | Urban | Rural |
|---|---|---|---|---|---|---|
| Migrant network * no. of adults in HH | | 0.142* (0.009) | 0.146* (0.012) | 0.138* (0.009) | 0.124* (0.022) | 0.149* (0.009) |
| Gender_child | | 0.001 (0.001) | – | – | 0.002 (0.002) | -0.0002 (0.001) |
| Age_child | | -0.001 (0.001) | -0.001 (0.001) | -0.0009 (0.002) | 0.0003 (0.001) | -0.001 (0.001) |
| Age2_child | | 0.0001 (0.00006) | 0.0001 (0.0001) | 0.00006 (0.0001) | -7.31e-06 (0.0001) | 0.0001 (0.0001) |
| Fathedu | | -0.003* (0.003) | -0.002* (0.001) | -0.003* (0.001) | -0.001 (0.001 | -0.004* (0.001) |
| Mothedu | | -0.002 (0.001) | -0.001 (0.001) | 0.0008 (0.001) | -0.0008 (0.002) | 0.0007 (0.001) |
| Head gender | | -0.187* (0.008) | -0.174* (0.001) | -0.198* (0.012) | -0.218* (0.068) | -0.151* (0.012) |
| Head age | | 0.0004 (0.0001) | -0.0003** (0.0001) | 0.0005* (0.0002) | -0.0003 (0.0001) | 0.0006* (0.0001) |
| No_child | | -0.0001* (0.0002) | -0.0002 (0.001) | 0.00007 (0.001) | 0.001** (0.002) | -0.0007* (0.001) |
| No_b.earners | | -0.007* (0.001) | -0.006* (0.001) | -0.007* (0.001) | -0.009* (0.002) | -0.006* (0.001) |
| Lnpcexp | | 0.017* (0.004) | 0.016* (0.004) | 0.018* (0.005) | 0.016** (0.006) | 0.017* (0.005) |
| Region | | -0.005* (0.002) | -0.003 (0.002) | -0.009** (0.002) | – | – |
| No. of adults | 0.003 (0.004) | | | | | |
| Sample size | 31,392 | 31,392 | 16,639 | 14,753 | 11,502 | 19,890 |

Notes: * significant at 1%, ** significant at 5%, *** significant at 10%.
Standard errors are given in parentheses (clustered at PSU level).
The dependent variable is remittances (binary, = 1 if the household receives remittances).
*Source*: Authors' calculations.

Table 3 presents the results of the IV probit model and the marginal effects of these variables on school enrollment. The results show that remittances have an overall significant, positive impact on child school enrollment. Children from remittance-receiving households have a 34 percent higher chance of enrolling in school compared to children from nonrecipient households. A separate gender analysis shows that the impact is stronger for girls. The impact of remittances is 13 percentage points higher for girls' enrollment in school than boys.

**Table 3: IV probit model results for child school enrollment: overall, by gender, by region**

| Variable | All | Male | Female | Urban | Rural |
|---|---|---|---|---|---|
| Remittances | 0.340* | 0.281* | 0.410* | 0.188* | 0.436* |
| | (0.015) | (0.012) | (0.022) | (0.015) | (0.022) |
| Gender_child | 0.138* | – | – | 0.053* | 0.178* |
| | (0.008) | | | (0.008) | (0.010) |
| Age_child | 0.313* | 0.309* | 0.308* | 0.251* | 0.324* |
| | (0.006) | (0.007) | (0.011) | (0.007) | (0.009) |
| Age2_child | -0.015* | -0.014* | -0.015* | -0.012* | -0.016* |
| | (0.0003) | (0.000) | (0.000) | (0.000) | (0.000) |
| Fathedu | 0.059* | 0.056* | 0.061* | 0.038* | 0.067* |
| | (0.003) | (0.004) | (0.004) | (0.004) | (0.005) |
| Mothedu | 0.080* | 0.052* | 0.109* | 0.061* | 0.084* |
| | (0.012) | (0.008) | (0.019) | (0.005) | (0.030) |
| Head gender | 0.057 | 0.037 | 0.077 | 0.072 | 0.023 |
| | (0.054) | (0.061) | (0.074) | (0.075) | (0.084) |
| Head age | 0.0007*** | 0.001* | 0.0006 | 0.001* | 0.0003 |
| | (0.0004) | (0.0004) | (0.0006) | (0.005) | (0.0005) |
| No_child | -0.010* | -0.005* | -0.015* | -0.008* | -0.010* |
| | (0.003) | (0.003) | (0.004) | (0.003) | (0.004) |
| No_b.earners | -0.026* | -0.037* | -0.013** | -0.030* | -0.023* |
| | (0.003) | (0.004) | (0.005) | (0.004) | (0.004) |
| Lnpcexp | 0.079* | 0.076* | 0.065* | 0.084* | 0.056* |
| | (0.011) | (0.016) | (0.019) | (0.020) | (0.021) |
| Region | 0.107* | 0.058* | 0.154* | – | – |
| | (0.008) | (0.013) | (0.018) | | |
| Wald test of exogeneity | 44.87* | 41.55* | 24.98* | 11.00* | 37.23* |
| F-statistics | 648 | 368 | 287 | 190 | 464 |
| Sample size | 31,392 | 16,639 | 14,753 | 11,502 | 19,890 |

Notes: * significant at 1%, ** significant at 5%, *** significant at 10%.
Standard errors are given in parentheses (clustered at PSU level).
The dependent variable is school enrollment (binary, = 1 if the child is currently enrolled).
*Source*: Authors' calculations.

The literature shows that the impact of remittances on child school enrollment is not uniform across regions (see Sherpa, 2011; Mansuri, 2006;

Miluka & Dabalen, 2008). A regional segregation (rural and urban samples) shows that remittances have a stronger impact on children living in rural areas. In terms of marginal effects, remittances increase the likelihood of rural children being enrolled in school by 43.6 percent, which is about 24 percentage points more than for urban children. This means that remittances help to reduce the gender and regional gap in school enrollment in Pakistan.

Our results support the findings of previous studies conducted on Pakistan. Arif and Chaudhry (2015) find that the migration impact on school enrollment is positive and significant for younger children, but insignificant for older children. Similarly, Mansuri (2006) shows that migration has a positive effect on school enrollment. Our results also support her finding that migration reduces the gender gap in school enrollment.

The results for the other control variables are in accordance with what we would expect and conform to the literature. The impact of child gender is significant and positive: boys are more likely to attend school than girls. This may be because people are biased toward boys' education (Mansuri, 2006). The coefficient of the age variable is positive and that of age-squared is negative and significant. The relationship is quadratic in the case of child age, which implies that, up to a point, age increases the probability of attending school. Thereafter, it decreases the probability of school attendance because, as the child grows older, the opportunity cost of education also increases.

The coefficients of the mother and father's level of education are significant and positive, but the coefficient of the mother's education is higher than that of the latter. For the girls' sample, the impact of parental education is significantly greater, which means that better educated parents place more value on girls' education and vice versa. The higher value of the mother's education for the girls' sample means that households with educated mothers are more likely to send their daughters to school.

The coefficient of the number of children is negative and significant: families with more children have lower rates of school attendance. The positive coefficient of per capita expenditure indicates that families with more resources are more likely to send their children to school. The positive coefficient of region indicates that children living in urban areas are more likely to enroll in school. This may be because urban households value education more than their rural counterparts or because urban areas provide more opportunities to enroll.

### 5.2. Impact of Remittances on Child School Attainment

A censored ordered probit model is estimated to gauge the impact of remittances on child school attainment. In the first stage, we regress remittances on the instrumental and control variables. In the second stage, the predicted value of the dependent variable and the residuals are used as independent variables. The results of the model for the overall sample and subsamples across gender and region are presented in Tables 4–5. Table 4 gives the first-stage results, where remittances are regressed on the IV (the migrant network interacted with the number of adult male members in the household) and other control variables.

**Table 4: First-order results for IV censored ordered probit model**

| Variable | All | Male | Female | Urban | Rural |
|---|---|---|---|---|---|
| Migrant network * no. of | 1.020* | 1.073* | 1.004* | 1.182* | 0.975* |
| adults in HH | (0.030) | (0.039) | (0.047) | (0.064) | (0.034) |
| Gender_child | 0.013 | – | – | 0.097 | -0.023 |
| | (0.046) | | | (0.074) | (0.059) |
| Age_child | -0.049 | -0.052 | -0.036 | 0.021 | -0.072 |
| | (0.048) | (0.064) | (0.073) | (0.075) | (0.064) |
| Age2_child | 0.002 | 0.002 | 0.001 | -0.001 | 0.003 |
| | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) |
| Fathedu | -0.080* | -0.058* | -0.112* | -0.040*** | -0.112* |
| | (0.015) | (0.020) | (0.024) | (0.023) | (0.021) |
| Mothedu | 0.033*** | 0.025 | 0.043 | 0.015 | 0.056*** |
| | (0.019) | (0.025) | (0.029) | (0.025) | (0.032) |
| Head gender | -1.066* | -1.026* | -1.120* | -1.327* | -0.821* |
| | (0.105) | (0.145) | (0.155) | (0.145) | (0.160) |
| Head age | 0.012* | 0.009* | 0.016* | 0.003 | 0.018* |
| | (0.001) | (0.002) | (0.002) | (0.003) | (0.002) |
| No_child | -0.042* | -0.026 | -0.070* | -0.032 | -0.046* |
| | (0.013) | (0.017) | (0.022) | (0.023) | (0.017) |
| No_b.earners | -0.202* | -0.202* | -0.199* | -0.309* | -0.166* |
| | (0.022) | (0.029) | (0.033) | (0.042) | (0.025) |
| Lnpcexp | 0.366* | 0.324* | 0.428* | 0.328* | 0.416* |
| | (0.054) | (0.070) | (0.080) | (0.069) | (0.079) |
| Region | -0.134** | -0.075 | -0.215** | – | – |
| | (0.052) | (0.069) | (0.081) | | |
| Sample size | 21,046 | 12,059 | 8,987 | 9,046 | 12,000 |

Notes: * significant at 1%, ** significant at 5%, *** significant at 10%. Standard errors are given in parentheses.
The dependent variable is remittances (binary, = 1 if the household receives remittances).
***Source***: Authors' calculations.

The impact of the IV is positive and significant. The results for the other variables concur with theory and past research. From the first-stage regression, we use the predicted value of remittances in the second stage of the model. The results show that the negative impact of remittances becomes stronger and significant (Table 5). This means that children from migrant households (receiving remittances) are less likely to complete a higher level of schooling. Moreover, they are more likely to drop out of school when moving from a lower to a higher grade. The gender analysis shows that girls living in remittance-receiving households are less likely to attain a higher level of schooling. The impact of remittances on child school attainment is insignificant in the urban sample, but the negative impact of remittances on child school attainment is significant in the rural sample.

**Table 5: IV censored ordered probit model results for child school attainment: overall, by gender, by region**

| Variable | All | Male | Female | Urban | Rural |
|---|---|---|---|---|---|
| Remittances | -0.506* | -0.363** | -0.703* | -0.304 | -0.577* |
| | (0.150) | (0.151) | (0.201) | (0.240) | (0.171) |
| Gender_child | 0.034*** | – | – | -0.026 | -0.031 |
| | (0.019) | | | (0.033) | (0.026) |
| Age_child | 0.786* | 0.791 | 0.781* | 0.770* | 0.810* |
| | (0.025) | (0.030) | (0.038) | (0.038) | (0.031) |
| Age2_child | -0.012* | -0.013* | -0.012* | -0.008* | -0.015* |
| | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) |
| Fathedu | 0.045* | 0.045* | 0.045** | 0.035* | 0.045* |
| | (0.008) | (0.007) | (0.012) | (0.011) | (0.010) |
| Mothedu | 0.090** | 0.069* | 0.114** | 0.053* | 0.194*** |
| | (0.041) | (0.011) | (0.048) | (0.012) | (0.109) |
| Head gender | -0.034 | -0.110 | 0.039 | 0.072 | -0.088 |
| | (0.136) | (0.121) | (0.165) | (0.155) | (0.139) |
| Head age | 0.002** | 0.002 | 0.002 | 0.003** | 0.002 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| No_child | 0.006 | -0.019* | -0.011 | 0.001 | 0.009 |
| | (0.007) | (0.007) | (0.009) | (0.011) | (0.009) |
| No_b.earners | -0.010 | -0.012 | -0.006 | -0.009 | -0.011 |
| | (0.012) | (0.010) | (0.020) | (0.018) | (0.014) |
| Lnpcexp | 0.153* | 0.195* | 0.098* | 0.201* | 0.174* |
| | (0.020) | (0.017) | (0.028) | (0.019) | (0.056) |
| Region | -0.033 | 0.001 | -0.074 | – | – |
| | (0.067) | (0.0267) | (0.087) | | |
| Sample size | 21,046 | 12,059 | 8,987 | 9,046 | 12,000 |

Notes: * significant at 1%, ** significant at 5%, *** significant at 10%.
Standard errors are given in parentheses (clustered at PSU level).
The dependent variable is school attainment, which is a categorical variable.
***Source***: Authors' calculations.

Miluka and Dabalen (2008) report the negative impact of migration on school attainment in Albania. Acosta, Fajnzylber, and Lopez (2008) also find that remittances have a negative effect on child school attainment in some Latin American countries. For Pakistan, Arif and Chaudhry (2015) show that the impact of migration on children's accumulated years of schooling is positive for the overall sample aged 5–17 years and the subsample aged 12–17 but the results are negative when they do not control for district fixed effects in the analysis.

The impact of the other control variables on child educational attainment is the same as in the case of child school enrollment. Child age has a positive impact, but its square has a significant, negative impact on school attainment. Parental education has a positive impact on children's education. The mother's education coefficient is higher for the girls' sample than for the boys' sample, indicating the significant role of educated mothers in their children's – and especially their daughters' – education. Household expenditure affects child educational attainment positively, but the estimated impact is higher for rural areas.

Why does the remittances variable affect child schooling attainment negatively? The literature on migration and remittances points to many factors explaining why the impact of remittances should become negative (see McKenzie & Rapoport, 2006; Miluka & Dabalen, 2008). Remittances have a positive impact on educational attainment through the income effect, which eases the credit constraint of the household and increases opportunities for households to invest more in their children's education. Migrant remittances are a direct outcome of migration. Other outcomes of migration can have a negative impact on schooling, a key outcome being parental absence, which leaves children who may be enrolled in school without someone to supervise their education. This may induce earlier dropouts.

Lucas (2005) argues that migrant remittances encourage household investment in children's education, but migration itself can affect their schooling negatively. As Nasir et al. (2011) point out, in societies such as Pakistan where the father is largely responsible for his children and family members, his absence may affect schooling outcomes adversely when he is not there to supervise his children's social and work habits. Another negative impact of parental absence on children's education is that it may increase the responsibilities of school-going children, who might be compelled to spend more time on household chores or nonlabor work at the expense of their schoolwork.

On a larger scale, when working-age labor migrates abroad, the demand for child work carries higher remuneration, increasing the opportunity cost of education. This may induce school-going children to drop out and start working to bridge the short-term gap in the supply and demand of labor in their home country and to reduce the cost of migration.

Another important effect of migration is the incentive effect (see McKenzie & Rapoport, 2006), which affects child education negatively and can offset the positive impact of remittances. Children from migrant households might not migrate today, but may do so in the future. This prospect reduces the expected future returns on their education if they migrate for low skilled work. As a result, children from migrant households may be less likely to progress to higher levels of schooling than those from nonmigrant households.

Finally, the effect of migration on education may be negative if the remittances received are invested in the household's self-run business. In rural areas, where households often depend on their own labor supply, children may spend more time helping to run their family business. This is likely to induce dropouts among children who are currently enrolled.

## 6. Conclusion and Policy Recommendations

This study investigates the impact of migrant remittances on child school enrollment and attainment in Pakistan. This study is an effort to reinvestigate the issue by employing better econometric techniques such as controls for endogeneity and censored data for currently enrolled children. The analysis uses a recent, nationally representative dataset, the PSLMS for 2010/11. We disaggregate the whole sample by gender and region, looking at children aged 4–15 years. An IV probit model is used to analyze the impact of remittances on child school enrollment in Pakistan. For educational attainment, we use an IV censored ordered probit model. The IV technique is used to tackle the problem of endogeneity.

The results of the study suggest that the impact of remittances on child school enrollment is positive. Moreover, remittances have a strong impact on girls' enrollment. The separate analysis for rural and urban regions indicates that the impact is greater for the rural sample. Remittances are shown to increase school enrollment and reduce the gender gap in school enrollment, especially in rural areas.

The impact of remittances on child educational attainment is significantly negative for the overall and subsamples, except the urban sample. The negative impact is more pronounced for the girls' sample. Children in remittance-receiving households are less likely to progress from one level to the next. The negative impact of remittances on educational attainment may be due to the following outcomes of migration: parental absence, family disruption, labor market conditions and the incentive effect.

Parental education has a positive impact on children's education. The effect of the mother's education is more significant, especially for girls, suggesting that educated mothers play an important role in educating their children and reducing the gender gap in schooling. The control variable for the number of school-going children has a negative impact, which implies that larger households have lower levels of child education. Household income affects child schooling positively: families with more resources are more likely to invest in their children's education.

The study concludes that remittances have a positive impact on child enrollment, but a negative effect in the case of school attainment. The positive impact is unsustainable, given the higher dropout rate at higher levels of education where school attainment is concerned. Further investigation is needed to critically evaluate how best to channel remittances to maximize human capital accumulation in Pakistan. Moreover, the government must pay attention to increasing the returns on education compared to the returns on household enterprises.

**References**

Acosta, P. (2006). *Labor supply, school attendance and remittances from international migration: The case of El Salvador* (Policy Research Working Paper No. 3903). Washington, DC: World Bank.

Acosta, P., Fajnzylber, P., & J. H. Lopez (2008). Remittances and household behavior: Evidence for Latin America. In P. Fajnzylber & J. H. Lopez (Eds.), *Remittances and development: Lessons from Latin America* (pp. 133-170). Washington, DC: The World Bank.

Educational opportunities for boys and girls in Thailand. In D. Baker et al. (Eds.), *Inequality across societies: Families, schools and persisting stratification* (pp. 59–102). Bingley: Emerald Group Publishing.

Ahmed, V., Sugiyarto, G., & Jha, S. (2010). *Remittances and household welfare: A case study of Pakistan* (Economics Working Paper No. 194). Manila: Asian Development Bank.

Alcaraz, C., Chiquiar, D., & Salcedo, A. (2012). Remittances, schooling and child labor in Mexico. *Journal of Development Economics*, *97*(1), 156–165.

Amuedo-Dorantes, C., & Pozo, S. (2010). Accounting for remittance and migration effects on children's schooling. *World Development*, *38*(12), 1747–1759.

Arif, G. M. (2004). Effects of overseas migration on household consumption, education, health and labor supply in Pakistan. In H. Oda (Ed.), *International labor migration from South Asia* (chap. 5). Chiba, Japan: Institute of Developing Economies and Japan External Trade Organization.

Arif, R., & Chaudhry, A. (2015). The effects of external migration on enrolments, accumulated schooling and dropouts in Punjab. *Applied Economics*, *47*(16), 1607–1632.

Bhalotra, S. (2003). *Child labor in Asia and Africa* (Background paper prepared for the EFA Global Monitoring Report 2003/04). Retrieved from http://unesdoc.unesco.org/images/0014/001467/146764e.pdf

Bhalotra, S., & Heady, C. (2003). Child farm labor: The wealth paradox. *World Bank Economic Review*, *17*(2), 197–227.

Bhalotra, S., & Tzannatos, Z. (2003). *Child labor: What have we learnt?* (Social Protection Discussion Paper No. 0317). Washington, DC: World Bank.

Booth, A., & Tamura, Y. (2009). *Impact of paternal temporary absence on children left behind* (Discussion Paper No. 4381). Bonn: Institute for the Study of Labor.

Borraz, F. (2005). Assessing the impact of remittances on schooling: The Mexican experience. *Global Economy Journal*, *5*(1, art. 9), 1–32.

Calero, C., Bedi, A. S., & Sparrow, R. (2009). Remittances, liquidity constraints and human capital investments in Ecuador. *World Development*, *37*(6), 1143–1154.

Chaaban, J., & Mansour, W. (2012). *The impact of remittances on education in Jordan, Syria and Lebanon* (Working paper). Dubai: Middle East Youth Initiative.

Curran, S. R., Chung, C. Y., Cadge, W., & Varangrat, A. (2003). Educational opportunities for boys and girls in Thailand. In D. Baker et al. (Eds.), *Inequality across societies: Families, schools and persisting stratification* (pp. 59–102). Bingley: Emerald Group Publishing.

Deolalikar, A. B. (1997). *The determinants of primary school enrollment and household schooling expenditures in Kenya: Do they vary by income?* Unpublished manuscript, University of Washington, Seattle, WA.

De Serf, M. (2002). *The effects of family, social and background factors on children's educational attainment*. Unpublished manuscript, Illinois Wesleyan University, IL.

Edwards, A. C., & Ureta, M. (2003). International migration, remittances and schooling: Evidence from El Salvador. *Journal of Development Economics*, *72*(2), 429–461.

Elbadawy, A., & Roushdy, R. (2009). *Impact of international migration and remittances on child schooling and child work: The case of Egypt*. Paper prepared for the World Bank's MENA International Migration Program.

Emerson, P. M., & Souza, A. P. (2007). Child labor, school attendance and intra-household gender bias in Brazil. *World Bank Economic Review*, *21*(2), 301–316.

Ersado, L. (2005). Child labor and schooling decisions in urban and rural areas: Comparative evidence from Nepal, Peru and Zimbabwe. *World Development*, *33*(3), 455–480.

Farooq, M. S. (2013). An inclusive schooling model for the prevention of dropout in primary schools in Pakistan. *Bulletin of Education and Research*, *35*(1), 47–74.

Glick, P., & Sahn, D. E. (2000). Schooling of girls and boys in a West African country: The effects of parental education, income and household structure. *Economics of Education Review*, *19*(1), 63–87.

Hanson, G. H., & Woodruff, C. (2003). *Emigration and educational attainment in Mexico*. Unpublished manuscript, University of California at San Diego, CA.

Hassan, M., Mehmood, H., & Hassan, M. S. (2013). Consequences of worker's remittances on human capital: An in-depth investigation for a case of Pakistan. *Middle East Journal of Scientific Research*, *14*(3), 443–452.

Holmes, J. (2003). Measuring the determinants of school completion in Pakistan: Analysis of censoring and selection bias. *Economics of Education Review*, *22*(3), 249–264.

Ilahi, N., & Jafarey, S. (1999). Guest worker migration, remittances and the extended family: Evidence from Pakistan. *Journal of Development Economics*, *58*(2), 485–512.

King, E., & Lillard, L. (1987). Education policy and schooling attainment in Malaysia and the Philippines. *Economics of Education Review*, *6*(2), 167–181.

Lokshin, M., Bontch-Osmolovski, M., & Glinskaya, E. (2010). Work-related migration and poverty reduction in Nepal. *Review of Development Economics*, *14*(2), 323–332.

Lu, Y., & Treiman, D. J. (2007). *The effect of labor migration and remittances on children's education among blacks in South Africa* (Working Paper No. 001-07). Los Angeles, CA: California Center for Population Research.

Lucas, R. E. (2005). *International migration and economic development: Lessons from low-income countries*. Cheltenham: Edward Elgar.

Maitra, P. (2001). *Schooling and educational attainment: Evidence from Bangladesh* (Working Paper No. 7). Canberra: Australian National University, Australia South Asia Research Centre.

Mansuri, G. (2006). *Migration, school attainment and child labor: Evidence from rural Pakistan* (Policy Research Working Paper No. 3945). Washington, DC: World Bank.

Mara, I., Narazani, E., Saban, N., Stojilovska, A., … Zuber, S. (2012). *Analysis of literature on the effects of remittances on education and health of family members left behind*. Fribourg: Regional Research Promotion Programme – Western Balkans.

McKenzie, D., & Rapoport, H. (2006). *Can migration reduce educational attainment? Evidence from Mexico* (Policy Research Working Paper No. 3952). Washington, DC: World Bank.

