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Editorial Staff: Tele. No: 5874385

Telefax: 0092 - 42 - 5714936

E-mail: nina@lahoreschool.edu.pk

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Correspondence relating to subscriptions and changes of address should be sent to *The Lahore Journal of Economics*, 105-C-2, Gulberg III, Lahore - 54660 - Pakistan

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Contents **Vol. 11, 2006**

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Technical Efficiency and its Determinants in Potato Production, Evidence from Punjab, Pakistan

Abedullah, Khuda Bakhsh and Bashir Ahmad*

Abstract

Potato cultivation accounts for 5.71 percent in total cropped area of the Punjab province and it supplements the diet of the growing population at lower prices as compared to grains, meat and chicken. Data from 100 farmers, 50 each from the districts of Okara and Kasur during the year 2002-2003 (the autumn crop) has been collected. The study estimates the technical efficiency in potato production by employing the Cobb-Douglas stochastic production frontier approach. The null hypothesis of no technical inefficiency in the data is rejected. Our results indicate that potato farmers are 84 percent technically efficient, implying significant potential in potato production that can be developed. By shifting the average farmer to the production frontier, the average yield would increase from 8.33 tons per acre to 9.92 tons per acre using the available resources. The additional quantity of potatoes gathered through efficiency improvements would generate Rs. 990.81 ($16.51) million of revenue each year. Consultation with extension workers significantly contributes to the improvement of technical efficiency and implies that the extension department should be one of the major targeted variables from the policy point of view in order to improve technical efficiency in potato production.

Key Words: *Potato, stochastic production frontier, technical efficiency*

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Introduction

The population of Pakistan is growing at the rate of 2.1 percent per annum, with the addition of 3.1 million persons every year (Government of Pakistan, 2003). However, the supply of food crops is not keeping pace with

* The authors are Assistant Professor, Post Graduate Student, and Professor, respectively in the department of Environmental and Resource Economics, University of Agriculture Faisalabad, Pakistan.

population growth. To fill the gap between supply and demand, Pakistan invests its scarce resources to import grains and other food items. Wheat is a dominant crop while other labor intensive and more remunerative enterprises are ignored due to social taboos or other reasons. Vegetable cultivation is not only a cheap source of essential nutrients but it also creates more employment opportunities than that of growing other crops such as cereals (AVRDC, 2001). However, vegetable cultivation is limited to the vicinity of cities and comprises only one and two percent of the total cropped area in Pakistan and the Punjab, respectively (Government of Punjab, 2002) as compared to fifteen percent in Taiwan (Ali, 2000). This indicates a low availability of vegetables to consumers. Annual per capita consumption of vegetables is extremely low, 35.6 kg/capita/annum in Pakistan compared to 155 kg in Korea while the minimum recommended level is 73 kg/capita/annum (Ali and Abedullah, 2002).

Vegetable cultivation is inadequately addressed and given low priority by researchers and research institutes, and as a result the growth of vegetable production in the past decades remained low compared to other crops. Now policy makers are realizing the importance of vegetables and research budgets are being allocated to this neglected food frontier. The potato is one of the major vegetable crops in Pakistan in terms of area and output volume.

Potato production plays an important role in the economy of Pakistan in general and that of the Punjab in particular. On the one hand, it accounts for 5.71 percent in total vegetable cropped area of the Punjab providing economic benefits and creating employment opportunities for the rural poor. On the other hand, it supplements the food consumption of the growing population at lower prices as compared to grains, meat and chicken. The data from developed countries indicate that potatoes have 75 percent more food energy per unit area than wheat and 58 percent more than rice. Also, potatoes have 54 percent more protein per unit area than wheat and 78 percent higher than rice. Therefore, potato consumption is the best alternative to grains to maintain calorie intake.

It is generally believed that resources in the agricultural sector, especially in under-developed countries are being utilized inefficiently. According to our knowledge there exists very little literature dealing with technical inefficiency in vegetable production. A large body of literature exists dealing with technical efficiency in major crops, such as cereals (rice, wheat and maize) and cash crops (cotton and sugarcane) and some extended their research to estimate allocative efficiency as well. Bravo-Ureta and Pinheiro (1997), Taylor and Shonkwiler (1986), and Shapiro (1983)

estimated technical inefficiency between 30-34 percent in the Dominican Republic, Brazilian and Tanzanian agriculture. Hussain (1989) estimated 30 and 57 percent technical and allocative efficiency, respectively in Pakistan's agriculture. Ali and Flinn (1989) concluded that the profit of the rice farmers in Pakistan could be increased by 28 percent through improved efficiency. Bravo-Ureta and Evenson (1994) found technical and allocative inefficiency to be 40 and 30 percent, respectively in cotton production in Paraguay. In spite of the vast literature concentrating on cereals, we did not find much literature exploring efficiency in vegetable production except Wilson *et al.* (1998) and Amara *et al* (1999) who estimated technical efficiency in potato production in the UK and Canada, respectively. The present study will help fill this gap in Pakistan where no such study exists that explores efficiency in vegetable production. The main objective of the present study is to estimate technical inefficiency in potato production in Pakistan's Punjab province, by employing the stochastic production frontier approach and to determine the sources of inefficiency in order to develop policy parameters to improve the existing situation.

The organization of the paper is as follows. In the next section, a brief review on technical efficiency is summarized. In the second section, a conceptual and analytical framework explaining technical efficiency is discussed. The third section explains the study area and data collection procedure and delineates the empirical model with variable specification. Empirical results are presented in section 4 and conclusions are derived in the subsequent section.

2.1. Analytical Framework

When firms operate under uncertainty, fluctuations in output are mainly due to fluctuations in inputs, technical inefficiency and random shocks. The fluctuation due to variation in inputs can be captured through a production function specification. The variation in output due to technical inefficiency and random shocks can be captured and decomposed through the stochastic production frontier approach (parametric approach). The existence of inefficiency in production comes from inefficient use of scarce resources. The present study deals with the technical inefficiency in potato production. Technical efficiency (TE) can be estimated by employing different approaches, including the stochastic production frontier and data envelopment analysis (DEA), also called the non-parametric approach. These two methods have a range of strengths and weaknesses which may influence the choice of methods in a particular application and the constraints, advantages and disadvantages of each approach have been discussed by Coelli (1996) and Coelli and Perelman (1999). However, it is well documented that

the DEA approach works under the assumption of absence of random shocks in the data set. Since farmers always operate under uncertainty, the present study employs a stochastic production frontier approach introduced by Aigner *et al.* (1977); and Meeusen and van den Broeck (1977). Following their specification, the stochastic production frontier can be written as:

$$y_i = F\left(x_i, \beta\right) e^{\varepsilon_i} \qquad i = 1,2,.....N \tag{1}$$

where y_i is the yield of potatoes for the *i*-th farm, x_i is a vector of k inputs (or cost of inputs), β is a vector of k unknown parameters, ε_i is an error term. The stochastic production frontier is also called "composed error" model, because it postulates that the error term ε_i is decomposed into two components: a stochastic random error component (random shocks) and a technical inefficiency component as follows:

$$\varepsilon_i = v_i - u_i \tag{2}$$

where v_i is a symmetrical two sided normally distributed random error that captures the stochastic effects outside the farmer's control (e.g. weather, natural disaster, and luck), measurement errors, and other statistical noise. It is assumed to be independently and identically distributed $N\left(0, \sigma_v^2\right)$. Thus, v_i allows the production frontier to vary across farms, or over time for the same farm, and therefore the production frontier is stochastic. The term u_i, is a one sided (u_i>0) efficiency component that captures the technical efficiency of the *i*-th farmer. This one sided error term can follow different distributions such as truncated-normal, half-normal, exponential, or gamma [Stevenson, (1980); Aigner *et al.*, (1977); Green, (2000, 1990); Meeusen and Von den Broeck, (1977)]. In this paper it is assumed u_i follows a half normal distribution $N\left(0, \sigma_u^2\right)$ as typically done in the applied stochastic frontier literature.[1] The truncated-normal distribution is a generalization of the half-normal distribution. It is obtained by the truncation at zero of the normal distribution with mean μ, and variance, σ_u^2. If μ is pre-assigned to be zero, then the distribution is half-normal. Only two types of distributions are considered in FRONTIER 4.1 i.e. half-normal and truncated-normal

[1] On the basis of generalized likelihood ratio test, half-normal distribution is selected for the present study. The distribution of u_i would not affect the efficiency calculations and therefore this paper does not include gamma and exponential modeling of the error term [also see Kebede (2001) and Wadud (1999)].

distributions[2]. The two error components (*v* and *u*) are also assumed to be independent of each other. The variance parameters of the model are parameterized as:

$$\sigma_s^2 = \sigma_v^2 + \sigma_u^2 ; \qquad \gamma = \frac{\sigma_u^2}{\sigma_s^2} \quad and \quad 0 \le \gamma \le 1 \tag{3}$$

The parameter γ must lie between 0 and 1. The maximum likelihood estimation of equation (1) provides consistent estimators for the β, γ, and σ_s^2 parameter, where, σ_s^2 explains the total variation in the dependent variable due to technical inefficiency (σ_u^2) and random shocks (σ_v^2) together. Hence, equation (1) and (2) provide estimates for v_i and u_i after replacing ε_i, σ_s^2 and γ by their estimates. Multiplying both sides of equation (1) by e^{-v_i} and replacing the β's with maximum likelihood estimates yields the stochastic production frontier as:

$$y_i^{\bullet} = F\left(x_i, \beta^{\otimes}\right) e^{-u_i} = y_i e^{-v_i} \tag{4}$$

where y^*_i is the yield of potato of the *i*-th farm adjusted for the statistical random noise captured by v_i (Bravo-Ureta and Rieger, 1991). All other variables are as explained earlier and $\beta^{\otimes}$ is the vector of parameters estimated by maximum likelihood estimation. The technical efficiency (TE) relative to the stochastic production frontier is captured by the one-sided error components u_i>0, i.e.

$$e^{-u_i} = \left[\frac{y_i}{F\left(x_i, \beta^{\otimes}\right) e^{v_i}} \right] \tag{5}$$

The function determining the technical inefficiency effect is defined in its general form as a linear function of socio economic and management factors,

$$IE_i = F\left(Z_i\right) \tag{6}$$

More detail about dependent and independent variables is given in the empirical model.

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[2] The distribution of u_i would not affect the efficiency calculations and therefore this paper does not include gamma and exponential modeling of the error term [also see Kebede (2001) and Wadud (1999)].

3. Data Collection Procedure

For the purpose of this study, four districts were initially selected (Okara, Sahiwal, Pakpattan and Kasur) because they have the highest area allocated to potato cultivation. Of these, two districts, (Okara and Kasur) were selected by using the simple random sampling technique. The share of Okara and Kasur in total potato area in the Punjab province was found to be 24.24 and 9.11 percent, respectively. Two potato crops, namely autumn and spring, are cultivated each year in all districts of the Punjab province. However, more land is cultivated under the autumn crop compared to the spring crop. Because of this fact, data for the autumn crop was collected from Okara and Kasur districts of the Punjab.

The Okara district has cultivated, uncultivated and cropped areas of 237,000 acres, 848,000 acres, and 1.44 million acres respectively and the area sown more than once is 618,000 acres. With suitable climatic conditions, the intensity of potato cultivation is higher in this district than all other districts in the Punjab province.

In terms of climate, district Kasur is similar to the Okara district. District Kasur has cultivated, uncultivated, and cropped areas of 835,000 acres, 146,000 acres, and 1.21 million acres, respectively and the area sown more than once is 395,000 acres. After the Okara and Sahiwal districts, the intensity of potato cultivation is the highest in this district.

3.1. Sampling

Major potato growing villages were selected with the consultation of the Department of Agricultural Extension (Agriculture Officer) in the Okara and Kasur districts. A total of 100 farmers, 50 from each district were chosen by using a random sampling technique among the potato growers. A well structured and field pre-tested comprehensive interviewing schedule was used for the collection of detailed information on various aspects of the potato crop for the year 2002-03. Survey data had information on socio-economic characteristics of the farmers, input-output quantities, and management practices. Marketing data, collected from the farmers as part of the production survey includes information about the output disposal pattern, packing material and marketing cost. Data on the production constraints of potato production were also gathered. The mean value of household related variables (age, years of education, and frequency distribution of ownership and tenure status) and economic variables (input-output quantities and cultivated area) for two districts are reported and compared in Table-1. The quantity of seed, labor and area allocated to

vegetables is significantly higher in Okara district compared to Kasur district. However, cost of plant protection measures, farmyard manure, irrigation hours and yield is significantly higher in Okara compared to Kasur.

3.2. Empirical Model

The empirical strategy will comprises three steps. In the first step, we will estimate the Cobb-Douglas and translog production functions for potato cultivation, and select the best functional form using the likelihood ratio test. The estimation of the production function will help us to select the variables that will be used in the estimation of technical efficiency in Step 2. In Step 2, the stochastic frontier is estimated using the variables that had statistically significant coefficients for the production function in Step 1. Finally, in Step 3, the estimated technical efficiency from Step 2 is utilized in a regression to discover the sources of technical inefficiency.

Step 1: Selecting the Functional Form of the Production Function

Cobb-Douglas is a special form of the translog production function where the coefficients of the squared and interaction terms of input variables are assumed to be zero. In order to select the best specification for the production function (Cobb-Douglas or translog) for the given data set, we conducted hypothesis tests for the parameters of the stochastic production frontier model using the generalized likelihood-ratio statistic "LR" defined by

$$LR = -2 \ln \left[L(H_0) / L(H_1) \right] \qquad (7)$$

where, $L(H_0)$ is value of the likelihood function of the Cobb-Douglas stochastic production frontier model, in which the parameter restrictions specified by the null hypothesis, $H_0 = \beta_{ji} = 0$, (i.e. the coefficient on the squared and interaction terms of input variables are zero) are imposed; $L(H_1)$ is the value of the likelihood function for the full translog stochastic production frontier model (where the coefficient of the squared and interaction terms of input variables are not zero). If the null hypothesis is true, then "LR" has approximately a chi-square (or mixed chi-square) distribution with degrees of freedom equal to the difference between the number of parameters estimated under H_1 and H_0, respectively. We use the Cobb-Douglas (CD) and translog production functions and on the basis of the test statistic we discovered that the CD is the best fit to our data set.

On the basis of this test statistic we selected the Cobb-Douglas production function.

In addition to the above evidence, the Cobb-Douglas (CD) functional form (in spite of its restrictive properties) is used because its coefficients directly represent the elasticity of production. It provides an adequate representation of the production process, since we are interested in an efficiency measurement and not an analysis of the production structure (Taylor and Shonkwiler, 1986). Further, the CD functional form has been widely used in farm efficiency analyses.[3]

Step 2: Estimating the Stochastic Frontier

The stochastic production frontier (as given below) for potatoes, is empirically estimated by employing maximum likelihood estimation technique:

$$\ln y_i = \ln \beta_0 + \sum_{j=1}^{7} \beta_j \ln x_{ij} + v_i - u_i \qquad (8)$$

where,

y_i = yield of vegetables of the *i*-th farm in ton/acreage

β_0 is intercept and β_i's are response parameters or elasticity corresponding to each input

X_1 = tractor hour/ acreage

X_2 = seed in kg/ acreage

X_3 = family and hired labor used for all activities (except for harvest) in days/acreage

X_4 = Plant protection cost (Rs./acres)

X_5 = Farm yard manure in trolleys/ acreage

[3] The statement can be supported by the empirical literature reviewed in Battese (1992), and in Bravo-Ureta and Pinheiro (1993). Kebede (2001) and Bravo-Ureta and Pinheiro (1997) also employed a similar functional form. Moreover, different studies concluded that choice of functional form might not have a significant impact on measured efficiency levels (Wadud, 1999; Ahmed and Bravo-Ureta, 1996; Good *et al.,* 1993; Villano, 2005).

X_6 = fertilizer in kg of NPK nutrients/acreage

X_7 = hour of irrigation/ acreage

v_i = a disturbance term with normal properties as explained above

u_i = farm specific error term as defined in equation (2)

The model is estimated on per acreage basis by employing the Frontier Version 4.1 program developed by Coelli (1994). There are two reasons to estimate on a per acreage basis: first, it is intuitively simpler to directly interpret efficiency on a per unit area as opposed to per plot basis; second, farm size is collinear with other variables included in the model.

The error terms v_i and u_i are then found from the stochastic production frontier model and technical efficiency is predicted by replacing parameters with their maximum likelihood estimates. Subtracting v_i from both sides of equation (8) and by replacing β's with maximum likelihood estimates ($\beta^{\otimes}$s) yields:

$$\ln y_i^{\bullet} = \ln y_i - v_i = \ln \beta_0^{\otimes} + \sum_{j=1}^{7} \beta_j^{\otimes} \ln x_{ij} - u_i \qquad (9)$$

where, $y_i^{\bullet}$ now represents the farm's observed yield for the stochastic random noise captured by v_i (as explained in equation 5). The farm specific technical efficiency is estimated by using the relation as discussed in equation 6 and for our specific empirical model it is given below;

$$TE_i = \exp(-u_i) = \left[\frac{y_i}{\left(\beta_0^{\otimes} \prod_{j=1}^{7} x_{ij}^{\beta_j^{\otimes}} \right) e^{v_i}} \right] \qquad (10)$$

The literature indicates that a range of socio-economic and demographic factors determine the efficiency of farms (Seyoum *et al.* (1998); Coelli and Battese (1996); Wilson *et al.* (1998)) and another set of studies

concluded that land use, credit availability, land tenure and household labor, education (Kalirajan and Flinn (1983); Lingard *et al.* (1983); Shapiro and Muller (1977); Kumbhakar (1994)) are important determinants of efficiency. Techniques of cultivation, share tenancy, and farm size also influence the efficiency (Ali and Chaudhry (1990); Coelli and Battese (1996); Kumbhakar (1994)). Some environmental factors and non-physical factors like information availability, experience, and supervision might also affect the capability of a producer to utilize the available technology efficiently (Parikh *et al.* (1995); Kumbhakar (1994)).

The impact of farm size is ambiguous on efficiency. According to Sharif and Dar (1996), farm size is positively related with technical efficiency, because large farmers have much greater access to public services, credit and other inputs. On the other hand small farmers could be more efficient in utilizing limited available resources for their survival and due to economic pressure, but they could be less efficient too because of not using modern technologies due to financial constraints or because they are not viable for use on small farms. However, it might not be true to correlate the farm holding with inefficiency, especially in the case of vegetables where farmers have large farm holdings, but the area allocated to vegetable cultivation is only a part of total area available for cultivation. Hence, it is not rational to study the impact of farm size (total cropped area) on technical efficiency and that is why we attempted to study the impact of area allocated to only potato production on technical inefficiency rather than total land holding.

Step 3: Identifying Sources of Technical Inefficiency

The farm specific inefficiency ($1\text{-}TE_i$) is considered as a function of six different variables and the inefficiency effects model is estimated as:

$$IE_i = \delta_0 + \sum_{j=1}^{6} \delta_j Z_{ji} \qquad (11)$$

where, δ_0 is the intercept term and δ_j is the parameter for the j-th explanatory variable and

Z_{1i} = Age of the respondent in years

Z_{2i} = Education, i.e. Schooling years of the farmer

Z_{3i} = Ownership status, i.e. if owner then Z_{3i} = 1 otherwise zero

Z_{4i} = Consultation with extension staff, i.e. if consulted then Z_{4i} = 1 otherwise zero

Z_{5i} = Consultation with input dealers i.e. if consulted then Z_{5i} = 1 otherwise zero

Z_{6i} = Area allocated to potato production

4. Results and Discussion

Step 1 Results: Selection of the Cobb-Douglas Production Function

We tested the hypothesis whether the Cobb-Douglas production function is an adequate representation of the data using equation 8, given the specifications of the translog model. Alternatively, we tested to see if the coefficients of interaction and square terms in the translog production function were zero. The values of the log likelihood for the Cobb-Douglas and translog production functions were 43.7 and 20.1, respectively. By employing equation 7 we estimated the value of "LR" equal to 47.2. This value was compared with the upper five percent point for the χ^2_{35} distribution, which is 43.77. Thus the null hypothesis that the Cobb-Douglas stochastic production frontier is an adequate representation of the data was accepted, given the specifications of the translog stochastic production frontier.

Step 2 Results: Estimation of the Stochastic Frontier

The results of the Ordinary Least Square (OLS) and Maximum Likelihood Estimation (MLE) for the Cobb-Douglas production function as described in equation 8 are reported in Table-2.[4] Here we are interested in testing the null hypothesis $H_{0:}\ \delta_i = 0 = \gamma$ where, i = 1 ...7. It should be noted that the log-likelihood function for the full stochastic production frontier model is calculated to be 43.71 and the value for the OLS fit for the production function is 27.25. This implies that the generalized likelihood-ratio statistic for testing the absence of the technical inefficiency effect from the frontier is calculated to be LR = -2*(27.25-43.71) = 32.93. This value is estimated by Frontier 4.1 and reported as the "LR" test of the one sided error. The degrees of freedom for this test are calculated as q+1,

[4] The Ordinary Least Square (OLS) and Maximum Likelihood Estimation (MLE) for equation 8 are reported because the value of log likelihood function for OLS and MLE allow to test whether technical inefficiency exits or not. In case technical inefficiency does not exist then technically there will be no difference in the parameters of OLS and MLE.

where q is the number of parameters, other than γ specified to be zero in H_0, thus in our case q = 8. The value of the "LR" test is significant because it exceeds the value taken from Kodde and Palm (1986). Kodde and Palm (1986) is used in the cases where more than one parameter restriction with mixed chi-square distribution are involved. The log likelihood ratio test indicates that inefficiency exists in the data set and hence the null hypothesis of no technical inefficiency effects in potato production is rejected.

The sign of coefficients of all variables in equation 8 when estimated with MLE technique are positive except fertilizer and irrigation hours which are negative but insignificant (Table-2)[5]. This implies that fertilizer and irrigation hours do not affect the yield of the potato crop significantly. However, the negative sign of fertilizer might be due to the reason that farmers are using more fertilizer than the recommended level or at a declining marginal productivity level. However, future research should focus on exploring this critical issue. The irrigation hours have negative but non-significant impact on yield. This may be because the quality of ground water which is being used for irrigation is not suitable for agriculture purposes, or there could be over use of water in potato production. Further research is needed to determine the quality of ground water and its impact on potato production.

The Cobb-Douglas production function parameters can be interpreted directly as output elasticities. The parameters of tractor hours, quantity of seed and labor have positive signs and are statistically significant at the 1 percent level. This implies that these inputs are playing a major role in potato production. The elasticity of labor hours is highest compared to all variables included in the model, implying that the contribution of labor hours in total factor productivity is dominant. A one percent increase in the use of labor hours leads to a 0.236 percent increase in potato yield. This increase in yield is the result of better weeding and cultivation practices. Another important input is tractor hours used for land preparation. Results show that the potato yield could be improved up to 0.183 percent by using one percent more tractor hours in land preparation, because seed germination is high on well-prepared beds. Another important input in terms of its effect on the potato yield is seed. An addition of one percent seed increases output by 0.038 percent. The greater use of seed

[5] To analyze the impact of variety and planting date on output, variety dummies and planting week of the year was included in the production function as explanatory variables but we found all these variables insignificant and therefore excluded them in the final estimation.

increases the plant population in the field and thus increases yield. The mean technical efficiency is 84 percent, indicating that further potential exists to improve productive efficiency of the resources allocated to potato production (Table-4).

It is observed that the MLE estimate (using equation 8) of γ is 0.824 with estimated standard error of 0.096 (Table-2). This is consistent with the theory that the true γ-value should be greater than zero and less than one. The value of the γ-estimate is significantly different from one, indicating that random shocks are playing a significant role in explaining the variation in potato production, which is expected especially in the case of agriculture where uncertainty is assumed to be the main source of variation. This implies that the stochastic production frontier is significantly different from the deterministic frontier, which does not include a random error. However, it should be noted that 82 percent of the variation in yield is due to technical inefficiency and only 18 percent is due to the stochastic random error.

Step 3 Results: Identifying the Sources of Technical Inefficiency

In order to investigate the determinants of inefficiency, we estimated the technical inefficiency model elaborated in equation 11, where inefficiency is assumed to be the dependent variable. We used age of the decision maker as a proxy variable for experience in farming and the coefficient is highly statistically significant with a negative sign, which indicates that experience is inversely related with inefficiency. The education of the farmer also has a negative sign consistent with our expectations, but it is statistically insignificant. The sign of the coefficient of ownership status indicates that owners are less efficient than tenants, although the coefficient is not statistically significant. Consultation with extension workers significantly contributes to improved technical efficiency in potato production and this implies that the extension department should be one of the major targeted variables from the policy point of view in order to improve technical efficiency in potato production. Hence, there is a need to strengthen the role of the extension department in the crop sector and to make its role more effective. Due to a lack of extension services and their effective role, we find that farmers also discuss their crop related problems with input dealers. We find that contact with input dealers improves technical efficiency but the coefficient is not statistically significant. Finally, we try to explore the impact of total vegetable area on farm inefficiency and the results indicate that as area under vegetable production increases, inefficiency decreases (Table-3). It might be due to the reason that modern

technologies such as tractors and irrigation are more viable for use on large vegetable farms compared to small ones.

The frequency distribution of technical inefficiency is reported in Table-4. The maximum and minimum values of technical efficiency are 98 and 49 percent, respectively. The mean technical efficiency in potato production is 84 percent showing that potential exists to increase potato yield by using available resources more efficiently. The estimated mean technical efficiency is greater than that found by Amara, *et al.* (1999) for potato farmers (80.27 percent) in Quebec, Canada. For studies conducted in Pakistan, it is noted that the levels of technical efficiency for potato growers is less than that found by Hassan (2004) for wheat crops (93.6 percent) in the mixed farming system of Punjab, and by Ahmad, *et al.* (1999) for rice (85 percent) farmers.

In our case, seventy farmers are more than 80 percent technically efficient and 17 farmers are more than 70 but less than 80 percent technically efficient. Thirteen farmers are less than 70 percent technically efficient.

By improving technical efficiency from 84 to 100 percent, the average yield will increase from 8.33 ton per acre to 9.92 ton per acre with the available resources. The total area in the province of the Punjab under potato production is 226,600 acres and improvement in technical efficiency up to 100 percent would allow increasing potato production from 1,887,578 tons to 2,247,872 tons per year. This additional 360,294 tons of potato would raise Rs. 990.81 ($16.51) million of revenue each year. The results clearly demonstrate the substantial benefits of more efficient input use in the production of potatoes. If similar results prevail in the production of all vegetables, then it implies that improvement in resource use efficiency can contribute remarkably to increase revenue at the farm level.

5. Conclusion

The study employed the stochastic production frontier approach to estimate technical inefficiency in potato production. It is observed that potato farmers are 84 percent technically efficient, indicating that a substantial potential exists that can be explored by improving resource use efficiency in potato production. This improvement in resource use efficiency would generate an additional Rs. 990.81 ($16.51) million in the province. The results are derived only from potato production, which is only one vegetable among many others.

The coefficients on fertilizer and irrigation are negative but insignificant implying that both inputs are possibly being over utilized. Future research should focus on determining the optimum use of fertilizer nutrients for potato production. However, the coefficient on irrigation could be negative due to poor quality of ground water. The study also identifies that extension services are not being properly disseminated in the study area. Currently only 37 percent of farmers have any contact with extension workers. Given the large coefficient estimate on extension services in Table-3, improvement in these services can play a significant role in improving technical efficiency in potato production. It would be useful to focus future research on the economic evaluation of extension services by estimating the costs versus benefits of these services, which will enable policymakers to design appropriate agricultural policies with regard to the future role of extension services.