Miluka, J., & Dabalen, A. (2008). *Exploring the role of Albanian international migration on education*. Retrieved from http://siteresources.worldbank.org/ALBANIAEXTN/Resources/Exploring_Role_of_Albanian_International_Migration_on_Education.pdf

Morooka, H. (2004, April). *Educational consequences of emigration for children in China*. Paper presented at the Annual Meeting of the Population Association of America, Boston, MA.

Nasir, M., Tariq, M. S., & Rehman, F. (2011). *The effect of foreign remittances on schooling: Evidence from Pakistan* (Working Paper No. 66). Islamabad: Pakistan Institute of Development Economics.

Rivers, D., & Vuong, Q. (1988). Limited information estimators and exogeneity tests for simultaneous probit models. *Journal of Econometrics*, *39*(3), 347–366.

Sánchez, M. V., & Sbrana, G. (2009). *Determinants of education attainment and development goals in Yemen*. Retrieved from http://www.un.org/en/development/desa/policy/mdg_workshops/entebbe_training_mdgs/ntbtraining/sanchez_sbrana2009yemen.pdf

Sherpa, M. (2011). *Essays on determinants of human capital accumulation*. Unpublished PhD thesis, Oregon State University, Corvallis, OR.

Tansel, A. (2002). Determinants of school attainment of boys and girls in Turkey: Individual, household and community factors. *Economics of Education Review*, *21*(5), 455–470.

Wolfe, B. L., & Behrman, J. R. (1984). Who is schooled in developing countries? The roles of income, parental schooling, sex, residence and family size. *Economics of Education Review*, *3*(3), 231–245.

World Bank. (2013). *The migration and remittances factbook 2013*. Washington, DC: Author.

Zhao, M., & Glewwe, P. (2010). What determines basic school attainment in developing countries? Evidence from rural China. *Economics of Education Review*, *29*(3), 451–460.

*The Lahore Journal of Economics*
21 : 1 (Summer 2016): pp. 99–122

# Electricity Consumption Patterns: Comparative Evidence from Pakistan's Public and Private Sectors

**Karim Khan,[*] Anwar Shah[**] and Jaffar Khan[***]**

**Abstract**

*This study examines the behavioral aspect of Pakistan's energy crisis by comparing electricity consumption in the public and private sectors. Specifically, we compare consumption patterns of electricity across a sample of student hostels at two public sector universities and privately run student hostels. In addition, we collect household data for a sample of students at Quaid-i-Azam University (QAU) in Islamabad and compare their average electricity consumption with that of the public sector university hostels. We find that the latter's average consumption of electricity is significantly higher than among private hostels and households. In assessing the moral hazard problem of the public sector in this context, we test the energy conservation behavior of QAU students and the university administration. The results show that students are largely indifferent to conserving electricity, while the administration pays little attention to the use of energy-efficient lights and equipment.*

**Keywords**: Electricity consumption, public sector, private sector, moral hazard, conservation of electricity, organizational inefficiency.

**JEL classification**: H83, D12, D00, D03, D04.

## 1. Introduction

Pakistan's severe energy crisis has prevented the economy from reaching its potential in recent years. At the same time, the demand for energy is increasing continuously. For instance, from 2001 to 2008, the demand rose by almost 6 percent per annum (Kessides, 2013). This surge in demand has led to continuous growth in the gap between demand and supply over the last 30 years. In May 2012, the shortfall was estimated at 6,000 MW (National Electric Power Regulatory Authority, 2011a, 2011b).[1]

[*] Assistant Professor, Pakistan Institute of Development Economics, Islamabad
[**] Assistant Professor, Department of Economics, Quaid-i-Azam University, Islamabad.
[***] MPhil Student, Department of Economics, Quaid-i-Azam University, Islamabad.

[1] See also http://tribune.com.pk/story/154420/countrywide-energy-shortage-as-pepco-increases-loadshedding/ and http://www.theguardian.com/global-development/2012/may/29/pakistan-energy-shortfall-coal-power-plants.

This declined slightly to 4,250 MW in June 2013 with the demand for power at 16,400 MW and power generation (supply) at 12,150 MW. However, the gap is still alarming.[2] Predictions for the near future indicate that the gap between demand and supply is likely to increase to 8,000 MW by 2017 and to 13,000 MW by 2020 (Shahbaz, 2011).

The energy crisis can be studied from two perspectives: the supply side and the demand side. The supply side incorporates issues related to the production and distribution of electricity. The demand side relates to the inefficient use of electricity, which in Pakistan, is the dominant problem. According to Ullah, Khan and Akhtar (2014), 52 percent of the increase in energy intensity since 1972 was caused by the inefficient use of energy. This evidence is supplemented by the fact that Pakistan lags far behind most developed and many developing countries in terms of efficiency. For instance, for each dollar of GDP, Pakistan consumes 15 percent more energy than India and 25 percent more than the Philippines. In addition, Pakistan's energy consumption per unit of GDP is fivefold that of the average for developed countries and twice that of the world average. The potential saving from the efficient use of energy in Pakistan is estimated at 18 percent or 11.16 million tons of oil-equivalent (MTOE), which would result in a 51 percent reduction in net oil imports (Pakistan Energy Sector Taskforce, 2010).[3] All these trends imply that Pakistan has the potential to save electricity through demand-side measures, but has failed to do so thus far.

At the global level, researchers and policymakers have paid special attention to the trends and dimensions of the energy crisis, including higher energy prices, the instability in the supply of different components, rapid energy depletion and global warming. While there is substantial research on energy problems in the context of Pakistan, most studies have looked at changes in energy prices and their relation to economic growth, inflation and other macroeconomic indicators (see, for instance, Jamil & Ahmad, 2010; Javid, Javid & Awan, 2013; Shahbaz & Feridun, 2012). To our knowledge, no original work has been carried out from a micro-perspective in Pakistan. This study endeavors to initiate this angle by discussing the behavioral aspect of the demand for energy in Pakistan. In particular, we are interested in examining whether electricity consumption behavior differs between the public and private sectors and, if so, why.

[2] In 2008, the shortfall reached 4,000 MW for the first time. The Pakistan Ministry of Planning, Development and Reform (2015) reported a peak shortfall of 7,000 MW on average as of July 2014.

[3] The Pakistan Energy Sector Taskforce (2010) estimates that 6.1 MTOE (or 15.4 percent of the total energy consumed in the country) could potentially have been saved in the fiscal year 2008 alone.

In order to support our hypothesis, we have collected data on the electricity consumption of two public sector universities and a sample of private hostels and households in Islamabad. Specifically, we compare the average consumption of electricity per capita between the university hostels and the private sector hostels and households. We find a significant difference in the consumption of electricity between the two sectors. The average consumption across the public sector hostels, however, is not significantly different. Our findings support the hypothesis that public sector universities are characterized by inefficient energy use.

We examine the behavioral aspect of this inefficiency based on a survey conducted at the Quaid-i-Azam University (QAU) hostels, which documents the number of rooms left locked with electrical appliances still running. The results show that a significant number of students leave their rooms locked without having switched off the electrical appliances inside. This implies that, as consumers, students in the public sector are indifferent to the conservation of electricity. We have also collected data on the types of electrical lights used, which shows that little attention is paid to switching to energy-efficient devices at public sector universities.

Section 2 describes the literature. Sections 3 and 4 provide a theoretical background and methodology. Section 5 describes the data collected. Section 6 analyzes the results and Section 7 concludes the study.

## 2. A Review of the Literature

The literature on the behavioral aspect of energy consumption focuses on three strands: users' behavior at the institutional level, household behavior and the use of electricity-efficient appliances. The first strand includes considerable research asserting that the provision of free electricity in institutions makes people less likely to conserve electricity (see Siero, Bakker, Dekker & van den Burg, 1996; Scherbaum, Popovich & Finlinson, 2008; Zhang, Wang & Zhou, 2013a, 2013b, 2014).

Different factors shape such behavior. Scherbaum et al. (2008) focus on individual-level factors, but find that the public environmental consciousness is an important predictor of personal environmental norms. These, in turn, affect self-reported energy-saving behavior at the workplace.[4] In contrast, Zhang et al. (2013b, 2014) gauge the role of variables such as social and individual benefits, and the organization's

[4] Scherbaum et al. (2008) do not find any direct effect of the environmental worldview on self-reported energy-saving behavior.

own energy-saving norms. They suggest that environmental, personal and organizational benefits as well as the organization's energy conservation patterns induce employees to conserve electricity.

The second strand of the literature examines households' energy-saving behavior.[5] Abrahamse, Steg, Vlek and Rothengatter (2007) look at the effect of tailored information, tailored feedback and goal setting on energy consumption and saving behavior. They show that households that have been exposed to interventions save 5.1 percent in energy consumption compared to households in the control group, which saved only 0.7 percent. Ek and Söderholm (2010) argue that, in Sweden, providing specific information on energy saving plays an important role in energy conservation. Moreover, the willingness to save electricity differs by age group – retired people appear more willing to save than the average individual.

In a similar study, Brounen, Kok and Quigley (2013) examine the role of awareness and energy literacy in the behavior of Dutch households. They find that households that are more aware of their energy consumption are also more efficient because they conserve and organize their energy consumption better. Gyberg and Palm (2009) show that information in the residential sector can help achieve sustainable energy systems and control excess demand for energy in people's daily lives.[6]

Other studies analyze the role of socio-demographic and economic variables. Abrahamse and Steg (2009) assert that family size and income have a significant effect on households' direct and indirect energy consumption.[7] Wang, Zhang, Yin and Zhang (2011) find that smaller expenditures, subsidized energy conservation, social norms and the experience of energy shortfalls enhance electricity-saving behavior among Chinese households. However, the discomfort caused by energy-saving activities still has a negative effect on conservation behavior.[8]

---

[5] See: Barr, Gilg and Ford (2005); Lindén, Carlsson-Kanyama and Eriksson (2006); Sardianou (2007); Abrahamse, Steg, Gifford and Vlek (2009); Thøgersen and Grønhøj (2010); Martinsson, Lundqvist and Sundström (2011).

[6] Feng, Sovacool and Vu (2010) argue that economic benefits and awareness play an important role in energy conservation.

[7] Abrahamse and Steg (2009) find that, among Dutch households, socio-demographic variables are more important than psychological variables in determining energy consumption.

[8] The other control they use – similar to the level of education, income and gender – has no impact on people's willingness to reduce electricity consumption.

The third strand of the literature focuses on the use of electricity-efficient appliances (including lights, air conditioners, washing machines, refrigerators, TV sets, etc.). Guan, Mills and Zhang (1997) examine the problems and prospects of energy-efficient lighting in China. They find that lack of awareness, the cost-effectiveness of power efficiency projects, primitive manufacturing processes and strong incentives to export energy-efficient products constrain the local use of efficient lighting.

Government policies also have an impact on the adoption of energy-efficient appliances. Ma, Andrews-Speed and Zhang (2011) find that energy-efficient appliances and the government's energy efficiency polices have positive implications for energy conservation in China. Accordingly, they suggest that energy conservation can be enhanced by subsidizing and promoting the use of energy-efficient appliances. Ma, Andrews-Speed and Zhang (2013) find that households prefer comfort and convenience over energy conservation, but that this behavior can be changed through economic incentives such as charging higher prices for electricity or offering discounts on the use of energy-efficient appliances.

## 3. Theoretical Framework

Our starting point is the standard classification of goods shown in Table 1, which divides goods in a society into four categories. Private goods are competed for, that is, individuals can be excluded from their use. Common property resources are defined by two characteristics: it is difficult to exclude users and the use of the good by one user diminishes the benefits available to other users. Nonrival goods from which users can be readily excluded (the opposite of common property resources) are called "spite goods" because this exclusion does not enhance welfare.[9] Common property resources are similar to public goods in that user exclusion is difficult, but they are also similar to private goods in that users must compete for them. By contrast, public goods can neither exclude users nor are users compelled to compete for them.

**Table 1: A taxonomy of goods**

| | **Rival** | **Nonrival** |
|---|---|---|
| Excludable | Private goods | Spite goods |
| Nonexcludable | Common property | Public goods |

***Source***: Bowles (2006).

[9] Examples include collecting a toll on a little-used highway or charging for admission to an uncrowded museum.

In most Pakistani public sector universities, the consumption of electricity is divided into three categories of use: (i) the electricity that is used in common areas such as classrooms, libraries, laboratories and public access routes, (ii) the consumption of electricity specifically by employees in offices, and (iii) the electricity used by students in residence.

In the first category, the consumption is paid for by the university as public university fees are subsidized,[10] that is, electricity is a "public" good. This means that employees and students do not pay for the electricity they consume during working or class hours. Hence, it is likely that, in the absence of moral responsibility and the positive marginal cost of an extra unit of electricity, students and employees will be indifferent to whether their electricity consumption is efficient. Similarly, in the third case, there is the probability of moral hazard with regard to electricity consumption.

In contrast, private hostels are run for profit and, as a consequence, resident students are fully liable for the costs they incur.[11] As profit-maximizing agents, hostel owners will do their best to reduce their running costs, for instance, by monitoring the unnecessary or overuse of electricity. Moreover, the profit motive may induce them to use electricity-efficient appliances to reduce costs. All these factors will ensure the optimal consumption of electricity in private hostels. In the same way, households are fully liable for the cost of the electricity they consume. As neoclassical economic agents, they will equate their marginal cost of electricity with the marginal benefit of consumption. This is their incentive to avoid overuse and to use electricity-efficient appliances in their homes.[12]

Based on this discussion, we hypothesize that the consumption of electricity is inefficient in the public sector compared to the private sector. There are three justifications for this hypothesis. First, in the public sector, the marginal cost of using an additional unit of electricity is 0 while the marginal benefit is positive. This implies a higher level of average consumption in public sector university hostels than in private hostels and households. Second, the cost of electricity to individuals in the public sector is hidden and, therefore, we expect they will not bother to avoid using extra electricity. Third, in the public sector in Pakistan, there is no formal or informal punishment mechanism for the misuse of electricity, which significantly reduces the transaction cost associated with any misuse.

---

[10] Universities are financed mainly by the federal government through the Higher Education Commission.

[11] In particular, this payment must ensure that hostel owners have profit rates as an incentive.

[12] For a detailed discussion, see Stern and Gardner (1981); Stern (2000); Howard (1997).

## 4. Methodology

We carry out a comparative analysis of the public and private sectors by using two public sector universities – QAU in Islamabad and the University of Baluchistan in Quetta – as case studies. We have collected electricity consumption data for the university hostels, 18 private hostels in Islamabad and the households of a sample of QAU students. In comparing the data for the public sector and the private sector, we expect a significant difference in consumption patterns.

Next, we investigate the behavioral causes for this difference. In particular, we are interested in showing that users in the public sector are indifferent to the conservation of electricity. For this purpose, we conduct two types of behavioral observations. First, we survey the QAU hostels to determine how many rooms are left locked but with the lights inside switched on. We expect this to be the case for a significant number of rooms. Second, we compare the types of electrical appliances used in both sectors. Again, we expect private sector users to be more concerned about electricity-efficient appliances than public sector users.

## 5. Collection and Characteristics of Data

The data for the two universities' electricity consumption was obtained from their monthly bills, to access which we submitted a formal application to the relevant department at each university. We also asked for information on the number of students and staff and the types of lighting used in each block.[13] Next, we noted down the 14-digit reference number on the bill (see Table A1 in the Appendix for details) and used it to download the user's annual billing data for 2013 and 2014 from the district electrical supply company's website. For a comparative analysis, we calculated the per capita electricity consumed in units[14] (the total number of consumed units divided by the number of actual users).

As Table A1 in the Appendix shows, QAU has nine hostels, five annexes and six student residences. Collectively, these comprise 1,051 rooms, including accommodation for both men and women. QAU has

[13] We needed the number of students and staff that actually consumed electricity in each block in order to find the per capita consumption of electricity. The enumerator also counted the number of each type of light in each block.
[14] Per capita consumption of electricity can also be measured in monetary terms. However, electricity companies in Pakistan charge progressively higher rates for different units of electricity consumed, which makes the monetary measure impractical for analytical comparison. Alternatively, our measure of the per capita consumption of electricity is independent of pricing policies.

approximately 8,000 students, around 33 percent of who live in its hostels. The University of Baluchistan has around 9,500 students and 17 hostels, one of which is for women. Around 1,700 students live in these hostels, which comes to almost 18 percent of the total student population.

The second sample comprises 18 privately run hostels in Islamabad. The data collected included the 14-digit reference number obtained from each hostel owner's electricity bill, the total number of resident students, and the types and number of lights used in each case. Informal discussions revealed that these hostels are administered primarily by the owners, which implies that it is in their interest to monitor the use of electricity.

Finally, the household data on electricity consumption was collected through a questionnaire distributed among a random sample of QAU students living at the university hostels (see Appendix).[15] Among other information, they were asked to record their 14-digit electricity bill reference number and the total number of energy savers, tube-lights, bulbs, air conditioners, etc., used in their homes. Based on this information, we used the reference numbers to download each user's billing data and recorded the total number of units consumed by each household. The data represents households across 35 districts in Pakistan. Of almost 400 questionnaires distributed, only 260 were completed and returned. After accounting for those with missing information, the net number of usable questionnaires dropped to 106.

## 6. Empirical Evidence

The empirical findings are based on a comparison of electricity consumption across the public and private sectors, and a behavioral explanation for the differences observed.

### *6.1. Comparative Analysis of Public and Private Sector Consumption*

Table 2 summarizes the electricity consumption data collected from the two universities and the private sector hostels and households. The average monthly consumption per student ranges from 26.41 to 104.12 units in the QAU hostels (or 26.41 and 79 if we remove the outlier). In contrast, the average monthly consumption per student ranges from 8.93 to 27.87 units in the private hostels. The level of energy consumed at

[15] The data was collected from a sample of undergraduate, graduate and doctoral students. Although the questionnaire was also distributed among the women's hostels, the response rate there was low.

the QAU hostels is significantly higher than that consumed at the private sector hostels ($p < 0.05$).[16] Both types of hostels offer a similar level of services,[17] which implies that the public sector hostels use energy less efficiently because they consume more while providing the same services. This characterizes the problem of moral hazard, where the findings indicate that students misuse or overuse electricity in the public sector.

**Table 2: Comparative electricity consumption**

**A. Public sector**

| Hostel name | Average consumption per month in units | Total number of students | Average monthly consumption per student in units |
|---|---|---|---|
| *QAU* | | | |
| Hostel #01 | 9,903 | 265 | 37.37 |
| Hostel #02 | 6,513 | 245 | 26.59 |
| Hostel #03 | 15,863 | 215 | 73.78 |
| Hostel #04 | 17,460 | 221 | 79.00 |
| Hostel #05 | 26,550 | 255 | 104.12 |
| Hostel #06 | 14,363 | 378 | 38.00 |
| Hostel #07 | 8,407 | 237 | 35.47 |
| Hostel #08 | 10,087 | 245 | 41.17 |
| Hostel #09 | 10,740 | 247 | 43.48 |
| Three annexes | 11,732 | 249 | 47.12 |
| C-43 | 744 | 19 | 39.15 |
| C-44 | 660 | 19 | 34.74 |
| C-45 | 746 | 20 | 37.29 |
| C-46 | 586 | 19 | 30.82 |
| C-47 | 695 | 19 | 36.58 |
| C-48 | 502 | 19 | 26.41 |
| *University of Baluchistan* | | | |
| Hostel blocks 1–15 | 45,907 | 1,216 | 37.75 |
| Hostel block 16 | 8,227 | 289 | 28.47 |
| Girls' hostel | 19,373 | 339 | 57.15 |

**Continued…**

[16] This $p$-value is the corresponding value of the t-statistic of unequal means while using the monthly consumption per student as the observation. See the simple regression for statistical inference in Table 4, in which the dummy for the public sector is highly significant.

[17] In Islamabad, most private hostels offer services such as hot water in winter, cold water in summer, a fan in the room, a regular water supply and ironing facilities, etc. QAU offers the same services.

**Table 2: Comparative electricity consumption** (Continued...)

**B. Private sector**

| Hostel name | Average consumption per month in units | Total number of students | Average monthly consumption per student in units |
|---|---|---|---|
| Ali | 257 | 18 | 14.30 |
| Bilal | 210 | 10 | 21.04 |
| Chughtai | 177 | 12 | 14.72 |
| Danish | 1,728 | 62 | 27.87 |
| Ehsan | 197 | 11 | 17.95 |
| Fasal | 836 | 28 | 29.85 |
| Ghazi | 203 | 12 | 16.88 |
| Haris | 410 | 18 | 22.78 |
| Idrees | 353 | 20 | 17.67 |
| Jamsheed | 286 | 32 | 8.93 |
| Kurram | 1,341 | 52 | 25.78 |
| Liaqat | 681 | 32 | 21.28 |
| Moeen | 310 | 20 | 15.52 |
| Nashaad | 343 | 15 | 22.85 |
| Owais | 273 | 20 | 13.65 |
| Perooz | 477 | 18 | 26.51 |

**C. Household data**

| Category | Sum of average monthly consumption | Total number of individuals in household | Average monthly consumption per person |
|---|---|---|---|
| Lowest 25% | 1,962.58 | 263 | 7.46 |
| Second lowest 25% | 3,276.83 | 200 | 16.38 |
| Second highest 25% | 4,568.92 | 179 | 25.52 |
| Highest 25% | 9,316.17 | 286 | 32.57 |

Notes: Average monthly consumption = total annual consumption in a typical year / 12. Average monthly consumption per student = average monthly consumption of hostel / number of resident students.
Total number of households = 106, divided into four quartiles based on average monthly consumption of electricity. Average monthly consumption per person for each quartile = sum of average monthly consumption by all households in that quartile / total number of household members in that quartile.
***Source***: Authors' calculations.

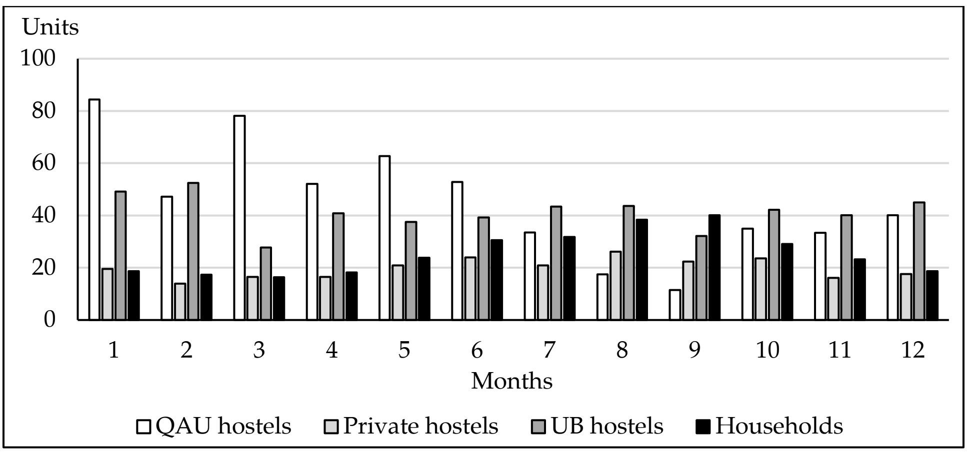
In order to check the robustness of this result, we analyze the data for another public sector university, the University of Baluchistan, and the sample of private households.[18] Table 2 shows that the average monthly consumption of electricity per student in the university's hostels

[18] The household data survey was conducted at QAU (see the questionnaire in the Appendix for details).

is not very different from that of the QAU hostels. This indicates that students' energy use behavior is similar across the two public sector universities. A comparison with the household sample shows that average consumption in the public sector is greater.

To check for the effects of outliers, we compare the average monthly consumption per person across all four types of consumers for a typical year.[19] As Figure 1 shows, in most months (except August and September), the consumption per student at QAU is greater than that of the private hostels. However, given that universities are closed in the summer, it is not suitable to compare the average consumption in these months.[20] In spite of this effect, the t-test of unequal variances shows a significant difference in the electricity consumption of the two types of hostels ($p < 0.05$). This anomaly is not robust with regard to the University of Baluchistan, where the average monthly consumption is larger than that of the private hostels all year round.

**Figure 1: Comparative electricity use per student in public sector and private sector hostels**




Similarly, if we compare the average consumption of electricity at QAU with the average consumption of the household sample, we find that the university consumes more energy than the households in all months except August and September. However, the households consume more electricity in the summer when the use of electrical

[19] This, in turn, allows us to counter any billing errors on the part of the electricity company or the effect of an individual hostel that may be an outlier.
[20] The regulations for running private hostels are not well enforced in Pakistan. It is possible that they are used for other purposes during the summer holidays, but we have no data to confirm this.

appliances such as exhaust fans, air conditioners and refrigerators increases. In comparison, the QAU hostels are usually closed during the summer. Again, this result is not robust with respect to the University of Baluchistan, which consumes more electricity per student than the households all year round.

The highest level of average consumption at QAU falls in January, possibly because students use nontraditional means of heating during the peak of winter.[21] However, if this is the case, it has an important behavioral policy implication: permitting students to use individual heaters or providing a centralized heating system might address the moral hazard problem of electricity consumption. The relatively low consumption per student during July, August and September reflects that the QAU hostels are closed, although this pattern does not emerge for the University of Baluchistan hostels.

We apply the Mann–Whitney U test for a paired comparison of per person consumption across all types of consumers. As Table 3 shows, QAU's average monthly consumption of electricity is significantly different from that of the private hostels and households; the same holds for average consumption at the University of Baluchistan. The average consumption of the two universities, however, is similar.

**Table 3: Results of Mann–Whitney U test**

| **Comparison** | **p-value** |
|---|---|
| QAU hostels vs. private hostels | 0.0027*** |
| QAU hostels vs. households | 0.0111** |
| University of Baluchistan hostels vs. private hostels | 0.0000*** |
| University of Baluchistan hostels vs. households | 0.0003*** |
| QAU hostels vs. University of Baluchistan hostels | 0.6442 |

Note: *** $p < 0.01$ and ** $p < 0.05$.
***Source***: Authors' calculations.

The results imply that (i) electricity user behavior in the public sector is different from that of the private sector, and (ii) public sector organizations do not show any significant difference in their electricity use behavior. Table 4 confirms this finding, using a dummy variable for the public sector in a simple regression.

[21] University hostels in Pakistan tend not to be heated in the winters and the use of individual heaters is not allowed. However, in the absence of administrative monitoring, students often use individual heaters.

**Table 4: Simple regression results**

| | Dependent variable = per person electricity consumption |
|---|---|
| Intercept | 19.98*** |
| Public sector dummy | 24.99*** |
| $R^2$ | 0.43 |

Note: *** $p < 0.01$.
***Source***: Authors' calculations.

### *6.2. Behavioral Explanation for Differences in Public and Private Sectors*

This section analyzes the misuse of electricity by end-users and explains in part organizational inefficiency as far as the use of electricity-efficient appliances is concerned.

#### *6.2.1. Misuse of Electricity in QAU Hostels*

Table 5 gives the results of the survey documenting the misuse of electricity in the QAU hostels. One indicator of students' conservation behavior is whether or not they switch off the lights in their room when leaving. This is measured by the number of rooms left locked with the lights inside switched on. The survey was carried out at three different times: from 0900 to 1300, from 1400 to 1700, and from 1800 to 2100 hours. The three survey rounds were conducted on three different days.

**Table 5: Misuse of electricity in QAU hostels**

| Hostel name | No. of rooms | First survey 0900 to 1300 | | | Second survey 1400 to 1700 | | | Third survey 1800 to 2100 | | | Misuse % across three surveys |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Locked rooms | Lights on | Misuse % | Locked rooms | Lights on | Misuse % | Locked rooms | Lights on | Misuse % | |
| Hostel #01 | 105 | 75 | 57 | 76.00 | 75 | 63 | 84.00 | 26 | 17 | 65.38 | 77.84 |
| Hostel #02 | 104 | 71 | 58 | 81.69 | 62 | 54 | 87.10 | 31 | 14 | 45.16 | 76.83 |
| Hostel #03 | 103 | 56 | 49 | 87.50 | 76 | 59 | 77.63 | 27 | 22 | 81.48 | 81.76 |
| Hostel #04 | 102 | 77 | 66 | 85.71 | 72 | 61 | 84.72 | 40 | 32 | 80.00 | 84.13 |
| Hostel #05 | 116 | 66 | 54 | 81.82 | 80 | 61 | 76.25 | 33 | 21 | 63.64 | 75.98 |
| Hostel #06 | 114 | 73 | 62 | 84.93 | 57 | 49 | 85.96 | 62 | 51 | 82.26 | 84.38 |
| Hostel #07 | 53 | 43 | 31 | 72.09 | 29 | 24 | 82.76 | 31 | 26 | 83.87 | 78.64 |
| Hostel #08 | 115 | 71 | 59 | 83.10 | 51 | 44 | 86.27 | 42 | 31 | 73.81 | 81.71 |
| Hostel #09 | 115 | 78 | 67 | 85.90 | 52 | 42 | 80.77 | 44 | 35 | 79.55 | 82.76 |
| Five annexes | 100 | 61 | 47 | 77.05 | 48 | 37 | 77.08 | 27 | 19 | 70.37 | 75.74 |
| Six C-type hostels | 24 | 22 | 14 | 63.64 | 18 | 11 | 61.11 | 5 | 3 | 60.00 | 62.22 |
| Average of all hostels | | | | 79.95 | | | 80.33 | | | 71.41 | 79.71 |

***Source***: Authors' calculations.

In the first two survey periods, almost 80 percent of the hostel rooms were left locked with the lights inside switched on. This decreases to around 70 percent in the third survey round, which may be because most students remain in their rooms in the evening. Hostels 1, 2 and 5 and the C-type hostels are women's hostels. We find no difference in the misuse of electricity where gender is concerned. Most students also tended to leave their fans switched on, but we did not collect data on this. Thus, students' indifference to saving electricity might partly explain the higher average consumption at QAU relative to the private hostels and households.

*6.2.2. Organizational Inefficiency in the Selection of Electrical Equipment*

In addition to consumer inefficiency, there is also organizational inefficiency in the public sector to consider. Table 6 compares the use of electricity-efficient lights across the public and private sectors.

**Table 6: Comparative use of efficient lighting appliances in public and private sectors**

| Lighting appliance | QAU hostels | | Private hostels | | Households | |
|---|---|---|---|---|---|---|
| | No. | As % of total | No. | As % of total | No. | As % of total |
| Tube-lights | 17,369 | 95.6 | 72 | 7.8 | 508 | 25.1 |
| Bulbs | 519 | 2.9 | 10 | 1.0 | 212 | 10.5 |
| Energy savers | 280 | 1.5 | 831 | 91.0 | 1,302 | 64.4 |
| Total | 18,168 | 100.0 | 913 | 100.0 | 2,022 | 100.0 |

*Source*: Authors' calculations.

Clearly, there is a considerable difference in the use of energy-efficient appliances in the two sectors. The private sector uses relatively more energy-efficient appliances than the public sector. Out of a total of 18,168 large and small lights installed at QAU, the number of tube-lights is 17,369 (95.6 percent), the number of bulbs is 519 (2.85 percent) and the number of energy savers is merely 280 (1.54 percent). In comparison, the percentage of energy savers installed in the private hostels and households is 91 and 64.4 percent, respectively. This shows that using energy-efficient appliances is still a low priority in the public sector compared to the private sector; it also reflects QAU's organizational inefficiency in this context.

## 7. Conclusion

This study was motivated by the literature on the moral hazard and "free rider" problems associated with public goods.

Based on this argument, we compare the consumption patterns of electricity across the public and private sectors, using a sample of public sector university hostels and privately run hostels to represent the two sectors. We also conduct a short survey to compare the average energy consumption of public sector hostels and households. Finally, we analyze the behavioral causes of the inefficiency that emerges – both on the part of users and the university administration – in the public sector.

There are three main findings of this study. First, the average consumption of electricity per capita in the public sector is significantly higher than in the private sector, including both the private hostels and households. This result is robust with respect to different organizations in the public sector (QAU and the University of Baluchistan). This has an important policy implication, given Pakistan's energy crisis. In order to offset the rising demand for electricity through conservation, policymakers must focus on the public sector. A twofold strategy is needed to enhance organizational efficiency in terms of monitoring the use of electricity, and addressing consumer behavior by developing norms that discourage the misuse of electricity. Employing both formal and informal institutional structures can help control the moral hazard associated with the misuse of electricity in the public sector.

Second, the survey finding that almost 80 percent of hostel rooms at QAU are left locked with the lights inside switched on implies considerable indifference to energy conservation among students. We recommend devising an efficient monitoring and punishment mechanism to discourage this consumption behavior at public sector institutions.

Finally, we find that the use of energy-efficient lighting in the public sector is a negligible 1.54 percent relative to 91 percent in private hostels and over 64 percent in the households sampled. This implies that the organizational structure at public sector institutions is significantly inefficient with regard to the use of energy savers. Expanding the scale at which energy-efficient appliances are used in this sector would help conserve electricity. However, future research is needed in this area to provide clear guidelines for overcoming the energy crisis.

**References**

Abrahamse, W., & Steg, L. (2009). How do socio-demographic and psychological factors relate to households' direct and indirect energy use and savings? *Journal of Economic Psychology*, *30*(5), 711–720.

Abrahamse, W., Steg, L., Gifford, R., & Vlek, C. (2009). Factors influencing car use for commuting and the intention to reduce it: A question of self-interest or morality? *Transportation Research Part F: Traffic Psychology and Behavior*, *12*(4), 317–324.

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2007). The effect of tailored information, goal setting and tailored feedback on household energy use, energy-related behaviors and behavioral antecedents. *Journal of Environmental Psychology*, *27*(4), 265–276.

Barr, S., Gilg, A. W., & Ford, N. (2005). The household energy gap: Examining the divide between habitual and purchase-related conservation behaviors. *Energy Policy*, *33*(11), 1425–1444.

Bowles, S. (2006). *Microeconomics: Behavior, institutions and evolution*. Princeton, NJ: Princeton University Press.

Brounen, D., Kok, N., & Quigley, J. M. (2013). Energy literacy, awareness and conservation behavior of residential households. *Energy Economics*, *38*, 42–50.

Ek, K., & Söderholm, P. (2010). The devil is in the details: Household electricity saving behavior and the role of information. *Energy Policy*, *38*(3), 1578–1587.

Feng, D., Sovacool, B. K., & Vu, K. M. (2010). The barriers to energy efficiency in China: Assessing household electricity savings and consumer behavior in Liaoning Province. *Energy Policy*, *38*(2), 1202–1209.

Guan, F., Mills, E., & Zhang, Q. (1997). Energy-efficient lighting in China: Problems and prospects. *Energy Policy*, *25*(1), 77–83.

Gyberg, P., & Palm, J. (2009). Influencing households' energy behavior: How is this done and on what premises? *Energy Policy*, *37*(7), 2807–2813.

Howard, G. S. (1997). *Ecological psychology: Creating a more Earth-friendly human nature*. Notre Dame, IN: University of Notre Dame Press.

Jamil, F., & Ahmad, E. (2010). The relationship between electricity consumption, electricity prices and GDP in Pakistan. *Energy Policy*, *38*(10), 6016–6025.

Javid, A. Y., Javid, M., & Awan, Z. A. (2013). Electricity consumption and economic growth: Evidence from Pakistan. *Economics and Business Letters*, *2*(1), 21–32.

Kessides, I. N. (2013). Chaos in power: Pakistan's electricity crisis. *Energy Policy*, *55*, 271–285.

Lindén, A.-L., Carlsson-Kanyama, A., & Eriksson, B. (2006). Efficient and inefficient aspects of residential energy behavior: What are the policy instruments for change? *Energy Policy*, *34*(14), 1918–1927.

Ma, G., Andrews-Speed, P., & Zhang, J. (2011). Study on Chinese consumer attitudes on energy-saving household appliances and government policies: Based on a questionnaire survey of residents in Chongqing, China. *Energy Procedia*, *5*, 445–451.

Ma, G., Andrews-Speed, P., & Zhang, J. (2013). Chinese consumer attitudes towards energy saving: The case of household electrical appliances in Chongqing. *Energy Policy*, *56*, 591–602.

Martinsson, J., Lundqvist, L. J., & Sundström, A. (2011). Energy saving in Swedish households. The (relative) importance of environmental attitudes. *Energy Policy*, *39*(9), 5182–5191.

National Electric Power Regulatory Authority. (2011a). *Annual report 2010–11*. Islamabad: Author.

National Electric Power Regulatory Authority. (2011b). *State of industry report 2011*. Islamabad: Author.

Pakistan Energy Sector Taskforce. (2010). *Integrated energy sector recovery report and plan*. Manila: Friends of Democratic Pakistan, Asian Development Bank and Government of Pakistan.

Pakistan, Ministry of Planning, Development and Reform. (2015). *Annual plan 2015–16* (chap. 18). Islamabad: Author.

Sardianou, E. (2007). Estimating energy conservation patterns of Greek households. *Energy Policy*, *35*(7), 3778–3791.

Scherbaum, C., Popovich, P. M., & Finlinson, S. (2008). Exploring individual-level factors related to employee energy-conservation behaviors at work. *Journal of Applied Social Psychology*, *38*(3), 818–835.

Shahbaz, M. (2011). *Electricity consumption, financial development and economic growth nexus: A revisit study of their causality in Pakistan* (MPRA Paper no. 35588). Retrieved from https://mpra.ub.uni-muenchen.de/35588/

Shahbaz, M., & Feridun, M. (2012). Electricity consumption and economic growth: Empirical evidence from Pakistan. *Quality and Quantity*, *46*(5), 1583–1599.

Siero, F. W., Bakker, A. B., Dekker, G. B., & van den Burg, M. (1996). Changing organizational energy consumption behavior through comparative feedback. *Journal of Environmental Psychology*, *16*(3), 235–246.

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407–424.

Stern, P. C., & Gardner, G. T. (1981). Psychological research and energy policy. *American Psychologist*, *36*(4), 329–342.

Thøgersen, J., & Grønhøj, A. (2010). Electricity saving in households: A social cognitive approach. *Energy Policy*, *38*(12), 7732–7743.

Ullah, A., Khan, K., & Akhtar, M. (2014). Energy intensity: A decomposition exercise for Pakistan. *Pakistan Development Review*, *53*(4), 531–549.

Wang, Z., Zhang, B., Yin, J., & Zhang, Y. (2011). Determinants and policy implications for household electricity-saving behavior: Evidence from Beijing, China. *Energy Policy*, *39*(6), 3550–3557.

Zhang, Y., Wang, Z., & Zhou, G. (2013a). Antecedents of employee electricity-saving behavior in organizations: An empirical study based on norm activation model. *Energy Policy*, *62*, 1120–1127.

Zhang, Y., Wang, Z., & Zhou G. (2013b). Determinants and implications of employee electricity-saving habit: An empirical study in China. *Applied Energy*, *112*, 1529–153.

Zhang, Y., Wang, Z., & Zhou, G. (2014). Determinants of employee electricity saving: The role of social benefits, personal benefits and organizational electricity saving climate. *Journal of Cleaner Production*, *66*, 280–287.

# *Appendix*

**Table A1: Hostel reference numbers and addresses**

| Public sector hostels | Reference no. |
|---|---|
| *QAU* | |
| Hostel #01 | 27-14131-0215600 |
| Hostel #02 | 27-14131-0215700 |
| Hostel #03 | 27-14131-0214200 |
| Hostel #04 | 27-14131-0214300 |
| Hostel #05 | 27-14131-0214500 |
| Hostel #06 | 27-14131-0052540 |
| Hostel #07 | 27-14131-0052541 |
| Hostel #08 | 27-14131-0052542 |
| Hostel #09 | 27-14131-0052543 |
| Women's annex | 27-14131-0119431 |
| Men's annex | 27-14131-0214400 |
| Women's annex H-5 | 27-14131-0214401 |
| C-43 (women's hostel) | 02-14131-0304400 |
| C-44 (women's hostel) | 02-14131-0304300 |
| C-45 (women's hostel) | 02-14131-0304200 |
| C-46 (women's hostel) | 02-14131-0304100 |
| C-47 (women's hostel) | 02-14131-0304000 |
| C-48 (women's hostel) | 02-14131-0304500 |
| *University of Baluchistan* | |
| Hostel blocks 1–15 | 24481120977600 |
| Hostel block 16 | 24481140658800 |
| Women's hostel | 24481120977700 |

| Private sector hostels | Reference no. |
|---|---|
| *Main Murree Road, Barakho, Islamabad* | |
| Ali | 10-14131-3382100 |
| Bilal | 10-14131-3472700 |
| Chughtai | 10-14131-3472400 |
| Danish | 12-14131-3917300 |
| Ehsan | 10-14131-3472500 |
| Fasal | 12-14131-3912800 |
| Ghazi | 10-14131-3472501 |
| Haris | 10-14131-3471800 |
| Idrees | 10-14131-3470300 |
| *Sector F-6, Islamabad* | |
| Jamsheed | 14-14111-3167900 |
| *Chatta Bakhtawar, Chak Shahzad, Islamabad* | |
| Kurram | 09-14119-3606300 |
| Liaqat | 09-14119-3606200 |
| Moeen | 09-14119-3608600 |
| Nashaad | 09-14119-3607800 |
| Owais | 09-14119-4008600 |
| Perooz | 09-14119-4009000 |

**Survey questionnaire**

Dear respondent,

Assalam-o-Alaikum,

This questionnaire aims to collect information on the electricity consumption of households. You are requested to spare the time to answer all the questions below to the best of your knowledge. Your cooperation will enable us to explore various dimensions of the current electricity crisis. The data will be used for research at the MPhil level at the School of Economics at Quaid-i-Azam University, Islamabad.

Thank you in advance for your cooperation.

MPhil scholar

**Personal information**

Age:

Level of education: MPhil/PhD/MSc/BA/FSc/matric/below matric

Gender: Male/female

District:

**Household information**

Family structure: Joint/nuclear

Where do you live? Official house/own house/rented/other

Total number of family members:

Below 10 years:

Between 10 and 18 years:

Above 18 years:

Total number of males:

Total number of females:

House constructed:

1 year ago/2 years ago/5 years ago/10 years ago/more than 10 years ago

Total number of rooms:

Total number of energy savers:

Total number of tube-lights:

Total number of bulbs:

Total number of air-conditioners (if any):

Does your family receive an electricity bill regularly? Yes/no

Please write down the 14-digit reference number of the electricity bill:

Please tick the relevant answer to the following questions:

My family is aware of energy-saving appliances.

Yes/no/don't know

My family members turn off the lights when there is bright sunlight.

Yes/no/don't know

All my family members know that conserving electricity decreases expenditure.

Yes/no/don't know

The elders in my family encourage electricity saving.

Yes/no/don't know

Do you think students conserve electricity at QAU in the same way they would at home?

Yes/no/don't know

*The Lahore Journal of Economics*
21 : 1 (Summer 2016): pp. 123–150

# Cost Efficiency and Total Factor Productivity: An Empirical Analysis of Pakistan's Insurance Sector

**Uzma Noreen[*] and Shabbir Ahmad[**]**

**Abstract**

*This study uses data envelopment analysis and the Malmquist index to examine the impact of financial sector reforms on the efficiency and productivity of Pakistan's insurance sector over the period 2000–09. Our results indicate that the sector is cost-inefficient, with an average score of 58 percent – an outcome of the inappropriate use of inputs. The Malmquist productivity index performs better, indicating an improvement in total factor productivity of about 3 percent on average. The second-stage Tobit regression analysis shows that large firms are relatively inefficient from an allocative perspective as they are unable to equate the marginal product of inputs with their factor prices. Furthermore, the results demonstrate that private firms are more efficient than public firms in the nonlife insurance sector. The empirical findings suggest that a more competitive environment, diversified products and innovative technology could improve the productivity of insurance firms in Pakistan.*

**Keywords**: Data envelopment analysis, efficiency, productivity, Malmquist index.

**JEL classification**: C14, D22, G22.

## 1. Introduction

The insurance sector plays a diverse role by supporting individuals, entrepreneurs and companies confronting multiple risks in addition to its role as a financial intermediary. A well-organized insurance sector is essential to promote sustainable economic growth and stabilization by fostering capital mobilization as well as efficient investment through financial markets (State Bank of Pakistan, 2005). Despite the importance of the insurance sector in Pakistan's socioeconomic development and its distinct functions relative to other

---

[*] Lecturer, International Institute of Islamic Economics, International Islamic University, Islamabad.
[**] Postdoctoral research fellow, Australian Institute of Business and Economics, University of Queensland, Australia; Assistant Professor (on leave), International Institute of Islamic Economics, International Islamic University, Islamabad.

financial institutions, it has not received much attention from policymakers. The sector remains underdeveloped and considerably small in terms of premiums, insurance density and penetration.[1]

Insurance penetration in Pakistan is substantially low at US$ 6.6 with a density of 0.7 percent in 2009 in comparison with peer countries and across the region. For instance, insurance penetration and density in India were US$ 54.3 and 5.2 percent in 2009, respectively (Swiss Re, 2010). The low density and dissemination of the insurance business in Pakistan may be a result of the country's low income per capita, general lack of awareness of the importance of insurance, the sharp increase in the cost of living, a low savings rate, inflation, and religious and other cultural factors.

Following the financial liberalization of the early 1990s, Pakistan opened its insurance market to domestic and foreign insurers. However, it was not until the early 2000s that the private insurance sector experienced a growth momentum with the development of its business and domestic firms. The insurance industry in Pakistan has become fairly developed in recent years by transforming from a monopolistic to a competitive market. Like other financial institutions, the insurance industry has also undergone deregulation, but the pace of implementation has been sluggish. As a result, it is the component of the financial sector with the highest share of government ownership (State Bank of Pakistan, 2010).

The growth of the insurance industry and its economic importance has attracted research interest in the wake of financial sector reforms.[2] While a rich and diverse body of literature focuses on insurance efficiency in developed economies, few studies have measured the performance of the insurance sector in developing countries (see, for example, Mansoor & Radam, 2000; Kao & Hwang, 2008), particularly in Pakistan. The present study examines the performance of Pakistan's insurance industry to gauge whether financial sector reforms have improved its efficiency and productivity, and to determine which factors are responsible for these.

Specifically, we concentrate on estimating its cost efficiency, decomposition (into technical and allocative efficiency) and total factor

---

[1] Insurance density is defined as the gross premium per capita and insurance penetration as the gross premium as a percentage of GDP.

[2] See, for instance: Meador, Ryan and Schellhorn (1997); Berger and Humphrey (1997); Cummins and Zi (1998); Worthington and Hurley (2002).

productivity (TFP). We also correlate various factors that influence the efficiency of the insurance sector, such as ownership structure, various services offered (life and nonlife insurance policies) and profitability indicators. Thus, the study contributes to the literature on insurance sector efficiency in developing countries in general and Pakistan in particular. It also provides insights into avenues for future research.

Section 2 provides an overview of the insurance sector in Pakistan. Section 3 reviews the relevant literature on efficiency. Section 4 discusses the methodology followed. Section 5 describes the selected variables. Section 6 analyzes the empirical results and Section 7 concludes the paper.

## 2. An Overview of Pakistan's Insurance Sector

Pakistan's insurance sector has a long history that goes back to independence, at which time, the sector was heavily dominated by foreign insurance companies. There were 77 foreign companies operating in Pakistan compared to seven domestic companies, most of them state-owned. In 1953, the Government of Pakistan set up the Pakistan Insurance Corporation to encourage local insurers to participate. Subsequently, the National Co-Insurance Scheme was launched with the support of local insurers to compete with foreign insurers by increasing the participation of local firms and helping smaller insurance firms compete with foreign rivals. As a result, the number of local firms grew to 60 while that of foreign insurance firms fell to seven. Until 1972, the insurance sector was run by private companies. However, in 1972, the life insurance sector was nationalized and the State Life Insurance Corporation was established, which took over all the assets and liabilities of the private sector. In 1976, the National Insurance Corporation was established to nationalize the general insurance business.