The above conclusions are valid only for potato production but it will be quite useful to conduct a comprehensive study on the other major vegetables to develop a clear-cut policy for vegetables, a neglected food frontier in Pakistan. Such information will facilitate policy managers to strike a balance in resource allocation among agricultural and non-agricultural sectors and even among different crops within the agricultural sector.

Table-1: Summary statistics for different variables of potato farmers in the Okara and Kasur regions of Punjab, Pakistan

Variables	Okara			Kasur		
	Mean	Min.	Max.	Mean	Min.	Max.
Household Characteristics						
Operator's age (years)	45.7 (12.8)	24.0	85.0	42.9 (14.6)	25.0	80.0
Operator's education (years)	7.9 (3.6)	0.0	12.0	7.2 (3.8)	0.0	12.0
Tenure						
Owners (frequency)	25			25		
Tenants (frequency)	23			25		
Consultation with extension staff (no.)	17			20		
Consultation with input dealers	18			13		
Vegetable Production						
Land preparation (tractor hours/acreage)	6.5 (1.5)	4.5	9.0	6.9 (1.3)	3.8	9.5
Seed (tons/acreage)	1.3* (0.1)	1.2	1.8	1.2* (0.2)	0.9	1.6
Labor (hours)/acreage	70.8* (32.5)	27.8	190.3	54.1* (15.5)	29.2	102.3
Plant protection measures (Rs/acreage)	1496.0* (477.9)	500.0	2300.0	1731.1 * (550.4)	455.0	3000.0
Farmyard manure (trolley/acreage)	1.2* (1.9)	0.0	6.0	1.9* (1.8)	0.0	5.0
Fertilizer (kg/acreage)	223.1 (56.8)	121.0	340.0	231 (45.8)	133.0	321.0
Irrigation (hours/acreage)	13.1* (4.4)	0	22.5	19.7* (3.7)	10.0	24.0
Vegetable area (acreage)	48.9* (53.7)	3.0	200.0	21.1* (21.5)	1.0	75.0
Yield (ton/acreage)	8.2* (2.1)	4.0	15.0	8.9* (2.3)	5.9	17.0

Figures in parenthesis are standard deviation

* indicates significance of means between two districts at the ten percent probability level

Table-2: OLS and Maximum Likelihood Estimates of the Cobb Douglas Stochastic production Frontier Function[a]

Variable	OLS Coefficients	MLE Coefficients
Intercept	1.242*	1.010*
	(0.637)	(0.509)
Ln Tractor hours	0.079	0.183*
	(0.096)	(0.076)
Ln Seed	0.038*	0.038*
	(0.013)	(0.001)
Ln Labor hours	0.238*	0.236*
	(0.061)	(0.054)
Ln Plant Protection cost	-0.015	0.018
	(0.055)	(0.048)
Ln Farm Yard Manure	0.002	0.006
	(0.073)	(0.006)
Ln Fertilizer (NPK)	-0.038	-0.026
	(0.088)	(0.070)
Ln Irrigation Hours	0.024	-0.006
	(0.064)	(0.054)
σ^2	0.036	0.055
		(0.083)
Γ		0.824*
		(0.096)
Log Likelihood function	27.251	43.717

Figures in parenthesis are standard errors

* and ** indicates significance at one and ten percent probability levels respectively

a. Coefficient estimated by employing equation 8 with OLS and MLE techniques, respectively.

Table-3: Inefficiency Effect Model[b]

Variables	MLE coefficients
Intercept	0.697*
	(0.229)
Age of the respondent	-0.010*
	(0.005)
Education	-0.008
	(0.012)
Ownership status	0.058
	(0.086)
Consultation with extension staff	-0.500*
	(0.251)
Consultation with input dealers	-0.056
	(0.083)
Vegetable area	-0.002**
	(0.002)

Figures in parenthesis are standard errors

* and ** indicates significance at one and ten percent probability level respectively

[b] Coefficient estimated by employing equation 11

Table-4: Frequency Distribution of Technical Efficiency for Individual Farms

Efficiency interval[b]	Frequency
0.800<TE<1.00	70
0.700<TE<0.800	17
0.600<TE<0.700	9
0.500<TE<0.600	3
0.400<TE<0.500	1
Average	0.844
Minimum	0.493
Maximum	0.976

[b.] TE close to one indicates higher level of technical efficiency

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Technical Efficiency of Some Selected Manufacturing Industries in Bangladesh: A Stochastic Frontier Analysis

Md. Azizul Baten[*], Masud Rana[*], Sumonkanti Das[*] and Md. Abdul Khaleque[**]

Abstract

This paper investigates the technical efficiency of selected manufacturing industries of Bangladesh using a stochastic frontier production function approach suggested by Battese and Coelli (1992) applied to panel data. A feasible Cobb-Douglas stochastic frontier production function, which has time-varying technical inefficiency effects, was estimated. Two alternative distributions were used to model the random inefficiency term: a truncated normal distribution and a half-normal distribution. The estimated average technical efficiency for four groups of industries of Bangladesh over the reference period was 40.22% of potential output for the truncated normal distribution, whereas it was 55.57% of potential output for the half-normal distribution.

Keywords: Stochastic frontier, Production function, Technical efficiency

Introduction

One of the most important and fascinating aspects of economic change in Bangladesh in the last three decades has been the growth of manufacturing. There is great scope for the manufacturing sector of Bangladesh to improve its technical efficiency; without improving its technical efficiency, the sector cannot play the desired role in the process of economic development of the country. The manufacturing process may play a vital role in the development process by creating new jobs, increasing exports, and displacing imports. But efficiency is the first condition that has

[*] Department of Statistics, Shah Jalal University of Science and Technology, Sylhet-3114, Bangladesh.
[**] Department of Statistics and Computer, Dhaka Commerce College, Dhaka, Bangladesh.

to be achieved to be competitive internationally. In order to accelerate the development process, industries have to be come technically efficient.

Following the seminal paper by Farrell (1957), frontier production functions were introduced and have been widely applied by different researchers. The stochastic frontier production function was independently proposed by Aigner, Lovell and Schmidt (1977), Meeusen and van don Broeck (1977) and Battese and Corra (1977), and there have been a vast range of applications in the literature. (For literature surveys see Greene (1993) and Rao and Coelli (1998)). The model was originally defined for the analysis of cross-sectional data but various models to account for panel data have been introduced by Pitt and Lee (1981), Cornwell, Schmidt and Sickles (1990), Kumbhakar (1990), Kumbhakar, Ghosh and Mcgukin (1991). Battese, Malik and Broca (1993) and Battese. Malik and Gill (1996) studied the frontier production function, considering four years of panel data for each of four districts of Pakistan and a modified Cobb-Douglas production frontier in which the models for the technical inefficiency effects were specified by Battese and Coelli (1992,1995). Battese and Coelli (1995) proposed a stochastic frontier production frontier for panel data, which has firm effects assumed to be distributed as truncated normal random variables, which are also permitted to vary systematically with time and in which the inefficiency effects are directly influenced by the number of variables. By using the same model, Taymaz and Saatci (1997) estimated the stochastic production frontier for Turkish textile, cement and motor vehicle industries. A frontier production function studied by Ajibefun, Battese and Kada (1996) applyied time-varying inefficiency model using eleven years of data on rice production in prefectures in Japan. They suggested that the traditional average response function, which does not account for the technical inefficiency of production, is not an adequate representation of the data. Tzouvelekas *et. al*. (1999) investigated the relative contribution of technical efficiency, technological change and increased input use to the output growth of the Greek olive-oil sector using a stochastic frontier production function approach applied to panel data. Jafrullah (1996) studied the technical efficiency of 19 four-digit manufacturing industries of Bangladesh and concluded that the manufacturing industries of Bangladesh analyzed were not highly technical but efficient.

In fact, few studies have been done to see the technical efficiency of Bangladeshi manufacturing industries using panel data. Future, efficiency has seldom been studied for manufacturing industries in Bangladesh using the stochastic frontier production function [Jafrullah M, (1996)]. Since estimation of the production function by standard panel analysis does not

present information such as efficiency in the production function, we analyze the stochastic frontier production function in this study.

The objective of this study is to apply the stochastic frontier production function to investigate the technical efficiencies of four three-digit level industries of Bangladesh for panel data. This study is important in predicting the technical efficiencies for the selected group of manufacturing industries, but also indicates the trend of efficiency over the period, 1981/82 – 1999/2000. At the same time, it is desirable to see whether technical efficiency is time varying or time invariant. The paper proceeds as follows: the next section reviews the stochastic frontier production function approach to modeling inefficiency. This includes a discussion of the determinants of inefficiency used here. The data is discussed in section 3, while section 4 provides and discusses the results from estimating the stochastic production frontier. Finally, the last section presents conclusions.

Stochastic Frontier Model with Technical Efficiency Effects

In this study we have considered the Stochastic Frontier Model to measure the technical efficiency of selected manufacturing industries in Bangladesh. The framework assumes the existence of a best practice frontier corresponding to fully efficient operation in the industry under investigation. This frontier defines the maximum level of output that can be obtained from any vector of resource inputs in the absence of uncertainty. The stochastic component of the frontier consists of two types of disturbance or error terms. The first is a regular symmetric disturbance that represents statistical noise in a typical regression. The second disturbance or error term, which is firm specific, is a one-sided deviation from this idealized frontier, and is referred to as technical inefficiency. The greater the amount by which the realized production falls short of the stochastic frontier, the greater the level of technical inefficiency.

The measurement of technical inefficiency has received renewed attention since the late eighties from an increasing number of researchers, as the frontier approaches to efficiency measurement have become more popular. The introduction of the frontier approach has raised the level of analysis and broadened the range of efficiency hypotheses that can be formulated and tested. The production frontier approach to technical inefficiency measurement makes it possible to distinguish between shifts in technology from movements towards the best-practice frontier. By estimating the best-practice production function (an unobservable function) this approach calculates technical efficiency as the distance between the frontier and the observed output. The advantage of frontier analysis is that

it provides an overall, objectively determined, numerical efficiency value and ranking of individual firms that is not otherwise available. The stochastic frontier approach allows observations to depart from the frontier due to both random error and inefficiency.

This paper adopts the model specification of Battese and Coelli (1992) who proposed a stochastic frontier production function for (unbalanced) panel data with firm effects that can vary systematically over time and are assumed to be distributed as truncated normal random variables. Thus the model is

$$Y_{it} = X_{it}\beta + (V_{it} - U_{it}) \quad i = 1,2,.....N, \quad t = 1,2,.. ...T \qquad (1)$$

where, Y_{it} is the logarithm of the production of the *i*-th industry in the *t*-th time period. X_{it} is a vector of input quantities of the *i*-th industry in the *t*-th time period and β is a vector of unknown parameters. The error term comprises two separate parts. V_{it} are random variables assumed to be identically and independently distributed (iid) $N(0,\sigma_v^2)$ and independent from U_{it}. U_{it} captures technical inefficiency in production. U_{it} is defined by Battese and Coelli (1992) as:

$$U_{it} = U_i \{\exp[-\eta(t-T)]\} \qquad (2)$$

where U_i $i = 1,2,.....N$ are assumed to be firm-specific non-negative random variables independently distributed as non-negative truncations at zero of the distribution $N(\mu,\sigma_u^2)$. η is an unknown parameter to be estimated, which determines whether inefficiencies are time-varying or time invariant.

In this model, the technical inefficiency effect for the *i*-th industry in the *t*-th time period, U_{it} is defined to be the product of an exponential function of time, $\exp[-\eta(t-T)]$, involving the unknown parameter, η, and the non-negative random variable U_i, which is the technical inefficiency effect for the *i*-th industry in 1999/2000, the last year of our data set. If η is positive, then $-\eta(t-T) \equiv \eta(T-t)$ is positive for $t < T$ and so $\exp[-\eta(t-T)] > 1$, which implies that the technical inefficiencies of industries decline over time. However, if η is

negative, then $-\eta(t-T)<0$ and thus technical inefficiencies increase over time.

The primary advantage of a stochastic frontier production is that it enables one to estimate U_i and therefore to estimate industry specific technical efficiencies. The measure of technical efficiency is equivalent to the ratio of the production of the *i*-th industry in the *t*-th time period to the corresponding production value if the industry effect U_i is zero.

Given the specifications of the stochastic frontier production function, defined by equation (1), the technical efficiency of the *i*-th industry in the *t*-th time period is defined by:

$$TE_{it} = (X_{it}\beta - U_{it})/(X_{it}\beta) \qquad (3)$$

where U_{it} and $X_{it}\beta$ are defined by the specifications of the model in equation (1).

The technical efficiencies are predicted using the conditional expectation of the function U_{it} given the composed error term of the stochastic frontier (c.f. Battese and Coelli (1995)). On the basis of panel data, if the production frontier being estimated is Cobb-Douglas, like equation (1), it can be expressed in the following form:

$$Y_{it} = A\, L_{it}^{\beta_L}\, K_{it}^{\beta_K}\, e^{Vit}\, e^{-Uit} \qquad (4)$$

where V_{it} follows $N(0,\sigma_v^2)$ and U_{it} follows a half or truncated normal distribution at zero. Taking natural log on both sides of equation (4), the following equation is obtained:

$$\ln Y_{it} = \ln A + \beta_L \ln L_{it} + \beta_K \ln K_{it} + (V_{it} - U_{it}) \qquad (5)$$

the subscripts, *i* and *t* represents *i*-th industry (i = 1, 2, 3, 4) and *t*-th year of observation (*t* = 1, 2, 3, ...16), respectively. The one-sided distribution of U_{it} guarantees inefficiency to be positive only.

Given the specifications of the stochastic frontier production function, defined by equation (1), the null hypothesis, that technical inefficiency is not present in the model, is expressed by $H_0:\gamma=0$, where γ is the variance ratio, explaining the total variation in output from the

frontier level of output attributed to technical efficiencies and defined by $\gamma = \frac{\sigma_u^2}{\sigma_v^2 + \sigma_u^2}$. This is done with the calculation of the maximum likelihood estimates for the parameters of the stochastic frontier model by using the computer program FRONTIER Version 4.1 (Coelli 1996). The parameter γ must lie between 0 and 1. If the null hypothesis is accepted, this would indicate that σ_u^2 is zero and hence that the U_{it} term should be removed from the model, leaving a specification with parameters that can be consistently estimated using ordinary least squares.

Further, the null hypothesis that the technical inefficiency effects are time invariant and that they have half-normal distribution are defined by $H_o : \eta = 0$ and $H_o : \mu = 0$ respectively. These hypotheses are tested using the generalized likelihood ratio test and the generalized likelihood ratio statistic, λ is defined by $\lambda = -2 \ln [L(H_o) / L(H_1)]$, where H_o and H_1 are the null and alternative hypotheses involved. If the null hypothesis, H_o, is true, then λ is asymptotically distributed as a Chi-square (or mixed Chi-square) random variable. If the null hypothesis involves $\gamma = 0$, then λ has mixed Chi-square distribution (see Coelli, 1995, 1996) because $\gamma = 0$ is a value on the boundary of the parameter space for γ.

Data sources and variables construction

Data description

Data for the selected group of industries have been drawn from the Census of Manufacturing Industries (CMI), conducted by the Bangladesh Bureau of Statistics (BBS) every year. Our area study covers selected 3-digit census factories, under the registered manufacturing sectors of Bangladesh over the reference period 1981/1982 to 1999/2000. As data for three years, viz., 1994/1995, 1996/1997, and 1998/1999 were not published, data for the remaining 16 years have been considered for our present study. The estimates at constant prices (1981/1982=100) are derived.

The study focuses on a selected group of industries of the Bangladesh registered manufacturing sector. The selected group of industries are food manufacturing industries, beverage industries and tobacco industries under group one; textile manufacturing industries and apparel under group two; leather and its products, footwear and rubber products under group three; and non-metallic mineral products, fabricated metal

products, electrical and non-electrical machinery under group four. The industries are grouped based on their nature.

The food manufacturing sector, presented in group one, plays an important role in the economy being necessary goods that are needed for daily life. Group two consists of textile manufacturing industries and apparel from which Bangladesh earns a major part of its foreign currency. About 75% of the total exports of Bangladesh came from this group. About 10 million people depend on the textile industries directly and indirectly for earning their livelihood. Every year Bangladesh earns about 6,500 million US dollars by exporting textile products. Leather and its products are another important sector for earning foreign currency.

Variable construction

Value added (Y): Gross value added figures are used in this study to represent value added and is equal to gross output minus industrial cost. Industrial costs include the cost of raw materials, fuel and electricity. We use value added instead of net value added to avoid the arbitrariness involved in depreciation estimates. To obtain the gross value added series in 'constant prices', the yearly current values were deflated by the industry price index of the relevant year.

Capital (K): Capital is one of the essential inputs in measuring productivity. Gross fixed assets are used in this study as capital inputs and these are the book values of land, buildings, machinery, tools, transport and office equipment, etc. The gross values of fixed assets have been weighted by the base year rates of return to get the measure of capital input. The rate of return is the ratio of non-wage value added to fixed assets as used here. The weighted capital input was then deflated by the capital goods price index that stands as a proxy of the whole machinery price index.

Labor (L): The number of employees directly or indirectly in production is used in this study as a labor input. It covers all workers including administrative, technical, clerical, sales and purchase staff. Thus all production and non-production workers except temporary daily casuals and unpaid workers are included in the analysis. In brief, they include production workers, salaried employees, and working proprietors. The best measure of labor input is the number of hours worked. As no such data are available for any industry, employment figures were taken as the second measure and were weighted by the base year wage rates to obtain measures of labor input.

Empirical Results

Estimation

The maximum-likelihood estimates of the parameters in the Cobb-Douglas stochastic frontier production function were obtained by using the FRONTIER 4.1 program (Coelli, 1996). Tables 1 and 2 show the estimation results of the Cobb-Douglas production function on the basis of the stochastic frontier model by the method of maximum-likelihood estimation. The ordinary least square estimates of the parameters are used as initial values (to estimate) for the maximum-likelihood estimates of the parameters. The adjusted R-squared for the ordinary least square estimates is 0.78, which indicates that 78 percent total variation of the output is explained by the input variables.

The maximum-likelihood estimate of the parameter with time-varying inefficiency effects for labor input is 0.0006 and -0.0268 for the truncated normal distribution and half-normal distribution respectively presented in Table-1, which indicates that they are insignificant. Bangladesh is one of the most densely populated countries and it has a labor surplus economy and so labor has a low output elasticity (see Coelli et. al., 2003). The parameter estimate for capital input is significantly different from zero at the 1 percent level of significance for both the distributions. Again the elasticities of labor (β_L) and capital (β_K) respectively, indicate the values of 0.0006 and 0.2865. Like the previous results in panel analysis, the stochastic frontier production function also shows greater elasticity for capital than for labor. However, economies of scale show variable returns to scale as 0.2871 in the stochastic frontier production function. Here it is not important to show increasing returns to scale or decreasing returns to scale, because we do not have an inference on the estimation of efficiency in the production function by the stochastic frontier model. In addition, inefficiency of the production function is calculated by the error term. In the truncated and half-normal distributions, the ratio of industry specific variability to total variability, γ, is positive and significant at the 1 percent level, implying that industry specific technical efficiency is important in explaining the total variability of output produced. However, the γ-estimate associated with the variance of the technical inefficiency effects is relatively small. The estimates for the parameters for the time-varying inefficiency model (1), presented in Table-1, indicate that the technical efficiency effects tend to decline over time since the estimate for the η parameter is positive (i.e. $\hat{\eta}$ =0.0255). Also the parameter μ is positive indicating that the distribution of the inefficiency effects is not more concentrated about zero than that of the half-normal distribution.

Table-1: Maximum-Likelihood Estimates of the Cobb-Douglas Stochastic Frontier Production Function with Time-Varying Inefficiency Effects for the Selected Manufacturing Industries in Bangladesh

		Truncated Normal			Half-Normal		
Variable	**Parameter**	**Coefficient**	**S.E.**	**t-Statistics**	**Coefficient**	**S.E.**	**t-Statistics**
Constant	β_o	264.2533***	73.4665	3.5969	157.7610***	40.6610	3.8780
Labor input	β_L	0.0006	0.0254	0.0242	-0.0268	0.0275	0.9730
Capital input	β_K	0.2865***	0.0546	5.2526	0.3443***	0.0521	6.5966
			Variance parameter				
Sigma-Squared	σ^2	12377.180***	1.0301	11992.668	12376.782***	1.0004	12324.670
Gamma	γ	0.5280***	0.0966	5.4655	0.5109***	0.0936	5.4529
Mu	μ	161.6853**	83.5765	1.9346	0	0	0
Eta	η	0.0255**	0.0127	2.0060	0.0452***	0.0193	2.3350
Likelihood Function			-373.1902			-374.1612	

S.E. = Standard error

Note: *** Significant at 1 per cent level ($p<0.01$)
** Significant at 5 percent level ($p<0.05$)

Table-2: Maximum-Likelihood Estimates of the Cobb-Douglas Stochastic Production Frontier with Time-Invarying Inefficiency Effects for the Selected Manufacturing Industries in Bangladesh

		Truncated Normal			Half-Normal		
Variable	**Parameter**	**Coefficient**	**S.E.**	**t-Statistics**	**Coefficient**	**S.E.**	**t-Statistics**
Constant	β_o	144.111***	42.6268	3.380	119.160***	23.4097	5.0902
Labor input	β_L	-0.0151	0.0294	-0.5128	-0.0219.2	0.0291	-0.7541
Capital input	β_K	0.3531***	0.0522	6.765	.36357***	0.0519	7.0044
		Variance parameter					
Sigma-Squared	σ^2	12377.663***	1.2363	10012.099	12376.92***	1.0063	12299.18
Gamma	γ	0.4713***	0.0922	5.1115	0.48588***	0.0928	5.2361
Mu	μ	0.8590**	78.0632	1.1003	0	0	0
Eta	η	0	0	0	0	0	0
Mean efficiency			0.5619			0.6227	
Likelihood Function			-375.504			-376.05	

S.E. = Standard error

Note: *** Significant at 1 per cent level ($p<0.01$)
** Significant at 5 percent level ($p<0.05$)

On the other hand, in Table-2, the maximum-likelihood estimates of the parameter (with time-invarying inefficiency effects) for the labor input, are negative and insignificant for both the truncated and the half-normal distributions, while the coefficient of capital input values are positive and highly significant. In the case of both the truncated and half-normal distributions, the values of γ are positive and are highly significant demonstration that technical inefficiency exists in the selected manufacturing industries of Bangladesh. However, the γ-estimate associated with the variance of the technical inefficiency effects is relatively small. The η parameter is restricted to zero in the model with time-invarying inefficiency effects.

Tests

The results of formal tests of various null hypotheses were obtained using the likelihood ratio (L-R) statistic and are presented in Table-3. These are obtained by using the values of log-likelihood functions for the selected manufacturing industries and the stochastic frontier production function. The first null hypothesis $H_o : \gamma = 0$, which specifies that there are no technical inefficiency effects in the model, is rejected by the data. So the average response function is not an adequate representation of the data. This implies that the technical inefficiency effects associated with manufacturing industries in Bangladesh are significant. The technical inefficiency effects having a half-normal distribution, is tested by the null hypotheses $H_o : \mu = 0$. In our study this hypothesis is accepted which indicates that the half normal distribution is preferable to the truncated normal (at zero) distribution for the technical inefficiency effect. The hypothesis $H_o : \eta = 0$ is rejected, indicating that the technical inefficiency effect varies significantly over time.

Table-3: Generalized Likelihood-Ratio Tests of Hypotheses for Parameters of the Stochastic Frontier Production Function for the selected Manufacturing Industries in Bangladesh

Null Hypothesis	Log-Likelihood Function	Test Statistic λ	Critical Value	Decision
$H_o:\gamma=0$	- 380.1052	13.8300	7.05	Reject H_o
$H_o:\eta=\mu=0$	-376.0553	5.7302	5.99	Accept H_o
$H_o:\mu=0$	-374.1612	1.942	3.84	Accept H_o
$H_o:\eta=0$	-375.5045	4.6286	3.84	Reject H_o

Technical Efficiency

The estimates of technical efficiency for the different groups of industries, obtained by using the FRONTIER 4.1 program (Coelli, 1996), are presented in Table-4. The mean efficiency for the truncated normal distribution is found to be 0.4022 and the range is 0.0033 to 0.6979 whereas for the half-normal distribution, mean efficiency is 0.5557 ranging from 0.0173 to 0.8951. This implies that 40.22% and 55.57% of potential output is being realized in the selected manufacturing industries of Bangladesh according to the truncated (at zero) normal distribution and half-normal distribution respectively. There is a wide variation in the technical efficiencies of selected manufacturing industries. The mean technical efficiency of both distributional forms implies that the selected manufacturing industries are not achieving 100 percent of potential output. The hypothesis test confirmed the existence of inefficiency. The estimated industry-specific technical efficiency measures for each year are presented in Table-4 while Figure 1 shows the relevant probability histogram. The mean efficiency for the truncated normal distribution indicates the range of values between 0.2812 and 0.5096 while for the half-normal distribution the mean efficiency varies from 0.3898 to 0.6901. The technical efficiency measures increased in both distributions in each group of industries. In other words, the overall average levels of efficiency have increased over the period 1981/82 – 1999/2000. Nevertheless, individual technical efficiency estimates exhibit considerable variation. The half-normal distribution gives higher technical efficiency estimates than the truncated normal distribution. Group one was the most efficient group relatively whereas group three is the least efficient. Although the growth rate of technical efficiency for group three is found to be the greatest, its technical efficiency remains the lowest.

Table-4: Estimated Technical Efficiencies of Group of Manufacturing Industries in Bangladesh by Two Distribution

	Efficiency for Truncated Normal					Efficiency for Half Normal				
Year	Group one	Group Two	Group Three	Group Four	Mean	Group One	Group Two	Group Three	Group Four	Mean
1981-1982	0.5573	0.4669	0.0033	0.0973	0.2812	0.7934	0.6147	0.0173	0.1338	0.3898
1982-1983	0.5684	0.4803	0.0284	0.1200	0.2993	0.8025	0.6317	0.0607	0.1721	0.4168
1983-1984	0.5793	0.4934	0.0528	0.1421	0.3169	0.8113	0.6480	0.1022	0.2086	0.4425
1984-1985	0.5899	0.5061	0.0767	0.1637	0.3341	0.8196	0.6636	0.1419	0.2436	0.4672
1985-1986	0.6002	0.5185	0.0999	0.1848	0.3508	0.8276	0.6784	0.1798	0.2770	0.4907
1986-1987	0.6102	0.5307	0.1225	0.2052	0.3672	0.8352	0.6926	0.2160	0.3089	0.5132
1987-1988	0.6200	0.5425	0.1446	0.2253	0.3831	0.8425	0.7062	0.2506	0.3395	0.5347
1988-1989	0.6296	0.5540	0.1662	0.2448	0.3986	0.8494	0.7192	0.2837	0.3686	0.5552
1989-1990	0.6389	0.5652	0.1871	0.2638	0.4138	0.8561	0.7316	0.3154	0.3965	0.5749
1990-1991	0.6480	0.5761	0.2076	0.2823	0.4285	0.8624	0.7434	0.3456	0.4232	0.5937
1991-1992	0.6569	0.5868	0.2275	0.3004	0.4429	0.8685	0.7548	0.3745	0.4487	0.6116
1992-1993	0.6655	0.5972	0.2470	0.3180	0.4569	0.8743	0.7656	0.4021	0.4730	0.6288
1993-1994	0.6739	0.6073	0.2659	0.3351	0.4706	0.8799	0.7760	0.4285	0.4963	0.6452
1995-1996	0.6821	0.6172	0.2844	0.3519	0.4839	0.8852	0.7858	0.4538	0.5185	0.6608
1997-1998	0.6901	0.6269	0.3024	0.3682	0.4969	0.8902	0.7953	0.4779	0.5398	0.6758
1999-2000	0.6979	0.6363	0.3200	0.3841	0.5096	0.8951	0.8043	0.5010	0.5601	0.6901
Average	0.6318	0.5566	0.1710	0.2492	0.4022	0.8496	0.7195	0.2844	0.3693	0.5557

Conclusion

In this study, we have analyzed the stochastic frontier production function using panel data in selected manufacturing industries in Bangladesh. We have observed that the estimated values of the time-varying inefficiency parameter, η, are positive for both the truncated and the half normal distribution. These indicate that technical inefficiency has declined over the reference period. Tests for different null hypotheses involved in the stochastic frontier production function showed that the technical inefficiency effects for the selected manufacturing industries in Bangladesh are significant. It has been found that the mean efficiencies according to the truncated and the half normal distributions are 0.4022 and 0.5557 respectively. Here it should be noted that although the growth in technical efficiency was statistically significant over time as tested by the null hypothesis, the rate of increase in technical efficiency has been very slow over time in Bangladesh.