Like many other developing countries, Pakistan initiated financial sector reforms in the 1990s. As a result of financial deregulation, private domestic and foreign firms were allowed to enter the insurance business, although the pace of new entries remained slow. Although the government stepped in to provide a level playing field for the private sector, state-owned corporations continued to dominate the life insurance market, likely due to their large networks and customer base, expertise and low premium rates. On the other hand, the growth of nonlife insurers in the private sector was constrained by their lack of professional expertise and small capital base compared to state-owned firms (State Bank of Pakistan, 2005).

The insurance industry underwent significant structural changes after the Securities and Exchange Commission of Pakistan (SECP) introduced a series of reforms to help make the nonbanking financial sector more competitive. The most significant development was the promulgation of the Insurance Ordinance 2000, which laid down a comprehensive regulatory framework for the insurance industry. The purpose of this ordinance was to develop a dynamic, competitive insurance industry by strengthening regulatory and supervisory measures (State Bank of Pakistan, 2005).

With the implementation of the ordinance, both the public and private sectors saw a persistent improvement in their capital base, asset structure[3] and profitability. The new regulatory requirements also led to the closure of weak, unprofitable private sector insurers, particularly in the nonlife sector. In the last few years, Pakistan's insurance industry has shown signs of healthy growth.[4] Several other factors have also contributed to this: an overall stable macroeconomic environment, improved per capita income, the growth of private sector credit and the expansion of the trade sector (State Bank of Pakistan, 2008).

Table 1 shows the asset composition of the insurance sector in state-owned, private and foreign companies, both under life and nonlife insurance. Clearly, life insurance dominates the overall industry.

**Table 1: Asset structure of the insurance industry, 2001–09**

(Shares in percent)

| Shares | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|
| Life | 73.7 | 73.7 | 71.4 | 71.0 | 70.6 | 67.1 | 59.0 | 62.2 | 64.3 |
| State-owned | 71.6 | 71.2 | 67.7 | 66.8 | 65.5 | 61.5 | 52.2 | 56.2 | 56.3 |
| Private | 1.1 | 1.5 | 2.4 | 2.6 | 3.1 | 3.3 | 4.3 | 3.6 | 5.0 |
| Foreign | 0.9 | 1.0 | 1.3 | 1.6 | 2.0 | 2.3 | 0.8 | 2.4 | 3.0 |
| Nonlife | 23.4 | 23.1 | 24.5 | 25.5 | 26.6 | 30.2 | 37.3 | 33.4 | 31.7 |
| State-owned | 9.9 | 9.4 | 9.3 | 8.6 | 8.4 | 7.4 | 6.6 | 6.5 | 6.9 |
| Private | 12.7 | 12.8 | 14.2 | 15.9 | 17.4 | 22.0 | 30.0 | 26.2 | 24.0 |
| Foreign | 0.8 | 0.9 | 1.0 | 0.6 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 |
| Reinsurance | 2.9 | 3.2 | 4.1 | 3.8 | 2.8 | 2.6 | 3.2 | 3.6 | 3.2 |

[3] Under the Insurance Ordinance, the SECP required general insurers to raise their paid-up capital from PRs 120 million in 2007 to PRs 300 million by 2011. Life insurers were required to increase their paid-up capital from PRs 300 million to PRs 500 million by the end of 2011.

[4] In recent years, there has been a significant increase in gross premiums: about 17 percent in the nonlife sector and 36 percent in the life sector (Insurance Association of Pakistan, 2008).

| Shares | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|
| State-owned | 2.9 | 3.2 | 4.1 | 3.8 | 2.8 | 2.6 | 3.2 | 3.6 | 3.2 |
| Takaful | … | … | … | … | … | 0.3 | 0.5 | 0.7 | 0.8 |
| GDP share | 2.6 | 2.8 | 2.9 | 2.8 | 2.9 | 3.0 | 3.4 | 2.9 | 2.8 |
| Total assets* | 113.4 | 129.8 | 151.4 | 174.6 | 201.7 | 246.1 | 325.1 | 341.4 | 386.8 |

* Assets in billion rupees.
***Source***: State Bank of Pakistan, *Financial Stability Review* for 2007/08 and 2009/10.

The life insurance business is still dominated by publicly owned companies, which constitute about 56 percent of the life insurance business in Pakistan. Nonlife insurance constitutes only 31 percent of the insurance industry, although its share has grown significantly from 23.4 percent in 2001 to 31.3 percent in 2009. Notably, the bulk of the nonlife business is owned by the private sector compared to the life insurance subsector. As the last row of the table shows, there has been substantial growth in the assets of the insurance industry during 2001–09.

Table 2 presents the capital adequacy measures of the nonlife insurance sector, including the ratio of capital to total assets, equity growth rate and the growth rate of total assets. On average, the nonlife insurance sector has performed well on these indicators during 2002–09. The equity of (nonlife) insurance companies has grown at an average rate of 26.3 percent, while asset growth has remained about 25.3 percent per annum.

**Table 2: Capital adequacy measures of nonlife insurance sector**

| Year | Capital/total assets | Growth rate of equity | Growth rate of assets |
|---|---|---|---|
| 2002 | 17.0 | 18.1 | 18.7 |
| 2003 | 15.0 | 15.3 | 13.8 |
| 2004 | 15.0 | 19.1 | 45.8 |
| 2005 | 12.0 | 27.4 | 22.1 |
| 2006 | 11.0 | 59.3 | 34.8 |
| 2007 | 7.8 | 72.2 | 67.1 |
| 2008 | 10.3 | -9.8 | -5.9 |
| 2009 | 10.3 | 8.8 | 7.9 |
| Average | 12.3 | 26.3 | 25.5 |

***Source***: State Bank of Pakistan, *Financial Stability Review* for 2007/08 and 2009/10.

Table 3 presents the same financial indicators for the life insurance sector, which has also shown considerable improvement in terms of performance. Equity and assets have grown at remarkable rates in recent years, having increased to 28 percent and 13.5 percent, respectively.

**Table 3: Capital adequacy measures of life insurance sector**

| Year | Capital/total assets | Growth rate of equity | Growth rate of assets |
|---|---|---|---|
| 2002 | 1.4 | 18.6 | 14.4 |
| 2003 | 1.7 | 20.2 | 12.6 |
| 2004 | 1.5 | 37.6 | 15.1 |
| 2005 | 1.5 | 31.5 | 14.9 |
| 2006 | 1.7 | 28.9 | 15.4 |
| 2007 | 1.5 | 40.4 | 17.5 |
| 2008 | 1.8 | 2.0 | 11.6 |
| 2009 | 1.9 | 44.9 | 6.8 |
| Average | 1.6 | 28.0 | 13.5 |

***Source***: State Bank of Pakistan, *Financial Stability Review* for 2007/08 and 2009/10.

Summing up, the insurance sector in Pakistan indicates healthy trends in recent years. The liberalization of the insurance industry has reduced the share of the public sector, particularly in nonlife insurance, which has encouraged the private sector to enter the market and create a more competitive environment.

## 3. The Literature on the Efficiency of the Insurance Sector

Part of what motivates this study is our aim to evaluate the impact of deregulation and financial liberalization on the efficiency and performance of financial institutions. Several studies measure insurance efficiency using parametric and nonparametric approaches, but most concentrate on developed countries, particularly on the US insurance industry (see Amel, Barnes, Panetta & Salleo, 2004). These studies focus on efficiency, productivity and scale economies in the US insurance industry and try to correlate these with the pre- and post-deregulation period. For instance, Cummins and Weiss (1993), Gardner and Grace (1993), and Yuengert (1993) measure the X-efficiency of either life or property insurance in the US. Cummins, Weiss and Zi (1999) use a frontier analysis to examine efficiency differences across various organizational forms in the US. Cummins, Tennyson and Weiss (1999) apply the data envelopment analysis (DEA) method to study the efficiency performance of mergers and acquisitions.

Studies focusing on the performance of the Canadian insurance sector include Bernstein (1999), who analyzes TFP growth in Canadian life insurance over the period 1979–89, and McIntosh (1998), who uses data for 1988–91 to assess the scale efficiency of the Canadian insurance industry. Both studies show that the Canadian insurance sector has improved significantly in terms of efficiency and productivity.

Rees and Kessner (1999) evaluate the direct effects of the pre-1994 European Union (EU) policy of deregulation on the efficiency of British and German life insurance companies. They find that the latter's level of efficiency (48 percent) remained lower than that of the UK market (57 percent). Moreover, the regulatory reforms of the EU Commission have improved buyers' welfare relative to the highly regulated German market. Noulas, Lazaradis, Hatzigayios and Lyroudi (2001) analyze the impact of the legal framework on the efficiency of nonlife insurance in Greece and report an average score of 64.69 percent. Further, they point out that high operating costs and low productivity are the main problems facing the Greek insurance sector. They suggest mergers and acquisitions in the sector to gain benefits from large-scale operations, thus improving efficiency.

Other studies on Europe focus on productivity measurement using the Malmquist index and stochastic frontier analysis. They show that both efficiency and productivity in these countries altered significantly due to deregulation – see Cummins, Turchetti and Weiss (1996) for Italy; Cummins and Rubio-Misas (2006) for Spain; Fenn et al. (2008) for Europe; Bikker and van Leuvensteijn (2008) for the Netherlands.

Although most of the literature centers on the performance of either the US or other developed countries, from 2000 onward many studies have investigated the efficiency and productivity of the insurance sector in Asia. Fukuyama (1997) looks at changes in the production efficiency and productivity of the life insurance sector in Japan, focusing on ownership structures under different economic circumstances. Karim and Jhantasana (2005) apply stochastic frontier analysis to evaluate cost efficiency and its relationship with profitability in Thailand's life insurance industry. The study highlights that firm size is positively correlated with mean efficiency, implying that larger firms adopt best practices. As discussed above, many studies have focused on insurance sector efficiency and productivity in developed as well as developing countries. While all the key studies note that deregulation has improved the efficiency and productivity of the insurance sector worldwide, there is significant variation in efficiency scores across countries.

The literature concludes that the efficiency of the US insurance sector is primarily a result of scale operations, and the mergers and acquisitions that occurred after liberalization and deregulation. Similarly, the European insurance sector has also improved significantly in terms of efficiency and productivity – partly a result of the consolidation of different companies as well as the diversification and competitive environment generated by recent financial liberalization. Studies on Asian economies share the same premise in terms of efficiency and productivity measures, but their results vary significantly across countries – see Mansoor and Radam (2000); Karim and Jhantasana (2005); Hao and Chou (2005); Jeng and Lai (2005).

Numerous studies have examined Pakistan's banking efficiency to compare and evaluate the sector's performance before and after deregulation – see di Patti and Hardy (2005); Burki and Niazi (2006); Burki and Ahmad (2010). In recent years, the significant growth of the country's insurance sector has warranted further analysis of its efficiency and productivity. This study aims to fill this gap.

## 4. Methodological Framework

The idea of cost efficiency and its decomposition into technical and allocative efficiency was first presented by Farrell (1957), who pointed out that a producer's main concern was how to expand the firm's level of output without having to use more resources. A firm is deemed technically inefficient if it fails to produce the maximum possible output from a given level of input, while allocative inefficiency means that the firm is not using an optimal input mix to produce a certain level of output at given prices (Coelli, 1996). The former arises due to poor management and inferior input quality, while the latter occurs when the firm fails to equate its marginal products with the respective input prices.

A number of frontier techniques are used to measure efficiency, which are further classified as parametric or nonparametric approaches.[5] Both have specific advantages and disadvantages (see Cummins & Zi, 1998).[6] We investigate insurance efficiency within the DEA framework,

---

[5] Parametric approaches include the stochastic frontier approach, the thick frontier approach and the distribution-free approach. Nonparametric approaches include data envelopment analysis and free disposal hull.

[6] The parametric approach entails specifying the functional form of production, cost and profit frontiers, and certain distributional assumptions about the error term. On the other hand, the nonparametric approach does not assume any specific functional form for evaluating efficiency

which is a nonparametric mathematical programming approach to frontier estimation and is based on the work of Farrell (1957) and its extensions.[7] The main advantage of this approach is that it demands less data and does not impose the specification of any functional form. Further, DEA enables one to analyze the efficiency of each firm separately, making it easier to identify efficiency and productivity changes firm by firm (Cummins & Xie, 2008). The main disadvantage associated with DEA is that it does not separate inefficiency from the error term and considers the entire deviation from the frontier to be inefficiency. However, this drawback can be countered partly by using post-efficiency regression analysis (Worthington & Hurley, 2002).

The DEA method involves constructing a nonparametric best-practice frontier or a piecewise linear surface obtained from the observed dataset, which serves as the reference point or benchmark for comparison. The resultant efficiency measure, ranging between 0 (least efficient) and 1 (most efficient), depicts the distance from each unit to the frontier.

### *4.1. Measurement of Cost Efficiency*

Cost efficiency measures how close a firm's cost is to what a best-practice firm's cost would be in producing the same output bundle under the same conditions. The cost (or economic) efficiency of a firm consists of allocative efficiency and technical efficiency. The nonparametric cost-minimizing approach used in this study allows us to decompose cost efficiency into its different components.

We specify an input price vector to calculate a measure of cost efficiency for each firm by solving this envelopment form of the following linear programming (LP) problem (see Fare, Grosskopf, Norris & Zhang, 1994):

Min $w_i' l_i^*$ subject to:

$$-q_i + Q\lambda \geq 0$$

$$l_i^* - L\lambda \geq 0$$

---

and, therefore, does not take into account the error term. Obviously, both approaches have certain advantages and disadvantages.

[7] DEA is used widely in measuring banking efficiency. For a survey of the DEA literature, see Knox Lovell (1993), Ali and Seiford (1993), and Seiford (1996). For a survey of DEA in banking, see Berger and Humphrey (1997).

$NI'\lambda = 1$

$\lambda \geq 0$ (1)

The symbol $l_i^*$ in this relationship is the cost-minimizing vector of input quantities (calculated by LP); $w_i$ and $q_i$ represent input prices and output levels, respectively, for the *i*th decision-making unit (DMU); *Q* is the (*m*×*n*) matrix of outputs; *L* is the (*k*×*n*) matrix of inputs; *NI* is an (*n*×1) vector; and λ is an (*n*×1) vector of constants, where $n$ is the number of DMUs. The cost efficiency of each observation indicates the amount by which the cost of production rises due to technical and allocative inefficiency. In other words, the cost efficiency is the ratio of the minimum cost to the observed cost. The allocative efficiency (AE) is calculated residually by dividing cost efficiency (CE) by technical efficiency (TE), such that AE = CE/TE.

To measure technical efficiency, we specify an input-oriented LP problem of the form

$min_{\gamma,\lambda}\gamma$ subject to:

$-q_i + Q\lambda \geq 0$

$\gamma l_i - L\lambda \geq 0$

$\lambda \geq 0$ (2)

where $\gamma$ is a scalar, $\lambda$ is an (*n*×1) vector of constants, *Q* is the (*m*×*n*) matrix of outputs and $L$ is the (*k*×*n*) matrix of inputs. For the *i*th DMU, the vectors $l_i$ and $q_i$ represent inputs and outputs, respectively. After solving the LP problem given above, the value of $\gamma$ will represent the efficiency score of the *i*th DMU, where the condition $\gamma \leq 1$ will hold, with a value equal to 1 indicating a technically efficient unit on the frontier. To obtain the value of $\gamma$ for each DMU, the LP problem will be solved *n* times.

Given the assumption of constant returns to scale, the LP problem (2) does not fully envelop the dataset and thus enlarges the feasible region. Therefore, in the second round, we relax the assumption of constant returns to scale by introducing the convexity constraint $NI'\lambda = 1$ in (2) and writing it in a modified form, where *NI* is an (*n*×1) vector while all other symbols are as defined above. A measure of scale efficiency is obtained by substituting the $NI'\lambda = 1$ restriction with $NI'\lambda \leq 1$ in (3):

Min $\gamma$

$\gamma, \lambda$ subject to

$-q + Q\lambda \geq 0$

$\gamma l_i - L\lambda \geq 0$

$NI'\lambda = 1$

$\lambda \geq 0$ (3)

A common difficulty encountered when measuring technical efficiency using DEA is known as input-slacks and output-slacks, which are sections of the piecewise linear frontier that run parallel to the x-axis or y-axis and may lead to inaccurate measurement of technical, pure technical and scale efficiency in the LP problems specified above. Therefore, it is better to use the multistage methodology suggested by Coelli (1996), which resolves the problem of slacks.

### *4.2. Measurement of TFP*

Productivity change is defined as the ratio change in outputs to the change in inputs. We use the Malmquist index to measure changes in efficiency and productivity over time (see, for example, Caves, Christensen & Diewert, 1982). One can measure the productivity change between periods $t$ and $t$ + 1 relative to either technology in period $t$, $(M_0^t)$, or relative to technology in period $t+1$, $(M_0^{t+1})$, using distance functions:

Following Caves et al. (1982):

$$M_0^t = \left[\frac{D_0^t(x^{t+1},y^{t+1})}{D_0^t(x^t,y^t)}\right] \text{ and } M_0^{t+1} = \left[\frac{D_0^{t+1}(x^{t+1},y^{t+1})}{D_0^{t+1}(x^t,y^t)}\right]$$

where the subscript 0 refers to output orientation, $D^t$ $(D^{t+1})$ represents the distance function at time $t$ ($t$ + 1), and $x^t$ $(x^{t+1})$ and $y^t$ $(y^{t+1})$ are the input and output vectors at time $t$ and $t$ + 1. The productivity change measure between two time periods generally changes if the reference technology is different (Cummins & Weiss, 1996). To avoid an arbitrary choice of reference technology, following Fare et al. (1994), the Malmquist productivity index can be described as the geometric mean of these two indices:

$$M_0^t(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\left\{\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)}\right\} \times \left\{\frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)}\right\}\right]^{1/2} \quad (4)$$

When this index exceeds unity, it indicates an increase in productivity between periods $t$ and $t + 1$, while an index value of less than unity implies a decline in productivity. A value equal to unity means no change. Fare et al. (1994) decompose this change in productivity into two components (the change due to technical efficiency and the change due to technology) by factoring as follows:

$$M_0^t(x^{t+1}, y^{t+1}, x^t, y^t) = \left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)}\right)\left[\left\{\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})}\right\} \times \left\{\frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)}\right\}\right]^{1/2} \quad (5)$$

The first component measures the efficiency change, while the second measures technological change over time. The change in technical efficiency shows the shift in the firm's position relative to the production frontier over time. The value of the efficiency change will be greater than 1 if technical efficiency is higher in period $t + 1$ than in period $t$; if efficiency deteriorates between the two periods, then the value will be less than 1.

The second factor, technological change, captures the shift in technology (that is, in the production frontier itself) over time. Thus, values of technological change greater than 1 imply technological progress and values less than 1 indicate technological regress (Cummins & Weiss, 1996).

### *4.3. Second-Stage Regression Analysis: Tobit Model*

In this section, we estimate a Tobit regression model to correlate the sample firms' characteristics with other exogenous factors influencing the efficiency of the insurance industry.[8] Since our efficiency estimates are continuous and censored at 0, we estimate Tobit regressions in the second-stage analysis, the standard form of which is:

$$y_{it}^* = x_{it}'\beta + \varepsilon_{it}$$

$$y_{it} = y_{it}^* \text{ if } y_{it}^* > 0$$

$$y_{it} = 0 \text{ if } y_{it}^* \leq 0 \quad (6)$$

[8] In regression analyses, the DEA-based calculated scores of technical, allocative and cost efficiency are included as dependent variables in three separate regressions.

where $y_{it}^*$ is the latent variable and $y_{it}$ is the efficiency of the individual insurance company in each year. The panel Tobit regression being estimated is:

$$y_{it} = \alpha_0 + \sum_{i=1}^{k} \alpha_i z_{it} + \varepsilon_{it} \quad (7)$$

We use technical, allocative and cost efficiency as the dependent variables obtained in the first-stage analysis; $Z_{it}$ is a vector of explanatory variables such as the size of the firm, return on assets (ROA), market share and dummies for ownership and business type to explain the efficiency differentials prevailing due to these characteristics.

## 5. Dataset and Variables

Our data on the insurance industry was drawn from the annual reports of insurance companies for the period 2000 through 2009. The sample consists of the 12 largest insurers operating in Pakistan, which accounts for 84 percent of the insurance market overall in terms of premium.[9] Two firms are from the life insurance sector and hold 85 percent of its market share; the remaining ten firms are general insurers that comprise 84 percent of the nonlife insurance sector's market share. A summary of inputs, outputs, input prices and control variables is given in Table 4.

In the literature on insurance efficiency, the choice of input-output variables is subject to intense debate (see Sealey & Lindley, 1977, for a detailed discussion). Eling and Luhnen (2010b) review 80 studies on insurance efficiency and find that 46 have used claims/benefits as an output while 32 have used the premium as a proxy for output. However, there is no consensus on which is the more appropriate variable as both proxies have their own advantages and disadvantages (see Yuengert, 1993; Diacon, Starkey & O'Brien, 2002).

In this study, we use two outputs – net premium income[10] (Q1) and invested assets (Q2) – in line with the insurance efficiency literature (see Hardwick, 1997; Noulas et al., 2001; Greene & Segal, 2004; Hao & Chou, 2005). The net premium (Q1) is a proxy output for the risk

---

[9] In 2009, the total number of insurance companies in Pakistan was 53. We have selected only the top 12 because the remaining firms were too small in terms of size and market share.
[10] The data on the net premium (calculated by excluding reinsurance expenses from the gross earned premium) income is taken from the "statement of premiums" section of insurance firms' annual reports.

pooling/bearing function as policyholders buy risk protection through insurance contracts by paying the premium. The value of the firm's invested assets[11] (Q2) is a proxy measuring the intermediation function[12] of insurance firms (Cummins & Xie, 2008; Eling & Luhnen, 2010a).

**Table 4: Summary statistics for inputs, input prices and outputs**

| Variable | Mean | Median | SD |
|---|---|---|---|
| *Outputs (PRs million)* | | | |
| Q1 Net premium | 2,510 | 580 | 4,433 |
| Q2 Invested assets | 11,343 | 943 | 30,585 |
| *Inputs* | | | |
| L1 Labor (number of employees) | 754 | 272 | 1,121 |
| L2 Total fixed assets (PRs million) | 156 | 63 | 191 |
| L3 Business services (PRs million) | 699 | 87 | 1,746 |
| L4 Equity capital (PRs million) | 2,328 | 722 | 3,860 |
| *Input prices* | | | |
| P1 Price of labor (PRs) | 342,368 | 316,769 | 175,771 |
| P2 Price of total fixed assets (total fixed assets/total assets) | 0.207 | 0.178 | 0.149 |
| P3 Price of business services (business services/total assets) | 0.060 | 0.040 | 0.066 |
| P4 Price of equity capital (total equity/total assets) | 0.359 | 0.332 | 0.214 |
| *Control variables* | | | |
| Z1 Total assets (PRs million) | 32,284 | 2,141 | 200,260 |
| Z2 Return on assets (net income/total assets) | 0.0894 | 0.071 | 0.137 |
| Z3 Equity/total assets (ratio) | 0.359 | 0.332 | 0.214 |
| Z4 Market share (in %, calculated on the basis of premium share of firm in market) | 7.338 | 1.837 | 11.458 |
| Z5 Natural log of total assets | 9.500 | 9.330 | 0.787 |
| Firms/observations | | 12/120 | |

***Source***: Authors' calculations.

The choice of input variables is not as controversial as that of outputs in the insurance industry. Three input variables – labor, capital (physical and equity)[13] and business services (materials) – are used most commonly to measure the efficiency of this sector (Greene & Segal, 2004; Karim & Jhantasana, 2005; Jeng, Lai & McNamara, 2007; Cummins & Xie,

[11] This consists of investment in equities, mutual funds, government securities and fixed income securities, etc. The data on invested assets is taken from the balance sheets of individual firms.
[12] Intermediation activities consist of investing the amount of premiums received until the claim payment date; most of the insurer's net profit is generated from investing in marketable securities.
[13] This is important because insurers need to maintain equity capital to pay out any claims to their policyholders if losses exceed the expected limits.

2008). Eling and Luhnen (2010b) find that 61 out of 95 studies reviewed use at least labor and capital as inputs, and most add a third category (generally business services).

We include four inputs: labor (L1), total fixed assets (L2), business services (L3) (which comprise operating expenses, excluding salaries and depreciation) and financial capital (L4). The insurance industry is labor-intensive and expenditure on labor makes up almost a third of the firm's total expenses.[14] Labor input is measured by the number of employees at each firm. The price of labor (W1) is the sum of total salaries, wages and benefits to employees divided by the total number of employees working at that firm.

We include physical capital (L2) as an input by taking the value of fixed assets (equipment and real estate, etc.). The price (W2) of total fixed assets is calculated by dividing depreciation expenses by total fixed assets. The third input, operating expenses (L3), includes expenditure on real estate, printing and stationery, computers, communication, travel, legal fees, management and advertisement, excluding salaries and depreciation costs. The price of operating expenses (W3) is calculated by dividing business services by total assets. Equity capital (L4) is considered the most important input for insurers. On the basis of the data available, we measure the price of equity capital (W4) by dividing equity capital by total assets.

Insurers, financial analysts and policymakers often need to know which factors determine efficiency differences among firms. Identifying these is important to analyze efficiency and productivity differentials across insurance firms to aid their decision making. We include different variables to examine the relationship between firm size, market share and business environment. For instance, the ROA variable is used to investigate the relationship between profitability and efficiency (Greene & Segal, 2004).

A common hypothesis in insurance analysis is that larger firms are more efficient than smaller firms based on economies of scale. To capture the effect of firm size on efficiency, we use the log of total assets; to determine the interaction between efficiency changes and firm size, we include the squared term for total assets. Hao and Chou (2005) argue that firms with a larger market share collect more revenue and profits and,

[14] Some studies divide labor into two categories: agent labor and home office labor (Fukuyama, 1997; Cummins et al., 1998; Karim & Jhantasana, 2005). Here, we look at total labor as one category because firms' annual reports do not give separate information on home office and agent labor.

hence, are more efficient than firms with a smaller market share. Market share is thus considered an indicator of the firm's efficiency. The equity-to-total-assets ratio gauges the impact of different capital ratios on the firm's efficiency. We also include two dummy variables to capture ownership structure (whether the firm is publicly or privately owned) and business type (life or nonlife insurance), which may also have some effect on efficiency.

We hypothesize that higher profitability (ROA), market share and leverage (equity to total assets) have a positive effect on firm efficiency, but we are not certain about the impact of size (measured by total assets), ownership structure and business type.

## 6. Results and Discussion

This section discusses the results for cost efficiency obtained using DEA[15] and its decomposition into technical, allocative and cost efficiency. We also measure TFP by decomposing it into technical efficiency change and technological change.

### *6.1. Efficiency Scores*

The average efficiency scores of the sample firms for each year are presented in Table 5. These indicate that, on average, the insurance industry is technically efficient. However, its allocative efficiency is somewhat lower, consequently leading to cost inefficiency. We find mixed trends for technical efficiency, although it increases from 96 percent in 2000 to 97 percent in 2009. The average cost efficiency of the sector is only 57 percent over 2000–09, showing that insurance firms could have reduced their expenditure by about 43 percent from the existing level to produce the same output.

[15] We use the Data Envelopment Analysis Program developed by Coelli (1996) to measure cost efficiency and the Malmquist index.

**Table 5: Average efficiency scores, 2000–09**

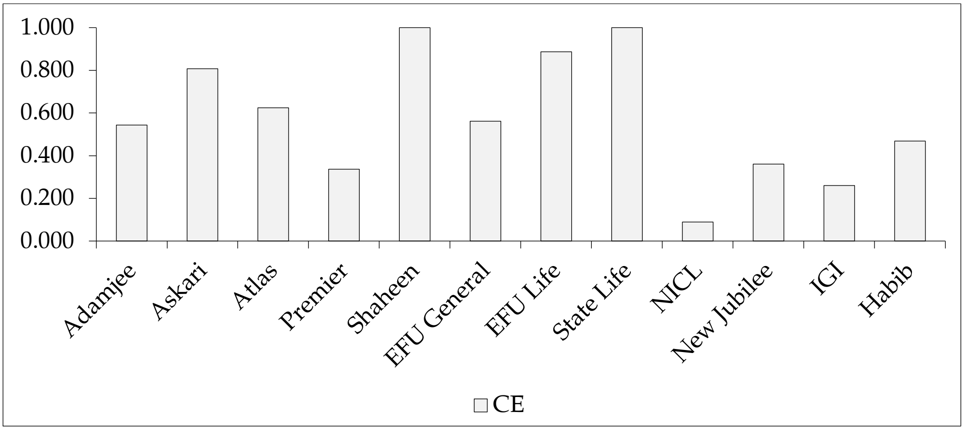
| Year | Technical efficiency | Allocative efficiency | Cost efficiency |
|---|---|---|---|
| 2000 | 0.964 | 0.668 | 0.643 |
| 2001 | 0.972 | 0.701 | 0.681 |
| 2002 | 0.952 | 0.690 | 0.655 |
| 2003 | 0.924 | 0.668 | 0.610 |
| 2004 | 0.935 | 0.690 | 0.647 |
| 2005 | 0.956 | 0.631 | 0.612 |
| 2006 | 0.932 | 0.549 | 0.525 |
| 2007 | 0.985 | 0.489 | 0.480 |
| 2008 | 0.958 | 0.461 | 0.447 |
| 2009 | 0.972 | 0.484 | 0.477 |
| Mean | 0.955 | 0.603 | 0.577 |

***Source***: Authors' calculations.

Notably, the insurance sector's allocative efficiency remains about 40 percent during the period of analysis, which may have contributed significantly to its cost inefficiency. Both allocative and cost efficiency decrease continuously after 2004. The low level of allocative efficiency reveals that firms have not done very well in choosing a cost-minimizing combination of inputs. In other words, they have failed to equalize the marginal rate of technical substitution to the factor price ratio. This implies that their factor inputs are not close substitutes. Keeping in view these results, we can conclude that the insurance industry has generally failed to allocate its resources efficiently.

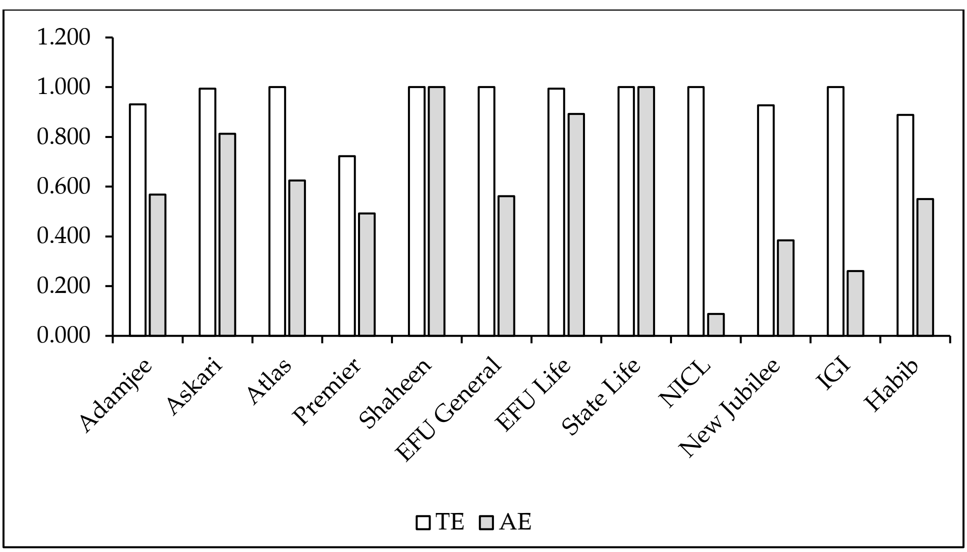
Figures 1 and 2 illustrate the cost, technical and allocative efficiency of each firm. Of all the firms, State Life remains 100 percent cost-efficient: it has several advantages in being the largest market share holder in terms of branch networks and holds more than 60 percent of the insurance sector's total assets. Similarly, the sector has improved its business, ultimately enhancing its operational efficiency and profitability over time. Having successfully overcome its operational expenditures may have increased the overall efficiency of the industry.

**Figure 1: Average cost efficiency, 2000–09**




State Life, EFU and NICL are the most technically efficient firms. All three are larger than the others in terms of business volume and outreach, which may have put them at an advantage in optimizing their input resources. Premier remains on the lowest frontier with the smallest efficiency score (0.416). Similarly, Habib and Askari are less efficient than their peer firms. One reason for the low efficiency of these firms may be their limited business diversification, which can hinder firms from using optimal input levels compared to larger firms. To catch up with the efficient firms, these companies need to employ a more efficient input combination.

**Figure 2: Average allocative and technical efficiency, 2000–09**



It is important to note that allocative efficiency dominates cost efficiency in our sample. Even firms with the highest technical efficiency show low cost efficiency because they remain less efficient so far as resource allocation is concerned. These results are not unexpected: the insurance sector is highly monopolized and this monopolistic structure and product differentiation may have led firms to be less careful in using their resources efficiently. However, the more competitive environment that has begun to emerge post-deregulation may improve the resource allocation mechanism of the industry in coming years.

### *6.2. Malmquist Index Results*

This section presents the results for TFP and its components. There are several methods for computing the Malmquist productivity index (see, for example, Fare et al., 1994). We estimate the output-oriented Malmquist index in this study, which is based on DEA, using a balanced panel of 12 insurance companies to yield the productivity index and its components for Pakistan's insurance sector. Table 6 presents the average results for the Malmquist index and its components, that is, changes in technical efficiency, technology and TFP.

If the value of the Malmquist index and any of its components exceeds unity, this indicates an improvement in performance. A value equal to unity implies no change and a value less than unity reflects a deterioration in performance. The results show that, on average, the insurance sector's TFP (and its components) rose by 3 percent annually. Similarly, there was a significant improvement in technical efficiency, which grew by 2.7 percent on average, consistent with our previous results for cost efficiency obtained on the basis of DEA. However, we find no significant improvement in technological change, which rose on average by a negligible 0.2 percent annually.

**Table 6: Average Malmquist index results, 2001–09**

| Year | EFFCH | TECHCH | TFPCH |
|---|---|---|---|
| 2001 | 1.064 | 1.002 | 1.066 |
| 2002 | 1.049 | 0.757 | 0.794 |
| 2003 | 0.943 | 1.081 | 1.024 |
| 2004 | 1.072 | 1.020 | 1.093 |
| 2005 | 1.096 | 1.125 | 1.233 |
| 2006 | 0.952 | 1.166 | 1.118 |
| 2007 | 1.096 | 0.945 | 1.035 |
| 2008 | 0.962 | 1.040 | 1.002 |
| 2009 | 1.029 | 0.949 | 0.976 |
| Mean | 1.027 | 1.002 | 1.030 |

Note: EFFCH = efficiency change, TECHCH = technological change, TFPCH = total factor productivity change.
*Source*: Authors' calculations.

As the table shows, there was a decline in productivity in 2002, which may have been an outcome of the prudent regulations introduced by the SECP, implemented at the end of 2001. Consequently, the insurance sector also had to comply with these regulations and adjust its operations according to business rules – this may have caused firm productivity to slip. However, soon after 2002, the insurance industry was able to raise its productivity standards in a more competitive environment, which continued to improve in the following years. We also observe that productivity fell in 2009, which may have been a consequence of declining economic growth overall, a high inflation rate, floods, the global financial crisis and Pakistan's internal security situation.

### *6.3. Determinants of Efficiency*

In the second stage, we perform a panel Tobit regression analysis to correlate firms' characteristics and exogenous factors with the performance of the sample insurers.[16] The empirical results are presented in Table 7.

[16] A Tobit specification was used to accommodate the efficiency score left censored at 0.

**Table 7: Panel Tobit estimates**

| | Technical efficiency | | Allocative efficiency | | Cost efficiency | |
|---|---|---|---|---|---|---|
| | **Coeff.** | **SE (p-value)** | **Coeff.** | **SE (p-value)** | **Coeff.** | **SE (p-value)** |
| Total assets | 0.078 | 0.254 (0.759) | -1.669 | 0.262 (0.000) | -1.543 | 0.290 (0.000) |
| Total assets-sq. | -0.006 | 0.013 (0.655) | 0.066 | 0.014 (0.000) | 0.058 | 0.016 (0.000) |
| Equity to total assets | 0.002 | 0.073 (0.969) | -0.923 | 0.075 (0.000) | -0.881 | 0.084 (0.000) |
| Market share | 0.002 | 0.002 (0.418) | 0.014 | 0.002 (0.000) | 0.016 | 0.003 (0.000) |
| Return on assets | 0.039 | 0.083 (0.644) | 0.166 | 0.086 (0.001) | 0.182 | 0.095 (0.060) |
| Ownership | -0.067 | 0.040 (0.103) | -0.016 | 0.042 (0.693) | -0.040 | 0.047 (0.389) |
| Business type | -0.038 | 0.037 (0.312) | -0.166 | 0.038 (0.144) | -0.191 | 0.043 (0.000) |
| 2001 | 0.011 | 0.396 (0.776) | 0.052 | 0.040 (0.203) | 0.058 | 0.045 (0.201) |
| 2002 | -0.006 | 0.040 (0.886) | 0.048 | 0.041 (0.244) | 0.044 | 0.046 (0.342) |
| 2003 | -0.028 | 0.041 (0.496) | 0.083 | 0.042 (0.052) | 0.058 | 0.047 (0.218) |
| 2004 | -0.015 | 0.041 (0.722) | 0.133 | 0.043 (0.003) | 0.124 | 0.048 (0.011) |
| 2005 | 0.010 | 0.042 (0.814) | 0.158 | 0.044 (0.000) | 0.174 | 0.049 (0.001) |
| 2006 | -0.009 | 0.043 (0.832) | 0.217 | 0.045 (0.000) | 0.228 | 0.050 (0.000) |
| 2007 | 0.053 | 0.046 (0.257) | 0.250 | 0.047 (0.000) | 0.284 | 0.052 (0.000) |
| 2008 | 0.033 | 0.050 (0.517) | 0.216 | 0.051 (0.000) | 0.245 | 0.058 (0.000) |
| 2009 | 0.050 | 0.049 (0.318) | 0.247 | 0.051 (0.000) | 0.287 | 0.057 (0.000) |
| Cons. | 0.836 | 1.178 (0.480) | 10.66 | 1.214 (0.000) | 10.15 | 1.348 (0.000) |
| Observations | 120 | | 120 | | 120 | |
| Log likelihood | 110.13 | | 106.53 | | 93.96 | |
| LR $chi^2$ (16) | 12.66 | | 275.85 | | 254.01 | |

Note: We estimate the Tobit year fixed effects and Tobit random effects using a time trend; the results for both are very similar.
***Source***: Authors' calculations.

Asset size has an inverse relationship with the performance indicator, implying that larger firms have failed to produce cheaper output vis-à-vis smaller firms. The former's suboptimal use of inputs has increased the cost of producing various insurance services. These results are not unusual if we look at the market structure of the industry, which is highly skewed. This trend continues as the square of the size variable is positive, which emphasizes the promotion of the insurance industry in a more competitive environment.

We also include a leverage (equity to total assets) variable to verify whether firms with more liquidity perform better than those with less liquidity. In contrast to studies such as Cummins and Nini (2002) and Cummins et al. (2007), our results do not support the theory that firms with higher leverage are more efficient than those with less leverage. One of the reasons for this contradiction may be the limited data available. However, what is noticeable is that small insurance companies have a higher capital-to-assets ratio than larger firms, but are less efficient, perhaps due to the limited scale operations discussed earlier.

We introduce a dummy variable for ownership, equal to 1 for private firms and 0 for state-owned firms. The results indicate that state-owned companies lag behind private firms in terms of cost management, particularly in the nonlife sector. However, the dummy variable for the nature of the business shows that life insurance firms are more efficient than nonlife insurance firms. We include ROA to verify the relationship between the firm's profitability and efficiency. The results indicate that more profitable firms tend to be more efficient. Market share also has a significant and positive relationship with the efficiency of an insurance firm.

The cost efficiency of the insurance industry follows a mixed trend over the period of analysis. The technical efficiency results indicate that the insurance sector has been able to produce a given output level using a minimum level of inputs, and expand its operations significantly on the whole. However, allocative efficiency severely affects the overall cost efficiency, possibly given the highly concentrated and regulated nature of the insurance sector in the past.

## 7. Conclusion

This study provides a comprehensive efficiency analysis of Pakistan's insurance sector, which has developed fairly well post-liberalization and deregulation. We analyze and decompose the cost efficiency of a representative sample of Pakistani insurance firms over the period 2000 to 2009. Our DEA-based results indicate that the sample firms have remained technically efficient. The insurance sector shows 95.5 percent efficiency on average over the period of analysis, but experiences allocative inefficiency, which appears to be the main driver of cost inefficiency overall.

We find mixed trends for cost efficiency in the insurance industry, which may be a sign of the continuing impact of reforms that were initiated to make the sector more competitive and self-reliant. The prevalence of allocative inefficiencies in the insurance sector is likely due to its highly concentrated and regulated nature in the past. It is therefore necessary to remove these distortions as far as possible. The Malmquist productivity index components indicate that technical efficiency has been the main contributor to changes in the sector's productivity. However, we find no evidence that changes in technology itself have improved overall productivity. This suggests a need for innovative and diversified products in the insurance industry in Pakistan.

The main implication of this study is that firms find it difficult to apply cost-effective techniques. Firms should rationalize their expenditure on unprofitable branches and overused labor by adopting modern technologies and rescaling their operations. Incorporating automated processes and empowering clients to transact directly would help in this context. In the changing socioeconomic environment, firms should rethink the traditional products on offer and develop new product lines to cater to the evolving needs of clients and businesses, for instance, crop insurance, livestock insurance and different health insurance products. The insurance business in Pakistan is heavily concentrated: policymakers need to ensure a more competitive environment and market-based options for this sector. Business diversification is likely to have a positive impact on productivity.

While this study estimates the efficiencies of insurance firms in the post-reform period after the Insurance Ordinance 2000 was implemented, future research could extend this to include the performance of firms in the pre-reform period. Furthermore, decomposing productivity into its various components, such as scale and scope economies, could provide key policy insights, given the sector's rapid growth in recent years.

## References

Ali, A. I., & Seiford, L. M. (1993). The mathematical programming approach to efficiency analysis. In H. O. Fried, C. A. Knox Lovell & S. S. Schmidt (Eds.), *The measurement of productive efficiency: Techniques and applications* (pp. 20–59). New York: Oxford University Press.

Amel, D., Barnes, C., Panetta, F., & Salleo, C. (2004). Consolidation and efficiency in the financial sector: A review of the international evidence. *Journal of Banking and Finance*, *28*(10), 2493–2519.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: international survey and directions for future research. *European Journal of Operational Research*, *98*(2), 175–212.

Bernstein, J. I. (1999). Total factor productivity growth in the Canadian life insurance industry: 1979–1989. *Canadian Journal of Economics*, *32*(2), 500–517.

Bikker, J. A., & van Leuvensteijn, M. (2008). Competition and efficiency in the Dutch life insurance industry. *Applied Economics*, *40*, 2063–2084.

Burki, A. A., & Ahmad, S. (2010). Bank governance changes in Pakistan: Is there a performance effect? *Journal of Economics and Business*, *62*(2), 129–146.

Burki, A. A., & Niazi, G. S. K. (2006). *Impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan* (CMER Working Paper No. 06-49). Lahore: Lahore University of Management Sciences.

Caves, D., Christensen, L., & Diewert, W. (1982). The economic theory of index numbers and the measurement of input, output and productivity. *Econometrica*, *50*(6), 1393–1414.

Coelli, T. (1996). *A guide to DEAP version 2.1: A data envelopment analysis (computer) program* (CEPA Working Paper No. 96/08). Armidale, NSW: University of New England.

Cummins, J. D., & Nini, G. (2002). Optimal capital utilization by financial firms: Evidence from the property-liability insurance industry. *Journal of Financial Services Research*, *21*(1), 15–53.

Cummins, J. D., & Rubio-Misas, M. (2006). Deregulation, consolidation and efficiency: Evidence from the Spanish insurance industry. *Journal of Money, Credit and Banking*, *38*(2), 323–355.

Cummins, J. D., & Weiss, M. A. (1993). Measuring cost efficiency in the property-liability insurance industry. *Journal of Banking and Finance*, *17*(2–3), 463–481.

Cummins, J. D., & Weiss, M. A. (1998). *Analyzing firm performance in the insurance industry using frontier efficiency methods* (Working Paper No. 98-22). Philadelphia, PA: University of Pennsylvania, Wharton Financial Institutions Center.

Cummins, J. D., & Xie, X. (2008). Mergers and acquisitions in the US property-liability insurance industry: Productivity and efficiency effects. *Journal of Banking and Finance*, *32*(1), 30–55.

Cummins, J. D., & Zi, H. (1998). Comparison of frontier efficiency methods: An application to the US life insurance industry. *Journal of Productivity Analysis*, *10*(2), 131–152.

Cummins, J. D., Tennyson, S., & Weiss M. A. (1999). Consolidation and efficiency in the US life insurance industry. *Journal of Banking and Finance*, *23*(2–4), 325–357.

Cummins, J. D., Turchetti, G., & Weiss, M. A. (1996). *Productivity and technical efficiency in the Italian insurance industry* (Working Paper No. 96-10). Philadelphia, PA: University of Pennsylvania, Wharton Financial Institutions Center.

Cummins, J. D., Weiss, M. A., & Zi, H. (1999). Organizational form and efficiency: The coexistence of stock and mutual property-liability insurers. *Management Science*, *45*, 1254–1269.

Diacon, S. R., Starkey, K., & O'Brien, C. (2002). Size and efficiency in European long-term insurance companies: An international comparison. *The Geneva Papers on Risk and Insurance*, *27*(3), 444–466.

di Patti, E. B., & Hardy, D. C. (2005). Financial sector liberalization, bank privatization and efficiency: Evidence from Pakistan. *Journal of Banking and Finance*, *29*(8–9), 2381–2406.

Eling, M., & Luhnen, M. (2010a). Efficiency in the international insurance industry: A cross-country comparison. *Journal of Banking and Finance*, *34*(7), 1497–1509.

Eling, M., & Luhnen, M. (2010b). Frontier efficiency methodologies to measure performance in the insurance industry: Overview, systematization and recent developments. *The Geneva Papers*, *35*, 217–265.

Fare, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994). Productivity growth, technical progress, and efficiency change in industrialized countries. *American Economic Review*, *84*(1), 66–83.

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society, Series A (General)*, 120(3), 253–290.

Fenn, P., Vencappa, D., Diacon, S., Klumpes, P., & O'Brien, C. (2008). Market structure and the efficiency of European insurance companies: A stochastic frontier analysis. *Journal of Banking and Finance*, *32*(1), 86–100.

Fukuyama, H. (1997). Investigating productive efficiency and productivity changes of Japanese life insurance companies. *Pacific-Basin Finance Journal*, *5*(4), 481–509.

Gardner, L. A., & Grace, M. F. (1993). X-efficiency in the US life insurance industry. *Journal of Banking and Finance*, *17*(2–3), 497–510.

Greene, W. H., & Segal, D. (2004). Profitability and efficiency in the US life insurance industry. *Journal of Productivity Analysis*, *21*, 229–247.

Hao, J. C. J., & Chou, L.-Y. (2005). The estimation of efficiency for life insurance industry: The case in Taiwan. *Journal of Asian Economics*, *16*(5), 847–860.

Hardwick, P. (1997). Measuring cost inefficiency in the UK life insurance industry. *Applied Financial Economics*, *7*(1), 37–44.

Insurance Association of Pakistan. (2008). *Insurance yearbook, 2007–2008* (pp. 20–27). Karachi: Author.

Jeng, V., & Lai, G. C. (2005). Ownership structure, agency costs, specialization and efficiency: Analysis of keiretsu and independent insurers in the Japanese nonlife insurance industry. *Journal of Risk and Insurance*, *72*(1), 105–158.

Jeng, V., Lai, G. C., & McNamara, M. J. (2007). Efficiency and demutualization: Evidence from the US life insurance industry in the 1980s and 1990s. *Journal of Risk and Insurance*, *74*(3), 683–711.