Figure 1: Trend of technical efficiency by group of manufacturing industries (Truncated Normal)

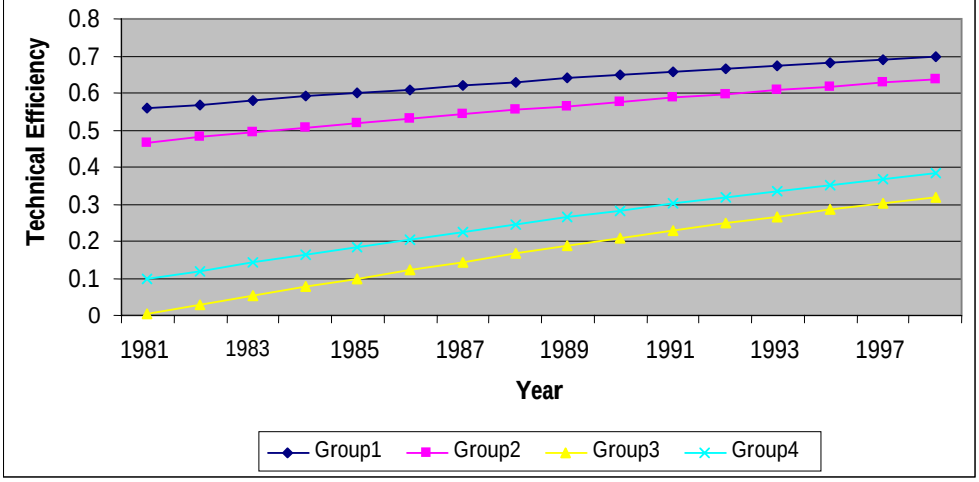


Figure 2: Trend of technical efficiency by group of manufacturing industry (Half Normal)

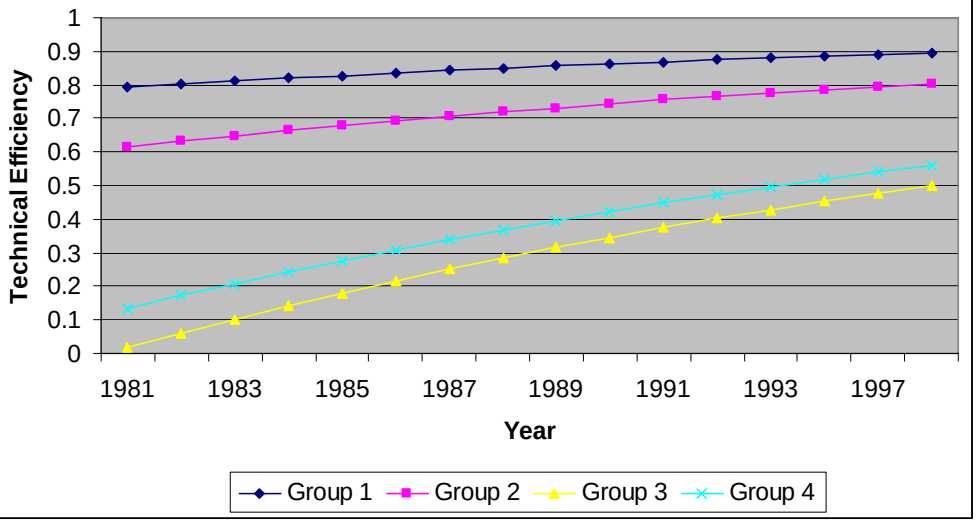
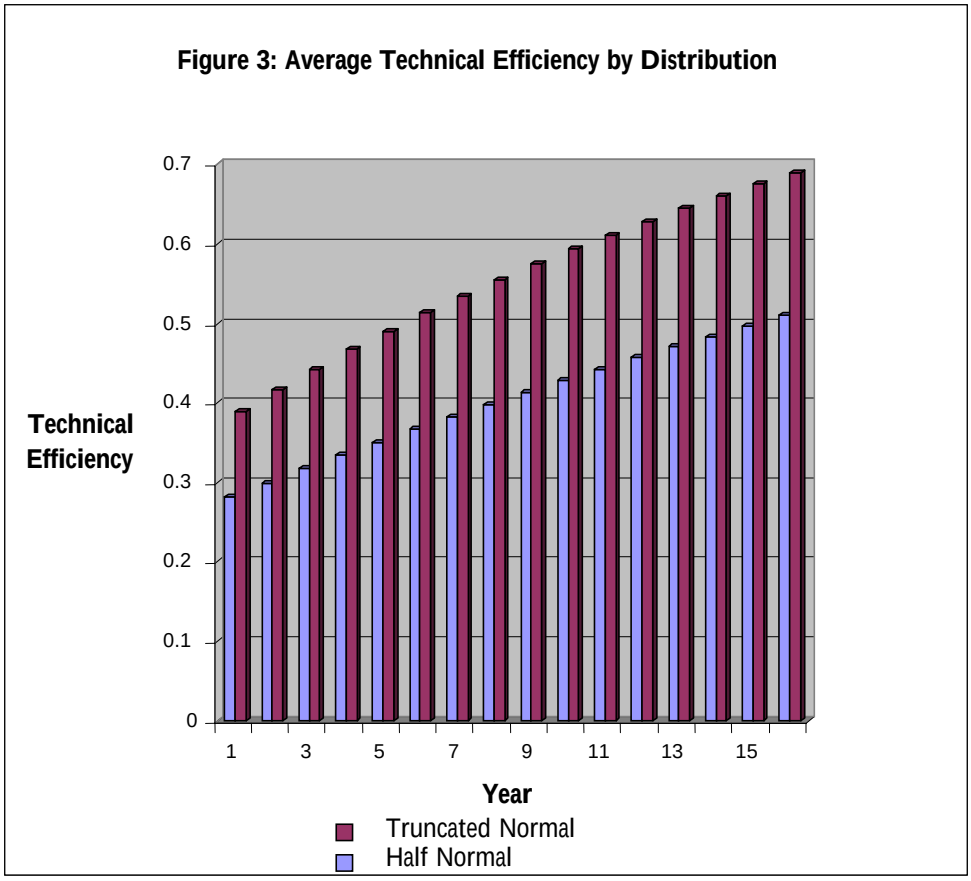


Figure 3: Average Technical Efficiency by Distribution



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Willingness to Pay for Margalla Hills National Park: Evidence from the Travel Cost Method

Himayatullah Khan*

Abstract

This study, which is among the first in Pakistan to value recreational benefits, estimates the benefits of the Margalla Hills National Park near Islamabad. The study examines how much park visitors are willing to pay to visit the park. Annual benefits from the park are considerable—the total annual consumer surplus or economic benefit obtained from recreation in the park is approximately Rs. 23 million (US $ 0.4 million). Various factors influence the value visitors obtain from the park — these include travel cost, household income, and the quality of the park. Improvements in the quality of the park are estimated to increase recreational benefits by 39%. The study recommends that a park entrance fee of Rs. 20 per person be introduced, which could be utilized for park management. This would generate nearly Rs. 11 million in revenues annually, a sizable amount of money that represents about 4% of the annual budget allocated to the environment sector in Pakistan.

JEL Classification:

Keywords: Environmental valuation, willingness to pay, total recreational value, consumer surplus, environmental resources, national parks, Pakistan.

1. Introduction

* The author is Professor at the Institute of Development Studies, NWFP Agricultural University, Peshawar and currently on deputation to Department of Development Studies, COMSATS Institute of Information Technology, Abbottabad. This paper is based on Himayatullah (2003). The author gratefully acknowledges the financial support provided by the South Asian Network for Development and Environmental Economics (SANDEE). The author also is heavily indebted to Dr. Herath Gunateleka, Prof. Karl G. Maler and Prof. Partha Dasgupta for their valuable criticism, expert comments and suggestions. The study would have never been completed without their help.

Like many other developing countries, Pakistan is seeking to revitalize its tourism sector, including nature tourism to an expanding system of national parks and reserves. In South Asia, Pakistan is one of the poorest in bio-diversity. It has experienced high rates of deforestation in recent years (World Resource Institute, 1996). Forests cover as little as 5 % of the country's area. Due to an ever-increasing population, it is losing more and more forest cover primarily because of conversion of forest to agricultural as well as residential uses. The Government of Pakistan has, in recent years, expressed a serious concern over deforestation and has shown significant interest in the growth of a renowned national park system. Pakistan has a number of national parks, reserves, and wildlife refuges in different parts of the country. Despite the limited number of national parks and reserves, their management is far from satisfactory. This is partly because of insufficient government funds and open access of visitors to these places. Currently, entry to national parks in Pakistan is free. However, revenue can be generated by introducing entry fees that could be spent on the improvement of the quality of the parks. There is a need for a thorough investigation of how these parks can be well managed and how these environmental resources can be valued. No study on the valuation of national parks in Pakistan has ever been conducted.

Natural resource systems such as lakes, rivers, streams, estuaries, forests and parks are used extensively by people for various kinds of recreational activities. Natural resource systems provide valuable services to people. From an economic perspective, these services have two important features. The first is that the economic value of these services depends upon the characteristics of the natural resource system. Knowledge of the values of these services may be important for a variety of resource management decisions. The second important feature is that access to the resource for recreation is typically not allocated through the markets. Rather, access is typically open to all visitors at a zero price or a nominal entrance fee that bears no relationship to the cost of providing access. And there is no or little variation in these access prices over time or across sites to provide data for the econometric estimation of demand functions (Freeman, 1993).

Like other environmental resources and public goods, national parks benefit society in many different ways. According to Isangkura (1998), they not only perform ecological functions but also provide recreational facilities to those who visit these parks. National parks also help enhance precious foreign exchange earnings to national exchequers. Pakistan is very deficient in forest resources because, as mentioned earlier, forests cover only 5 percent of its area and there are only a few parks in the country. National parks, however, tend to be threatened by forest fire, soil erosion, human

settlement inside the parks, pollution created by villagers or visitors to the parks as well as encroachment by local villagers. The overall negative impacts caused by one or another human activities is often associated with the insufficient levels of funding for the management of these parks (Isangkura, 1998).

There are two major sources of funds required for park management. There are the federal and/or provincial government budgetary allocation and revenues generated from park entry fees. The government budget allocated for management of national parks tends to be very limited since it must compete with other developmental programs including education, health care, infrastructure, defense spending, among other programs in the country (Isangkura, 1998). Therefore, the other alternative, fees, can be used to generate additional revenues for park management. At present only a nominal or no entry fee is charged. Charging entry fees for these parks can generate sufficient funds. Furthermore park revenue from entry fees may be increased provided parks are priced suitably. This suggests, given that the federal government budget for National Park management will likely remain small, adjusting park entrance fees may provide the needed park revenue. There is a dire need for their management on a sustainable basis, which in turn requires their correct valuation. The present study probes into the possibility of enhancing park entry fees to account for the recreational benefits that national parks provide tourists. This study focuses on the Margalla Hills National (MHNP) Park, Islamabad.

The present study deals with valuation of the Margalla Hills National Park (MHNP) in northern Pakistan. The data were collected with the help of an on-site sample survey in 2002-03. The study used systematic random sampling method to collect data from a sample of 1,000 visitors. It considered an individual travel cost model for environmental resources in a theoretical framework consistent with the fundamental principles of consumer behaviour. This model was applied to individual household data to estimate the willingness to pay (WTP) for park visitation. It also estimated the price and income elasticities of visitors' demand for park visitation. The study also found that the sample respondents visited the MHNP 9 times per year with their average yearly expenditures on recreation at Rs. 5,500. Their mean monthly income was Rs. 12,000. The average total cost to the MHNP was Rs. 3,500. About 67% of the respondents were male and 33% were female. As many as 60% were married and 40% single. The average age of the respondents was 39 years and the average household size was about 7. More than half (55 %) of the respondents had primary-level education. About 24% were illiterate. As many as 42% of sample households were in the income group of Rs.10,000-20,000 per month. More than one-fifth

(23%) of households had a monthly income in the range of Rs.5,000-10,000. Some 20% of households had income of Rs.20,000-50,000. Travel costs incurred by individuals were inversely related to park visitation rates. This implies that the higher the travel cost paid by visitors to reach MHN Park, the less frequently they visit. In addition to travel cost, household income had a positive impact on recreational demand. Visitors with high income were willing to pay 1more visits to the park. This implies that if the income level of visitors increased, so would the recreational demand. The education of visitors had a positive sign while the age variable had a negative sign. However, both these variables had insignificant coefficients. The paper also found that the total consumer surplus was equal to Rs. 23.2 million and total recreational value 200.1 million. The paper compared the present consumer surplus and total recreational value with those in a projected scenario and concluded that if the quality of the park were improved it would yield yearly consumer surplus and total recreational value to the tune of Rs.32.01 million and 208.9 million, respectively.

The overall goal of the study is to measure the recreational value of the Margalla Hills National Park, Islamabad, Pakistan. The specific objectives of the study are to: (a) investigate if there exists the usual functional relationship between travel cost (p) and park visitation (q); (b) determine factors that affect the visitors' willingness to pay (WTP) for recreational services of the park; (c) estimate the consumer surplus and recreational value (benefits) of the MHN Park; (d) find out whether improvement in recreational benefits of the park would lead to a higher demand for park visitation; and (e) suggest policy recommendations as to how overall benefits of the park can be improved.

2. Literature review

There is a growing body of literature that focuses on valuing ecotourism and wilderness areas in developing countries. The primary approaches used in these studies -Travel Cost (TC) Method and Contingent Valuation (CV) - were both pioneered in the United States and have only recently been applied in developing countries. The TC approach assumes that various factors affecting visitors' travel costs, including both direct costs and the opportunity costs of visitors' time, influence the length and frequency of visitation to a given destination. The TCM has limitations, particularly in applications to multiple destination trips (Pearse, 1968). Because the TCM is an indirect valuation method and is based on actual costs and in case of multiple destination trips it is difficult to segregate the cost for a particular site. In addition, assumptions such as the homogeneity of marginal costs and preferences of visitors from each origin are

questionable (Wennergen, 1964). To circumvent such limitations, studies that have estimated use values of protected areas in developing countries have often excluded nonresidents (Durojaiye and Ipki, 1988; Tobias and Mendelssohn 1991), or if foreign visitors are included, restrictive simplifying assumptions have been imposed (Mungatana and Navrud, 1994). While studies using TC have provided useful insights into the value of ecotourism in protected areas in developing countries, they have typically focused more on estimating consumer surplus than on evaluating user fees as a guide toward designing improved park pricing strategies, the primary objective of this study.

On the contrary, CV relies on surveys containing hypothetical valuation scenarios in order to generate values for goods that cannot be priced directly through a market (Cummings, Brookshire, and Schulze, 1986). Thus, CV has more flexibility than TC in that a survey can be designed to elicit many different types of values, not only the use value of a specific area such as a national park. Although CV has been applied to developing countries less often than TC (Lindberg and Johnson, 1994), there is growing recognition of the importance of these applications, particularly when results have direct implications for natural resource management and policy. CV has been used to measure total preservation value, which includes both use and non-use components (Echeverria, Hanrahan, and Solorzano, 1995). Use values have been examined through analyses of the explanatory factors influencing WTP for increases in entrance fees and trip costs as well as improvements in park amenities (Abala, 1987; Baldares and Laarman, 1990; Moran, 1994; Shultz, Pinnazo, and Cifuentes, 1997). It is important to note that both CVM and TCM are alternative methods of valuation. CVM is also known as stated-preference method where the respondents just state their preference in a hypothetical situation. On the other hand, the TCM is also called indirect or revealed-preference method and the respondents report what he or she has actually paid.

Relevant literature also shows the superiority of TCM over CVM (Freeman, 1993; Koasa-ard *et al*. 1995 and Garrod and Willis, 1999; Arin and Sills, 2001; and Ward and Beal; 2000. The present study uses TCM for estimating consumer surplus as well as total consumer value. It also uses CVM to find out how the visitors will behave if the quality of park were improved. Thus a combination of TCM and CVM is used in this study.

There are a number of environmental valuation studies but only some have used the economic approach to calculate welfare measurement[6]. The Lumpinee Park study by Grandstaff and Dixon (1986) and a joint study by Thailand Development Research Institute (TDRI) and Harvard Institute for International Development (HIID) on Khao Yai National Park (Kaosa-ard, Patmasiriwat, Panayotou, and Deshazo, 1995) are two main studies conducted in Thailand which have used economic valuation methods. Both studies have combined the travel cost method (TCM) with the open-ended contingent valuation method (CVM) to assess willingness to pay (WTP).

Chase *et al*. (1998) studied ecotourism demand and differential pricing of natural park access in Costa Rica. The study presents a conceptual framework and empirical analysis of the impacts of introducing a differential entrance fee policy at three national parks in Costa Rica. Contingent behavior methodology has been designed to elicit information on foreign tourists' hypothetical park visitation behavior at alternative entrance fee levels. The study has also estimated park visitation demand functions and price and income elasticities. It has also discussed revenue maximizing fees and applications of differential pricing principles to park management in Costa Rica. As a case study, Chase *et al*. (1988) contributes to an understanding of the role that economic analysis can play in the management of protected areas.

Grandstaff and Dixon (1986) used the zonal TCM and found the consumer surplus of Lumpinee Park use value to be 132 million bahts. Similarly, the CVM found this value to the tune of 130 million bahts.

Kaosa-ard *et al*. (1995) used the TCM to measure the Khao Yai National Park use value and the CVM method to measure its nonuse value. The TCM estimates showed the direct benefit of 1,420 bahts per visit, of which 870 bahts is the consumer surplus. The average WTP for entrance fee is 22 bahts per person. The average WTP after some improvements is 44 bahts per person. The average nonuse value for Thais and non-Thais is 730 bahts and 183 bahts respectively per person per year. These findings indicated that the value of Khao Yai National Park was certainly positive and of a reasonable magnitude. This suggests some positive marginal benefit of park improvements. When compared to the marginal cost, it indicated that park improvements would yield a net gain to society.

[6] For further details about environmental valuation methods, see Bateman and Willis (1999) and Freeman (1993).

Another study (Isangkura, 1998) used the contingent ranking method to measure the value of environmental benefits of three recreational areas in northern Thailand. The study found that it was easier for the respondents to indicate their preferences in the contingent-ranking format than in the open-ended WTP format. The parameter estimates from the indirect utility function were used to calculate the welfare gains derived from visiting these recreational areas. These welfare gains were then used to determine the entrance fees. The findings of the study showed that an increase in the entrance fees would raise park revenues. The study suggested that increased revenue could be used for recreational management and would help ensure the continuity of recreational services provided by national parks in Thailand.

Arin and Sills (2001) studied developing tourism in the national parks of the Republic of Georgia. The study used CVM to determine potential revenue capture by the park, with a split sample evaluating the impact of 'annual pass' vs. 'daily entrance fee' payment vehicle on WTP and on expected numbers of and length of visits. The study found that approximately 70 % of the respondents would visit at least once in the coming year. The probit model results showed that more educated younger residents of Tbilisi with large budgets for leisure activities were more likely to visit the parks. The mean predicted expenditures per trip (excluding park fee) were 150 lari (2 lari = US $1) with significant explanatory factors including city of residents and travel preferences. According to this study the model of WTP for an annual pass had a greater number of significant coefficients on variables theoretically and intuitively expected to influence WTP, including size of household, car ownership, leisure budget, and number of past visits to natural areas. The study found that older respondents' and women's WTP were less as were households who listed picnicking as one of their outdoor activities. These results suggest that respondents might have better understood the annual pass payment vehicle.

The review of relevant studies shows that even though some studies (Grandstaff and Dixon, 1986 and Kaosa-ard, *et. al.,* 1995) carefully measured the environmental benefits, these two studies focused on a single park and did not include park substitutability in their analysis. Only one study undertaken in Thailand (Isangkura, 1998) was based on the multi-park system. Studies conducted in other developing countries, though somewhat better, suffered from methodological limitations of one type or another. For example, some studies have not used the correct time value, or ignored relevant explanatory variables in their analysis. Some have used small sample size and others have not covered latest published studies in their review. No

such study has ever been conducted in Pakistan. The present study, which studies valuation of the MHN Park, Islamabad will be the first of its nature in Pakistan and can be considered as pioneering work in park valuation in this country.

3. Research methods

Three different approaches are used to estimate recreational values of such environmental resources: Productivity changes method, contingent valuation methods (CVM), and travel cost methods (TCM). From a utility perspective, the value arising from the change in production approaches ignores the consumer surplus generated by the recreation experience, and as a result underestimates the total value of the recreation experience (Seenprachawong, 2001). Most studies of parks use the TCM and CVM to estimate the consumer surplus of visitors (Nam and Son, 2001).

Conventional household production function (HPF) models investigate changes in the consumption of commodities that are substitutes or complements for each other. This framework can be extended to derive an indirect mechanism for evaluating individual preferences for, and consumption of, non-market goods. The travel-cost method (TCM) is a prominent example of an HPF-type approach and uses the cost of traveling to a non-priced recreation site as a means of inferring the recreational benefits that the site provides. TCM studies have consistently shown that as the price of access (cost of travel) increases, the visit rate to the site falls. The TCM is usually estimated as a trip generating function where the visit rate depends upon the cost of travel to the site, travel costs to substitute sites, and other socio-economic characteristics of the visitors (Garrod and Willis, 1999). This study employs the TCM.

4. Theoretical Framework

This study follows Freeman's approach (1993) and assumes that the individual's utility depends on the total time spent at the site (MHN Park in this case), the quality of the park, and the quantity of the numeraire. With the duration of the visit fixed for simplicity, the time on site can be represented by the number of visits. The individual solves the following utility maximizing problem[7]:

$$Max \quad u(X, r, q) \tag{1}$$

Subject to the twin constraints of monetary and time budgets:

[7] This section draws heavily on Freeman (1993) and Ward and Beal (2000).

$$M + p_w t_w = X + cr \quad (2)$$

and

$$t^* = t_w + (t_1 + t_2) r \quad (3)$$

Where X shows the quantity of numeraire whose price is one, r, number of visits to the MHN Park, q, environmental quality at the site, M, exogenous income, p_w, wage rate, c, monetary cost of a trip, t^*, total discretionary time, t_w, hours worked, t_1, round-trip travel time, and t_2, time spent on site.

We assume that r and q are weak complements in the utility function implying that the number of visits will be an increasing function of the site's environmental quality. The time constraint reflects the fact that both travel to the site and time spent on the site take time away from other activities. Thus there is an opportunity cost to the time spent in the recreation activity. We also assume that the individual is free to choose the amount of time spent at work and that work does not convey utility (or disutility) directly. Thus the opportunity cost of time is the wage rate. Finally, we also assume that the monetary cost of a trip to the site has two components: the entry fee f, which could be zero, and the monetary cost of travel. This cost is $p_d d$, where p_d is per-mile cost of travel and d is the distance to the site and return from it.

Substituting equation (3) into (2) yields:

$$M + p_w t^* = X + p_r r \quad (4)$$

where p_r is the full price of a visit given by

$$p_r = c + p_w (t_1 + t_2) \quad (5)$$

$$= f + p_d d + p_w (t_1 + t_2) \quad (6)$$

As equation (5) makes clear, the full price of a visit consists of four components: the entry fee, the monetary cost of travel to the site, the time cost of travel to the site, and the cost of time spent at the site. On the assumption that individuals are free to choose the number of hours worked at a given wage rate, the two time costs are valued at the wage rate.

Maximizing equation (1) subject to the constraint of equation (4) will yield the individual's demand functions for visits:

$$r = r(p_r, M, q) \quad (6)$$

If all individuals spend the same amount of time at the site, and have the same wage, then this component of the price of a visit is the same for all individuals. Given these assumptions, the data on rates of visitation, travel costs, and variation in entry fees (if any) can be used to estimate the coefficient on p_r in a travel cost-visitation function. Because of the linearity of equation (5), the coefficient on p_r can be used to derive the individual's demand for visits to a site as a function of the entry fee.

We further assume that there are substitute sites available. In such cases, the interactions and the substitution effects among sites must be modeled explicitly. This calls for some form of multi-site model. Multi-site models are estimated as systems of demand equations. For each site j (j = 1,...,j,...,m), a demand equation of the following form is specified:

$$r_{ji} = r_j\ (pr_{ji},\ pr_{ki},\ M_i,\ q_j)$$

$$i = (i = 1,...i,...,s),\ (k = 1,...,\ k,...,m),\ \textit{and}\ k \neq j \quad (7)$$

Where r_{ji} is the number of visits individual i makes to the site, pr_{ji} is the full price of a visit by i to j, and pr_{ki} is the set of substitute prices for visits to other sites. This type of model can be estimated from data on individual observations (see, for example, Freeman 1993 and McConnell, 1985).

5. Variables and data

Economic theory and the considerable experience of recreation managers have shown that demographic and other independent variables are thought to influence recreation visitation. Apart from demographic variables, the most important variables include travel cost, travel time, substitute sites and site quality and congestion. Demographic variables such as age, sex, education, income, employment status, rural versus urban residence, and family size are thought to affect recreational demand.

Intuitively, age would appear to be an important determinant of demand for park visitation and is expected to be inversely related. That is, as age increases, participation decreases. Sex may be another determinant. We expect that men are more likely to participate than women. Regarding education, people with higher education would appear to appreciate outdoor nature-based activities more than people with less formal education. Household income has also, generally, been found to have a positive correlation with participation in many outdoor recreational activities. We expect that the higher the household income, the higher will be the

number of park visitations. Urban dwellers are likely to participate more than people from rural areas. A park of better quality may attract an individual more often than one of poor quality.