Kao, C., & Hwang, S.-N. (2008). Efficiency decomposition in two-stage data envelopment analysis: An application to nonlife insurance companies in Taiwan. *European Journal of Operational Research*, *185*(1), 418–429.

Karim, M. Z., & Jhantasana, C. (2005). Cost efficiency and profitability in Thailand's life insurance industry: A stochastic cost frontier approach. *International Journal of Applied Econometrics and Quantitative Studies*, *2*, 19–36.

Knox Lovell, C. A. (1993). Production frontiers and productive efficiency. In H. O. Fried, C. A. Knox Lovell & S. S. Schmidt (Eds.), *The measurement of productive efficiency: Techniques and applications* (pp. 3–67). New York: Oxford University Press.

Mansoor, S. A., & Radam, A. (2000). Productivity and efficiency performance of the Malaysian life insurance industry. *Jurnal Ekonomi Malaysia*, *34*, 93–105.

McIntosh, J. (1998). Scale efficiency in a dynamic model of Canadian insurance companies. *Journal of Risk and Insurance*, *65*(2), 303–317.

Meador, J. W., Ryan, H. E., & Schellhorn, C. D. (1997). *Product focus versus diversification: Estimates of X-efficiency for the US life insurance industry* (Working Paper No. 97-16). Philadelphia, PA: University of Pennsylvania, Wharton Financial Institutions Center.

Noulas, A. G., Lazaradis, J., Hatzigayios, T., & Lyroudi, K. (2001). Nonparametric production frontier approach to the study of efficiency of nonlife insurance companies in Greece. *Journal of Financial Management and Analysis*, *14*, 19–26.

Rees, R., & Kessner, E. (1999). Regulation and efficiency in European insurance markets. *Economic Policy*, *14*(29), 363–397.

Sealey, C. W, & Lindley, J. T. (1977). Inputs, outputs and a theory of production and cost at depository financial institutions. *The Journal of Finance*, *32*(4), 1251–1266.

Seiford, L. M. (1996). Data envelopment analysis: The evolution of the state of the art (1978–1995). *Journal of Productivity Analysis*, *7*(2–3), 99–137.

State Bank of Pakistan. (2005). Developments in the insurance sector. In *Pakistan financial sector assessment 2005* (pp. 105–121). Karachi: Author.

State Bank of Pakistan. (2008). Risk assessment of the insurance sector. In *Financial Stability Review 2007–08* (pp. 213–225). Karachi: Author.

State Bank of Pakistan. (2010). *Financial stability review 2009–10*. Karachi: Author.

Swiss Re. (2010). *World insurance in 2009: Premiums dipped, but industry capital improved* (Sigma No. 2/2010). Zurich: Author.

Worthington, A. C., & Hurley, E. V. (2002). Cost efficiency in Australian general insurers: A nonparametric approach. *The British Accounting Review*, *34*(2), 89–108.

Yuengert, A. M. (1993). The measurement of efficiency in life insurance: Estimates of a mixed normal-gamma error model. *Journal of Banking and Finance*, *17*(2–3), 483–496.

*The Lahore Journal of Economics*
21 : 1 (Summer 2016): pp. 151–182

# Was the SAFTA (Phase II) Revision Successful? A Case Study of Bangladesh's RMG Exports to India

**Namra Awais***

**Abstract**

*Bangladesh has experienced phenomenal growth in its readymade garments (RMG) sector and become the world's second-largest RMG exporter after China. Given the country's robust position in this context, many observers expected that the SAFTA revisions under Phase II – which allowed Bangladesh's apparel products duty-free and quota-free access to the Indian market – would lead to a surge in Indian imports of apparel and RMGs. However, this did not materialize. This study analyzes Indo–Bangladesh trade in RMGs in order to determine the underlying reasons for this anomaly. Using Balassa's concept of revealed comparative advantage, the study establishes the strong comparative advantage enjoyed by Bangladesh though the results also show a lack of effective trade complementarity between the two countries. Overall, the findings suggest that India enjoys economies of scale in RMG production – as Bangladesh's competitor, India has artificially maintained a secure regime through a combination of domestic export incentives and nontariff measures to restrain imports.*

**Keywords**: Bangladesh, India, comparative advantage, liberalization, RMGs, SAFTA.

**JEL classification**: F13, F14, F15.

## 1. Introduction

As low-technology manufactures, textiles and garments (T&G) occupy a pivotal place in the export portfolio of the larger economies within the South Asian Association for Regional Cooperation (SAARC), including Bangladesh, India, Pakistan and Sri Lanka (Table 1). Of these, Bangladesh has experienced phenomenal export growth in the readymade garments (RMG) sector, becoming the world's second-largest exporter of clothing after China. This particular segment has become the backbone of the economy, with the clothing sector accounting for 78 percent of total exports in 2014

* Teaching and Research Fellow, Graduate Institute of Development Studies, Lahore School of Economics.

compared to a negligible 0.001 percent in 1976. Today, despite the fact that Bangladesh is categorized as a least developed country (LDC), its RMG sector is seen as a promising success story. The sector employs approximately 4 million people, of which 85 percent are women.

**Table 1: Clothing and textiles as a percentage of total merchandise exports**

| | Bangladesh | | India | | Pakistan | | Sri Lanka | |
|---|---|---|---|---|---|---|---|---|
| Year | Clothing | Textiles | Clothing | Textiles | Clothing | Textiles | Clothing | Textiles |
| 2009 | 78.84 | 5.87 | 7.28 | 5.52 | 19.16 | 37.15 | 44.45 | 1.89 |
| 2010 | 77.39 | 6.58 | 4.96 | 5.67 | 18.36 | 36.66 | 40.58 | 2.00 |
| 2011 | 78.62 | 7.77 | 4.84 | 5.06 | 17.93 | 35.78 | 41.14 | 1.93 |
| 2012 | 78.75 | 6.50 | 4.66 | 5.15 | 17.15 | 35.43 | 42.70 | 2.41 |
| 2013 | 80.72 | 6.50 | 5.38 | 6.04 | 18.11 | 37.18 | 44.19 | 2.31 |

*Source*: Author's calculations based on data from the WTO Statistics Database.

Bangladesh was not traditionally an exporter of textiles and garments (T&G): till the 1970s, its exports were dominated by jute and jute products. However, it was a beneficiary of the Multi-Fiber Agreement, which controlled clothing quotas and supported underdeveloped countries by giving them favorable market access. Thus, in the 1980s, investors took advantage of the export quotas, making T&G a strategic sector of Bangladesh's economy. The phasing out of the quota system in 2005, however, gave rise to skepticism about the competitiveness of Bangladesh's RMGs and its prospects of continued success (Joarder, Hossain & Hakim, 2010).

Interestingly, Bangladesh survived the phasing-out period and remains internationally competitive to date (ibid). One of the reasons for this is that the country has preferential market access to its major export destinations, which are now sources of enhanced revenue. It enjoys preferential treatment under the Everything But Arms (EBA) initiative in the European Union (EU) and respective Generalized System of Preference (GSP) schemes in countries including Canada, Japan and the US (Rahman, 2014).

In 2011, under the South Asian Free Trade Agreement (SAFTA) Revision Phase II,[1] India allowed similar special concessions to the LDCs in the region. The Phase II revision aimed mainly at reducing the sensitive list[2] maintained by SAFTA signatories by 20 percent. India granted the highest

[1] This was effective from 1 January 2012.

[2] Sensitive lists include those products that are of special interest to member countries and are, therefore, exempted from low SAFTA tariffs.

concessions by reducing its sensitive list by 95 percent for the LDCs in the region. This entailed liberalizing its tariff lines from 480 items to 25 items, inter alia, and providing duty-free-quota-free access (DFQF) to 46 tariff lines pertaining to RMGs of which it had been cautious (Table A1 in the Appendix). For the nonleast developing countries (NLDCs) in the region, which included Pakistan and Sri Lanka, the sensitive list was reduced from 868 items to 614 items.

This DFQF access to the Indian market was seen as a window of opportunity for Bangladesh's RMG exports to penetrate the largest market in the region. Unfortunately, this failed to materialize. The aims of this study are to analyze pre- and post-revision trends in India's RMG imports from Bangladesh for the periods 2010–12 (before revision) and 2013–15 (after revision), and to investigate the underlying factors hindering the growth of these imports. Accordingly, we focus on the following questions:

- If both India and Bangladesh export the same products in the RMG sector, which country enjoys a higher comparative advantage in production?
- Is there any trade complementarity between Bangladesh and India, i.e., does the former export RMGs while the latter imports RMGs?

To address these questions, we calculate the revealed comparative advantage (RCA) for both countries' RMG exports, using data at the HC 4-digit level for the period 2010–14. We also construct a trade complementarity index (TCI) using data at HC 6-digit level for the same years. The study reveals that Bangladesh enjoys a higher RCA in all major product lines and thus has a higher comparative advantage than India in RMG production. The TCI shows that there is no trade complementarity between the two countries: both export RMGs and are essentially competitors.

This paper is divided into 6 sections. Section 2 reviews the subject literature. Section 3 presents an overview of bilateral trade relations between Bangladesh and India. Section 4 calculates the RCA and demonstrates the strong position enjoyed by Bangladesh. It also analyzes pre- and post-revision trends in Indo–Bangladesh trade in RMGs. Section 5 explains why Bangladesh's RMGs have failed to penetrate the Indian market by calculating the TCI, comparing costs in both countries and examining the prevalence of nontariff barriers (NTBs) in India. Section 6 concludes the study.

## 2. Literature Review

Following the success of other regional blocs, seven South Asian countries – Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka – formed SAARC in 1985 to cooperate mutually on economic, social and cultural fronts. With economic cooperation being at the heart of the agreement, a framework for regional integration – the South Asian Preferential Trade Agreement (SAPTA) – was approved in 1993 and implemented in 1995. This was considered a precursor to SAFTA. SAPTA was based on a positive-list approach, with negotiations centering on individual products. This proved time-consuming, while political rivalries meant that the most commonly traded goods were not considered for preferential tariffs. Ultimately, the agreement became redundant (Kelegama, 2007).

SAFTA began in 2006 and was based on a negative-list approach with an eight-year phasing-out period. Although the agreement was better articulated and envisaged a vigorous trade environment – that would come about by facilitating specialization, reducing tariffs, removing NTBs, expanding production capacities and improving technology – it has not lived up to its potential. Intra-SAARC trade remains around 4 percent of the total trade in the region (Taneja, Ray, Kaushal & Chowdhury, 2011). Nadkarni (2014) calculates the total value of intra-regional SAARC exports to be US$ 3 billion in 2013, which is far smaller than it should be.

The core reason for this is that SAFTA has applied a sensitive-list approach whereby members maintain a list of items that are deprived of concessional tariffs to protect local industries not fit for competition. This has restricted trade: Weerakoon and Thennakoon (2006) and Weerakoon (2010) estimate that 53 percent of South Asia's total intra-regional import trade is excluded from the Tariff Liberalization Program under SAFTA. Indo–Pakistan rivalry is cited as a preeminent reason for the stunted success of SAARC: were the two countries able to maintain cordial relations, the region's trade prospects would be magnified.

Numerous studies – using gravity models, computable general equilibrium and partial equilibrium – have attempted to ascertain the economic gains of regional integration in South Asia. Their findings indicate mixed results. Coulibaly (2005) concludes that SAFTA should result in net export creation, whereas Srinivasan and Canonero (1995) and Banik and Sengupta (1997) show that the impact of free trade is far larger for smaller countries in the region than for India. Contrary to this, Rahman (2003) finds the dummy variable for South Asia to be insignificant, indicating that regional integration is unlikely to generate significant trade expansion in this region.

Bayson, Panagariya and Pitigala (2006) argue that SAFTA has a fairly high likelihood of diverting rather than creating trade, given that member countries' most efficient suppliers were unlikely to be located in the region. Their study highlights three main reasons for this. First, any free trade agreement among SAARC countries is economically unattractive if India is excluded, considering their nominal share of GDP and world trade flows. Second, all countries except for Sri Lanka maintain high tariffs. Third, the political economy of selection, whereby certain sectors are excluded from preferential tariffs, gives rise to strong lobbies advocating their respective interests. The spirit of a regional trade agreement (RTA) is, essentially, to "create trade," thereby enhancing welfare.

However, critics have raised concerns that this might not reduce import prices in domestic markets – for instance, Indian exporters might find Bangladesh a "captive market" for their exports and charge prices at par with international markets (World Bank, 2006). Rahman, Shadat and Das (2006) show that Bangladesh, India and Pakistan would gain more from an RTA than Nepal, the Maldives and Sri Lanka. In terms of real income, however, India and Sri Lanka would perform better than Bangladesh.

The SAFTA (Phase II) revisions are an attempt by member countries to strengthen intra-regional trade. India has granted the most concessions to the region's LDCs, which gives them a chance to access South Asia's largest market. Among these, Bangladesh is a particularly interesting case for two reasons. First, it has always been subject to a bilateral trade deficit with India and this presents an opportunity to reduce the trade gap. Second, Bangladesh is the second-largest exporter of RMGs in the world; preferential access to India could provide another potential export market.

Given the high protection level of around 65.5 percent until 2004, it was difficult for Bangladeshi garments to penetrate the Indian market (World Bank, 2006). However, under preferential market access, Bangladeshi garments have begun to compete with domestic manufacturers in India and interested Indian investors, who have invested around US$ 80 million in 35 garment factories in Bangladesh (Islam, Raihan & Mollah, 2013). This concession has given the country an opportunity to explore the third-largest export destination for its garment commodities, following the EU and the US (ibid).

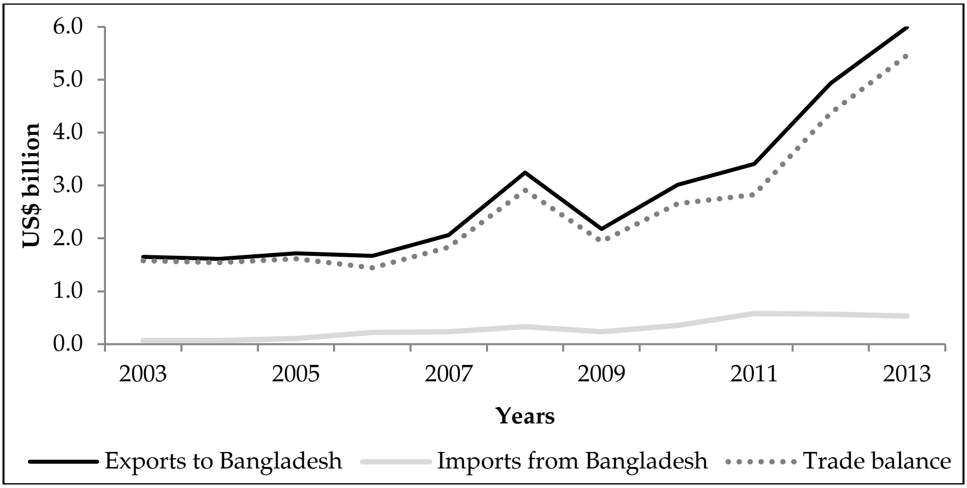
However, the extent to which Bangladesh will benefit from these concessions is still questionable due to inherent issues within SAARC. The lack of similarity between Bangladesh's exports and India's imports restricts their trade complementarity (Basu & Datta, 2007). This is tested empirically by Mayer and Wood (2001), using cross-country regressions. They conclude that South Asia's exports are concentrated in labor-intensive products, in which the region has a comparative advantage. Wood and Calandrino (2001) emphasize that the low level of education in India means that its comparative advantage in manufacturing still lies in labor-intensive products such as clothing and footwear.

Other impediments to the success of these concessions are concentrated in NTBs. The literature on Indo–Bangladesh trade agrees on the need to enhance infrastructure – the region is notorious for weak border trade. Cross-border transactions incur substantial costs in terms of time and expense, thereby exacerbating inefficiencies. Although many documentation procedures have been simplified, the transaction costs of India's exports to Bangladesh have risen (De & Ghosh, 2008). Infrastructural and transport improvements are, therefore, key to increasing trade between the two countries (Acharya & Marwaha, 2012).

## 3. Bilateral Trade Relations Between Bangladesh and India

As the largest market in SAARC, India enjoys a trade surplus with all other countries in the region, especially those that are LDCs. The largest volume of trade is with Bangladesh, which translates into the largest trade surplus. Overall, India's trade surplus with Bangladesh has increased from US$ 1.6 billion to US$ 5.5 billion over 2003–13, reflecting a deterioration in the latter's trade deficit with India (see Figure 1). Although India is one of Bangladesh's top five importers, its exports to Bangladesh are only 2 percent of its total exports. Thus, trade relations between the two countries are skewed in favor of India.

**Figure 1: Bilateral trade between India and Bangladesh**




*Source*: UN Comtrade.

During 2003 to 2013, India's exports to Bangladesh showed an increasing trend. In 2003, they amounted to US$ 1.65 billion, rising to US$ 3.24 billion by 2008. Despite a slight decline in 2009 to US$ 2.18 billion, exports continued to increase thereafter, reaching US$ 6 billion in 2013. In comparison, India's imports from Bangladesh have remained low, amounting to US$ 71 million in 2003 and increasing to US$ 530 million in 2013. Imports rose from US$ 358 million in 2010 to US$ 579 million in 2013, remaining in this range. This can be attributed to the SAFTA Phase II revisions under which the number of items on the sensitive list was reduced to merely 25. However, the impact was not all that significant: observers had expected this provision of duty-free market access to increase Bangladesh's exports to India by 134 percent (De, Raihan & Kathuria, 2012). Although Bangladesh has a comparative advantage over India in RMG production, its share of exports to India is meagre compared to that of other countries.

The Standard International Trade Classification (SITC) Revision 3 system categorizes all tradable commodities into ten groups. This helps us examine trends among the commodity groups that dominate India's exports to and imports from Bangladesh over the period 2003–13 (Tables A2 and A3 in the Appendix). The composition of India's exports to Bangladesh is restricted to a few commodity groups. The main sectors are food and live animals (SITC 0), crude materials (inedible, except fuels) (SITC 2), chemicals and related products (SITC 5), manufactured goods classified by material (SITC 6), and machinery and transport equipment (SITC 7). Exports of food and live animals have declined from 38.30 percent in 2003 to 21.80 percent in 2013, while chemicals and related products have risen from 8.61 percent to 11.43 percent.

The major change has been the surge in crude materials (inedible, except fuels), which rose from 2.45 percent to 14.74 percent. Manufactured goods classified by material and machinery and transport equipment have maintained a consistent share over this period, averaging 27 percent and 14 percent, respectively. The main Indian export to Bangladesh is cotton (HS code 52), the core raw material for RMGs. Cotton exports to Bangladesh comprise 27 percent of India's total cotton exports (Table 2).

**Table 2: India's cotton exports to Bangladesh**

| Cotton exports | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 |
|---|---|---|---|---|---|
| Value (US$ million) | 455.29 | 1,081.39 | 1,076.74 | 1,505.76 | 1,576.84 |
| As percentage of total exports | 18.71 | 33.35 | 28.42 | 29.27 | 25.57 |

*Source*: India, Ministry of Commerce and Industry.

Table 3 indicates an increasing trend in Bangladesh's cotton imports from 2009/10 to 2013/14, which rose from US$ 3,397 million to US$ 5,351 million. India is its second-largest source of cotton imports, accounting for 31 percent after 40 percent imported from China in 2013/14. Other main import sources include the US, Pakistan and Thailand.

**Table 3: Cotton imports of Bangladesh**

| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 |
|---|---|---|---|---|---|
| Cotton imports (US$ million) | 3,397.0 | 4,321.0 | 4,628.2 | 5,288.5 | 5,350.8 |
| **Major sources of cotton imports for Bangladesh (percentage)** | | | | | |
| China | 39.2 | 41.4 | 39.5 | 40.9 | 40.1 |
| India | 27.6 | 22.2 | 30.0 | 31.4 | 30.8 |
| Pakistan | 13.2 | 13.1 | 12.5 | 11.6 | 11.1 |
| US | 4.8 | 7.7 | 1.8 | 2.0 | 1.8 |
| Thailand | 1.8 | 1.6 | 1.2 | 1.3 | 1.1 |

*Source*: International Trade Statistics.

Imports from Bangladesh are concentrated in food and live animals (SITC 0), crude materials (inedible, except fuels) (SITC 2), chemicals and related products (SITC 5), manufactured goods classified by material (SITC 6) and miscellaneous manufactured articles (SITC 8). There has been a decline in crude materials (inedible, except fuels) from 29.26 percent in 2003 to 16.82 percent in 2013. Imports of chemicals and related products have deteriorated heavily from 40.45 percent in 2003 to 2.06 percent in 2013. Indian imports of manufactured goods and miscellaneous manufactured articles have increased from an average of 6–7 percent in 2003 to 31.32 and 32.94 percent in 2008 and 2013, respectively (Table A3 in the Appendix). The main items under these heads include leather and leather products, textile yarns and fabrics, and nonmetal mineral manufactures.

Table 4 gives the percentage contribution of major products to these classifications. Over the years, the shares of leather and nonmetal manufactures have declined, whereas that of textile yarns and fabrics has increased – largely explaining the increase in imports under these heads. Other than these, the main imports include fertilizers and jute products (De et al., 2012).

**Table 4: Composition of manufactured goods and miscellaneous manufactured articles (percent)**

| Description | 2003 | 2008 | 2013 |
|---|---|---|---|
| Leather and leather goods | 20.66 | 7.05 | 3.78 |
| Textile yarns and fabrics | 60.35 | 75.36 | 82.75 |
| Nonmetal mineral manufactures | 16.85 | 15.90 | 9.98 |
| Other | 2.13 | 1.69 | 3.48 |
| Total | 100.00 | 100.00 | 100.00 |

*Source*: UN Comtrade.

## 4. Was the SAFTA (Phase II) Revision Successful?

This section gauges whether the preferential treatment granted to Bangladesh by India has been successful. We calculate the RCA index for RMGs for both countries to ascertain which country enjoys a higher comparative advantage. Based on the rationale of comparative advantage, we examine the trends in trade under the concessions granted by India.

### 4.1. RCA Index

RCA is used to assess a country's export potential for a particular commodity, thus indicating which exports warrant expansion. The RCA index of country $i$ for product $j$ is measured by the product's share of the country's exports in relation to its share of world trade:

$$RCA_{ij} = \frac{X_{ij}/X_{it}}{X_{wj}/X_{wt}}$$

where $X_{ij}$ and $X_{wj}$ are, respectively, the value of country $i$'s exports of product $j$ and world exports of product $j$. $X_{it}$ and $X_{wt}$ refer to the country's total exports and world total exports, respectively. A value of less than unity implies that the country has a revealed comparative disadvantage in the product. Similarly, if the index exceeds unity, the country is said to have an RCA in the product.

Bangladesh has an average RCA of 33.3 percent in the production of RMGs compared to 2.3 percent for India (Table 5). This is because it has the distinctive benefit of a stock of cheap labor: the average monthly minimum wage is US$ 68, which is the second-lowest in the world after Sri Lanka (International Labour Organization, 2014). This is accompanied by a set of supportive government policies, including cash compensation schemes, bonded warehouses, back-to-back letters of credit, duty drawback schemes and tax concessions, all of which make Bangladesh's RMG exports competitive in the international market.

**Table 5: RCA for clothing**

| Country | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| Bangladesh | 31.28 | 33.51 | 34.50 | 34.30 | 33.00 |
| India | 2.89 | 2.15 | 2.13 | 2.03 | 2.20 |

***Source***: Author's calculations based on data from the WTO Statistics Database.

To investigate the competitive edge enjoyed by Bangladesh, we calculate its RCA at the HC 4-digit level for 11 products that dominate the country's exports (Table 6).[3] For all these product lines, Bangladesh has a considerably high comparative advantage compared to India. The highest

[3] Product lines with exports increasing by US$ 500,000 (for Bangladesh) are used for calculation.

RCA is in men's shirts (6205), averaging around 83.5 compared to 4.1 for India. This is followed by knitted or crocheted t-shirts or vests (6109), with an average RCA of 70.6 as opposed to 3.4 for India, and by other products including jerseys and cardigans (6110), babies' garments and clothing (6111), and noncrocheted men's ensembles, suits, shirts and shorts (6203).

Of all the product lines mentioned, India has the largest advantage in the production of women's shirts and blouses (6206), averaging 7.8, although Bangladesh still has an RCA of 25.6. This is interesting because, for this particular product line, Indian exports outperform those of Bangladesh in absolute terms, amounting to US$ 1.58 million in 2014 compared to US$ 0.57 million for the latter (Table 7).

**Table 6: RCA at HS code 4-digit level**

| HS code | Description | Bangladesh | | | | | India | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2011 | 2012 | 2013 | 2014 | 2010 | 2011 | 2012 | 2013 | 2014 |
| 6109 | T-shirts or vests, knitted or crocheted (K/C) | 70.97 | 75.09 | 73.88 | 67.03 | 66.14 | 3.33 | 3.15 | 3.42 | 3.42 | 3.59 |
| 6110 | Jerseys, pullovers, cardigans | 52.78 | 52.69 | 47.21 | 44.93 | 41.87 | 0.36 | 0.33 | 0.27 | 0.29 | 0.35 |
| 6104 | Women's suits, dresses, skirts and similar items | 17.83 | 17.44 | 15.33 | 14.50 | 17.45 | 1.04 | 0.89 | 0.80 | 0.70 | 0.97 |
| 6105 | Men's shirts (K/C) | 35.45 | 34.35 | 33.66 | 38.37 | 44.84 | 5.02 | 4.04 | 3.65 | 3.08 | 3.38 |
| 6108 | Women's slips, pajamas, etc. | 24.54 | 26.15 | 29.97 | 27.51 | 26.41 | 1.96 | 2.42 | 2.48 | 2.40 | 2.43 |
| 6111 | Babies' garments (K/C) | 42.65 | 48.74 | 49.84 | 49.04 | 45.33 | 4.80 | 5.18 | 5.50 | 5.42 | 5.59 |
| 6203 | Men's suits, ensembles, shirts, shorts and similar items | 43.35 | 43.86 | 47.27 | 47.24 | 50.65 | 1.31 | 1.29 | 1.41 | 1.36 | 1.36 |
| 6204 | Women's suits, dresses, skirts and similar items (not K/C) | 25.46 | 28.06 | 33.44 | 32.74 | 27.47 | 2.69 | 2.85 | 2.70 | 2.40 | 2.30 |
| 6205 | Men's shirts | 76.10 | 82.12 | 90.03 | 87.54 | 81.71 | 4.93 | 4.41 | 4.14 | 3.62 | 3.54 |
| 6206 | Women's blouses, shirts, shirt-blouses | 25.43 | 26.08 | 27.43 | 25.81 | 23.43 | 9.48 | 8.84 | 7.10 | 6.83 | 6.75 |
| 6201 | Men's overcoats, cloaks, wind-jackets and similar items | 20.88 | 20.72 | 22.69 | 21.05 | 20.10 | 0.08 | 0.06 | 0.07 | 0.09 | 0.08 |

***Source***: Author's calculations based on data from the ITC database.

**Table 7: Exports of women's blouses, shirts and shirt-blouses**

| Country | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| Bangladesh | 367,607 | 448,758 | 466,724 | 553,558 | 573,509 |
| India | 1,468,865 | 1,709,830 | 1,287,118 | 1,596,554 | 1,579,752 |

Note: Items classified under HS code 6206. All values in US$ million.
*Source*: ITC database.

### 4.2. *Extent of Tariff Concessions Under the Revision*

Tariffs on textiles and clothing are lower in India than in Bangladesh (Table 8), but India maintains a dual tariff structure in these product groups whereby the charge is either ad valorem or a specific duty (whichever is higher). Pasha and Imran (2012) point out that the general specific duties are far higher, sometimes exceeding 100 percent, especially on value-added products; in some cases, the amount is even more than the binding tariffs under the World Trade Organization (WTO). They calculate the effective and ad valorem tariffs on textiles in India (see Table 9), which gives us a fair evaluation of the rates being charged.

**Table 8: Average MFN-applied tariffs (percent)**

| Product group | Bangladesh | India |
|---|---|---|
| Textiles | 19.4 | 12.2 |
| Clothing | 24.4 | 13.0 |

*Source*: World Tariff Profiles database.

**Table 9: Distribution of effective and ad valorem tariffs on textiles in India (percent)**

| Range | Rate | Percentage |
|---|---|---|
| 0 to 10 | 35 | 15.7 |
| Above 10 to 25 | 83 | 37.2 |
| Above 25 to 50 | 61 | 27.4 |
| Above 50 to 100 | 31 | 13.9 |
| Above 100 | 13 | 5.8 |
| Total | 223 | 100.0 |

*Source*: Pasha and Imran (2012).

Under the SAFTA Phase II revisions, India offered special concessions, reducing duty rates to 0 percent for LDCs, which meant DFQF access for Bangladesh's RMG exports to India. The scope of these concessions was viewed in the context of the EBA agreement between Europe and Bangladesh, which gave the latter a similar status to GSP-plus. It was presumed that exports would, therefore, follow a similar rising pattern. One of the main reasons for this prediction was the high comparative advantage enjoyed by Bangladesh, especially in articles of apparel (described by HS codes 61 and 62). This strengthened the rationale for expecting a surge in Bangladesh's RMG exports to India. The next section discusses the impact of these concessions on the trade patterns of both countries.

### *4.3. Pre- and Post-Revision Trends in India's RMG Imports*

Given Bangladesh's robust position as a producer of the product lines listed in Section 4.1 vis-à-vis the theory of comparative advantage, we would expect its trade with India to have increased. Articles of apparel under HS codes 61 and 62, for example (Table 10), were predicted to penetrate the Indian market. However, imports of knitted or crotched articles of apparel (HS code 61) fell by 29 percent just after the year India granted preferential access. India's imports grew by 55 percent and then by 79 percent in 2014/15. The value of total imports was recorded at US$ 30.6 million for 2014/15, which is negligible relative to its total imports of US$ 448 million in this product category.

Imports of t-shirts and vests (6109) surged by 20 percent post-revision, reaching US$ 3.28 million. Imports in this category have trended upward, reaching US$ 15.6 million in 2014/15. Imports of knitted or crocheted cardigans and pullovers (6110) diminished two years after the revision, following which they increased from US$ 1.51 million in 2013/14 to US$ 6.87 million in 2014/15. A similar decline of 46 percent occurred in men's shirts (6105) post-revision, but imports of this product line gradually increased by 7.65 percent and 12.56 percent in subsequent years, reaching US$ 1.5 million in 2014/15.

Other product lines denoted by HS codes 6104, 6108 and 6111 account for imports from Bangladesh approximating US$ 1 million, an insignificant sum. Among these, the import value of babies' garments (6111) declined by 44 percent in 2014/15. Imports of articles of clothing not knitted or crocheted (HS code 62) account for relatively higher figures, but indicate a declining growth trend post-revision from 103 percent to 59 percent. This continued to deteriorate in subsequent years, falling to 51 percent in 2013/14 and to 17 percent in 2014/15. Overall, post-revision growth has averaged 42 percent, which is not particularly high.

**Table 10: India's imports of apparel and RMGs from Bangladesh**

| HS code | Description | Pre-SAFTA revision | | | Post- SAFTA revision | | |
|---|---|---|---|---|---|---|---|
| | | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 |
| 61 | Articles of apparel, knitted/crocheted (K/C) | 1.46 | 6.79 | 15.46 | 11.04 | 17.10 | 30.60 |
| 6109 | T-shirts or vests, K/C | 0.46 | 2.39 | 2.74 | 3.28 | 7.14 | 15.59 |
| 6110 | Jerseys, pullovers, cardigans, K/C | 0.13 | 0.98 | 3.72 | 1.81 | 1.51 | 6.87 |
| 6104 | Women's suits, ensembles, skirts, dresses and similar items | 0.01 | 0.89 | 1.09 | 0.58 | 0.35 | 0.61 |
| 6105 | Men's shirts, K/C | 0.21 | 0.83 | 2.27 | 1.23 | 1.32 | 1.49 |
| 6108 | Women's slips, petticoats, pajamas, etc. | 0.01 | 0.05 | 0.05 | 0.36 | 0.88 | 1.06 |
| 6111 | Babies' garments and clothing, K/C | 0.02 | 0.03 | 0.42 | 1.08 | 2.21 | 1.24 |
| 62 | Articles of apparel, not K/C | 4.32 | 16.28 | 33.04 | 52.44 | 78.97 | 92.90 |
| 6203 | Men's suits, ensembles, jackets, trousers, shorts and similar items | 2.27 | 4.15 | 12.45 | 23.18 | 39.74 | 56.01 |
| 6204 | Women's suits, ensembles, skirts, dresses and similar items | 0.72 | 1.69 | 5.14 | 1.24 | 4.20 | 8.64 |
| 6205 | Men's shirts | 1.15 | 0.95 | 10.36 | 23.96 | 28.04 | 21.74 |
| 6206 | Women's blouses, shirts and shirt-blouses | 0.06 | 0.00 | 0.06 | 0.15 | 0.34 | 1.21 |
| 6201 | Men's overcoats, cloaks, wind-jackets and similar items | 0.00 | 0.04 | 0.05 | 0.21 | 1.58 | 0.91 |

Note: All values in US$ million.
***Source***: India, Ministry of Commerce and Industry.

The highest imports are of men's ensembles, jackets and similar items (6203), accounting for US$ 56 million in 2014/15. These imports increased just after the revision by 86 percent, after which they have gradually risen at a slower rate. Imports of women's suits, ensembles, skirts and similar items that are not knitted or crocheted (6204) declined post-revision, but then increased gradually, reaching US$ 8.64 million in 2014/15.

Imports of men's shirts (6205) show a different trend, having increased by almost 1,000 percent pre-revision in 2011/12. They continued to grow at a declining rate until 2014/15, when they fell from US$ 28 million in 2013/14 to US$ 22 million. Other items that count as notable exports by Bangladesh include women's blouses (6206) and men's overcoats and cloaks (6201), but India's imports in these categories are only nominal. This is a striking trend because it implies that favorable market access has not yielded any extraordinary results, with imports from Bangladesh accounting for approximately US$ 0.12 billion. In comparison, the US, which offers no equivalent preferential terms, has substantially higher RMG imports from Bangladesh, averaging about US$ 1 billion.

In 2012, the then commerce minister of India, Anand Sharma, said that the concessions granted had "completely addressed the concerns of all SAARC LDC members as all items of their export interest are now allowed for import in India at zero duty."[4] Despite these assurances, the analysis of trade trends reveals that Bangladeshi RMGs have been unable to capture the Indian market. This begs the following questions: (i) why has there been no remarkable surge in Bangladesh's exports to India despite the duty-free regime and its higher RCA, and (ii) could these concessions potentially alter trade prospects in favor of Bangladesh?

## 5. Impediments to Bangladesh's Exports

This section seeks to answer the questions we have just raised by testing whether trade between Bangladesh and India is complementary or competitive, testing whether costs of production are higher in Bangladesh and examining the prevalence of NTBs in India.

### *5.1. Trade Complementarity Between Bangladesh and India*

The TCI provides useful information on the prospects of intra-regional trade, showing how well the structure of a country's imports and

[4] http://articles.economictimes.indiatimes.com/2012-02-17/news/31071455_1_sensitive-list-safta-south-asian-free-trade

exports match. The conventional index used to estimate trade complementarity is as follows:

$$TCI_{jk} = 1 - \Sigma \frac{(|m_{ik} - x_{ij}|)}{2} \qquad \text{where } 0 \leq \text{TCI} \leq 1$$

where *TCI* represents trade complementarity between countries *j* and *k*, $m_{ik}$ is the share of the *i*th commodity in the total imports of country $k$ and $x_{ij}$ is the share of the *i*th commodity in the total exports of country *j*. The higher the magnitude of the TCI, the greater will be the trade complementarity between the two countries.

The results show that, except in babies' garments (6111), the magnitude of trade complementarity between the two countries is considerably high. This implies that the supply of Bangladesh's exports matches a certain level of demand in India, indicating good prospects for intra-regional trade. However, this formula has a drawback: it ignores the possibility that a country might be both an importer and exporter. This is the case where India is concerned: not only does it import these product lines, but it is also a prominent exporter.

**Table 11: TCI at HS code 6-digit level**

| HS code | Description | TCI | | | | |
|---|---|---|---|---|---|---|
| | | 2010 | 2011 | 2012 | 2013 | 2014 |
| 6109 | T-shirts or vests, knitted or crocheted (K/C) | 0.70 | 0.73 | 0.69 | 0.66 | 0.67 |
| 6110 | Jerseys, pullovers, cardigans | 0.73 | 0.62 | 0.75 | 0.77 | 0.76 |
| 6104 | Women's suits, dresses, skirts and similar items | 0.53 | 0.50 | 0.45 | 0.45 | 0.42 |
| 6105 | Men's shirts (K/C) | 0.96 | 0.91 | 0.98 | 0.97 | 0.96 |
| 6108 | Women's slips, pajamas, etc. | 0.54 | 0.50 | 0.43 | 0.45 | 0.48 |
| 6111 | Babies' garments (K/C) | 0.05 | 0.06 | 0.06 | 0.05 | 0.05 |
| 6203 | Men's suits, ensembles, shirts, shorts and similar items | 0.66 | 0.67 | 0.72 | 0.68 | 0.65 |
| 6204 | Women's suits, dresses, skirts and similar items (not K/C) | 0.58 | 0.58 | 0.60 | 0.59 | 0.53 |
| 6205 | Men's shirts | 0.86 | 0.86 | 0.86 | 0.89 | 0.90 |
| 6206 | Women's blouses, shirts, shirt-blouses | 0.74 | 0.68 | 0.59 | 0.51 | 0.50 |
| 6201 | Men's overcoats, cloaks, wind-jackets and similar items | 0.64 | 0.78 | 0.80 | 0.83 | 0.81 |

***Source***: Author's calculations based on data from the ITC database.

Bangladesh's exports are concentrated in the RMG sector, which comprises 70–80 percent of its total exports, but only 6–7 percent of India's total exports. Despite this, India is a major exporter of T&G and was among the top 15 world clothing exporters in 2012, contributing about 3 percent to total world exports compared to 5 percent in Bangladesh's case (International Labour Organization, 2014).

Table 12 gives the export figures for garments and apparel under HS codes 61 and 62 for both countries. The main product line in which Bangladesh has a lead against India is knitted or crocheted apparel (HS code 61). India's trade has hovered around US$ 4–7 billion in this category, whereas it has increased to US$ 14 billion for Bangladesh – double the amount of Indian exports in this category. Exports of apparel that is not knitted or crocheted (HS code 62) have increased from US$ 6 billion to US$ 9 billion for India and from US$ 7 billion to US$ 14 billion for Bangladesh. Although the latter's growth in exports has been exceptional over the years, Indian exports have also trended upward.

**Table 12: Total clothing exports (US$ million)**

| HS code | Country | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 |
|---|---|---|---|---|---|---|
| 61 | India | 4,566 | 5,807 | 5,466 | 6,959 | 7,482 |
| | Bangladesh | 9,449 | 11,842 | 11,519 | 13,218 | 14,759 |
| 62 | India | 6,038 | 7,937 | 7,430 | 8,743 | 9,056 |
| | Bangladesh | 7,478 | 9,982 | 11,322 | 13,359 | 14,145 |

***Source***: ITC database.

Table 13 provides deeper insight into Indian export trends within the product categories that are Bangladesh's most prominent exports. For all products except for women's blouses (6206), Bangladesh has higher export values with increasing trends, but India has replicated this pattern, maintaining continuous growth in these product lines. Essentially, it is competing with Bangladesh.

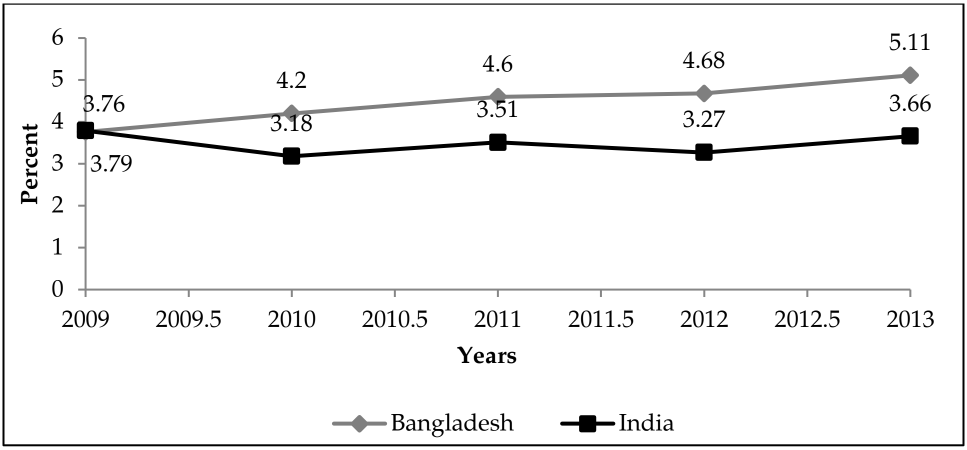
**Table 13: Exports by product lines (US$ '000)**

| Code/country | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| HS code 6109 | | | | | |
| Bangladesh | 3,298,320 | 4,307,533 | 4,171,696 | 4,566,341 | 5,141,855 |
| India | 1,697,994 | 2,073,624 | 2,093,953 | 2,600,305 | 2,721,750 |
| HS code 6108 | | | | | |
| Bangladesh | 345,697 | 419,980 | 468,835 | 545,379 | 619,492 |
| India | 295,748 | 437,065 | 414,041 | 518,898 | 544,158 |
| HS code 6105 | | | | | |
| Bangladesh | 359,613 | 456,818 | 421,386 | 566,371 | 732,218 |
| India | 545,803 | 603,645 | 486,767 | 495,366 | 528,083 |
| HS code 6111 | | | | | |
| Bangladesh | 306,916 | 421,979 | 440,082 | 545,476 | 592,265 |
| India | 370,330 | 504,040 | 517,539 | 656,646 | 698,232 |
| HS code 6203 | | | | | |
| Bangladesh | 2,183,794 | 2,831,601 | 2,954,332 | 3,523,764 | 4,545,863 |
| India | 708,829 | 932,386 | 942,380 | 1,104,634 | 1,170,464 |
| HS code 6204 | | | | | |
| Bangladesh | 1,659,382 | 2,217,547 | 2,622,953 | 3,072,439 | 3,221,717 |
| India | 1,876,276 | 2,528,932 | 2,255,945 | 2,456,203 | 2,580,624 |
| HS code 6206 | | | | | |
| Bangladesh | 367,607 | 448,758 | 466,724 | 553,558 | 573,509 |
| India | 1,468,865 | 1,709,830 | 1,287,118 | 1,596,554 | 1,579,752 |

*Source*: ITC database.

This reinforces the notion that India itself is a major RMG exporter and, hence, a competitor of Bangladesh. Figure 2 shows that India, despite facing dynamic competition from low-cost producers such as Vietnam and Bangladesh, has sustained an average 3 percent contribution to world clothing exports. On the other hand, Bangladesh's competitive edge is reflected in its growing share of world clothing exports, which has increased from 3 to 5 percent in five years. Overall, it means that this is one of India's major export segments, which explains why the concessions it has granted have yielded no significant results for Bangladesh.

**Figure 2: Share of world clothing exports**




*Source*: WTO Statistics Database.

### *5.2. Comparing Costs*

Despite its high RCA, India has managed to maintain a stable position and sustain its noncomplementarity vis-à-vis Bangladesh because it enjoys economies of scale in production, which makes the cost per unit lower and more competitive. Balassa's RCA index takes into account a country's exports of a particular product as a percentage of its total exports relative to the rest of the world – no other information on costs or factors of production is considered (Siggel, 2007). Thus, higher exports for a certain country can result from subsidies or other incentives such as favorable terms, as in the case of Bangladesh and its EU trading partners. This makes the index a deceptive measure of comparative advantage because India continues to produce the same RMG lines in which it has a far lower RCA than Bangladesh.

Nathan Associates (2009) have calculated the cost of producing and exporting a t-shirt for a given set of RMG producers. For India, the factory gate cost per garment is US$ 1.084, whereas it is US$ 1.097 for Bangladesh. This is despite the fact that Bangladesh has a lower labor cost, estimated at US$ 0.32 per hour compared to US$ 0.83 for India. Bangladesh's cost is higher because it incurs a fabric cost per kilogram of US$ 3.336 for material imported from China and an additional shipping cost of US$ 0.060. India, on the other hand, has a fabric cost per kilogram of US$ 3.019, which is usually locally manufactured and has no associated shipping cost. The fully landed cost per garment is also slightly lower for India: US$ 1.572 compared to US$ 1.595 for Bangladesh (see Table A4 in the Appendix).

Table 14 shows that, for all products pertaining to HS codes 61 and 62 at the 6-digit level, both India and Bangladesh had an equal volume of products with a lower cost per unit relative to each other in 2009. However, in 2011, India had a lower cost per unit for 92 percent of these products compared to Bangladesh. Clearly, India enjoys a lower cost per unit in production and benefits from economies of scale.

**Table 14: Cost per unit (percent)**

| Products with low cost per unit | 2009 | 2011 |
|---|---|---|
| For Bangladesh | 46.75 | 1.30 |
| For India | 46.75 | 92.21 |
| No data available | 6.49 | 6.49 |

Note: Calculated for the latest data available. This includes all products with sales exceeding US$ 1 million, pertaining to HS codes 61 and 62 at the 6-digit level.
*Source*: UN Comtrade.

### *5.3. Indian Export Incentives and NTBs*

Prior to 1994, India had a restrictive import regime under which T&G imports were banned. Since then, it has liberalized its trade regime considerably and is the only NLDC in SAARC to have extended preferential treatment to the region's LDCs under Article 11. Having done so, however, India has also retained a system of export incentives and import restrictions in the RMG sector and thus artificially maintained a restrictive regime.

The Indian government has been keen to enhance the manufacturing sector of the economy and greatly emphasized T&G in this context. The apparel and RMG sector has huge export potential and the ability to simultaneously create employment opportunities. The Indian Ministry of Textiles estimates the value of current apparel exports at US$ 45 billion and expects this to reach US$ 200 billion by 2025. In order to achieve this goal, the RMG sector is safeguarded via export incentive schemes.

These include special economic zones and export-oriented units that are given several incentives, such as income tax exemption for the first five years, duty-free imports and the procurement of domestic goods, exemption from central sales tax, and ease in clearance and customs procedures. Export-oriented manufacturers are given credit at subsidized rates and increased duty drawback rates for products pertaining to HC 61, 62 and 63, varying between 7 and 10 percent.[5] Other recent incentives include the following:

- *Scheme for integrated textile parks*. This initiative aims to create state-of-the-art infrastructure for the textiles industry. Given the significance of women's employment in the apparel sector, the finance minister has allocated additional funds for apparel units within these parks.[6]
- *Incubation centers in apparel manufacturing*. This scheme intends to encourage entrepreneurship in apparel manufacturing, enhance manufacturing capacity and create more job opportunities. The initiative aims to provide an integrated workspace that will help start-up businesses operationally and financially.[7]
- *Integrated skills development scheme*. This is a training program developed to impart the skills the industry needs that will allow firms to compete globally (India, Ministry of Textiles, 2013).