Travel costs also affect outdoor recreational demand. The relationship between travel cost and park visitation may be negative. On the question of what costs should be included, some researchers have closely investigated the costs of fuel, oil, tires, repairs and maintenance for vehicles to estimate appropriate travel costs. Seller, Stoll and Chavas (1985) used the cost of food, accommodation and fuel costs. Beal (1995) also found that the majority of respondents considered fuel, food, and accommodation costs as relevant to their trip decision. Regarding the value of on-site time, McConnel (1992) argued that the opportunity cost of on-site time should be included in the price variable. McConnel concluded that accounting for on-site time presents such a difficult problem that no systematic method had been developed, either conceptually or empirically. Smith, Desvousges and McGevney (1983) suggested that cost would be some proportion *k* of each individual's wage rate. Prices of substitute sites also affect recreational demand of the MHN Park. Some visitors may believe that each national park is unique and has no substitute. Conversely, for some people other forms of outdoor recreation (such as going to a movie) are substitutes for nature-based recreation in national parks. Freeman (1993) approached the substitute site dilemma by suggesting researchers ask visitors which other single site is visited frequently and include only that site's price as the relevant substitute price. He asserted that a next-best site yielding similar characteristics (a national park in this case) is the appropriate alternative. Ayubia National Park[8] in Galliat was identified as the closest substitute site for the MHN Park. It is located about 40 miles from MHNP. Site quality

[8] Ayubia National Park is located North of Murree in the Himalayan Range Mountains. Ayubia, consisting of four hill stations, namely, Khaira Gali, Changla Gali, Khanspur and Gora Dhaka, is spread over an area of 26 kilometers. These hill stations have been developed into a hill resort known as Ayubia. The chairlifts provided at this place are a matter of great attraction. It is an important place from the viewpoint of wild life, nature, ecotourism, and education. This park provides refuge to the elusive leopard and the black bear. Bird-watching is excellent here. There are steep precipices and cliffs on one side and on the other are tall pine trees. Wild animals are also found in the thick forests around. Mammals in the park include Asiatic leopard, black bear, yellow throated marten, Kashmir hill fox, red flying squirrel, Himalayan palm civet, masked civet and rhesus macaque. Birds in the park are golden eagle, griffin vulture, honey buzzard, peregrine falcon, kestrel, Indian sparrow hawk, hill pigeon, spotted dove and collared dove.

may also affect park visitation. The higher the site quality perceived by visitors, the higher will be the consumer benefits.

The data were collected by conducting a site-level survey during 2002-03. The sample size was 1000 respondents. Regarding sampling, Scheaffer *et al*. (1996) states that: "A systematic sample is generally spread more uniformly over the entire population and thus may provide more information about the population than an amount of data contained in a simple random sample." This study used systematic random sampling where every 10^{th} visitor was interviewed. In case of his/her refusal another visitor was interviewed. The sampling was arranged to reflect changes in seasonal uses of the park (34% in spring, 22% in summer, autumn and winter, respectively), as it is believed that visitors come to the MHN Park for recreation more in spring than in any other season.

6. Econometric Models

Economic theory does not suggest any particular functional form for TCMs. The most common practice is to statistically test various functional forms such as:

(1)	linear	$v = \alpha+\beta P$
(2)	log-linear	$log\ v = \alpha+\beta P$
(3)	double-log	$\log v = \alpha+log\ \beta P$
(4)	negative exponential	$v = \alpha+ log\beta\ P$

The estimated consumer surplus for an individual making v visits to the site in case of the linear form is given by $CS = -v^2 /2\beta$. The linear functional form implies finite visits at zero cost but has a critical cost above which the model predicts that negative visits will be demanded. However, the consumer surplus in case of log-linear is given by $CS = -v/2\beta$. This implies a finite number of visits at a zero cost and never predicts negative visits, even at a very high cost (Garrod and Willis, 1999). This study reports the estimated results of the linear functional form, as these were the best fit as compared to those found by estimating log-lin, double log functional forms.

The basic model used in this study depicts the number of visits to the MHN Park as a function of factors such as the travel cost, time spent in traveling, substitute sites, income, education, age, sex, rural versus urban

residence, family size, site quality and employment status. Thus, the model may be specified as follows:

$$v_i = \beta_0 + \beta_1 TC_i + \beta_2 Y_i + \beta_3 ST_i + \beta_4 A_i + \beta_5 E_i + \beta_6 FS_i + \beta_{6+k} \sum_{k=1}^{3} D_k + e_i \quad (8)$$

where v_i, the dependent variable stands for the number of visits by the *ith* individual to the MHN Park per period of time; ***TC*** for round trip total cost (Rs) to the site including travel time; ***Y*** for household income (Rs./month); ***ST*** for travel cost to and from a substitute site; ***A*** for age of the visitor; ***E*** for highest level of education gained by the visitor; ***FS*** for family size; D_1 for 1 if male and 0 otherwise; D_2 for 1 if urban dweller and 0 otherwise; D_3 for 1 if the visitor's perception about the site's recreational facilities is good and 0 if bad.

7. Description of the Study Site

The Margalla Hills National (MHN) Park constitutes the area of this study. The MHN Park is spread over an area of about 15,800 hectares. It is situated on the northern, eastern and western sides of Islamabad. It includes the Margalla Hills, Rawal Lake and Shakar Parian and was given the status of a national park in 1980 after the government recognized the growing threat to its flora and fauna. Of the three distinct units, the largest area, the Margalla Hills, of approximately 12,600 hectares has been affected by villagers living in direct contact and depending on the fertility of the land. The proper conservation of the area will gradually re-establish the environment to its natural state providing prospects for outdoor recreation in "unspoiled" nature with a focus on wildlife viewing, hiking and camping. The Margalla Hills consists of mountain wilderness, an urban recreation and cultural centre, and a large reservoir. The Rawal Lake of approximately 1,900 hectares represents a man-made park environment, which has the appearance of a natural ecosystem. To provide a continuous supply of drinking water, city planners reestablished part of a pre-historic lake, which created a rare opportunity for the population in the Capital Territory to experience a lake environment and waterfowl, enjoy sports in addition to common outdoor recreation activities such as picnics, strolls and jogging. It has a 2-km perimeter around the lakeshore buffer, which is a domestic water supply, waterfowl habitat, and recreational area. Shakar Parian, covering approximately 1,300 hectares represents an urban recreational and cultural park and provides the urban

population with an excellent recreational facility for activities such as sports, jogging, strolls and picnics.

The Park is a habitat for various species of animals and birds. The gray goral, barking deer, monkey, kalij, grey and black partridges and chir pheasants particularly arouse the interest of wild life enthusiasts. The Margalla Hills Park provides an excellent opportunity for bird watching. A chir pheasant hatchery has been established at Chak Jabri to raise captive chir pheasants that have become extinct in the hills. These are then released in the wild. Other mammals in the park include the Asiatic leopard, wild boar, jackal, rhesus macaque, leopard cat, gray goral sheep, chinkara gazelle (rare), red fox, pangolin, porcupine, yellow throated marten and fruit bats. Reptiles in the park are russelles viper, Indian cobra and saw scaled viper. Other birds in the park are the griffin vulture, laggar falcon, peregrine falcon, kestrel, Indian sparrow hawk, Egyptian vulture, white cheeked bulbul, yellow vented bulbul, paradise flycatcher, golden oriole, spotted dove, collared dove, larks, shrikes, and buntings.

8. Empirical results and discussion

The descriptive statistics of the sample respondents and the reasons for visiting the MHNP are given in Table-1 and Table-2, respectively. Nearly three-quarters (73%) of the visitors came to Islamabad for recreational purposes. Some 13% of visitors reported traveling as the reason for coming to Islamabad. As many as 42% of sample households fall in the income group of Rs.10,000-20,000 per month. More than one-fifth (23%) of households have monthly income in the range of Rs.5,000-10,000. Some 20% households have income of Rs.20,000-50,000. Taken together 65% households fall in the income range of Rs.5,000-20,000. Half of the visitors visited the park up to 2 times and 34% between 3-5 times a year. The percentage of visitors, who visited the park 6-10, 11-5, and 16-20 times a year, was 11%, 3% and 2%, respectively (Figure 1). The sample mean of visits was 7. Half the respondents considered the quality of the park as good compared to 35% who believed it bad or very bad, with about 15% answering with `don't knows'. These figures demonstrate that the majority of the visitors were happy with the recreational quality of the park. The majority (60%) of the visitors were from urban areas compared to 40% of the visitors who were from rural areas. Similarly, more than 62% of the respondents wanted an improvement in the quality of services of the park. On the question about how more resources should be allocated for park management, 38% of the respondents preferred an increase in entrance fee, 40% chose reallocation of the government budget, and 22% advocated voluntary donations towards the parks' management funds.

Table-1: Descriptive Statistics of the Respondents

Variables	Mean	Minimum	Maximum
No. of Recreational Trips	9.00	1.00	20.00
Yearly Spending on Ecotourism (Rs)	5,500	1,000	10,000
Household Monthly Income (Rs)	12,000	4,900	100,500
Distance (Km)	30	1.12	90.45
No. of Trips to MHN Park	7	1	15.00
No. of Trips to Substitute Parks	1.61	1.00	5.00
Age (Years)	38.95	17.00	65.60
Household Size	6.80	4.34	11.35
Sex:			
Male	67%		
Female	33%		
Marital Status:			
Married	60%		
Single	40%		
Education:			
None	24%		
Primary	55%		
Secondary	11%		
Technical diploma	3%		
Bachelor's Degree	5%		
Graduates	2%		
Residence:			
Urban (mainly from Islamabad and Rawalpindi)	60%		
Rural	40%		
Do you want improvement in quality?			
Yes	62%		
No	38%		
How should the money be raised?			
Increase entry fee	38%		
Govt. budget reallocation	40%		
Donation	22%		

Source: Survey

Figure-1: Frequency Distribution of the Trips to MHNP during Last 12 months

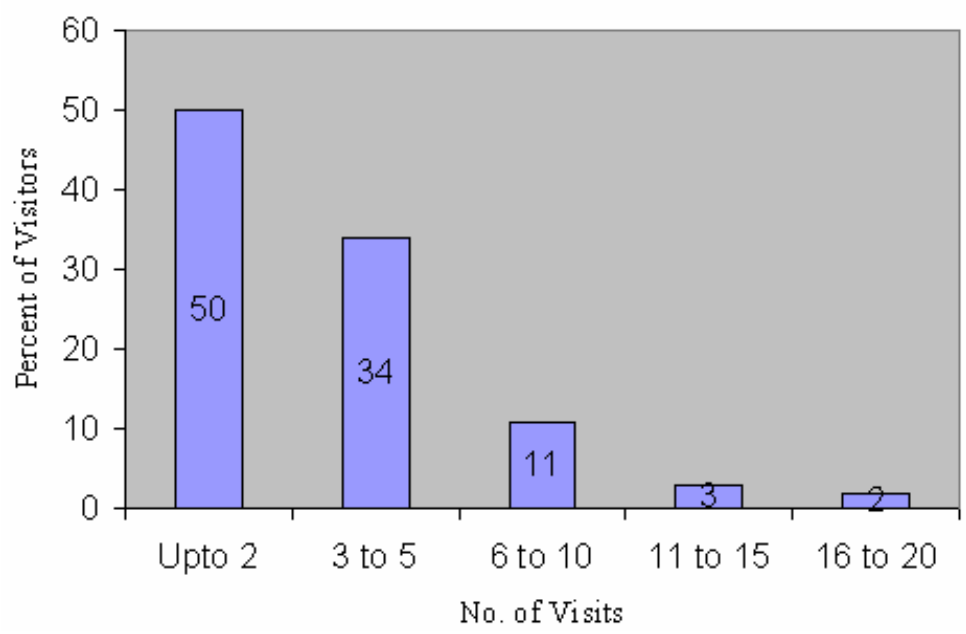


Table-2: Reasons for Visiting MHN Park by Sample Respondents

Reasons to Visit Park	No. of Respondents	Percent
Sightseeing	50	5
Walking	40	4
Bird watching	30	3
Relaxation	40	4
Exercising	60	6
Eating Seafood	100	10
Swimming	40	4
Boating	20	2
Combination	620	62
All	1000	100

Source: Survey.

Variables were included on the logic of the underlying economic theory. First the variables were tested for correlation. According to Loomis and Walsh (1997), an absolute value of 0.8 signifies multicollinearity. The correlation matrix displayed in Table-3 shows no correlation higher than 0.47, which indicates that multicollinearity is not a problem within our data set. All variables could thus initially be included in the analysis.

Table-4 reports the results of the travel cost regression model in a linear fashion. In these models, most coefficients have the expected signs. The coefficient on travel costs is negative and statistically significant. Similarly, the coefficient on household income is statistically significant and positive. The coefficient on substitute site is also positive but statistically insignificant.

As expected, high travel costs incurred by individuals are inversely related to the park visitation rate. This implies that the higher the travel cost paid by visitors to reach the MHN Park, the less the frequency of their visits. We may thus infer that there is less demand to visit the park by those visitors who live far away from it compared to those who live close to the park. This finding is in line with Nam and Son (2001), Landsdell and Gangadharan (2001) and Nillesen (2002).

In addition to travel cost, household income has a positive impact on recreational demand and has the correct algebraic sign. Visitors with high income are willing to pay more visits to the park. This implies that if the income level of the visitors increases so will the recreational demand.

Table-3: Correlation Matrix of Variables

Variables	No. of Visits V	Travel Cost TC	Income I	Substitute Cost SC	Education Edu	Age A	Household Size HS
V	1.00	-0.39	0.06	0.41	0.37	-0.13	-0.47
TC	-0.39	1.00	-0.37	0.09	-0.17	-0.23	0.21
I	0.06	-0.37	1.00	0.35	0.46	0.39	0.41
SC	0.41	0.09	0.35	1.00	-0.18	-0.15	-0.19
Edu	0.37	-0.17	0.46	-0.18	1.00	0.43	0.35
Age	-0.13	-0.23	0.39	-0.15	0.43	1.00	0.38
HS	-0.47	0.21	0.41	-0.19	0.35	0.38	1.00

Table-4: Estimated Results of Linear Regression Equations

Variable Dependent Variable	Coefficients (t-stats) No. of Visits
Intercept	2.35 (3.12)
Travel Cost	-0.04 (-2.68)***
Household Income	0.0053 (2.13)**
Price of Substitute	0.00021 (1.79)
Age	-0.014 (-1.49)
Education	0.0089 (1.37)
Family Size	0.0009 (0.15)
Dummy1 (1 for Male)	0.366 (1.34)
Dummy2 (1 for Urban Dweller)	0.008 (1.20)
Dummy3 1 if Visitor's Perception is Good	0.035 (2.13)**
R^2	0.53
F.Statistics	12.7

, and * indicate significance at 5% and 1% level, respectively.

There is no significant relationship between the cost of substitute sites and the demand for the MHN Park. This is not in line with the economic demand theory that the demand for a site will increase if prices of substitute sites increase. This may be due to the fact that the MHN Park has no perfect or close substitutes. We, however, tried to get some crude estimates of the price of a substitute site. It is however important to note that the coefficient of the substitute price has the expected positive sign. Education of visitors bears a positive sign while the age variable has a negative sign. However, both these variables have insignificant coefficients. The dummy variables for male, urban dweller and good perception of visitors about the environmental quality of the park have positive coefficients. However, only the latter dummy has a statistically significant coefficient. This implies that if the quality of services of the MHN Park were improved, visitors would wish to pay more visits to the park. We have also explored the possibility of the demand curve for the MHN Park shifting upwards to the right if its quality is improved. This is shown in Figure 2.

Most of the coefficients have the expected signs. According to the R^2 statistic, about 50% of the total variation in the dependent variable is explained.

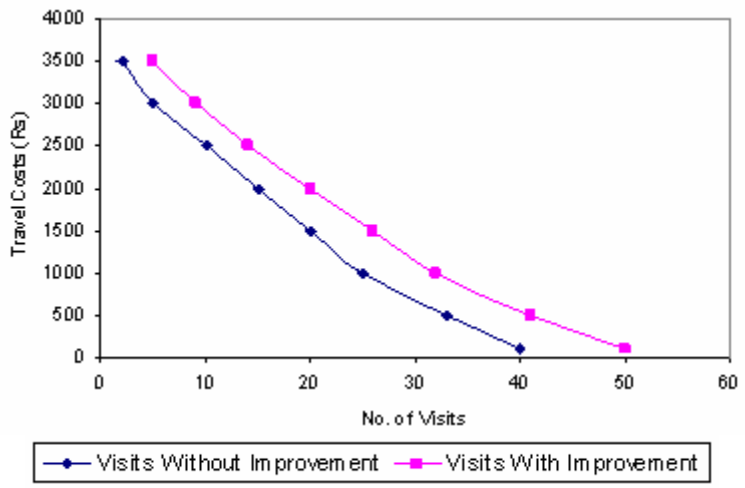
8.1 Demand curves

Two linear demand curves for MHN Park visitation were estimated from the survey data that are shown in Figure 2. The actual user demand for the MHN Park is represented by equation 9 and as the lower curve in Figure 2. Similarly a hypothetical demand for the MHN Park in case of improvement in the quality of park services is given by equation 10 and the upper curve in Figure 2. This implies that improvement in the quality of the services of the park would shift the demand curve upward to the right.

$$v_i = 38.16 - 0.011\ tc \quad (R^2=0.6813) \qquad (9)$$

$$v_i = 47.39 - 0.0129\ tc \quad (R^2=0.5786) \qquad (10)$$

Figure-2: Park Visitation Demand Curves



8.2 Demand Elasticities

For any particular park, elasticities of park visitation demand can be calculated from the marginal effects associated with the estimated demand coefficients. The estimated elasticities associated with the own-price, cross-price, and income variables are shown in Table-5. As is customary, the own-price elasticity is negative and is found to be significant at the 99 % confidence level. This is due to the inverse relationship between travel costs (price) and visitation demand (quantity). Cross price elasticity is positive but insignificant. This may be due to the reason that there are no close substitute sites or the visitors may not correctly reveal their preference for different parks. Finally, the demand for MHN Park visitation is (statistically significant) income elastic.

Table-5: Estimated Elasticities of Park Visitation Demand

Elasticity	MHN Park
Own-Price	-1.15*** (3.12)
Cross-Price	0.28 (1.67)
Income	0.087** (2.36)

*** Significant at 1 % level.

** Significant at 5 % level.

8.3 Recreational Value of the MHN Park

Table-6 shows consumer surplus and total recreational value of the MHN Park for the year 2002-03. The total recreational value equals the consumer surplus plus total cost of the visit. The annual monetary recreational value of the MHN Park is about Rs. 200 million (approximately US $3.47 million). This is the value that the park yields every year for the economy. However, this is not the revenue of the park. This value is distinguished into consumer surplus of the visitors and total travel cost of the visitors. The total travel costs paid by the visitors go to transportation companies and agents for service providers such as hotels, restaurants, tourist agencies, etc. In addition, the total recreational value was also projected in the case of park improvements which amounted to Rs. 209 million (US $ 3.63 million).

Table-6: Recreational Value of the MHN Park in 2002-03

	Consumer Surplus		**Recreational Value**	
	Actual	**New Scenario**	**Actual**	**New Scenario**
Per Visitor (Rs.)	231.0	319.0	1994.0	2081.4
Total (Rs.million)	23.2	32.01	200.1	208.9

Source: Survey

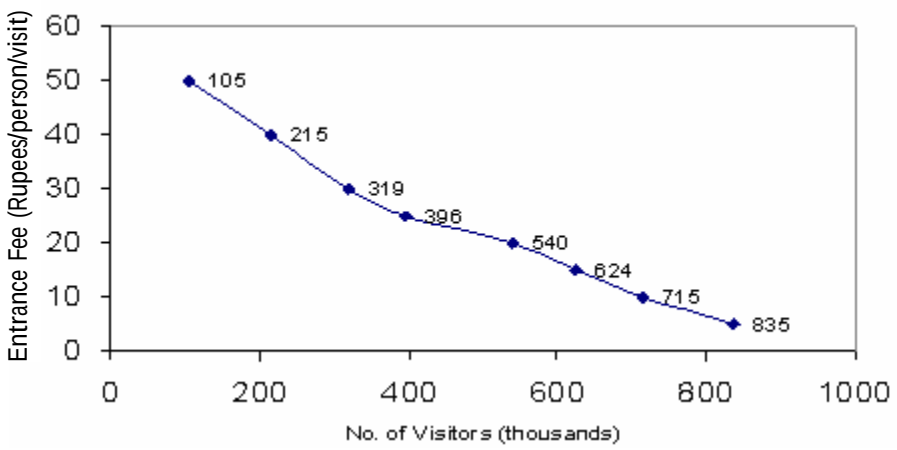
The total actual consumer surplus was estimated to be Rs 23.3 million. This shows the value of the benefit that visitors gained by visiting the MHN Park. It also indicates the amount the visitors are willing to pay to enjoy the park's environmental resources such as air, water, fish, birds and animals, and scenic beauty. This figure, however, does not show the non-use value of the MHN Park. The annual consumer surplus in the case of an improved park quality scenario was projected as Rs. 32.01 million.

8.4 Simulation of Entrance Fee

One of the policy goals of this study was to suggest an optimal entry fee that would maximize revenue for park authorities. We simulate the impact of increasing the entry fee from its current level of zero to Rs. 50 in Figure 3. Figure 3 shows an inverse relationship between the total annual number of visitors and the entrance fee. That is, when fees increase, visits decline. This is no different from the typical demand curve for any other good.

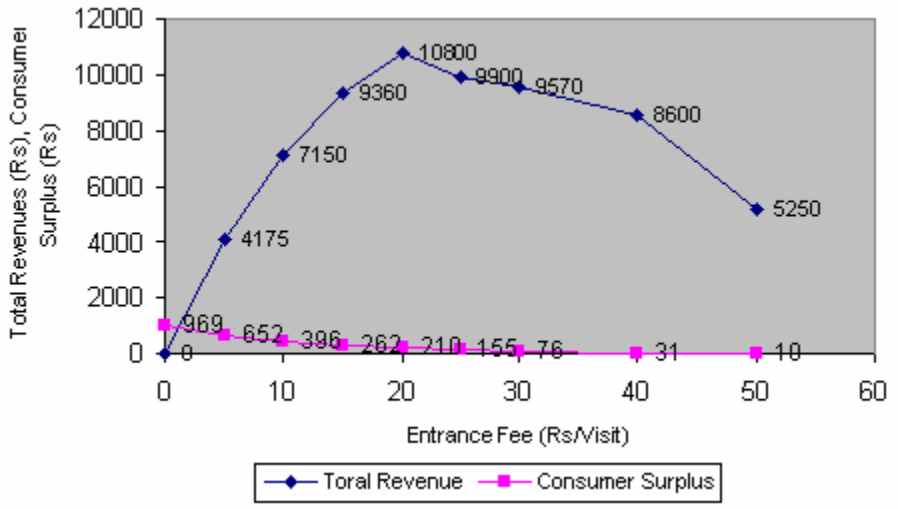
Figure 4 shows the total revenues to be generated from imposing various levels of entry fees. The data show that if a sum of Rs.20 were determined as the entry fee, it would generate the maximum total revenue (i.e., Rs. 10.8 million) annually. According to this figure, the total revenue to be generated from entry fees would constitute 4 % of the entire budget for the environment sector. Although the budget allocated for MHN Park was not reported accurately by the Park authorities, it is estimated that money generated from a park entry fee would constitute a significant proportion of the park budget. The Figure shows that the total revenue rises initially as the entry fee is enhanced from zero to Rs. 15, reaches its maximum at a fee of Rs. 20, and declines thereafter, implying that Rs. 20 would be an optimal entrance fee. The figure also reveals the fact that as entry fees increase, the consumer surplus declines. Initially, it is Rs. 969 per person when the entrance fee is zero and declines to Rs. 10 when the entrance fee is Rs. 50 per visit. When the entrance fee is Rs. 20, the consumer surplus is Rs. 210.

Figure-3: Visitors of MHNP Distinguished by WTP at Different Entrance Free



Ideally, we would have liked to compare revenues generated from the entry fee with the costs of improvements in park quality. But, in the absence of reliable cost estimates[9] for park improvements, the present study could not make such a comparison. The recommendation that the entry fee be set at Rs. 20 is based on revenue and consumer surplus as well as the researcher's own observations.

Figure-4: Entrance Fee, Total Revenue and Consumer Surplus



9. Conclusions and policy implications

In the wake of growing eco-tourism and the increasing interest on the part of NGOs and governments in natural resource conservation, non-market valuation techniques are needed to estimate the economic benefits of environmental resources such as national parks in these areas. The present study used the individual travel cost model (ITCM) for analyzing and measuring the total recreational value of the MHN Park.

Using the ITCM, the consumer surplus per visit was estimated at Rs. 231 and the recreational benefit per visit was about Rs.1,994. The total annual consumer surplus was estimated at Rs.23.2 million and total recreational value at Rs.200.1 million. Using the ITCM, linear and semi-log demand curves were estimated. Own-price, cross-price and income

[9] Although a number of attempts were made at an official level to inquire about the costs of improvements, it was impossible to get such estimates from the relevant officials. No one was in a position to provide such information. Thus, we could not simulate cost estimates of park improvement vis-à-vis total revenue and consumer surplus.

elasticities of demand for the MHN Park were also estimated. The MHN Park is highly own-price and income elastic. The demand curves show that if the quality of the MHN Park is improved, it will attract more visitors and generate more revenues. This calls for the government to reallocate the budget for park management so that total recreational benefits of the park may be increased.

The MHN Park constitutes a valuable environmental resource. Although, at present the visitors do not pay any entrance fee, there is a large consumer surplus of welfare to be gained from the existence of the Park. In the future, if the number of visitors to the MHN Park increases, it would, it is expected, become more valuable. Although the estimated recreational value is only one aspect of the total value of the Park, it indicates that with proper conservation and management, tourism can be a significant source of benefits.

This study constitutes the first published estimate of the economic value of National Parks and other environmental resources in Pakistan. This type of valuation has implications for management at the MHN Park as well as other parks at risk.

The MHN Park has high values from both the use (i.e., recreational and tourism, educational and scientific research) and non-use values (i.e., genetic resources, and known and unknown future uses of ecological functions).

Governments at various levels are now the common planning units for natural resource management and are seriously considering the plight of their natural resources and are developing management plans accordingly. Such plans require budgeting and support from different departments and agencies, but often lack economic justification to help decision-makers appreciate what they are supporting. In this regard, there is an effort to raise awareness among local and national government decision-makers of the value of park resources and what would be lost if they were destroyed or not properly managed for long-term sustainability. This information helps justify investments in management and protection at a level of government that is directly concerned with its natural resource base.

The focus of this study is the valuation of environmental resources and how this information can be used to improve planning to national parks management in Pakistan. Government planners envision the MHN Park as an eco-tourism destination. It is representative of a number of national parks in Pakistan. It is in need of improved management so that economic and

other benefits can be restored and enhanced. The MHN Park can generate enormous economic value through recreation. Keeping in view the large amount of consumer surplus and recreational value of the MHN Park, the Federal and provincial level governments can justify larger annual budget allocations for the management of natural resources.

Alternatively, the government may also consider using an entry fee to the MHN Park. The generated 'user value' of the park provides a guideline for the possible introduction of entrance fees and makes a strong argument for sustaining the area, as it has been demonstrated that benefits derived are large. In addition, the estimated value may also help in promoting the protection of other natural areas, and are thus presumably even more dependent on fair decision-making within the policy arena. Since the consumers (visitors) are willing to pay much higher than they actually pay for Park visitation, an entry fee of about Rs.20 per person may be used. This would generate a great deal of money that could be used for improving park management.

The study showed that the visitors were willing to pay more than what they actually pay and that an entrance fee of Rs.20 per person per visit would generate sufficient amount of money to be used for park improvement. This, however, would reduce the overall consumer surplus. Thus, the drawback of this would be that the poor will be negatively affected as they would be less able to visit the park if an entrance fee were charged.

Critical issues remain to be explored further before the recommended policy for the benefit value capture can be fully realized. These include policy procedures and the process for implementation, including information sharing and consultation. The administrative organization for implementation and enforcement will also require investigation.

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Population Growth and Economic Development: Test for Causality

Khalid Mushtaq*

Abstract

This paper examines the existence of a long-run relationship between population and per capita income in Pakistan for the period 1960-2001 using cointegration analysis. Unit root results show that population is integrated of order zero while per capita income is integrated of order one; further, Johansen's procedure show that no long-run cointegrating relationship exists. Thus, population growth neither causes per capita income growth nor is caused by it. A corollary is that population growth neither stimulates per capita income growth nor reduces it.

I. Introduction

The relationship between population growth and economic development has long been theoretically and empirically analyzed by various schools of thought in economics. Most development economists believe that rapid population growth is detrimental to growth. Population growth reduces savings and the capital-labor ratio. It raises the dependency ratio, and puts strains on education and health systems as well as the food supply. Larger and larger populations may also contribute to environmental degradation.

However, there are also some who believe that population growth promotes economic development. They argue that population growth stimulates consumer demand, allowing a country to take greater advantage of economies to scale. At the same time, a large population can provide a large and cheap labor supply, as well as be a source of innovation. Some also claim that rural areas are under-populated in some countries in Africa and Latin America, leaving arable land uncultivated.

* The author is Assistant Professor in the Department of Agricultural Economics, University of Agriculture, Faisalabad, Pakistan.

For example, Thirwall (1994: p.143) states that,

> "The relation between population growth and economic development is a complex one, and the historical evidence is ambiguous, particularly concerning what is cause and what is effect. Does economic development precede population growth, or is population growth a necessary condition for economic development to take place? Is population growth an impediment or a stimulus to economic development?"

Following Thirlwall (1972), this paradox can be summarized using the identity: Y=P (Y/P) where Y is output or income and P is population. Totally differentiating and dividing by Y gives: dY/Y=dP/P+d(Y/P)/(Y/P). The relationship between the two terms on the right hand side i.e., population growth and per capita income growth is crucial: if the relationship is positive, population growth unambiguously increases both per capita and aggregate income; while if the relationship is negative, per capita income (and hence living standards) fall.

Hagen (1959) distinguishes between exogenous and induced population growth, implying an ambiguity regarding the causality with per capita income growth. If population growth is exogenous, there are two relevant hypotheses: should population growth cause per capita income growth, the former is an impediment to rising living standards if there is an adverse effect on both savings and the capital: labor ratio – the hypothesis of Coale and Hoover (1958); conversely, population growth (and growth of the labor force) can stimulate living standards if specialization and scale economies occur. Alternatively, population growth is endogenous if technological improvements increase per capita income, which improves health and lowers the death rate thereby increasing the population. These arguments are well known [e.g. Kelley (1988) or Simon (1992: part 2)].

This paper tests the causality between population and per capita income in Pakistan for 1960-2001 using cointegration analysis. The paper is structured as follows: Section 2 discusses the empirical method, Section 3 discusses the data and results, and Section 4 concludes.

2. Empirical Method

Many time series are non-stationary and in general OLS regressions between such data are spurious. The presence of a unit root in the autoregressive representation of a time series leads to non-stationarity, and such series, referred to as being integrated of order one (I(1)), must be first-

differenced to render them stationary (or integrated of order zero). Where the I(1) series move together and their linear combination is stationary, they are referred to as being cointegrated and the problem of spurious regression does not arise. Cointegration implies the existence of a meaningful long-run equilibrium (Granger, 1988). Since a cointegrating relationship cannot exist between two variables which are integrated of a different order, we first test for the order of integration of the variables.

We begin by testing for the presence of unit roots in the individual time series using the augmented Dickey-Fuller (ADF) test [Dickey and Fuller (1981); Said and Dickey (1984)], both with and without a deterministic trend. The number of lags in the ADF-equation is chosen to ensure that serial correlation is absent using the Breusch-Godfrey statistic (Greene (2000), p.541)). In testing for unit roots using the augmented Dickey-Fuller (ADF) test, we follow the sequential procedure of Dickey and Pantula (1987): the null of the largest possible number of unit roots, assumed to be three, is tested and, if rejected, that of two unit roots is tested and so on until the null is not rejected. If the variables are integrated of the same order, Johansen's (1988) procedure can then be used to test for the presence of a cointegrating vector between population and income. The procedure is based on maximum likelihood estimation of the error correction model:

$$\Delta z_t = \delta + \Gamma_1 \Delta z_{t-1} + \Gamma_2 \Delta z_{t-2} + \Lambda + \Gamma_{p-1} \Delta z_{t-p+1} + \pi z_{t-p} + u_t \qquad (1)$$

where z_t is a vector of I(1) endogenous variables, $\Delta z_t = z_t - z_{t-1}$, and π and Γ_i are $(n \times n)$ matrices of parameters with $\Gamma_i = -(I - A_1 - A_2 - \ldots - A_i)$, $(i = 1, \ldots, k-1)$, and $\pi = I - \pi_1 - \pi_2 - \ldots - \pi_k$. The term πz_{t-p} provides information about the long-run equilibrium relationship between the variables in z_t. Information about the number of cointegrating relationships among the variables in z_t is given by the rank of the π-matrix: if π is of reduced rank, the model is subject to a unit root; and if $0 < r < n$, where r is the rank of π, π can be decomposed into two $(n \times r)$ matrices α and β, such that $\pi = \alpha\beta'$ where $\beta' z_t$ is stationary. Here, α is the error correction term and measures the speed of adjustment in Δz_t and β contains r distinct cointegrating vectors, that is the cointegrating relationships between the non-stationary variables. Equation (1) can be rewritten in full as:

$$\begin{bmatrix} \Delta P_t \\ \Delta (Y/P)_t \end{bmatrix} = \begin{bmatrix} \delta_1 \\ \delta_2 \end{bmatrix} + \sum_{i=1}^{p-1} \begin{bmatrix} \Gamma_{i,11} & \Gamma_{i,12} \\ \Gamma_{i.21} & \Gamma_{i,22} \end{bmatrix} \begin{bmatrix} \Delta P_{t-i} \\ \Delta (Y/P)_{t-i} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} \begin{bmatrix} P_{t-p} \\ (Y/P)_{t-p} \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \qquad (2)$$

The Johansen procedure estimates (1), and trace statistics are used to test the null hypothesis of at most r cointegrating vectors against the alternative that it is greater than r. If cointegration exists between P_t and $(Y/P)_t$, the model in (2) can then be used to test Granger-causality (Granger, 1969) in either direction or feedback between P_t and $(Y/P)_t$.

3. Data and Results

Annual data for population (in millions) and real per capita income (in rupees) is used for Pakistan for 1960-2001. Population has trended upwards at a relatively constant rate, increasing by over 300 per cent from 46 million in 1960 to 142 million in 2001 at an average annual growth rate of 2.74 per cent. Real per capita income has also trended upwards but more erratically; it has increased from 397 rupees in 1960 to 24,314 rupees in 2001.

We examine the time series properties of the series, in logarithms, following the sequential testing procedure of Dickey and Pantula (1987) and test for up to three unit roots. Multiple unit roots in all series are rejected and Table-1 reports the results of testing for one unit root using ADF-tests both with and without a linear trend. Both models indicate that the series P_t is stationary but the trend is significant and the series $(Y/P)_t$ has a unit root and the trend is insignificant. It is clear that P_t is trend stationary, that is, integrated of order zero, I(0), while $(Y/P)_t$ is non-stationary, that is I(1), and is stationary in differences.

Table-1: ADF-Tests for Unit Roots

Variable	Non-Trended Model	Trended Model
P_t	-3.37	0.33
$(Y/P)_t$	-0.62	-2.62
Crit. Value	-2.93	-3.50

Note: Critical values (95% confidence level) are taken from Fuller (1976, p. 373)

The above conclusions are also substantiated by applying Phillips-Perron unit root tests (from the paper Phillips and Perron (1988)). That P_t is I(0) and $(Y/P)_t$ is I(1) implies that a meaningful relationship between them cannot exist. However, the usefulness of unit root tests is contentious [e.g., Sims (1988)] and Holden and Perman (1994: p.88-9)

argue that using the Johansen procedure obviates the need for unit root tests since the existence of a cointegrating relationship between two variables implies the presence of unit roots. Accordingly, Equation (1) is estimated assuming that the variables and the data generating process have deterministic trends. Table-2 shows the trace statistics and results indicate that no cointegrating vector is present so that a long-run relationship between population and per capita income does not exist.

Table-2: Cointegration Results

H_0	Trace Statistics	
r=0	15.23	(25.77)
$r \leq 1$	5.42	(12.39)

Note: Critical values in the parentheses.

4. Conclusions

This paper examines the possible existence of a long-run relationship between population growth and per capita income growth in Pakistan for 1960-2001 using cointegration analysis. We find that the population is trend stationary, while per capita income has a unit root; hence a long-run relationship between the two variables cannot exist. Since the testing for unit roots is contentious, we also apply Johansen's procedure to test for cointegration between the two variables; no cointegrating vector can be found, confirming the conclusions of the unit root tests. Thus, population growth neither causes per capita income growth nor is caused by it. A corollary is that population growth neither stimulates per capita income growth nor detracts from it.

If our result is generalized, any such statistically significant correlation in the literature is spurious. Our results also confirm that inappropriate inferences have sometimes been drawn from simple correlations or from regressions in previous studies using cross section data which sometimes purport to demonstrate causality, or at least, in Simon's (1992: p.200-21) case of non-causality in one direction. In reviewing these cross section results, Simon (1992: p.205) asks, 'do these studies imply that there is no long-run positive effect?' Our results indicate that there is no long-run effect, positive or negative; causality therefore is not an issue.

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Regulatory Response to Market Volatility and Manipulation: A Case Study of Mumbai and Karachi Stock Exchanges

Jamshed Y. Uppal[*] and Inayat U. Mangla[**]

Abstract

This study examines the regulatory intervention in India and Pakistan in response to episodes of excessive market volatility and manipulation and its effectiveness in achieving declared objectives. Our empirical analysis indicates that while the Indian regulatory agencies seem to have achieved their objectives in curtailing manipulative and speculative behavior, there appears to be little impact on such behavior in the case of the Karachi Stock Exchange. Significant differences in the regulatory effectiveness and industry structure may explain the difference in the market behavior outcomes following regulatory interventions. A stronger competitive environment in India, because of the existence of multiple organized exchanges, seems to facilitate effective enforcement of public policy.

Key Words: *Stock market volatility, manipulation, speculation, scams, corporate governance, regulatory dialectics.*

Jel Classification*: G15, G18, G28, K22, O16*

1. Introduction

The last two decades have seen unprecedented growth and volatility in the stock markets of developing countries. As emerging markets continue to grow and assume a more prominent role in the economy, the regulatory framework evolves along side, although with delays and sub-optimal solutions, which are characteristic of political processes. Regulatory development takes place, in many cases, as a response to financial crisis, scandals and scams in an effort to restore the investors' confidence in the markets and institutions. Financial service firms on the other hand indulge

[*] Corresponding Author: Associate Professor of Finance, Department of Business and Economics, Catholic University of America, Washington, D.C. 20064; Email: uppal@cua.edu.
[**] Professor of Finance, Haworth College of Business, Western Michigan University, Kalamazoo, MI-49008;Email : inayat.mangla@wmich.edu.

in *avoidance behavior* to circumvent regulation. The interplay of market evolution and regulatory response seems to be similar to the one described by Edward Kane in relation to the regulation of financial institutions (Kane, 1983 and 1988). Kane describes it in Hegelian fashion as "a delayed reaction to interacting dialectical processes." The conflicting elements play out as a Hegelian thesis and antithesis, to evolve into a new policy synthesis. However, the new synthesized policy mix generates its own contradictions in the on-going dialectical process. We propose that in the case of emerging markets, a similar dialectic develops due to an unsustainable conflict between free market forces and the policy stance of regulators.

Public interest theory of regulation justifies intervention in cases of market failure due to monopoly or market power, asymmetric or imperfect information, and the existence of externalities or of public goods. Since informational imperfections are inherent in financial markets, a basic task of a financial regulator is, therefore, to reveal information and prevent the misuse of asymmetric or insider information. Regulators of financial markets should ensure efficient intermediation by financial markets of savings, price discovery, allocation of investment, and the pricing and hedging of risk. Regulatory agencies can add value by reducing problems of information asymmetry and moral hazard, by enhancing transparency and disclosure and mitigating conflicts of interest. Another feature of financial markets is the presence of network effects, where value to any one individual increases with the increase in the number of participants. The resulting herding behavior can lead to excessive volatility and sharp swings in the stock prices (Wilhelm, 2001).

The regulators in the emerging markets should be concerned about excessive volatility since, among other factors, it reflects possible market manipulation and speculative trading. A lack of trust in the fairness of markets due to the potential for manipulation and irrational trading, highlighted by recurring scandals, scams, and speculative bubbles, exacerbates market volatility. Such manipulative and speculative behavior imposes implicit costs on market participants and increases the cost of intermediation. The inefficiencies in market intermediation increase the cost of capital, which can be a drag on the economic development. Kane (1988) sees financial instability as a cost of inefficient financial regulation. Mian and Atif (2005) document the direct cost of poor governance of market intermediaries. A major task for the regulator thus becomes reducing volatility.

In this study we describe the regulatory dialectics in two emerging markets in South Asia, namely India and Pakistan, which lend themselves for

comparative analysis of regulation of markets due to commonalities in institutional structures and traditional financial instruments and practices. The two markets share a common genesis, a common civil code, and a similar cultural and regulatory environment. In recent times the two markets have had their own cycles of boom and bust, periods of superlative growth, as well as of sharp decline and volatility.

In section II we draw comparisons between the cycle of dialectics in the two countries, regulatory response to market manipulation and volatility, and its effectiveness in achieving declared objectives. We study episodes of speculative market behavior and regulatory response in India and Pakistan; two episodes in the former and one in the later. In these periods, allegations of massive speculation, manipulation and scandals led to political pressures on the regulators to phase out a traditional institution common to the two countries, that is, of *"badla"* or Carry-Over-Trade (COT) financing, which is explained in the following section. In section III we provide a brief description of the speculative episodes and the regulatory response in the two countries. Section IV explains the empirical methodology used to examine the change in market behavior following regulatory intervention. Section V presents results of the study. We note that while the Indian regulatory response seems to have achieved its objectives in curtailing manipulative and speculative behavior, there seems to be no impact on such behavior in the case of the Karachi Sock Exchange (KSE). The final section presents summary and conclusions.

II. Institutional Background:

Bombay Stock Exchange (BSE)

The Bombay Stock Exchange (BSE, now known as The Stock Exchange, Mumbai) is the oldest stock exchange in Asia, established in 1875. Over 4,700 stocks, with a total market capitalization of about US $553 billion, are traded on the exchange. The BSE is among the 5 biggest stock exchanges in the world in terms of transactions volume. Along with the National Stock Exchange (NSE), an emerging competitor established in 1994, the two exchanges represent more than a four-fifth share in aggregate turnover of the 23 stock exchanges in the country. The BSE was organized as an Association of Persons (AOP) until 2005, when the Exchange was de-mutualized and incorporated as an corporate entity. With the conversion from a mutual form to the corporate form, the trading rights and ownership rights have been delinked to address concerns regarding perceived and real conflicts of interest.

Following the economic reforms of July 1991, Indian stock markets have increasingly integrated with developed markets. Their exposure to fluctuations in global stock markets has increased as foreign institutional investors have become major players in the domestic markets since 1993. Over the years, Indian stock markets have strived to transform themselves to meet the demands of modern finance, for example, by developing a full-fledged derivatives market for futures and options. In the last decade, Indian stock markets, particularly the BSE, have witnessed many booms and busts and weathered several crises. The Sensex (BSE30), considered to be the barometer of the Indian economy, has shown relatively higher volatility during the post-reform period. The BSE has also seen a recurrence of financial irregularities; in the last decade two major and a few minor scams have affected the market badly.

A major institutional development was the setting up of the National Stock Exchange (NSE). The Bombay stock exchange was perceived to be backwards, and as an obstacle in the modernization of the capital markets. The National Stock Exchange of India was promoted by leading financial institutions at the behest of the Government of India, and was incorporated in November 1992. Within one year of the onset of equity trading at the NSE, it became India's most liquid stock market. The launch of derivatives in 2000 by the NSE further choked the Bombay Stock Exchange, which has lost market share to the NSE every year since then. In equity trading volume the BSE share slipped from 45% in 2000 to under 32% at present.

The NSE succeeded by harnessing new technology, building an ownership structure that kept it free of public sector bureaucratic control, adopting modern management practices, and basing its business model on user charges. Shah and Thomas (2001) summarize that, "NSE seems to have generated a dynamic process of change in the securities industry. It directly spawned new institutions (the clearing corporation and depository) and played a vital role in injecting new ideas into the securities markets (such as derivatives trading). Through competitive pressure, and by being a role model, it indirectly helped accelerate the process of change in other exchanges in the country. Thus the NSE's overall importance in the reforms process on the equity market has been quite considerable."

Karachi Stock Exchange (KSE)

The Karachi Stock Exchange (KSE), established in 1947, is the oldest and the most active of the three stock exchanges in Pakistan, and currently lists 662 companies with a total market capitalization of about $52

billion. The KSE100 represents major blue chips companies and is fairly representative of the market. Besides the KSE there are two regional stock exchanges in Lahore and Islamabad. The other two exchanges are however relatively inactive. For example, during July 2005-March 2006 the average daily turnover at the KSE was 462.4 million share, while at the LSE and ISE it was 65.4 and 1.7 million shares, representing 12% and 3% of the total market activity respectively.

Similar to other emerging markets, the KSE has a limited role in raising new capital; e.g., there were only five new listings in the market in 2005. Despite the small size of the market, it experiences a high turnover and high price volatility. From the plot of the KSE100 index over the five year period 2001-2005 (See Figure 1), one can see that the market experienced significant fluctuations over shorter time intervals. Finally, a skewed size distribution of stocks traded is observed for the KSE i.e., skewed in terms of size, trading patterns, volume of brokers' trading and weighted value of stocks in the index. This is particularly true for the top 20 stocks accounting for 85% of the overall turnover.

Exhibit A shows the salient features of the BSE and KSE for comparison. The KSE is a much smaller market compared to the BSE, both in terms of listed companies as well as market capitalization. The KSE represents only 0.7% of the total capitalization of emerging markets, compared to the BSE's 7.9% share. It is interesting to note the sharp contrast between Pakistan's capitalization ratio (which is low) and relatively high turnover ratio. This characteristic probably reflects noise trading and speculative elements in the market. The spectacular rise in the S&P/IFC Global Index of 410% over the 2001-05 period is remarkable, though the BSE's 260% appreciation also stands in sharp contrast with the performance elsewhere in the world. The appreciation in the KSE100 index and BSE30 index was 534% and 137% respectively for the same period. The Pakistani stock market appreciation was four times higher than the Indian market, despite a higher rate of growth in the Indian GDP for the same period. Exhibit A also shows that the PE ratio and Price to Book value of Pakistani companies included in the S&P/IFC Global Index is nearly 2/3, and the dividend yield nearly half of that of the Indian companies. These statistics suggest that the cost of capital for the Indian companies would be much lower than for the Pakistani companies. Another important difference is the higher degree of correlation of the BSE (0.69) with the S&P Composite Index, compared with correlation coefficient of 0.32 in case of the KSE, which reflects a higher degree of integration of the BSE with the international capital markets.

Exhibit A: Comparative Market Statistics

Market Statistic	Mumbai Stock Exchange		Karachi Stock Exchange	
Year	2001	2005	2001	2005
No of listed Companies	5,795	4,763	747	661
Market Capitalization (mil. US $)	110,396	553,074	4,944	45,937
Trading Value (mil. US $)	249,298	443,175	12,455	140,996
Turnover ratio (%)	191.4%	93.6%	226.8%	375.7%
P/E Ratio*	12.8	19.4	7.5	13.1
Price to Book Value*	1.9	5.2	0.9	3.5
Dividend yield (%)*	2.4%	1.3%	12.5%	2.5%
% Change in index (2005 over 2001)*		260%		410%
Share of emerging market capitalization		7.9%		0.7%
S&P/IFCG Index correlation		0.69		0.32
Gross Domestic Product (mil. US $)	478,524	691,163**	71,496	96,115**

Source: Global Stock Markets Factbook 2006, Standard and Poor's.

*Note: * based on S&P IFC Global Index; ** 2004 figures*

Besides the differences between the two markets in size, activity and other characteristics noted above, there are two aspects of the markets which may have a direct bearing on the regulatory response and its effectiveness in dealing with market manipulation and volatility in the two countries. First, there is a difference in the industry structure and competition among the stock exchanges. As already noted above, the India National Stock Exchange has emerged as the leading stock exchange in the country, with 45% market share, thus eliminating the BSE's monopolistic position that it enjoyed since its inception. The NSE along with 22 other active regional exchanges creates a more competitive environment than is the case in Pakistan. The KSE is still the dominant player in this case with a 85% share of the trading activity.

Secondly, there seems to be a significant difference between regulatory enforcement and effectiveness of public policy. Nageswaran and Krithivasan (2006), for example, claim that only Singapore, Hong Kong and

India are effective in enforcement among Asian countries. According to data compiled by Goyal (2004), the Securities and Exchange Board of India (SEBI) had taken up 657 cases for investigation in the period 1992-2003, and had completed 424 cases. 250 prosecutions were launched against collective investment schemes over 2001-03. During the same year there were 257 actions taken against brokers and others out of which there were 42 suspensions. SEBI's record in redressing grievances also appears to be effective; the redress rate is about 95%. In contrast, according to a survey conducted by La Porta et al. (2006) Pakistan scores rather low on the indices of (i) *orders to issuers, distributors and accountants* (ii) *criminal sanctions* and (iii) *public enforcement* which capture the extent to which a public regulator exercises investigative power and its ability to impose penalties. Pakistan's score on these three indices is 0.17, 0.08 and 0.58, compared to India's 0.67, 0.83 and 0.67 respectively. Mian and Atif (2005) remark with respect to Pakistan that, *"Thus, it is not surprising that to date there has hardly been any case in which a broker was prosecuted for improper activity."*

The Badla or Traditional Carry Forward System

An old and traditional informal institution common to both India and Pakistan is that of *"badla"*, meaning something in return. It is a local term for a forward trading facility, and essentially is a *repo* transaction carried out in a separate after-hours market where the borrower who takes the *badla* from a *badla* broker, carries forward his security exposure from the current settlement period to the next one, by sale of his position in the present period and its repurchase in the subsequent settlement period at a predetermined price differential. In the event of a purchase, the investor may want to carry forward the transaction to the next settlement cycle and for doing so, he has to compensate the seller who sold it with an intention of getting cash.

III. Market Crisis and Regulatory Response

The Indian Experience

In June 1991, the new Indian government accelerated the process of economic liberalization, privatization and opening up of the economy, setting off expectations of unprecedented growth and prosperity for the economy. The stock market started booming - the BSE Sensitive index rose from around 1000 in February 1991 to a peak of 4500 in March 1992. There was an enormous increase in the demand for margin finance by investors. On the other hand, there were heavy margins imposed by the

BSE, which led the market participants to find innovative solutions, sometimes not legal, to meet their financing requirements.

The new free market environment put immense pressure on the public sector, in particular the nationalized banks, to improve financial performance and capital adequacy. Banks, holding large cash balances not subject to reserve requirements under the Portfolio Management Scheme and cash raised by the public sector units through foreign exchange borrowing, became eager to explore new venues of higher returns. The market did not take long to find innovative ways of avoiding regulation and diverting funds from the banking system (from the inter-bank market for government securities) to the stock market. It was done mainly through the ready *forward deal* mechanism, a variant of *repo* or repurchase agreement, and the *badla* system often using fraudulent and non-existing securities. The resulting "securities scam," personified by Hashad Metha, led to a diversion of funds to the tune of over $ 1.2 billion from the banking system to the stock market during the period April 1991 to May 1992. For a detailed reconstruction of the scam and regulatory response see Barua and Varma (1993).

With the discovery of the scam, stock prices dropped by over 40% in less than two months, wiping out market value by $35 billion. The government responded by promulgating an ordinance with several harsh provisions, including confiscation of the properties of the accused in the scam. It set up a special court to try those accused in the scam. It also voided all transactions in "tainted shares" that had been routed through involved brokers and their firms, which also caused market disruption. Another unintended consequence was to slow down the reform process which busted the speculative boom of the early 1990's.

The *badla* system was blamed for causing "excessive speculation" in the market and for the irregularities in the stock exchanges in the form of non-enforcement of margins, non-reporting of transactions and illegal trading outside the stock exchange. Consequently, in March 1994 the Securities and Exchange Board of India (SEBI) effectively banned the facility, but, yielding to the demands from the brokerage community, introduced a modified *badla* system subject to certain safeguards effective January 1996. In 1997 further safeguards were put in place, such as segregation of carry forward transactions at the time of execution of trade, daily margins of 10%, one-half of which would be collected upfront, and overall carry forward limits per broker.

Barua and Varma (1993) argue that the origin of the scam lie in overregulation and artificial barriers between the money market and the

capital market. In terms of Kane's regulatory dialectics, major shifts in the technological and market constraints created contradictions with the antiquated regulatory framework. The regulatees' adaptive response of circumvention led to a sequence of *avoidance-reregulation and avoidance*.

In the late 1990's the *dotcom boom* in information, communications, and entertainment stocks all over the world contributed to the bull run on the BSE, which almost doubled in a short period from January 1999 to February 2000. The speculative spell led to overextended positions, and afforded many opportunities for fraud and manipulation, personified by the *Bombay Bull*, Ketan Parekh, considered to be the main villain. He had managed to manipulate ill-liquid stocks, known as the 'K-10' stocks, by borrowing from various companies and banks using the shares as collateral. It worked well in the bull market, but busted when the markets started crashing in March 2000, led by a fall in the NASDAQ. In the next two months, while the NASDAQ declined by 35.9%, the Sensex lost 23% and the K-10 stocks crashed by 67% (see ICFAI, 2002).

Following the crash in the stock markets, SEBI launched immediate investigations into the volatility of stock markets. SEBI also decided to inspect the books of several brokers who were suspected of triggering the crash. The Reserve Bank of India (RBI) ordered investigation into the capital market exposure of some banks, following media reports that some banks may have exceeded prudential norms of capital exposure, thereby contributing to the stock market volatility. The Bombay Stock Exchange (BSE) President was forced to resign following allegations that he had used some privileged information, which contributed to the crash. In the aftermath, at least eight people were reported to have committed suicide while hundreds of investors were driven to the brink of bankruptcy. The scam brought into question banks' funding of capital market operations and lending funds against collateral security. It also shattered investors' confidence in the functioning of the stock markets.

It appears that the dot-com bull market strained the regulatory framework through a manifold increase in the trading volumes, market value, and need for liquidity and financing. A conflict between economic forces and the regulatory processes developed as the regulatory adaptations lagged behind market developments. Ineffective regulations and surveillance of banking system and stock market financing (in particular informal financing through *badla*) permitted illegal and highly speculative positions. The ensuing market crash prompted SEBI to launch a cycle of regulation to control the damage including increasing margin requirements, imposing restrictions on short sales, and requiring stock deliveries following sale. It

suspended all of the broker member directors of BSE's board and banned trading by exchange officers. The *badla* system was banned, effective from July 2001, and a rolling settlement system was introduced.

The Pakistan Experience

The KSE experienced a steady bull run as reflected in both the KSE 100 index and trading volumes, starting just after the last stock market crisis in May 2002, which accelerated towards the end of 2004. The KSE 100 saw an unprecedented rise of 65%, from 6,218 on December 31, 2004 to 10,303 on March 15, 2005, along with an increase in the value traded from around $300-400 million to $1-2 billion per day. The market turned negative in the second half of March, 2005 and the index dropped as low as 6,939 on April 12, 2005, a decline of 32.7% from its peak. The sharp rise in the index could not be explained by any change in the fundamentals. The following precipitous fall is also somewhat of a puzzle. Such a meteoric rise in index and a subsequent crash is indicative of a classical speculative bubble in the equity market.