These export incentives, when combined with the provision of nontariff measures (NTMs), impede RMG imports. Import restrictions such as import licensing or NTMs are interventions applied by the Indian government to control domestic supplies. For instance, NTMs for the RMG sector are a way of protecting and promoting the domestic industry. Some of the main NTMs imposed by India include the following:

- *Customs clearance*. This is a time-consuming and complex procedure. Importers have to register with the Directorate General of Foreign Trade and acquire an importer-exporter code in order to import goods commercially. The documents required for clearance include a bill of entry, invoices, a packing list and a bill of lading. Other requirements might include an import license or country-of-origin certificate (CUTS International, 2014). On average, import procedures take 21 days to complete, which includes eight days to prepare the necessary documents and four days for customs clearance and technical inspections. The total cost incurred per container is US$ 1,462.[8]
- *Pre-shipping requirements*. The import of textile-related products requires a pre-shipment inspection certificate from a textile-testing laboratory accredited to the national accreditation agency of the

[5] The drawback duty rates are available from the Apparel Export Promotion Council of India at http://www.aepcindia.com/app/webroot/img/pdf/New-Duty-Drawback-2012-13.pdf

[6] http://texmin.nic.in/policy/guidelines%20of%20apparel%20manufacturing%20units.pdf

[7] http://texmin.nic.in/policy/Incubation_Scheme_Guidelines_Final.pdf

[8] http://www.doingbusiness.org/data/exploretopics/trading-across-borders

country of origin (WTO, 2011). Failure to provide this means that the importer must acquire this certificate from a designated lab in India. The rules on this are strict and even certificates issued by EU-accredited labs have been rejected by Indian customs authorities, with such consignments then being subject to repeat tests in India (WTO, 2011).

- *Port of destination*. Apparel must be imported through Jawaharlal Nehru Port in Mumbai.[9] This is an artificial barrier created by the Indian authorities. Goods from Bangladesh have to travel 2,320 nautical miles to reach Mumbai whereas the neighboring port of Kolkata involves a distance of 361 nautical miles.
- *Labeling requirements*. Indian imports must be labeled in Hindi (Devanagari script) as well as in English and comply with Indian standards. Failure to do so leads to nonclearance of the good being imported.[10]
- *Lack of infrastructure*. Infrastructural bottlenecks are one of the main hindrances to cross-border trade between India and Bangladesh. Most land trade is carried out across the Petrapole–Benapole border. The Indian side is marred by inefficiencies and lack of quality infrastructure. Inadequate warehouses, parking, cold storage facilities, stationery, goods scanners and weighbridges, etc., create delays in trade transactions and add to the cost.

Combined, these factors make RMG exports from Bangladesh less attractive, which explains why the forecasted surge did not emerge. India itself is catching up with an apparel and RMG export regime, attempting to sustain its position in the world market.

## 6. Conclusion

This paper has sought to investigate the trends in Bangladesh's RMG exports to India following the SAFTA revisions (Phase II) under which the sensitive list for LDCs was reduced to 25 items (mainly tobacco and beverages). Given Bangladesh's high comparative advantage, observers expected that its RMG exports would penetrate the Indian market, but this failed to materialize. Thus, our first key finding is that the concessions granted by India to Bangladesh (which include a status similar to GSP-plus) have not yielded any remarkable surge in the latter's RMG exports to India.

---

[9] http://web.ita.doc.gov/tacgi/OverSeasNew.nsf/alldata/India#Documentation
[10] http://web.ita.doc.gov/tacgi/OverSeasNew.nsf/alldata/India#Documentation

A key factor in this is the absence of effective trade complementarity between the two countries – an issue highlighted by Basu and Datta (2007). One reason for this is the similarity in resource endowments within the region due to which these countries have a common comparative advantage in labor-intensive manufacturing goods (Mayer & Wood, 2001). The lack of complementarity undermines the effectiveness of the preferential access granted to Bangladesh. Additionally, South Asia is marred by an economic power asymmetry whereby India, the region's dominant player, enjoys a larger market, better production capacities and economies of scale relative to its neighbors.

The situation is aggravated by the artificially secure regime that India maintains, given its position as a prominent RMG exporter and competitor of Bangladesh. India strategically combines export promotion incentives with different NTMs in order to restrict imports, creating hurdles for Bangladesh's exports by making them less attractive and uncompetitive for local traders. Thus, the second key finding is that India has maintained a nonmonetary secure regime for its T&G sector by playing on both the demand and supply sides, and introducing export incentives and NTMs that hinder RMG imports from Bangladesh. These measures, once adopted, make imports costlier and less competitive, thereby allowing India to combat low-cost competition from countries such as Bangladesh, Vietnam and Cambodia.

It also explains the anomaly we have discussed. Bangladesh has a significantly higher comparative advantage for all the product categories that occupy a pivotal place in its export portfolio. However, India trades in all these product lines as a competitor. This extent of "fruitless" liberalization by India raises several key questions, the first and foremost of which concerns the use of RCA as a measure of comparative advantage among countries. While the index might work in some instances, it is inadequate when comparing countries with similar factor endowments, such as those in South Asia.

Comparative advantage does not have to be the sole cause of international trade when increasing returns or economies of scale can also lead to specialization and trade (Krugman, 1987). Thus, when looking at comparative advantage, it is also worth considering production capacities, technological advancements and unit costs of production to obtain an accurate picture. Mayer and Wood (2001) show that economies of scale are important in explaining the volume and composition of trade among countries with similar factor endowments. Hence, the third key finding is that, while Balassa's RCA index reflects a country's success as an exporter relative to a worldwide norm, it is a deceptive measure of comparative advantage. In essence, it is a measure of competitiveness. India, on the other hand, enjoys a lower cost per unit and benefits from economies of scale. It contributes 3 percent to world clothing exports compared to 5 percent for Bangladesh. This underscores the former's stronghold in this sector and its position as a competitor. As a result, the concessions granted by India have failed to draw any positive or favorable trade trends for Bangladesh.

The main question that emerges from the analysis is whether India's attempt to liberalize trade reflects any intention of benefiting the LDCs in the region. Considering the NTBs it has imposed, India appears to be applying a dual policy. That said, the answer to this question is complex. Although India is striving to become the region's manufacturing hub, more time is needed to monitor trends in Indo–Bangladesh trade before drawing an effective conclusion.

Political mistrust in South Asia has also diluted the real concept of RTAs, which is to develop "deep integration" in the region. As Newfarmer and Piérola (2007) explain, RTAs succeed only when new competition emerges, which results in price reductions and the acquisition of new technology. For SAFTA to be successful, its partner economies need to work in collaboration and develop regional value chains for products such as RMGs – depending on their competitive edge – and engage in intra-regional trade. This would strengthen regional productivity and countries' bargaining capacity, in turn ensuring greater profits and inclusive growth. Resolving political disputes and eliminating NTMs within the region could be a first step toward the success of SAFTA.

## References

Acharya, L., & Marwaha, A. (2012). *Status paper on India–Bangladesh economic relations*. New Delhi: Federation of Indian Chambers of Commerce and Industry.

Banik, A., & Sengupta, N. (1997). Regional trade and investment: Case of SAARC. *Economic and Political Weekly*, *32*(46), 15–21.

Basu, S., & Datta, D. (2007). India–Bangladesh trade relations: Problem of bilateral deficit. *Indian Economic Review*, 42(1), 111–129.

Bayson, T., Panagariya, A., & Pitigala, N. (2006). *Preferential trading in South Asia* (Policy Research Working Paper No. 3813). Washington, DC: World Bank.

Coulibaly, S. (2005, March). *On the assessment of trade creation and trade diversion effects of developing RTAs*. Paper presented at the Annual Meeting of the Swiss Society of Economics and Statistics, Zurich.

CUTS International. (2014). *India-Bangladesh trade potentiality: An assessment of trade facilitation issues*. Jaipur: Author.

De, P., & Ghosh, B. (2008). Reassessing transaction costs of trade at the India–Bangladesh border. *Economic and Political Weekly*, *43*(29), 69–79.

De, P., Raihan, S., & Kathuria, S. (2012). *Unlocking Bangladesh–India trade: Emerging potential and the way forward* (Policy Research Working Paper No. 6155). Washington, DC: World Bank.

India, Ministry of Textiles. (2013). *Integrated skill development scheme for the textiles and apparel sector including jute and handicrafts*. Retrieved from http://texmin.nic.in/sites/default/files/ISDSguidelines-July2013.pdf

International Labour Organization. (2014). *Wages and working hours in the textiles, clothing, leather and footwear industries* (Issues paper for discussion at the Global Dialogue Forum on Wages and Working Hours in the Textiles, Clothing, Leather and Footwear Industries). Geneva: Author.

Islam, T., Raihan, A., & Mollah, M. M. H. (2013). Is Bangladesh a beneficiary of South Asian Free Trade Area (SAFTA)? *Journal of Economics and Development*, *15*(3), 36–58.

Joarder, M. A. M., Hossain, A. K. M., & Hakim, M. M. (2010). Post-MFA performance of Bangladesh apparel sector. *International Review of Business Research Papers*, *6*(4), 134–144.

Kelegama, S. (2007). Towards greater economic connectivity in South Asia. *Economic and Political Weekly*, *42*(39), 3911–3915.

Krugman, P. R. (1987). Is free trade passé? *Journal of Economic Perspectives*, *1*(2), 131–144.

Mahmood, T. (2000). SAARC and regional politics. *Pakistan Horizon*, *53*(4), 7–21.

Mayer, J., & Wood, A. (2001). South Asia's export structure in a comparative perspective. *Oxford Development Studies*, *29*(1), 5–29.

Nadkarni, V. (2014, July). *India and SAARC*. Paper presented at the FLACSO-ISA Joint International Conference, Buenos Aires.

Nathan Associates. (2009). *Cost competitiveness of Pakistan's textiles and apparel industry*. Washington, DC: United States Agency for International Development.

Newfarmer, R. S., & Piérola, M. D. (2007). South Asia Free Trade Area: Promises and pitfalls of preferential trade arrangements. In Z. F. Naqvi & P. Schuler (Eds.), *The challenges and potential of Pakistan–India trade* (pp. 29–58). Washington, DC: World Bank.

Otsubo, S. (1998). APEC and its developing members: An applied general equilibrium analysis of regional trading arrangement. *Journal of International Development Studies*, *7*(1), 1–17.

Pasha, H. A., & Imran, M. (2012). The prospects for Indo–Pakistan trade [Special edition]. *Lahore Journal of Economics*, *17*, 293–313.

Rahman, M. M. (2003, September). *A panel data analysis of Bangladesh's trade: The gravity model approach*. Paper presented at the Fifth European Trade Study Group Conference, Madrid.

Rahman, M. M. (2010). The factors affecting Bangladesh's exports: Evidence from the gravity model analysis. *Journal of Developing Areas*, *44*(1), 229–244.

Rahman, M. (2014). *Trade benefits for least developed countries: The Bangladesh case* (CDP Background Paper No. 18). New York, NY: United Nations Department of Economic and Social Affairs.

Rahman, M., Shadat, W., & Das, N. C. (2006). *Trade potential in SAFTA: An application of augmented gravity model* (Occasional Paper No. 61). Dhaka: Centre for Policy Dialogue.

Siggel, E. (2007, July). *International competitiveness and comparative advantage: A survey and a proposal for measurement*. Paper presented at the CESifo Venice Summer Institute, Venice.

Srinivasan, T. N., & Canonero, G. (1995). *Preferential trading arrangements in South Asia: Theory, empirics and policy*. Unpublished manuscript, Yale University, New Haven, CT.

Taneja, N., Ray, S., Kaushal, N., & Chowdhury, D. R. (2011). *Enhancing intra-SAARC trade: Pruning India's sensitive list under SAFTA*. New Delhi: ICRIER.

Weerakoon, D. (2010). The political economy of trade integration in South Asia: The role of India. *The World Economy*, *33*(7), 916–927.

Weerakoon, D., & Thennakoon, J. (2006). *India–Sri Lanka FTA: Lessons for SAFTA*. Jaipur: CUTS International.

Wood, A., & Calandrino, M. (2001). When other giant awakens: Trade and human resources in India. *Economic and Political Weekly*, *35*(52/53), 4677–4694.

World Bank. (2006). *India–Bangladesh bilateral trade and potential free trade agreement* (Bangladesh Development Series Paper No. 13). Dhaka: Author.

World Trade Organization. (2011). *Trade policy review: India*. Retrieved from https://www.wto.org/english/tratop_e/tpr_e/tp349_e.htm

# *Appendix*

**Table A1: List of apparel and RMG products liberalized under SAFTA Revision (Phase II)**

| Sl | Chapter, heading, sub-heading or tariff item of the First Schedule | Description of goods |
|---|---|---|
| 160 | 500720 | Other woven fabrics of silk, containing 85% or more by weight of silk or of silk waste other than noil silk |
| 170 | 610342 | Men's or boys' trousers |
| 171 | 610343 | Men's or boys' trousers, overalls and shorts, knitted, of synthetic fibers |
| 178 | 610462 | Women's or girls' trousers, overalls and shorts, knitted, of cotton |
| 179 | 610463 | All goods |
| 181 | 610510 | All goods |
| 182 | 610520 | All goods |
| 183 | 610610 | All goods, knitted |
| 185 | 610711 | All goods |
| 187 | 610721 | All goods |
| 189 | 610791 | All goods |
| 191 | 610821 | All goods |
| 192 | 610822 | Women's or girls' briefs and panties, knitted or crocheted, of manmade fibers |
| 193 | 610831 | Women's or girls' nightdresses and pajamas, knitted or crocheted, of cotton |
| 194 | 610910 | All goods |
| 195 | 610990 | All goods |
| 197 | 611020 | All goods |
| 198 | 611030 | All goods |
| 199 | 611090 | All goods |
| 200 | 611120 | Babies' garments and clothing accessories, knitted or crocheted, of cotton |
| 201 | 611130 | All goods |
| 203 | 611241 | Of synthetic fibers |
| 204 | 611300 | Garments, made-up, of knitted or crocheted fabrics of heading no. 59.03, 59.06 |
| 205 | 611420 | All goods |
| 208 | 611699 | All goods |
| 210 | 620332 | All goods |
| 211 | 620333 | All goods |
| 212 | 620342 | Men's or boys' trousers, overalls and shorts, woven, cotton |

| Sl | Chapter, heading, sub-heading or tariff item of the First Schedule | Description of goods |
|---|---|---|
| 214 | 620413 | All goods |
| 215 | 620452 | All goods |
| 216 | 620462 | Women's or girls' trousers, overalls and shorts, woven, cotton |
| 217 | 620520 | Men's or boys' shirts, woven, cotton |
| 218 | 620530 | Men's or boys' shirts, woven, manmade fibers |
| 219 | 620590 | All goods |
| 221 | 620630 | Women's or girls' blouses, shirts and shirt-blouses, woven, cotton |
| 222 | 620721 | All goods |
| 223 | 620821 | All goods |
| 224 | 620920 | All goods except hats |
| 225 | 620930 | All goods except hats |
| 226 | 621040 | All goods |
| 227 | 621050 | Sweaters, sweatshirts and waistcoats, knitted, cotton |
| 228 | 621111 | All goods |
| 229 | 621132 | All goods |
| 230 | 621133 | All goods |
| 233 | 621210 | All goods |
| 235 | 621710 | Made-up clothing accessories, woven |

***Source***: Bangladesh Garment Manufacturers and Exporters Association.

## Table A2: India's exports to Bangladesh

| SITC code | Description | 2003 | 2008 | 2013 |
|---|---|---|---|---|
| 0 | Food and live animals | 38.30 | 35.25 | 21.80 |
| 1 | Beverages and tobacco | 0.26 | 0.10 | 0.01 |
| 2 | Crude materials, inedible, except fuels | 2.45 | 11.89 | 14.74 |
| 3 | Mineral fuels, lubricants and related materials | 5.23 | 3.93 | 2.70 |
| 4 | Animal and vegetable oils, fats and waxes | 0.20 | 0.20 | 0.04 |
| 5 | Chemicals and related products, n.e.s. | 8.61 | 8.65 | 11.43 |
| 6 | Manufactured goods classified mainly by material | 29.03 | 24.15 | 28.30 |
| 7 | Machinery and transport equipment | 13.33 | 13.42 | 15.81 |
| 8 | Miscellaneous manufactured articles | 2.13 | 1.91 | 2.52 |
| 9 | Commodities and transactions not classified elsewhere in SITC commodities and transactions | 0.48 | 0.49 | 2.65 |
| Total | All commodities | 100.00 | 100.00 | 100.00 |

***Source***: UN Comtrade.

## Table A3: India's imports from Bangladesh

| SITC code | Description | 2003 | 2008 | 2013 |
|---|---|---|---|---|
| 0 | Food and live animals | 9.85 | 17.7 | 20.86 |
| 1 | Beverages and tobacco | 0.31 | 0.28 | 0.73 |
| 2 | Crude materials, inedible, except fuels | 29.26 | 11.18 | 16.82 |
| 3 | Mineral fuels, lubricants and related materials | 2.56 | 7.01 | 3.38 |
| 4 | Animal and vegetable oils, fats and waxes | 0.02 | 0.10 | 1.19 |
| 5 | Chemicals and related products, n.e.s. | 40.45 | 27.81 | 2.06 |
| 6 | Manufactured goods classified mainly by material | 7.71 | 31.32 | 32.94 |
| 7 | Machinery and transport equipment | 1.93 | 1.87 | 1.77 |
| 8 | Miscellaneous manufactured articles | 6.57 | 2.09 | 18.23 |
| 9 | Commodities and transactions not classified elsewhere in SITC commodities and transactions | 1.35 | 0.63 | 2.01 |
| Total | All commodities | 100.00 | 100.00 | 100.00 |

***Source***: UN Comtrade.

**Table A4: T-shirt production cost estimates**

| Garment making up by country | India | India | China | Pakistan | Bangladesh | Cambodia |
|---|---|---|---|---|---|---|
| Fabric source | India | China | China | Pakistan | China | China |
| *Main fabric* | | | | | | |
| Fabric cost per kg (US$) | 3.019 | 3.336 | 3.336 | 2.894 | 3.336 | 3.336 |
| Fabric shipping cost per kg (US$) | 0.000 | 0.069 | 0.000 | 0.000 | 0.060 | 0.069 |
| Fabric use per garment (kg) | 0.235 | 0.235 | 0.235 | 0.235 | 0.235 | 0.235 |
| Fabric waste (short pieces, end of rolls, faults) (%) | 5 | 5 | 5 | 5 | 5 | 5 |
| Main fabric cost per garment (US$) | 0.710 | 0.801 | 0.784 | 0.680 | 0.798 | 0.801 |
| *Trim cost per garment (US$)* | | | | | | |
| Thread | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 |
| Labels, tags | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 |
| *Packaging per garment (US$)* | | | | | | |
| Plastic poly bag | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 |
| Cardboard box/carton | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 |
| Total materials cost per garment | 0.870 | 0.961 | 0.944 | 0.840 | 0.958 | 0.961 |
| Labor-hour ($) cost in making up | 0.830 | 0.830 | 1.440 | 0.550 | 0.320 | 0.335 |
| Standard minutes per garment cut-make-trim-finish | 6.12 | 6.12 | 6.12 | 6.12 | 6.12 | 6.12 |
| Efficiency adjustment | 25 | 25 | 15 | 30 | 50 | 70 |
| Labor cost per garment (US$) | 0.106 | 0.106 | 0.169 | 0.073 | 0.049 | 0.058 |
| Reject garments (3%) | 0.029 | 0.032 | 0.033 | 0.027 | 0.030 | 0.031 |
| Manufacturing overhead per garment (25% on labor) (US$) | 0.026 | 0.026 | 0.042 | 0.018 | 0.012 | 0.015 |
| Inclusive of electricity, rent, indirect labor | | | | | | |
| Sales and administration costs (10% on labor) (US$) | 0.011 | 0.011 | 0.017 | 0.007 | 0.005 | 0.006 |
| *Total cost per garment: fabric, labor, overhead (US$)* | | | | | | |
| Sales and administration | 1.042 | 1.136 | 1.206 | 0.966 | 1.055 | 1.070 |
| Agent fee per garment (4% on total cost) | 0.042 | 0.045 | 0.048 | 0.039 | 0.042 | 0.043 |

***Source***: Nathan Associates (2009).

**Notes for Authors**

1. Manuscripts will be accepted for consideration on the understanding that they are original contributions to the existing knowledge in the fields of Economics, Banking, Current Affairs, Finance, Political Economy, Sociology, and Economic History.

2. Electronic copies of research articles, research notes, and book reviews – in English only – should be **submitted as an email attachment to: nina@lahoreschool.edu.pk and nina_lse@yahoo.com. Upon receipt, a confirmation email will be sent to the corresponding author containing a serial number identifying the article.**

3. The first page of the manuscript should have the title of the paper, the names(s) of author(s), and a footnote giving the current affiliation of the author(s) and any acknowledgments

4. **Articles submitted to the *Lahore Journal of Economics* must also include: (a) a brief abstract of about 100 words that summarizes the contents, (b) keywords and (c) Journal of Economic Literature (JEL) Classification Codes.**

5. The *Lahore Journal of Economics* will publish empirical papers only if the data used in the analyses are clearly and precisely documented and are readily available to the journal reviewers for purposes of replication. **At the time of submission of papers that have empirical work, authors must provide to the *Lahore Journal of Economics*, the data in Microsoft EXCEL format required for the replication of results.**

6. Detailed derivations of any main mathematical results reported in the text should be submitted separately along with the articles.

7. Each manuscript should be typed and should carry a margin of an inch and a half on the left-hand side and an inch on the right hand side of the typed page.

8. The graphic format for each mathematical formula, diagram, figure or chart should be in text mode for further editing.

9. Tables for the main text and each of its appendices should be numbered sequentially and separately. The title of each table should clearly describe the contents. The source of the table should be given in a footnote immediately below the line at the bottom of the table.

10. Footnotes should be numbered sequentially.

11. All references used in the text should be listed in alphabetical order of the authors' surnames at the end of the text. References in the text should include the name(s) of author(s) with the year of publication in parentheses, and all references should conform to the style of the Journal. Further information on questions of style may be obtained from the Associate Editor, *The Lahore Journal of Economics*, Lahore – Pakistan.

12. Book Reviews should give a description of the contents and a critical evaluation of the book. It should not exceed 5 or 6 typewritten pages.

13. Each author will receive two complimentary copies of *The Lahore Journal of Economics*.

# THE LAHORE JOURNAL OF ECONOMICS


## Lahore School of Economics

105-C-2, GULBERG III LAHORE, PAKISTAN. TEL: 35870704


## SUBSCRIPTION FOR PUBLICATIONS

1. **Kindly enter a subscription for the following publication of the Lahore School of Economics:**

| **Publication** | **Yearly subscription** (within Pakistan) | **Yearly subscription** (outside Pakistan) | **Period** (No. of years) | **Total Payment** |
|---|---|---|---|---|
| 1. The Lahore Journal of Economics | Rs. 600.00 | US $ 50 | …........... | …........... |

2. **The subscription is to be in the following name and address:**

Name: ------------------------------------------

Address: ------------------------------------------

------------------------------------------

------------------------------------------

3. **A crossed cheque/demand draft for the sum of Pakistan Rupees/US $________ is enclosed made out in the name of The Lahore School of Economics to cover the above subscription.**

4. **Please address your order to: Nina Gera, Publications, Lahore School of Economics, 104-C-2, Gulberg III, Lahore 54660, Pakistan.**

*Signature:* ------------------------------------

Name: ------------------------------------------

Date: ------------------------------------------

## The Lahore School of Economics

**The Lahore School of Economics (established 1993) is one of Pakistan's leading centres of learning for teaching and research in economics, finance and business administration. The Lahore School of Economics' objectives include: (i) The training of young Pakistanis as professional economists, finance managers, accountants, financial analysts, bankers and business executives, and (ii) Undertaking research in economics, management, finance and banking to further deepen understanding of major economic facts, issues and policies.**

**The Lahore School was granted a Charter in January, 1997 by an Act of the Provincial Assembly of the Punjab: The Lahore School of Economics Act 1997 (Act II of 1997). The Charter vests the powers of an independent degree granting institution to The Lahore School.**

**The Lahore School has both undergraduate and graduate programs in economics, business information systems and finance. Its postgraduate program leading to the MPhil and PhD degree is administered through the Lahore School's Centre for Research in Economics and Business (CREB). The student body and faculty comprise both national and expatriate Pakistanis and The Lahore School encourages expatriate Pakistanis to join as students or as faculty.**

**The Lahore School's publication program comprises The Lahore Journal of Economics (a bi-annual publication), Lahore Journal of Policy Studies, a Seminar Paper Series and a Text Book Series. The Program encourages both in-house and external contributors.**

**For further information, please call (Pakistan 92-42-) 35870704 or 36560969 or visit the Web page: www.lahoreschoolofeconomics.edu.pk**

*Printed by Lahore School of Economics Press*