Badla has been blamed as one of the reasons for the March 2005 crisis. Pakistan's influential financial newspaper The Business Recorder stated two problems with "*badla*" financing: first, *badla* financing is only open to a small number of market players, which also includes financial institutions, as opposed to share trading. Second, *badla* financing is provided by short-term investors and the hot money can disappear overnight. During 2004-05 KSE investors were willing to borrow at exorbitant *badla* rates (which were capped at 18% in the KSE, but rose in the uncapped Lahore Stock Exchange to over 100%) because the accelerated rise in stock prices made even expensive borrowing feasible. The COT (*badla*) financing ranged from 33% to 45% of investment at KSE throughout 2004. The higher demand for *badla* investment pushed the average *badla* rates from 9.4 % in 2003, to 11.4% in 2004, ranging from 12 to 19%, even though market interest rates remained stable at a relatively low level through most of 2004.

The growing availability of *badla* financing brokers and institutions added to the buying frenzy, though some of the major *badla* providers were simultaneously selling in the futures market. In other words, "there was a strong nexus between lenders and brokers/investors who could influence market sentiment to their own advantage" (Task Force Report, 2005). The chairman of SECP stated on July 16, 2005 that "*badla*" was the root cause of almost all previous crises at the bourses, and was to be rooted out, and that the *badla* and margin financing could not co-exist.

After the March 2005 crisis, a task force was set up by the Chairman of SECP to identify the causes for the situation arising at the country's three stock exchanges in March 2005 and to propose measures for strengthening and consolidating the regulatory regime, particularly with a view to enabling emergency intervention, preventing systematic risk and promoting market stability. The task force completed its report in July 2005 identifying a few areas that contributed to the instability in the stock prices. The Task Force recommended that there was a need for structural reforms and steps were needed to protect public interest by ensuring that the financial might that has been accumulated by the stock brokerage and *badla* financing institutions should be effectively checked and brought to a reasonable size to ensure that they are unable to manipulate the market and adhere to international practices.

Besides *badla* financing, other factors which contributed to this "bull run" included, increased liquidity due to higher foreign remittances, a regime of low interest rates, IPO's of public sector enterprises marked for divestment and floatation of more mutual funds. During this period, especially since the middle of October 2004, there was an unusual build-up in the media about the prospects of a rise in the KSE index. Statements from government officials linked the rise in the KSE index to good economic management, and indicated that the market was destined to rise further. The announcement of the impending accelerated program for the privatization of prominent and profitable public sector corporations fuelled the bullish sentiment. The conduct of corporate officials contributed to the market speculation; for example, rumors of new oil and gas discoveries which would raise stock value manifold went un-refuted or clarified by the management. There were allegations of "wash trades" and "pump and dump" plays by brokers.

The main thrust of the Pakistani regulators was to replace *badla* with formal financing arrangements. The State Bank of Pakistan (SBP) in collaboration with the Securities and Exchange Commission of Pakistan (SECP), came out with rules governing margin financing issued to stock brokers by banks. The SBP rules specified the conditions of extending such loans to stock market brokers with proper risk management and internal controls. It has also specified the minimum margin requirement of 30% and reminded banks of the per party limit, in case of such lending to brokers. The SECP intended to completely eliminate the carryover market (the badla market) by the end of December 2004. Initially, the plan was to replace it in 2003, but slow progress by the regulators has resulted in a delay.

Regarding replacement of *badla* financing, the regulatory bodies were seen as vacillating, as was described in an op-ed "*Badla is back*" in the

newspaper, the *News*. "But firmness doesn't appear to be the strong point of the Securities and Exchange Commission of Pakistan. ... What went wrong? Or, rather, how heavy was the pressure from vested interests? Were the members of the Karachi Stock Exchange so powerful that they managed to force the regulator to work in their interest? The SECP has not only proved to be a weak regulator but also exposed itself to the criticism that it acts first and thinks later," (The News, July 15, 2005).

There were other factors which reduced the effectiveness of the regulators' actions. First, the composition of the Task Force was not without conflicts of interest as its members also were on the Policy Board investigating matters which should have been the subject matter of the Board itself when formulating capital markets policies. Second, the common view is that the March debacle was due to excessive institutional selling and the withdrawal of *badla* financing simultaneously from the market. In the past, SECP had been criticized for allowing the brokerage houses to own commercial and investment banks which provided them additional resources to enter into *badla* financing and use it to manipulate the market. Third, the Task Force, a creation of SECP, could not look into the question of inadequate surveillance and weak implementation by SECP.

The Task Force also did not look into the role of KSE management in possibly precipitating the withdrawal of the *badla* facility, by calling upon the various brokers and institutions to reconfirm that they would be able to honor their obligations in the future contracts, and sending alarming signals to market players. As there were four SECP nominated directors on the KSE board, there was a possibility of conflict of interest. However, while the KSE does receive some oversight from the SECP, it is predominantly broker-managed, i.e., a majority of the exchange's board of directors including the chairman are brokers. The Task Force also did not investigate the allegation of market manipulation by certain mutual funds through withdrawing the *badla* financing and to take advantage of the pursuing crash.

IV. Empirical Analysis and Methodology

In order to empirically analyze the impact of the regulatory intervention, primarily abolishing of *badla* system, following market scams and episodes of speculative behavior, we study the return volatility in the two stock exchanges before and after the events. It is strongly argued in the finance literature (e.g., De Long, Shleifer, et al. 1990a, 1990b) that *noise traders* cause excessive trading and volatility. Speculative trading in derivative securities has also been blamed for causing excessive volatility (Jegadeesh and Subrahmanyam, 1993). Some economists have even argued

for imposing tax on short-term trades to contain volatility (e.g., Stiglitz 1989).

Among the related research, in the context of India, Bhattacharya *et al*. (2003) examine the stability of the day-of-the-week effect in returns and volatility during 1991–2000 and do not find the estimated coefficient of the dummy variable for *badla* financing to be significant. Goswami and Angshuman (2000) also report that *badla* trading had no impact on the day-of the-week pattern of returns. Eleswarapu and Krishnamurti (2005) study whether *badla* financing facility had led to speculative volatility on the Bombay Stock Exchange prior to March 1994. They do not "find any evidence that supports the allegations made by regulators that *badla* trading destabilizes the stock prices and causes excessive volatility." The impact of abolishing of *badla* system in Pakistan has not been studied so far to our knowledge. However, Ahmed, Rosser and Uppal (1996) document the existence of bubbles over the period 1987-1994. Mangla and Uppal (1996) report market inefficiencies. The existence of price manipulative behavior on the KSE is rigorously documented by Khawja and Mian (2005).

We conduct empirical analysis of the impact of regulatory intervention in the two markets in order to subdue speculative behavior with reference to stock price volatility. First, we examine the variance of stock returns and conduct an F-test for variance equality. Second, we modify the variance tests to exclude possible influence of the international stock markets and *conditional auto-regressive heteroskedasticity* on the variance process. Variance of the residuals from the GARCH-M model in the before- and after- sub-periods are tested for equality by employing the usual F-test. Third, we include a dummy variable in the GARCH variance equation to capture the impact of the regulatory response on the market volatility. Finally, we examine autocorrelation in the market returns in the two sub-periods. The GARCH methodology is further explain below.

Autoregressive conditional heteroskedasticity (ARCH) was proposed by Engle (1982) to explain the tendency of large residuals to cluster together. A general form of an ARCH/GARCH model is:

$y_t = \mathbf{X}_t\beta + u_t$, and the variance of u_t, h_t follows the process:

$$h_t = h(u_{t-1}, u_{t-2}, \ldots u_{t-q}, h_{t-1}, h_{t-2} \ldots, h_{t-p}, X_{t-1}, X_{t-2}, \ldots, X_{t-k}, \alpha)$$

where α is a set of unknown parameters. In the Bollerslav (1986) model, the variance term depends upon the lagged variances, as well as the lagged

squared residuals, to model persistence in volatility. The variance model for the standard GARCH (p, q) model is:

$$h_t = c_0 + a_1 u^2_{t-1} + a_2 u^2_{t-2} + \ldots + a_q u^2_{t-q} + b_1 h_{t-1} + a_2 h_{t-2} + \ldots + b_p h_{t-p}$$

GARCH-M models (Engle, Lilien, Robins (1987)) generalize the GARCH model by allowing a function of the variance (typically the variance itself) to enter the regression function. We employ a GARCH-M(1,1) model to account for the persistence in volatility in the returns series as follows:

$$R_t = \gamma_0 + \gamma_1 RI_t + \gamma_2 h_t + u_t \qquad \text{where } u_t \sim N(0, h_t) \qquad (1)$$

$$h_t = var(u_t) = c_0 + a_1 u^2_{t-1} + b_1 h_{t-1} \qquad (2)$$

In our model the set of explanatory variables ($\mathbf{X}_t$) consists of a vector of 'returns' on the MSCI World Index measured as $RI_t = ln(I_t) - ln(I_{t-1})$, as well as the conditional variance (h_t). The MSCI world index is included in the mean equation to capture the transmission of volatility from the international markets to the local market, which has been well documented in empirical research, and to allow us to focus on volatility arising from domestic factors. The conditional variance h_t is included in the mean equation to include the risk-return trade-off predicted in the finance literature, allowing for a more general specification of the return generating process. Though the relationship between portfolio returns and conditional variance (as a proxy for risk) is not a central issue in this paper, we note here that there are theoretical arguments predicting both a positive as well as a negative relationship between these two variables. The empirical evidence has also been mixed (see Shin (2005) for a recent survey).

Variance of the residuals from the GARCH-M model in the before- and after- regulatory change are then tested for equality employing the usual F-test. The impact on return volatility following regulatory response is further examined by including a dummy variable D_t in the variance equations (2) which takes a value of one for period after the change in the regulations and zero otherwise. The variance equation with the regulatory dummy is now as follows:

$$h_t = c_0 + a_1 u^2_{t-1} + b_1 h_{t-1} + dD_t \qquad (2a)$$

The coefficient on the dummy variable should capture the impact of regulatory intervention on the volatility of the market returns.

Data and Sample Period

Data for this study was taken from the Datastream International, Ltd. Database for the Karachi Stock Exchange 100 Index (KSE100) and for Bombay Stock Exchange index of 30 major companies (BSE30 SENSITIVE). Daily closing values of the indices were used for the period from 1/1/1993 to 12/29/1995, and from 1/1/2000 to 3/31/2003 for the BSE to cover the two periods during the period of change. The corresponding event window is from 1/1/2004 to 8/30/2006 for the KSE. We study the market behavior by dividing it into sub-periods, before and after the structural change was implemented, as shown below (Exhibit B):

Exhibit B: Study Period

Market	Event Date	Study Sub-Periods	No of Observations
BSE	March, 1994	Sub-Period I: 1/1/1993 to 2/28/1994	302
		Sub-Period II: 6/1/1994 to 12/29/1995	413
	July, 2001	Sub-Period I: 1/1/2000 to 6/29/2001	390
		Sub-Period II: 10/1/2001 to 3/31/2003	391
KSE	March, 2005	Sub-Period I: 1/1/2004 to 2/28/2005	303
		Sub-Period II: 8/1/2005 to 8/30/2006	283

For the BSE, we leave out a three month intervals between the sub-periods to allow the market to adjust to the new regulatory environment. For the KSE, we exclude five months since the issue remained under consideration for longer period and the change was not implemented immediately. All price data was converted to "returns" by taking the natural log differences of the index level P_t thus: $R_t = ln(P_t) - ln(P_{t-1})$.

V. Results

Figure 1 presents graphs of the market indices and return volatility for BSE and KSE for the periods under study. It is important to note that the Bombay stock exchange was quite bullish before the event date, March 1994, but had a mixed experience afterwards. During the 2000-03 period, the BSE index shows a general bearish trend. The graph for the KSE, however, shows that the market was strongly bullish before March 2005, but resumed its bullish course, after a brief 'crash' over the 3-4 month period. It is also observed that that the return volatility was lower for the

BSE in the post intervention sub-periods, while the volatility was higher in second sub-period for the KSE.

Summary statistical results for the first four moments for the return series are shown in Table-1. It is noteworthy that the return distributions in both countries exhibit significant departure from the normal distribution, Skewness and Kurtosis are very significant, and the Jarque-Bera statistic for both markets and for all periods strongly rejects normality hypothesis. Results for tests for difference in mean and variance of two sub-period samples are presented in Tables-2 and 3 respectively. For the 1994 instance of abolishing *badla* in India, the mean daily return for the BSE in the first sub-period is 0.1636%, while it is -0.0503% in the second sub-period. The t-test for mean difference is significant at 5% level; one-tail probability ($T \leq t$) is 3.5%. On the other hand, for the second event of banning *badla* system in 2001, the mean difference is not significant at conventional levels; the achieved significance level is 16.2%. In Table-2, the t-test for mean difference in the daily return on the KSE in the two sub-periods is not significant; the one-tail probability ($T \leq t$) is 23.6%. Though the mean difference is not significant, it is interesting to note that the sample mean daily returns in second sub-period, though lower than in the first sub-period, remains high relative to historic experience and to the other emerging markets. It seems that the KSE bullish sentiment continued to rule, contrary to the intentions of the regulators.

Table-3 (panel A) presents the test results for difference in the variance over the studied events in the two markets. For the BSE, the F-test for unequal variance strongly rejects the null hypothesis both for the 1994 and 2001 episodes. For the 1994-95 study period the variance of daily returns in the second sub-period was significantly lower than in the first; 0.0126% compared with 0.0327%. Similarly, for the 2000-03 study period, the variance in the later sub-period (0.0128%) is significantly lower than in the first sub-period (0.0420%). The behavior of the KSE, however, appears to be quite the opposite. The sample variance is actually higher in the second period than in the first, 0.0280% vs. 0.0098%, or approximately 2.8 times the first sub-period variance. The F-test for unequal variance rejects the null with a p-value of practically zero.

In order to study the response of the two markets with respect to the regulatory changes with more robust controls, we account for the possibility of international stock markets and *conditional auto-regressive heteroskedasticity* influencing the variance process. It was accomplished by including the MSCI World index in a GARCH-M model and then

conducting an equality of variance F-test on the residuals. The results of the test of variance equality are presented in panel B of Table-3. The results confirm the conclusion from the test on unadjusted variances reported in panel A, i.e., for the Indian experience the volatility subsided following regulatory measures, while it was exacerbated in the case of KSE. The shift in the variance is in the opposite direction for the two markets and is statistically significant in all cases with p-values approaching zero.

Table-4 reports results from estimation of the GARCH-M model with a dummy variable representing the regulatory change. The dummy variable for the Indian market has a negative coefficient which is statistically significant at 5% significance level. It indicates that the variance of the return process dropped significantly after the regulatory intervention. On the other hand in the case of the Karachi Stock Exchange the dummy variable is not statistically significant, although it is of positive sign. Thus the more robust test for the shift in volatility tends to support the conclusions of the simple test of variance equality. It is worth noting here that all GARCH variables C, A and B, corresponding to the GARCH equation (2) are statistically significant. In addition, the coefficient for MSCI World Index is statistically significant for the Indian market, while not significant for the Pakistani market. It seems to point to the greater integration of the Indian stock market with the financial markets of the rest of the world. We also observe that the coefficient on the GARCH-variance (h_t) is insignificant and of mixed sign, consistent with the weak and mixed results reported elsewhere (e.g., see Shin 2005).

We also examine the autocorrelation in the return series in the sub-periods following regulatory intervention, which is regarded as one indication of the speculative behavior. The estimated autocorrelations are reported in Table-5. The first order autocorrelation for the BSE in the 1993-1995 period seems to subside in the second sub-period, while it seems to increase in the second sub-period during 2000-03 episode. While the evidence from the autocorrelation function is mixed for the Indian case, in case of KSE the first-order autocorrelation is of a large magnitude (0.0988) and statistically significant in the period following regulatory intervention, compared to the pre-intervention period (-.0366). The increase in the autocorrelation function further suggests that the speculative behavior continued despite the changes brought about by the Pakistani regulators.

VI. Summary and Conclusions

In this paper we have analyzed episodes of marker manipulation and volatility and regulatory intervention in two emerging South Asian markets, India and Pakistan. These episodes conform well to Kane's theoretical framework of regulatory-dialectics depicting the interaction of financial and regulatory innovation. We observe a common pattern of *avoidance-reregulation-avoidance*, triggered by changes in the market and technological environment. Markets adapt to such changes in the form of innovation, avoidance and circumvention of regulation. The resulting conflict calls for a re-regulation response, which, however, is followed by another round of avoidance.

We draw comparisons between regulatory responses in the two countries to the episodes of speculative spells, manipulation and scandals and its effectiveness in achieving declared objectives. Our empirical analysis indicates that while the Indian regulatory agencies seem to have achieved their objectives in curtailing manipulative and speculative behavior, there seems to be little impact on such behavior in the case of the KSE. The bullish sentiment and volatility on the KSE continued unabated despite the measures taken by the SECP to curtail speculative trading allegedly fanned by the *badla* system. On the other hand, the regulators of the BSE appear to have succeeded in their goals of cooling off the market in the 1994-1995 as well as in the 2000-03 periods.

Though there are commonalities in terms of civil code, and cultural and business environments in the two countries, we note significant differences in the regulatory effectiveness and industry structure that may explain the difference in the market behavior outcomes following regulatory interventions. We note that the response of the Indian regulators in dealing with the market manipulations and speculative behavior appears to be much stronger and effective than was the case in Pakistan. The Indians regulatory response was three pronged: 1) discovering and punishing the guilty, 2) recovering the money, and 3) reforming the system. The Pakistani regulators on the other hand only pursued institutional restructuring mainly focusing on replacement of the *badla* system. No criminal or civil charges were filed, and no recovery was sought. This response may have been perceived by the market as weak, and may not have conveyed a strong signal to the market regarding government's resolve for effective enforcement. It is possible that extra-market manipulations by speculators, such as documented by Khawja and Mian (2005), may have frustrated the efforts of the KSE regulators. Another possibility is that the *badla* system may not have been a cause of the alleged speculative fever, as is reported by researchers for the BSE.

Another relevant factor is that in India, the National Stock Exchange is a viable competitor to the BSE. The competitive environment creates stronger pressures on the regulatees to self-regulate, reform, modernization and comply with the public policy. It strengthens the hands of the regulators in dealing with the recalcitrant and vested "clubby" organizational cultural which allegedly surrounds both stock exchanges. In the case of the KSE, however, its near monopoly position may have been a factor in frustrating the goals of the regulators.

Kane (1988) hypothesizes that innovation discovery and execution lags are typically shorter for regulatees than for regulators; in other words, private sector players are nimbler than bureaucrats. He attributes this difference to "differences in relevant information costs, differences in the extent of managerial commitment to the goals of regulation, and differences in the extent to which principal-agent conflicts can be resolved in government and private enterprises." The difference in effectiveness of public regulation in the two countries observed here may similarly be attributable to these factors. Future reforms in Pakistan should focus on reducing conflict of interest and agency problem in both private and public sectors improving enforcement and surveillance, as well as creating a more competitive environment among the stock exchanges.

Table-1: Summary Statistics

	Bombay Stock Exchange 1993-1995			**Bombay Stock Exchange 2000-03**			**Karachi Stock Exchange 2004-06**		
Index Return Daily Percent	*Jan 93 to Dec 95*	*Jan 93 to Feb 94*	*Jun 94 to Dec 95*	*Jan 00 to Mar 03*	*Jan 00 to Jun 01*	*Oct 01 to Mar 03*	*Jan 04 To Aug 06*	*Jan 04 to Feb 05*	*Aug 05 to Aug 06*
Mean	0.0222	0.1636	-0.0503	-0.0586	-0.0949	0.0207	0.1170	0.2025	0.1202
Variance	0.0206	0.0327	0.0126	0.0271	0.0420	0.0118	0.0248	0.0098	0.0280
Skewness	-0.1077	-0.2828	0.1524	-0.3388	-0.2583	0.2787	-0.4937	-0.5222	-0.5962
Kurtosis	2.9242	2.1863	0.8294	2.6123	1.1944	1.2321	1.7263	2.4753	1.3910
Minimum	-0.0899	-0.0899	-0.0385	-0.0742	-0.0742	-0.0395	0.1186	-0.0356	0.1064
Maximum	0.0563	0.0563	0.0418	0.0712	0.0712	0.0445	-0.0606	0.0342	-0.0606
Jarque-Bera	279.77	64.17	13.449	256.73	27.52	29.81	114.53	91.12	39.58
Observations	781	302	413	846	390	391	695	303	283

Table-2: Test for Mean Inequality

T-Test For Mean Difference:

Assuming Unequal Variances			
Index Return Daily Percent	**BSE30 1993-95**	**BSE30 2000-2003**	**KSE100 2004-06**
Mean Ist Sub-period	0.1636	-0.0949	0.2025
Mean 2nd Sub-period	-0.0503	0.0207	0.1202
t Stat	1.8172	-0.9848	0.7191
P(T<=t) one-tail	0.0349	0.1626	0.2362

Table-3: Test for Variance Difference

Panel-A: F-Test for Unequal Variances			
Index Return Daily Percent	**BSE30 1993-95**	**BSE30 2000-2003**	**KSE100 2004-06**
Variance Ist Sub-period	0.0327	0.0420	0.0098
Variance 2nd Sub-period	0.0126	0.0118	0.0280
F Stat	2.6024	3.5499	2.8469
P(F<=f) one-tail	0.0000	0.0000	0.0000
Panel-B: F-Test for Unequal Variances Using Residuals from the GARCH-M Model			
Index Return Daily Percent	**BSE30 1993-95**	**BSE30 2000-2003**	**KSE100 2004-06**
Variance Ist Sub-period	0.0333	0.0393	0.0098
Variance 2nd Sub-period	0.0123	0.0115	0.0280
F Stat	2.6998	3.4099	2.8476
P(F<=f) one-tail	0.0000	0.0000	0.0000

Table-4: Results of Garch Model Estimation

	BSE30: 1993-1995		BSE30: 2000-2003		KSE100: 2004-2006	
Variable	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**
Constant (γ_0)	-0.00101	-1.16	0.00033	0.44	0.00227	4.21**
RETMSCI (γ_1)	0.20251	1.94*	0.13811	3.71**	0.05749	0.83
GARCH-V (γ_2)	5.72384	1.23	-0.80969	-0.23	-0.76371	-0.26
C	0.00003	2.15**	0.00003	2.70**	0.00001	3.43**
A	0.10631	3.16**	0.14492	4.06**	0.24551	5.67**
B	0.79988	12.43**	0.75884	13.18**	0.72977	19.70**
DUMMY	-0.00002	-2.00**	-0.00002	-2.35**	0.00000	0.84
Observations	781		846		695	

** and ** indicate statistical significance level of 10% and 5% respectively.*

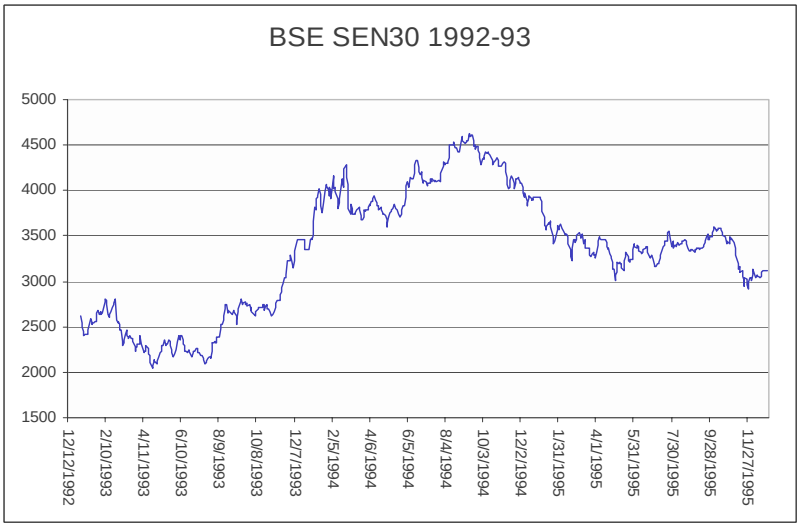
Table-5: Autocorrelation Estimation

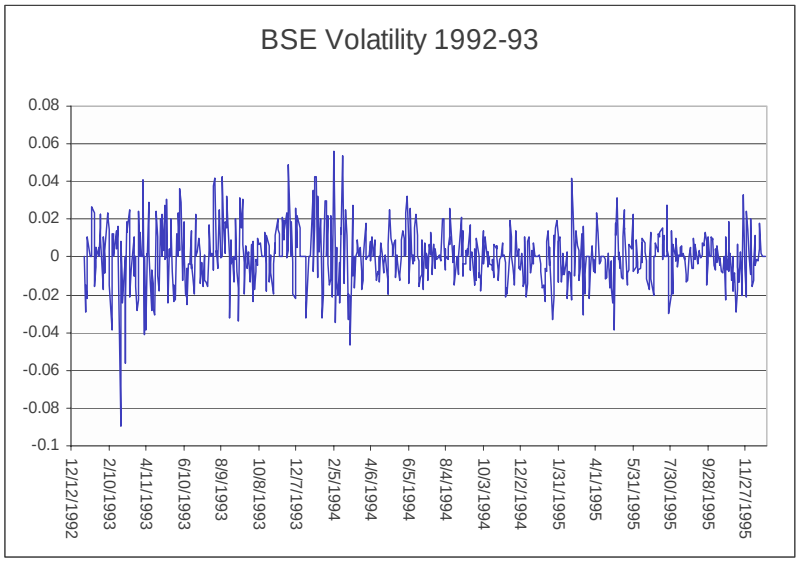
Index	**BSE30: 1993-95**			**BSE30: 2000-03**			**KSE100: 2004-06**		
Lags	Jan 93 to Dec95	Jan 93 to Feb 94	Jun 94 To Dec 95	Jan 00 to Mar 03	Jan 00 to Jun 01	Oct 01 to Mar 03	Jan 04 to Aug 06	Jan 04 to Feb 05	Aug 05 to Aug 06
1	0.0517	0.0370	0.0100	0.2263	0.1961	0.2459	0.0874	-0.0366	0.0988
2	0.0112	0.0258	-0.0046	-0.0017	-0.0157	0.0103	-0.0367	0.0366	-0.0397
3	-0.0186	-0.0374	0.0363	-0.0101	0.0058	-0.0389	0.0622	0.0718	-0.0384
4	0.0444	0.0047	0.1178	0.0010	-0.0173	0.0319	-0.0039	0.0247	-0.1076
5	-0.0262	-0.0519	0.0402	-0.0398	-0.0404	-0.0534	-0.0111	0.1112	-0.0056
6	-0.0503	-0.0538	-0.0339	-0.0198	-0.0110	-0.0308	-0.0255	0.0831	-0.1310
7	0.0678	0.0645	-0.0086	-0.0073	0.0044	-0.0200	0.0056	0.1071	-0.0766
8	-0.0542	-0.0902	0.0067	-0.0108	-0.0390	0.0495	-0.0149	-0.0184	0.0356
Q(4-0)	4.3471	1.3595	6.0808	40.2355	11.9075	26.2478	8.1320	2.5905	7.0171
Sig.	0.3611	0.8512	0.1932	0.0000	0.0181	0.0000	0.0869	0.6285	0.1350
Q(8-0)	13.5393	8.4824	7.2313	41.9285	12.9303	29.0480	8.8338	12.2324	14.1139
Sig.	0.0946	0.3878	0.5119	0.0000	0.1143	0.0003	0.3565	0.1411	0.0788

Q(L) refers to Lung Box Q-statistic for L lags, p-values are reported below.

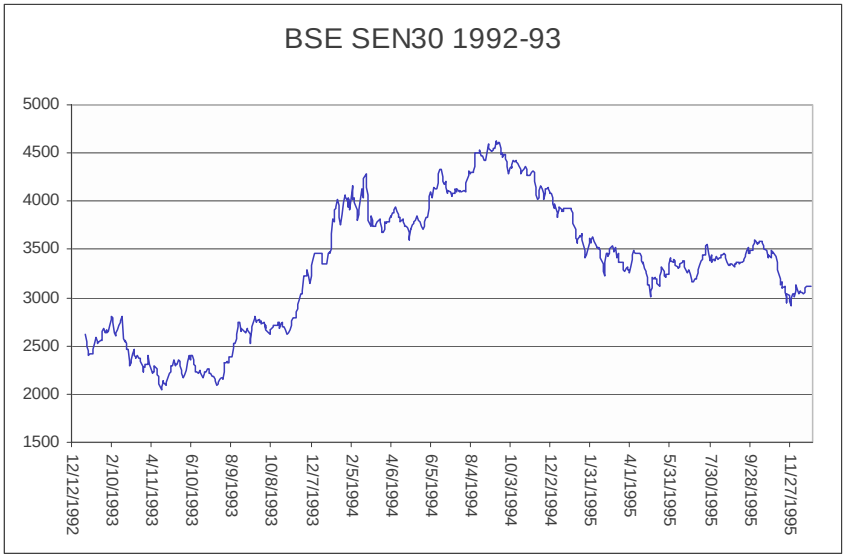
Figure-1: Stock Market Indices And Volatility

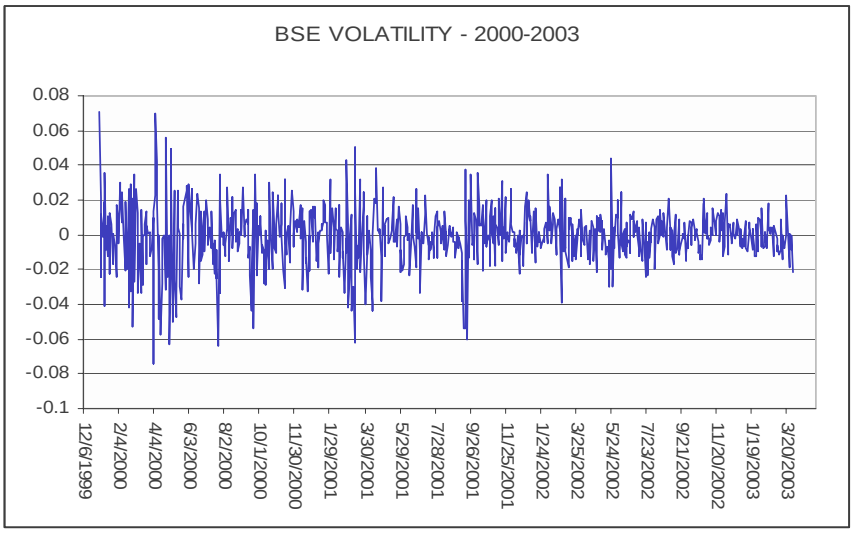
A: BSE, 1993-1995 Period



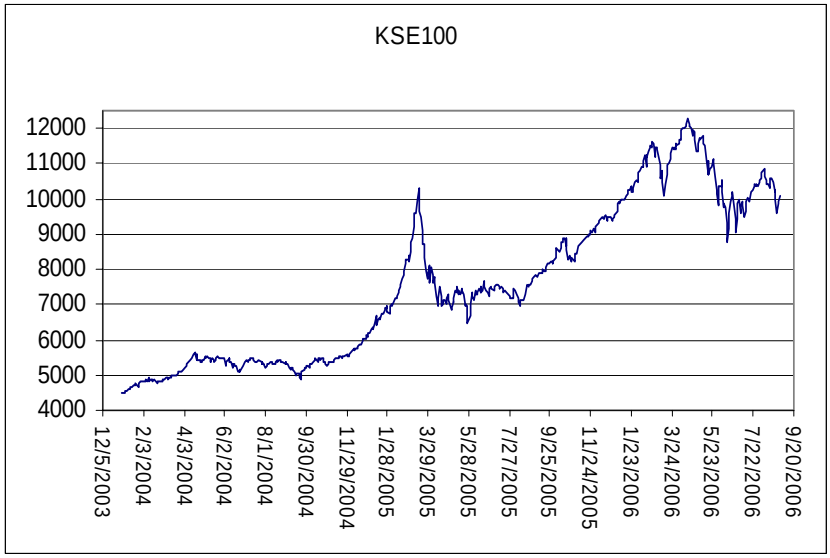


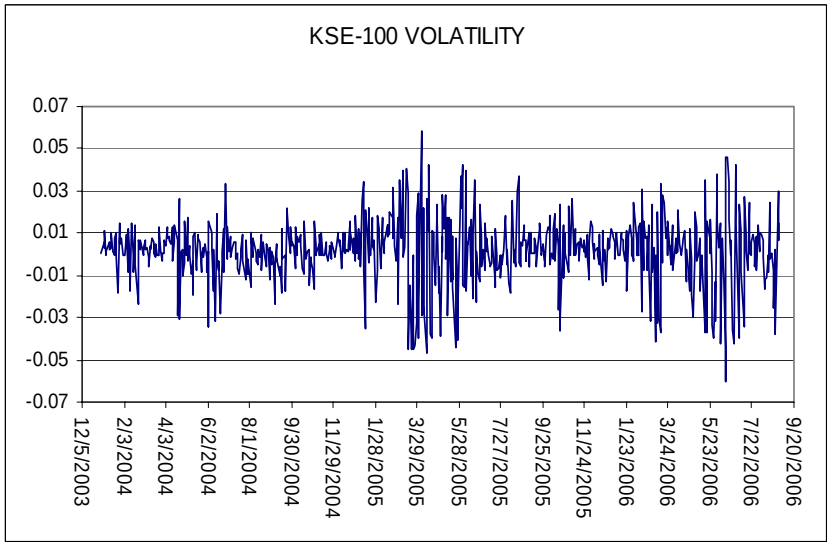
B: BSE, 2000-2003 Period





C: KSE, 2004-2006 Period





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Role of the Futures Market on Volatility and Price Discovery of the Spot Market: Evidence from Pakistan's Stock Market

Safi Ullah Khan*

Abstract

This paper focuses on the role of the financial futures market in the volatility of Pakistan's stock market and determines whether the stock futures price is capable of providing some relevant information for predicting the spot price. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) approach is used to measure volatility in the spot and the futures market and to analyze the relationships between spot and futures market volatility. Causality and feedback relationships between the two markets are analyzed and determined through the Vector Error Correction Model (VECM). Empirical results support the evidence that spot prices generally lead the futures prices in incorporating new information, and that volatility in the futures market does not increase volatility in the spot market. Rather the study finds more consistent support for the alternative hypothesis that volatility in the futures market may be an outgrowth of the volatile spot market.

I. Introduction

Following the March 2005 stock market crash in Pakistan, considerable blame for the market crash was laid at the doors of the financial futures market and many people in Pakistan even demanded the abolition of trading in financial futures contracts as it was mainly blamed for excess volatility in stock prices. This paper investigates the role of the financial futures market in the volatility of Pakistan's stock market and determines whether the stock futures price is capable of providing some relevant information for predicting the spot price. The Karachi Stock Exchange (KSE) is the largest of the three exchanges of Pakistan. It began operations with a 50 share index in 1950. As the market grew, a representative index was needed. The KSE-100 was introduced on

* The author is a PhD Fellow at Mohammad Ali Jinnah University, Islamabad and a faculty member at the Kohat University of Science and Technology, Kohat, NWFP, Pakistan.

November 1, 1991 and remains the most generally accepted measure of the Exchange. The KSE-100 Index is a capital weighted index and consists of 100 companies representing about 90 percent of the market capitalization of the Exchange. As of March 31, 2006, 663 companies were listed with a market capitalization of Rs. 3,257.062 billion (US $ 54.28) and having listed capital of Rs. 486.489 billion (US $ 8.11 billion). The KSE-100 Index closed at 11485.90 on March 31, 2006.

Exchange traded index futures were first introduced on the KSE-100 index on July 1, 2001. In Pakistan, futures contracts mature in thirty days, and the last day for trading in a contract is the last Friday of each month for those contracts that have reached maturity.

This paper strengthens the evidence that futures market volatility does not induce cash market volatility. Rather, this study finds more consistent support for the alternative hypothesis that volatility in the futures market may be an outgrowth of the volatile spot market.

The rest of the paper is organized as follows: The second section presents a brief literature overview, while the third section presents the data and methodology. The final section provides the conclusions and findings of the study.

2. Literature Review

There is little agreement among researchers as to the effect of futures contracts on the underlying ready market. Although there is a general perception that stock price volatility has increased due to the introduction of derivatives, the empirical evidence regarding this issue has not led researchers to a unanimous conclusion and the evidence is far from conclusive. In other words, conflicting arguments and empirical results exist as to why futures trading may increase or decrease volatility in the cash market.

Many researchers report results that support the general perception that futures trading has provoked volatility in the spot market. There are four contrasting opinions regarding the role of futures on stock prices and the vice versa. First, futures' trading has provoked volatility in the spot market, perhaps through excessive, and largely irrational, speculative activities. Moreover, uninformed speculation is thought to be greater in the futures markets due to the lower transaction costs associated with it (Sharown and Gregary, 1995). Figlewski (1981) also contends that if increased hedging demand is not offset by enough speculation, or if futures

traders are less informed than cash market participants, volatility in the cash market is increased. Prior empirical studies have attempted to establish the impact of futures trading on cash markets by comparing cash market volatility over the pre- and post-futures trading eras. For instance, Mabery, Allen and Gillbret (1989) conclude that volatility in spot markets rose subsequent to the introduction of the index futures. Harris (1989) reports a statistically significant increase in volatility due to futures trading. Lee and Ohak (1992) find that, following the introduction of index futures, the volatility of stock indices in Australia, Hong Kong, Japan, the U. K. and the U.S rose significantly. Antoious and Holmes (1995) reported that volatility in the spot market increased after the introduction of futures trading. They argue that the apparent volatility increase is the result of futures trading expanding the channels through which information flows into the market. Herbest and Marberly (1992) suggest that one of the main functions of the futures market is to act as a conduit for transmitting economic news to uniformed investors.

In the second view on the role of futures in determining stock prices, several studies deny any increase in spot market volatility resulting from the introduction of index futures trading. They conclude that futures attract more informed traders to the cash market, making it more liquid and, if anything, less volatile (Peridi and Koutmos, 1997). Figlewski (1981) notes that the ability of cash market participants to hedge with futures lowers volatility and improves the functioning of the cash market by reducing the risk premium embedded in cash price.

Illustrating the third view of futures and stock prices, some studies on the relationship between futures trading and stock market volatility find no such impact of futures trading on the stock market volatility after the introduction of the futures trading. Galloway and Miller (1997), for instance, investigating the relationship between stock index futures trading and stock return volatility in the Mid Cap 400 stock index after the introduction of the stock index futures, document a significant decrease in return volatility and systematic risk, and a significant increase in trading volume for the Midcap 400 stocks after the introduction of the Midcap 400 index futures. They find no difference in the behavior of the Midcap 400 stocks and no evidence of a relation between index futures trading and volatility in the stock market. Pericly and Koutmos (1997), using daily closing prices for S & P 500 index for a period from January 1953 to December 1994 report that no structural change has occurred in the conditional variance in the period following the introduction of the stock index futures and options. Darat and Rehman (1995) examined the role of index futures trading in spot market volatility for S&P 500 index

prices and S&P 500 futures prices for a period from November 1987 to 1997, and their empirical results suggest that index futures may not be blamed for the observed volatility in the spot market. Rather, they find strong and more consistent support for the alternative posture that volatility in the futures markets is an outgrowth of a turbulent cash market. Others who find similar results include Sharown and Gregary (1995), Board and Scuttliffe (2001), Franklin (1988), Edwards and Franklin (1988), Bessembinder and Senguin (1992), Faff and Mckenzie (2002), Ellueca and Lafuente (2003), Andreas and Koutmos (1997), Chan, Chan, and Karolyi (1991).

Illustrating an alternative way of looking at futures and stock prices, some researchers focus on the Granger Causal relation between the spot and the futures markets. This includes Schwert (1990), Stoll and Walley (1990), Abhayankar *et al* (1995), and Annand *et al* (1986) to mention a few. Some authors have found that futures volume has no effect on changes in the volatility of the spot market. Significant among them include Smith (1989), Santoni (1989).

Summarizing the results of the above mentioned articles and studies, existing empirical studies do not imply that an optimal level of futures trading volume to cash market volume exists. An empirical investigation in an emerging market such as that of Pakistan is required to establish the extent that level of futures trading affects cash price volatility and whether trading in the financial futures contracts play any role in the price discovery and the volatility of stock prices.

3. Data and Methodology

This paper uses the time series of daily closing value of the Karachi Stock Exchange (KSE-100) Index and the daily total nominal value of the futures contracts traded on the KSE-100 Index. Data on futures contracts were obtained from the KSE-100 Index online database while closing values for the stock index were obtained from *yahoofinance.com*. Trading in futures on the KSE-100 index started on July 1, 2001. The choice of the time period under study for stock futures contracts was dictated by the fact that data on the futures contracts is available from Jan 1, 2003. This study, therefore, covers the period from January 1, 2003 to December 9, 2005 for futures contracts. For the stock index, data covered the January 1, 1997 to December 9, 2005 period. Returns for both index and futures contracts are calculated by taking the first difference of log of two consecutive days.

$$R_t = Ln(P_t / P_{t-1}) \qquad (1)$$

To assess the distributional properties of the daily stock prices and the daily stock index futures changes, various descriptive statistics are reported in Table-1. The descriptive statistics for the two returns series are the mean, standard deviation, first to twelfth order autocorrelation, skewness, excess kurtosis, the Ljung-Box statistic (for testing the hypothesis that all autocorrelations up to lag 12 are equal to zero), and the Jarque-Bera normality statistic.

Table-1: Summary Statistics for Daily Spot and Futures Returns

		Spot Returns		**Futures Returns**
	Full Period	**Post Futures**	**Pre Futures**	**Futures**
Mean	0.102	0.187	0.005	0.031
Standard Deviation	1.866	1.574	2.156	2.035
Maximum	13.612	8.879	13.612	19.401
Minimum	-12.378	-7.449	-12.378	-16.738
Kurtosis	5.388	2.891	5.234	48.412
Skewness	-0.166	-0.108	-0.122	1.290
ADF Test Z(t)	-13.013**	-9.261**	-8.940**	-11.077**
(Q)12	27.62			201.94
J-B Test	211.59			5232.15

Note: The figures for the mean, standard deviation, maximum, and minimum are all in percentages. The full period for stock returns are divide into two groups namely the pre and the post futures period.

** shows significance at 1% level.

The full period for the stock returns is divided into two groups namely the pre-and the post-futures periods. The second column of Table-1 provides computed values for the full period of the stock returns. This period is from July 1, 1997 to December 9, 2005. The third column of Table-1 presents values for the post-futures period (i.e, Jan 1, 2003 to December 9, 2005 for stock returns). The fourth column of the table contains computed values of pre-futures time period for spot returns (i.e, July 1, 1997-December 31, 2002). The kurtosis, skewness and Jarque-Bera statistics in Table-1 indicate that the null hypothesis of a normal

distribution is rejected for both the series. Table-1 also reports Augmented Dickey Fuller test statistics for unit root in the returns series. Returns series are stationary.

The independence assumption of the T observation in both the series is tested by calculating the first to twelfth order autocorrelation coefficients. The statistical significance of any autocorrelation coefficient can be judged by its standard error. Barlett (1946) has shown that if a time series is purely random, the sample autocorrelation coefficients are approximately, $\hat{\rho}_k$ ~N(0, 1/n). Using the usual approximation of standard error of the estimated autocorrelation coefficients, first-order autocorrelation is not found for the stock returns series; it was found for the futures returns series but higher order autocorrelation appears to exist. The Ljung-Box Q (12) statistics for the cumulative autocorrelation up to twelfth-order autocorrelation in the two returns series are both greater than 21.02 (the 5% critical value from a χ^2 distribution with 12 degrees of freedom) implying that the hypothesis of independence in daily returns should be rejected. Overall, these results reject the independence assumption for the two returns series of Pakistan's stock market and warrant the use of GARCH specifications in modeling volatility for Pakistan's stock and financial futures markets.

3.1. Modeling the Volatility

To determine whether stock index futures increase stock price volatility, volatility in the ready and futures markets is examined using Generalized Autoregressive Conditional Heteroskedasticity (GARCH). This approach is a widely used and most effective measure in estimating and measuring volatility clustering in asset returns. Bolerslev (1986) extended the ARCH model, introduced by Engle (1982), to the GARCH model which allows for more flexible lag structures. By letting ε_t serve as a random error process, h_t as the variance of ε_t, and ψ_t as the information set of all information through time t, for a return series, R_t, the GARCH (p, q) model is given by:

$$R_t = \omega + \sum_{i=1}^{m} \phi R_{t-i} + \varepsilon_t \qquad (2)$$

$$\varepsilon_t \,|\, \psi_{t-1} \sim N(0, h_t),$$

Where R_t is an index of daily stock returns in logarithms forms as defined by equation (1) or futures returns for futures contracts, and conditional variance of returns h_t, is specified as:

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{q} \beta_i h_{t-i} \qquad (3)$$

The parameters in equation (3) should satisfy: $p \geq 0$, $q \geq 0$, $\alpha_0 \geq 0$, $\alpha_1 \geq 0$, $i = 1, \ldots\ldots, p$, $\beta_i \geq 0$, $i = 1, \ldots\ldots\ldots, q$. According to Akgiray (1989), allowing the conditional variances to depend on the past realized variances is particularly consistent with the actual volatility pattern of the US stock markets where there are both stable and unstable periods.

The orders of p and q in this paper are (1, 1) on the basis of the values of the Akaike Information Criteria. Therefore, the GARCH (1, 1) model is used in this study. According to the GARCH (p, q), the conditional variance of ε at time *t* depends not only on the squared error term in the previous time period [as is in ARCH(1)] but also on its conditional variance in the previous period. In this case, both α_1 and β_1 will be significant.

To model the spill-over effect of volatility in market A on market B, a lagged squared error term from the mean equation of the GARCH model for market A may be introduced into the GARCH model for market B as an explanatory variable in the conditional variance equation. The estimate of the coefficient of the lagged squared error term is then examined, and a significant estimate would suggest a spill-over effect. This spill-over effect from stock market to futures market or vice versa can be captured by the following specification:

$$h_t = \alpha + \sum_{j=1}^{k} \beta_j \varepsilon_{t-j}^2 + \sum_{i=1}^{p} \phi h_{t-i} + \sum_{g}^{\nu} \omega \varepsilon_{At-k}^2$$

where the $\varepsilon^2_{At\text{-}k}$'s are previous periods' shocks to either stock or futures market.

In the estimation of the GARCH model, one can begin with a general specification of the mean equation (2) and the variance equation (3). The orders of the AR and MA processes in the mean equation (2) are determined by the partial autocorrelation (PACF) and the autocorrelation function (ACF) of the returns series for both stock index and the futures contracts. The final GARCH specification is decided by looking at the

properties of the standardized residuals, which are conventional residuals divided by their one step ahead conditional standard deviation. If the model is correctly specified these should be independently identically distributed with mean zero and variance one. The best specification for KSE-100 Index and futures contracts is GARCH (1, 1) with the mean equations of ARMA (3, 3) for stock index and ARMA (2, 2) for futures contracts. Table-2 presents the estimation results of the GARCH model. The estimates of the GARCH (1, 1) model for both stock index and futures contracts show that all the parameters in the mean and the variance equations are statistically significant and the values of the estimated parameters α, α_1 and β_1 satisfy $\alpha > 0$, α_1, $\beta_1 > 0$. The Ljung-Box Q (36) statistics for the standardized residuals indicate that most of the linear dependence (autocorrelation) in the mean and variance has been captured by the GARCH (1, 1) specification.

Panel A and B of Table-2 present GARCH estimations for mean and variance equations for stock index and futures returns. These results reported in panel A show that under the variance equation for stock returns, the coefficient for the futures return is not statistically significant, implying that volatility in the futures market does not contribute to the volatility of stock returns. For futures returns as a dependent variable as reported in panel B, under the variance equation the coefficient of the stock returns is highly significant. This implies that an increase in the spot market volatility increases the volatility in the futures market. In other words, there is volatility spill-over from the stock index to the futures contracts series. This suggests that the futures market is not responsible for the increased volatility in the spot market. Rather volatility in the futures market may be an outgrowth of the turbulent stock market.

The coefficients describing the conditional variance process, α_1 and β_1, are highly significant for both futures and spot returns. This in turn implies that current volatility is a function of last period's squared innovation and last period's volatility. This phenomenon of volatility clustering has a long history as an empirical regularity of emerging markets that characterize high speculative prices.

The persistence of shocks to volatility is measured by $\alpha + \beta$ in the GARCH (1, 1) model. According to Engel and Bollerslev (1986), if $\alpha + \beta = 1$ in the GARCH (1, 1) model, a current shock persists indefinitely in conditioning the future variance. Chou (1988) states that because the sum $\alpha_1 + \beta_1$ represents the change in the response function of shocks to volatility persistence, a value greater than unity implies that the response function of volatility increases with time and a value less than unity implies that shocks

decay with time. The closer to unity the value of persistence measure, the slower is the decay rate (Hassan et al., 2006). For both spot and futures return series, $\alpha_1 + \beta_1$ is very close to unity, i.e., suggesting that shocks are explosive and that current innovations remain important for multi-step ahead forecasts. According to Poterba and Summers (1986) a significant impact of volatility on stock prices can only occur if a shock to volatility persists over a long time. A useful measure for such an assessment is the half-life (HL) which measures the time it takes for an innovation to die out. The half-life of volatility persistence can be calculated as follows: *ln (0.5)/ln (β)*. For KSE it takes approximately two business days for the impact of daily volatility shock to diminish by one-half [*(2=ln (0.5)/ln (0.71)*] and for futures returns it is almost nine days for shocks to diminish by one-half.

Table-2: GARCH Model: Relationship between spot and the futures returns volatility

$R_t = \phi R_{t-1} + \varepsilon_t$, *and* $h_t = \alpha_o + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} + \delta ret^*$

Panel A:	***Stock Returns***	***Log likelihood***	***2028.36***
Parameters	Coef.	Std. Err.	Z
ARMA			
Ω	0.002485	0.000399	6.22
Φ	0.089682	0.038973	2.30
Variance Equation			
α_o	1.15E-05	2.30E-06	4.98
ARCH(1)	0.264675	0.047633	5.556499
GARCH(1)	0.705991	0.041974	16.81952
ω *(Futures)*	-4.25E-06	1.52E-05	-0.27878
$Q(36)^{SDR}$	30.53	Prob (Q)	0.726
Panel B:	***Futures returns***	***Log likelihood***	***-124.5354***
Ω	0.013949	0.005699	2.44
Φ	-0.10245	0.054783	-1.87
Variance Equation			
α_o	0.000496	6.30E-05	7.87
ARCH(1)	0.077951	0.004375	17.81
GARCH(1)	0.939518	0.002537	370.37
ω *(Stock Returns)*	0.189586	0.015558	12.18
$Q(36)^{SDR}$	42.04	Prob (Q)	0.226

Note: ret stands for future o r stock returns in the variance equation.*

$Q(36)^{SDR}$ are Ljung-Box Q(36) statistics for standardized residuals

3.2. Co-Integration Test

The purpose of the co-integration test is to determine whether a stable relationship exists between the levels of two economic variables. Table-3 presents results of the co-integration test. It is evident that the futures price variable with the ADF statistics is significant at the 99% level. This implies that the hypothesis that some linear combinations of the spot price and the futures prices are *I* (1) can be rejected at the 1% level of significance and a long run stable relationship between the spot and the futures prices can be expected.

Table-3: Results of co-integration test

Test		1% Critical Value	5% Critical	10% Critical
Z(t)	-46.539	-3.43	-2.86	-2.57

One now needs to determine which price leads and which price follows. This is addressed in the following section.

3.3. Vector Error Correction Model (VECM)

Lein (1996), argue that if the two price series are found to be co-integrated, a VAR model should be estimated along with the error-correction term which accounts for the log-run equilibrium between spot and futures price movements. The error correction model (ECM) for co-integrated variables is commonly interpreted as reflecting partial adjustment of one variable to the other. It has been proven that two variables, which are co-integrated, have an error correction model representation. ECM is given in the following equations.

$$R_t^s = \alpha_1 + \sum_{i=1}^{m} \beta_{i1} R_{t-i}^f + \sum_{i=1}^{n} \gamma_{i1} R_{t-i}^s + \theta_s Z_{t-1} + \varepsilon_{i1} \qquad (3)$$

$$\left[R_t^f = \alpha_2 + \sum_{i=1}^{m} \beta_{i2} R_{t-i}^s + \sum_{i=1}^{n} \gamma_{i2} R_{t-i}^f + \theta_f Z_{t-1} + \varepsilon_{i2} \right] \qquad (4)$$

Where, R^s_t and R^f_t, are the returns at time *t* for the index and the futures contracts respectively. If some of the β_{i1} values are statistically not zero, then R^f_{t-1} is said to Granger cause R^s_t. Similarly, if some β_{i2}'s are not zero, then R^s_t are said to Granger cause R^f_t. If both $\beta^{i'}$s are significant then a feedback relationship is said to exist. If both the parameters are statistically equal to

zero, then both price series move contemporaneously. A standard F-test can be applied to test the null hypothesis that spot prices fail to Granger cause the futures prices or vice versa. Using the Akaike's (1969) Final Prediction Error criterion for determining the auto-regressive lag length, equation (3) and (4) are estimated for m = 3 and n = 4 by the least squares for futures and spot prices.

Z_{t-1} is the error correction term, which measures how the dependent variable adjusts to the previous period's deviation from long-run equilibrium. The no-arbitrage principle concludes that there is a cost-of-carry relationship between the spot and the futures prices depending on the time to maturity. Thus the Z_t should assume the following form: $Z_{t-1} = R^s_{t-1} - C - \alpha R^f_{t-1}$, where α is the co-integrating vector and *C,* the constant, is per period cost of carry. θ_s and θ_f are interpreted as the speed of adjustment parameters. A set of equations is estimated in a descending order of generality. The results of the VECM are given in Table-4. According to the Swartz Bayesian and the Log-likelihood ratio statistics, the appropriate lag length of the VECM model is four. Table-4 shows that for both equations of changes in lagged spot and futures prices, the error correction term coefficients are statistically significant. It is noted that θ_s = -.0328191, while θ_f = 6.39 indicating that the future price series, R^f_t, adjusts far more rapidly to the previous period's deviation from long-run than the spot price series. On the whole, two main conclusions follow from the error correction model: First, for eq. (3), all the lagged differences of the futures prices are insignificant. On the other hand, for equation (4), the lagged differences of the spot price are very significant. This suggests that the spot price has much more explanatory power for futures prices than the futures prices do for the spot. Moreover, overall, the estimated equation (3) is much better than the eq. (4) in terms of the R^2. One can conclude that the changes in the futures prices are well explained by the changes in the lagged spot prices and futures prices. Additionally, while the lagged spot prices play a role in eq. (4), the changes in the lagged futures prices are not significant in eq. (3). It indicates again that the spot market dominates the futures market but not the other way around.

Table-4: Results of Vector Error Correction Model

log likelihood 1640.783			
Stock Returns		**Futures Returns**	
Parameters	**Coeff.**	**Parameters**	**Coeff.**
α_1	0.0002	α_2	-0.00003
θ_s	-0.0328**	θ_f	6.3971*
R^s_{t-1}	-0.6872*	R^s_{t-1}	-4.4614*
R^s_{t-2}	-0.5692*	R^s_{t-2}	-2.7086*
R^s_{t-3}	-0.2286*	R^s_{t-3}	-0.2226
R^f_{t-1}	-0.0095*	R^f_{t-1}	0.6316*
R^f_{t-2}	-0.0054	R^f_{t-2}	0.3309*
R^f_{t-3}	-0.0029	R^f_{t-3}	0.1211*
R^2	0.38	R^2	0.77
Co-integrating Equation $Zt\text{-}1 = R^s_{t-1} - C - \alpha R^f_{t-1}$			
R^s_{t-1}	1	-	-
R^f_{t-1}	-0.356	0.018	-19.4*
C	0.0006	-	-

Note: ** shows significance at 5% and * shows significance at 1% level.

4. Conclusion

This paper focuses on the role of the futures market by taking Pakistan's turbulent stock market as an example and determines whether the stock futures price is capable of providing some relevant information for predicting the spot price. Results suggest that the spot price has much more explanatory power for futures prices than the futures prices do for the spot price. Under the GARCH model, results show that volatility in the futures markets may not contribute to the volatility of stock returns suggesting that the futures market is not responsible for the increased volatility in the spot market. Empirical findings support the evidence that futures trading may not be blamed for increased volatility in the spot market. On the contrary, these results support the alternative hypothesis that volatility in the futures market may in itself be an outgrowth of the volatile spot market. Consequently, more focus on other and more plausible sources of instability in the stock market, including investor psychology, capital market reforms, trading technology and market microstructures, are needed.

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The Disappearing Calendar Anomalies in the Singapore Stock Market

Wing-Keung Wong[*], Aman Agarwal[**] and Nee-Tat Wong[***]

Abstract

This paper investigates the calendar anomalies in the Singapore stock market over the recent period from 1993-2005. Specifically, changes in stock index returns are examined surrounding January (the January effect), on different days of the week (the day-of-the-week effect), around the turn of the month (the turn-of-the-month effect) and before holidays (the pre-holiday effect). The findings reveal that these anomalies have largely disappeared from the Singapore stock market in recent years. The disappearance of these anomalies has important implications for the efficient market hypothesis and the trading behavior of investors.

JEL Code: C10, G12, G15

Keywords: Calendar anomalies, January effect, day-of-the-week effect, turn-of-the-month effect, pre-holiday effect.

I. Introduction

Extensive evidence has been provided on the existence of calendar anomalies in the US and many other countries. The main calendar anomalies are the January effect, the day-of-the-week effect, the turn-of-the-month effect and the holiday effect. Despite the mounting evidence, the reasons for these anomalies have remained largely unknown. These anomalies are of particular interest because their existence violates the weak form of market efficiency. The weak form of market efficiency

[*] Associate Professor of Economics, Department of Economics, National University of Singapore, Singapore.
[**] Professor of Finance & Director (Offg), Indian Institute of Finance, Ashok Vihar, Delhi, India
ANU Distinguished Visiting Research Scholar, The Australian National University, National Graduate School of Management, Canberra ACT, Auastralia
[***] Lecturer, The Tourism Academy at Sentosa, Temasek Polytechnic, Singapore.

implies that in an efficient stock market, stock prices fully reflect all available information so that investors make only normal profits. Thus, investors cannot make abnormal returns by exploiting these anomalies. Given that these anomalies are relatively easy to exploit, they should have weakened or disappeared over time. However, most previous studies have not explicitly examined how these anomalies change over time.

In the Singapore stock market, various researchers have been documenting the existence of calendar anomalies. The main objective of this study is to re-examine the calendar anomalies in the Singapore market using an updated data set up to December 2005. Through this study, we found that the anomalies in the Singapore market have weakened recently.

The rest of the paper proceeds as follows. Section II contains the literature review while Section III discusses the background and development of the Singapore stock market. Section IV describes the data and methodology. Section V examines the individual calendar anomalies, while Section VI concludes.

II. Literature Review

January Effect

The January effect describes the phenomenon that stock returns in January are on average higher than for the other months. In the US stock market, the January effect was first documented by Rozeff and Kinney (1976). A later study by Keim (1983) showed that the January effect is largely confined to stocks of small firms and to the first few trading days in January.

The January effect has been observed in other countries. Gultekin and Gultekin (1983) investigated the January effect in seventeen major industrialized countries and found unusually high January returns in most of the countries studied (specifically, Australia, Belgium, Canada, Denmark, Germany, Japan, Netherlands, Norway, Spain, Sweden and Switzerland).

In the Singapore market, Wong and Ho (1986) found that the mean daily return in January is significantly higher than the returns in other months over the period 1975-1984. In addition, they found no significant differences between the mean returns on the last five trading days and those of the first five trading days of the year, a result inconsistent with the US evidence. Further evidence on the January effect in the Singapore market is provided by Agarwal and Rivoli (1989), Lee (1992) and Chan *et al* (1996).

Day-of-the-Week Effect

The day-of-the-week effect refers to the observation that stock returns are not equal across the days of the week. In particular, the mean return on Monday is negative and generally the lowest while the mean return on Friday is positive and generally the highest. Extensive evidence of the day-of-the-week effect has been documented in the US stock market, for example, French (1980), Gibbons and Hess (1981), Keim and Stambaugh (1984), Smirlock and Starks (1986), Lakonishok and Smidt (1988), Abraham and Ikenberry (1994) and Wang *et al* (1997). More recently, Mehdian and Perry (2001) found that the Monday effect has significantly declined and detected a reversal of the Monday effect in large capitalization stocks (represented by the S&P 500, the Dow Jones Composite and the NYSE Composite) in recent years.

The day-of-the-week effect has been widely reported in other countries. In Singapore, Wong and Ho (1986) documented a weekly seasonal pattern of stock returns over the period 1975-1984. Subsequent studies by Condoyanni *et al* (1987), Aggarwal and Rivoli (1989), Wong *et al* (1992) and Chan *et al* (1996) provide further evidence of the day-of-the-week effect in the Singapore market.

Turn-of-the-Month Effect

The turn-of-the-month effect refers to the unusually high stock returns at the turn of the month defined as the period from the last trading day of the previous month to the first three trading days of the current month. Using the Dow Jones Industrial Average (DJIA) index from 1897-1986, Lakonishok and Smidt (1988) found that the mean return on the turn-of-the-month trading days is about eight times higher than on other trading days. Extending the analysis to other countries, Cadsby and Ratner (1992) found that the turn-of-the-month effects are present in Australia, Canada, Switzerland, UK and West Germany but not in France, Hong Kong, Italy or Japan.

In Singapore, a study by Tan and Wong (1996) found a significant turn-of-the-month effect. They showed that the mean stock return on turn-of-month trading days is significantly higher than other trading days, over the period 1975-1994.

Holiday Effect

The holiday effect refers to the observation that the mean stock return is higher on the trading day immediately preceding holidays (pre-

holidays) than on other trading days. Ariel (1990) examined daily returns on the CRSP equally-weighted and value-weighted indices of NYSE and AMEX stocks from 1963-82 and found that the mean return on pre-holidays is significantly higher than the remaining trading days. Similar results are reported by Pettengill (1989) and Kim and Park (1994) who independently analyzed the US stock market over different time periods.

Cadsby and Ratner (1992) found that the holiday effects are significant in Australia, Canada, Hong Kong, Japan and US but not in France, Italy, Switzerland, UK and West Germany. They also found that, with the exception of Hong Kong, the countries exhibiting holiday effects do so before their own local holidays.

In the Singapore market, Tan and Wong (1996) showed that stock returns are significantly higher on pre-holidays than on other trading days in the period 1975-94 using the SES All Singapore Index. However, subsequent studies by Chan *et al* (1996) and others found that the holiday effect in Singapore is mainly a Chinese New Year effect as only the Chinese New Year has a significant holiday effect; the pre-holiday returns for the other holidays are not statistically significant.

III. Background and Developments on the Singapore Stock Market

The Singapore stock market, known as the Stock Exchange of Singapore (SES), is one of the fastest growing emerging stock markets in South East Asia. Approved by the Minister for Finance in Singapore under the provisions of the Security Industry Act, the Stock Exchange of Singapore Limited was incorporated on May 24, 1973 and commenced its operations on June 4, 1973. It is the only corporate body to operate a stock market of a security exchange in Singapore. Thereafter, following the merger of two established and well-respected financial institutions - the SES and the Singapore International Monetary Exchange (SIMEX) – the Singapore Exchange Limited (SGX) was inaugurated on December 1, 1999 to operate the stock market and futures market in Singapore. As of December 2005, the SGX listed 663 companies with a market capitalization of over S$ 427.9 billion. As of December 2005, the companies with the largest capitalization included Singapore Telecommunications, DBS Group (a financial service group) and United Overseas Bank. For 2005, the total turnover was nearly 181.5 billion shares valued at over S$ 200 billion.

Since the establishment of the Singapore capital market, various reforms have been implemented towards the development of a modern and efficient capital market including: revised tax systems, relaxation of exchange

controls, privatization of publicly owned enterprises, removal of restrictions on repatriation of profits and, most importantly, the opening of the share market to foreign investors. These policies led Singapore to achieve remarkable development in its stock market, which then became one of the most important markets in the region.

IV. Data and Methodology

The Straits Times Index, a market-capitalization weighted index of 55 (actively-traded) large capitalization stocks, from *Datastream International* covering the period from January 1993 to December 2005 is used in our study. To examine the anomalies, we analyze the entire period from January 1993 to December 2005 and further analyze the sub-periods: January 1, 1993 – December 31, 1997 (pre-crisis Period), and January 1, 1998 – December 31, 2005 (post-crisis Period) with the 1997 Asian Financial Crisis being a cut-off point to separate these sub-periods. The daily log-return used in our study is:

$$R_t = \ln\left(P_t / P_{t-1}\right) \tag{1}$$

where P_t is the closing value of stock index on day *t*.

As stock returns are well-known to be heteroscedastic, we incorporate the GARCH(1,1) model (Brooks and Ragunathan, 2003) into the mean equation to test for the January effect for the returns, such that:

$$R_t = \sum_{i=1}^{12} b_i D_{it} + \varepsilon_t, \tag{2}$$

$$\varepsilon_t / \psi_{t-1} \sim N(0, h_t) \text{ and } h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$$

where R_t is the daily return on day *t* defined in (1), D_{it} is a dummy variable to measure the monthly effects and is set equal to one if the day is in month *i* and zero otherwise, the coefficients b_i measure the mean daily return of the respective month, α_1 measures the ARCH effect and β_1 measures the GARCH effect of the volatility. If the value of the mean return is about the same for each month, then the estimates b_1 through b_{12} will be close to zero and the F-statistic will be insignificant.

Similarly, we adopt the following model to test for the day-of-the-week effect:

$$R_t = \sum_{i=1}^{5} b_i D_{it} + \varepsilon_t, \qquad (3)$$

$$\varepsilon_t / \psi_{t-1} \sim N(0, h_t) \text{ and } h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$$

where R_t is the daily return on day *t* defined in (1), D_{it} is a dummy variable which is equal to one if the day is a weekday *i* and zero otherwise, and the coefficient b_i represents the expected return for the corresponding day *i* of the week. If the mean return is similar for each day of the week, the estimates b_1 through b_5 will be close to zero and the F-statistic should be insignificant.

To test for the Turn-of-the-Month Effect and the Holiday Effect, we simply apply the simple t-test for two independent samples.

V. Empirical Findings and Interpretation

Testing for the January Effect

The January effect in the Singapore market has been found in the literature to be significantly positive relative to all other months, inferring that January attains the highest return on average. Different from the findings in the literature, our findings in Panel A of Table 1 first show that the mean daily return in January is positive but insignificant in the pre-crisis period of 1993-97, implying that though the mean daily return in January is higher than most of the other months in the pre-crisis period, the differences are not significant. In addition, our findings contradict the findings in the literature that the mean daily returns of the Straits Times Index are negative in the entire period as well as in the post-crisis period. This leads us to conclude that the January effect changes from positive in the pre-crisis to negative in the post-crisis period but the differences are not significant in either period.

Table-1: Test for January Effect

Panel A

Period		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993-2005	Coefficient	-0.0002	0.0003	-0.0010	0.0008	-0.0007	0.0002	0.0003	-0.0004	-0.0005	0.0009	0.0013	0.0014
	t-statistic	-0.3124	0.4090	-1.2732	1.0542	-0.9671	0.2482	0.3311	-0.5191	-0.6988	1.1327	1.6568[c]	1.8938[c]
1993-1997	Coefficient	0.0003	0.0002	-0.0021	0.0010	0.0013	-0.0014	-0.0003	0.0005	0.0010	-0.0012	0.0004	0.0020
	t-statistic	0.2587	0.2236	-2.0791[b]	1.0074	1.2986	-1.3320	-0.2563	0.5264	0.9868	-1.1837	0.3483	1.9726[b]
1998-2005	Coefficient	-0.0006	0.0004	-0.0003	0.0007	-0.0020	0.0012	0.0006	-0.0010	-0.0015	0.0022	0.0019	0.0011
	t-statistic	-0.5134	0.3437	-0.2578	0.6325	-1.8913[c]	1.0686	0.5342	-0.9130	-1.3932	2.0107[b]	1.7179[c]	1.0405

Panel B

	α_0	t-statistic	α_1	t-statistic	β_1	t-statistic	F-statistics	p-values	Q-Stat	p-values	LM Stat	p-values
1993-2005	0.0000002	7.3667[a]	0.1234	17.2078[a]	0.8696	142.0423[a]	1.0397	0.4086	8.1674	0.772	0.6721	0.7799
1993-1997	0.000002	5.9741[a]	0.2195	8.2297[a]	0.6878	20.4110[a]	1.3038	0.2097	8.7293	0.726	0.6861	0.7662
1998-2005	0.0000002	4.4166[a]	0.1047	12.8667[a]	0.8933	139.2546[a]	1.3920	0.1621	5.2368	0.950	0.4352	0.9499

The equation used is $R_t = b_1D_{Jan} + b_2D_{Feb} + \ldots + b_{12}D_{Dec} + \varepsilon_t$ where $\varepsilon_t / \psi_{t-1} \sim N(0, h_t)$ and $h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$.

The dummy variables (D_{Jan} , $D_{Feb, \ldots, D_{Dec}}$) have a value of 1 if the day is respectively in January, February, ... , December and zero otherwise.

[a, b, c] denotes significance at the 1%, 5% and 10% level.

Q-stat refers to the Ljung-Box test on the standardized residuals LM stat refers to the Ljung-Box tests on the squared standardized residuals.

In addition, Panel B of Table-1 shows that both ARCH and GARCH coefficients are highly significantly positive in the full period and both sub-periods, reflecting time dependence in the process and volatility shocks which are allowed to persist over time. The diagnostics check displayed in the Table exhibits the Ljung-Box tests on the standardized residuals (Q-stat) and on the squared standardized residuals (LM stat). As all the p-values are larger than conventional levels, we conclude that the fitted model is adequate and successful in capturing the dynamics in the first as well as second moments of the return series, which in turn implies that our analysis and conclusions are appropriate.

Testing for the Day-of-the-Week Effect

Table-2 reveals a weekly pattern of stock returns. As can be seen from Panel A, the results show that the mean Monday returns are negative in the full period as well as in the two sub-periods, as indicated by the negative coefficients for Monday. Additionally, the mean returns tend to increase as the week progresses with the highest returns on the last day of the week. This may explain why the mean returns of the first two days of the week are consistently lower than those of the last three days of the week. To test the equality of mean returns across the days of the week, the F-test was used. In the full period and in the pre-crisis period, the F-statistics are significant at the 5% level. However, in the post-crisis period, the F-statistics are insignificant. This shows that the day-of-the-week effect may no longer exist in the Singapore market.

Table-2: Test for day-of-the-week effect

Panel A

Period		Mon	Tue	Wed	Thu	Fri	F-stat
1993-2005	Coefficient	-0.0012	0.0002	0.0008	0.0002	0.0009	2.4571[b]
	t-statistic	-2.3914[b]	0.3973	1.6340	0.3499	1.9017[c]	[0.0313]
1993-1997	Coefficient	-0.0013	0.0001	0.0014	-0.0001	0.0007	1.9317[b]
	t-statistic	-1.9740[b]	0.0917	2.1105[b]	-0.2051	1.1212	[0.0863]
1998-2005	Coefficient	-0.0011	0.0003	0.0005	0.0004	0.0011	1.1724
	t-statistic	-1.6133	0.4068	0.6550	0.5252	1.5457	[0.3203]

Panel B

Period	α_0	α_1	β_1	Q-Stat	LM Stat
1993-2005	0.0000002[a] (7.3492)	0.1188[a] (17.3009)	0.8747[a] (149.1192)	5.6495 [0.342]	1.1463 [0.3334]
1993-1997	0.0000009[a] (5.7597)	0.2125[a] (8.0109)	0.7005[a] (20.9601)	2.5640 [0.767]	0.5230 [0.7590]
1998-2005	0.0000001[a] (4.2093)	0.0999[a] (13.0743)	0.8981[a] (148.4801)	4.6587 [0.459]	0.9672 [0.4365]

The regression equation used is $R_t = b_1D_{Mon} + b_2D_{Tue} + ... + b_5D_{Fri} + \varepsilon_t$ where $\varepsilon_t / \psi_{t-1} \sim N(0, h_t)$ and $h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$.

The dummy variables ($D_{Mon,}$ $D_{Tue, ...,}$ D_{Fri}) have a value of 1 if the day is respectively Monday, Tuesday, Wednesday, .., Friday and zero otherwise.

[a, b, c] denote significance at the 1%, 5% and 10% level respectively.

The parentheses figures are the t-statistics.

Q-stat refers to the Ljung-Box test on the standardized residuals LM stat refers to the Ljung-Box tests on the squared standardized residuals.

The bracketed figures are the p-values of the F-statistics, Q-statistics and LM statistics.

Similar to the situation in testing the Monthly effect, Panel B of Table-2 confirms the existence of both ARCH and GARCH effects in the full period as well as in both sub-periods and the diagnostics check infers that the fitted model is adequate and successful in capturing the dynamics in the first as well as second moments of the return series, which in turn implies that our analysis and conclusion are correct.

Testing for the Turn-of-the-Month Effect

Following previous studies, the turn-of-the-month is defined as the period from the last trading day of the previous month to the first three trading days of the current month. Table-3 compares the mean returns of turn-of-the-month trading days with other trading days. It can be seen from the Table that turn-of-the-month trading days earn higher returns, on average, than other trading days for the full period and two sub-periods.

Table 3: Test for turn-of-the-month effect

Period		Mean	Std Dev	Obs
1993-2005	Turn-of-the-month trading days	0.0017	0.0130	622
	Other trading days	-0.0002	0.0129	2768
	t-stat	3.2928[a]		
1993-1997	Turn-of-the-month trading days	0.0022	0.0098	239
	Other trading days	-0.0003	0.0107	1064
	t-stat	3.2880[a]		
1998-2005	Turn-of-the-month trading days	0.0015	0.0147	383
	Other trading days	-0.0001	0.0141	1704
	t-stat	1.8898[c]		

[a, b, c] denotes significance at the 1%, 5% and 10% level respectively

However, a one-tailed t-test of the difference of means between turn-of-the-month trading days and other trading days detected a significant decline of the turn-of-the-month effect from the pre-crisis period to the post-crisis period. These results show that the turn-of-the-month effect exists in the pre-crisis period but has diminished significantly thereafter.

Testing for the Holiday Effect

For the purpose of this study, a holiday is defined as a day on which the stock market is closed as a result of a public holiday. This definition follows the studies by Pettengill (1989) and Ariel (1990). Table-4 shows that the mean returns on pre-holidays are higher than that of other trading days for the full period and two sub-periods. The standard deviation of returns of pre-holidays is higher than those of other days so we infer that higher returns are accompanied by higher risk for the Straits Times Index.

Table 4: Test for holiday effect

Period		Mean	Std Dev	Obs
1993-2005	Pre-holidays	0.0025	0.0139	111
	Other trading days	0.00011	0.0129	3279
	t-stat	1.8955[c]		
1993-1997	Pre-holidays	0.0032	0.0133	41
	Other trading days	0.00005	0.0105	1262
	t-stat	1.8694[c]		
1998-2005	Pre-holidays	0.0021	0.0143	70
	Other trading days	0.00015	0.0142	2017
	t-stat	1.1072		

[a, b, c] denote significance at the 1%, 5% and 10% level respectively

A one-tailed t-test for the differences of the means between pre-holidays and other trading days is significant in the full period in the pre-crisis period. However, in the post-crisis period, the t-statistic is insignificant. This shows that the holiday effect has declined and over time and it may no longer exist in the Singapore stock market.

VI. Discussion and Conclusions

This study re-examines the calendar anomalies – January effect, day-of-the-week, turn-of-the-month effect and holiday effect in the Singapore stock market. In the pre-crisis period, our study generally supports previous findings of these anomalies in the Singapore market. However, analysis in the post-crisis period shows that these anomalies have significantly declined or disappeared. Our results also reveal for the first time that there has been a reversal, though insignificant, of the January effect over time since the Asian financial crisis.

The disappearance of the calendar anomalies implies that investors may no longer be able to generate abnormal returns by capitalizing on these anomalies. This is likely to be due to investors increasingly being aware and taking advantage of the anomalies which has priced away any advantage. In addition, high volatility combined with economic and financial instability after the 1997 Asian financial crisis may have resulted in the elimination of calendar anomalies. Moreover, the arrival of bad information such as the global economic downturn, terrorist attacks, the war in Iraq, and the SARS outbreak, have caused uncertainty that may have altered uninformed

investors' decisions. These may explain the absence of the calendar effect in the Singapore stock market.

Our findings support the argument that most anomalies will diminish and eventually disappear after their discovery as more and more investors exploit this effect. For example, after discovering the January effect, investors who expect the stock price to appreciate in January will then purchase before January and sell at the end of January. This will drive up the stock prices before January and push down the prices at the end of January, and result in the diminishing or even disappearance of the January effect. In addition, the calendar anomaly results in our paper can assist investors in their investment decision-making in the Singapore stock market. Disappearance of calendar anomalies would also lend support to the conjecture that Singapore's stock market satisfies the weak-form of the Efficient Market Hypothesis. While satisfactory clarifications have been found for such anomalies as the small firm in January (Keim, 1983), book-to-market (Fama and French, 1992), (Reinganum, 1988) and reversals (Debondt and Thaler, 1985), (Chopra, Lakonishok and Ritter, 1992) fuller explanations for the failure of the efficient markets hypothesis have ranged from risk premia (Fama and French, 1993) an illiquidity premium or inefficient markets (Lakonishok, Shliefer and Vishney, 1995).

We note that it is well-known that stock returns are heteroscedastic and hence a GARCH model is used to model the returns (Brooks and Ragunathan 2003). Our findings show that both ARCH and GARCH coefficients are highly significantly positive in the full period as well as in both sub-periods for the models of the monthly effects and the day-of-the-week effect; this reflects time dependence in the process and persistence of volatility shocks over time. This persistence captures the propensity of returns to cluster over time and explains the non-normality and nonstability of empirical asset return distribution. The diagnostic check concludes that the fitted model is adequate and successful in capturing the dynamics in the first as well as second moments of the return series, which in turn implies that our analysis and conclusions are appropriate.

It is also well-known that the error term for the return is not normal, (Clark 1973). However, the regression equation used in this paper is still valid by the central limit theorem.[10]

[10] Another approach would be the robust Bayesian sampling estimators (Matsumura *et al* 1990 and Wong and Bian 2000). Other alternatives include using other advanced

The disappearance of the calendar anomalies from the Singapore markets suggests that the Singapore (and probably other regional) markets are becoming more efficient, due mainly to more knowledgeable and experienced investors, advances in information technology and communications, lower cost of information, etc. Is this a global trend towards market efficiency? The best that can be said for now is that as with most things in life, only time will tell.

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statistics to improve the test, (Wong and Miller 1990, Tiku *et al* 2000, Fong and Wong 2006).

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On the Conditioning of the Financial Market's Reaction to Seasoned Equity Offerings*

Onur Arugaslan and **Louise Miller*****

Abstract

Consistent with asymmetric information arguments, prior research has shown that the financial market typically responds negatively to the announcement of a seasoned equity offering (SEO). Korajczyk and Levy (2003), however, suggest that while some firms time the issuance of their common stock to take advantage of outside investor overvaluations, financially constrained firms do not. We examine whether prior information on how financially constrained a firm is along with its growth prospects influences the financial market's response to the firm's announcement to sell common stock. We find evidence that the financial market does condition its response upon such information using a sample of SEOs from the U.S. Our results also have implications for the financial market's reaction to SEOs/rights offerings in emerging markets.

I. Introduction

Prior evidence suggests that, on average, the market reacts negatively to the announcements of seasoned equity offerings (SEOs) (see Asquith and Mullins (1986), Masulis and Korwar (1986), and Mikkelson and Partch (1986) for U.S. evidence). The leading explanations for the negative reaction to SEO announcements are based upon managers having private information that outside investors do not have. One explanation, developed in Myers (1984) and Myers and Majluf (1984), suggests that

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** Department of Finance and Commercial Law, Haworth College of Business, Western Michigan University, Kalamazoo, Michigan 49008-5420, USA.
*** Department of Accounting, College of Business and Technology, Texas A&M University-Commerce, Commerce, Texas 75429, USA.

managers seek to serve the interests of current shareholders by issuing additional stock only when either the company's stock is overvalued based on managers' private information about the company or when the company lacks demonstrably good investment prospects. Another explanation is the timing argument first presented in Baker and Wurgler (2002). Baker and Wurgler argue that a firm's current capital structure is primarily an artifact of its managers' past efforts to time the market in the issuance of securities.[11]

LaPorta *et al*. (1997) argue that firms located in emerging markets are characterized by high levels of information asymmetry. This suggests that the investors in emerging markets would react more negatively to the announcements of SEOs. However, Ariff and Finn (1989), Kang (1990), Tsangarakis (1996), and Lukose and Sapar (2004) find positive market reactions to announcements of rights issues in Singapore, Korea, Greece, and India, respectively.[12]

The differences in market reaction to equity offerings around the world demand an investigation of conditions that may explain those differences. Tsangarakis (1996) finds that the rights issues in Greece are perceived as conveying positive information about the firms' future prospects. He points out that the large ownership concentration in developing markets may mitigate the agency and adverse information effects compared to developed markets with large ownership dispersion. He also notes that different institutional settings may impact the market reaction to equity issues. Similarly, Bigelli (1998) finds a positive market reaction to combined rights offerings in Italy and shows two factors to be effective in explaining the contrasting market reaction to European rights issues when compared with the U.S. public equity issues: active insiders and an increase in the dividend yield associated with the rights offering.

Consistent with the earlier arguments, Baker and Wurgler (2000) find that when the percentage of new equity is higher than normal for their sample of U.S. firms, low stock market returns usually follow, which is consistent with overvaluation at the time of equity issuance. Examining a sample of seasoned equity offerings in the U.S., Long, Malitz, and Sefcik (1992) find that the stocks of firms issuing seasoned common equity are significantly overvalued in the market prior to the issue but

[11] Strictly speaking, the timing argument does not require managers to have private information that other investors do not if they only time relative to past prices instead of relative to future prices.

[12] In most European and Asian equity markets firms sell seasoned equity almost exclusively through rights offerings.

decline to their original levels in the year following. Moreover, Denis and Sarin (2001) focus on a sample of U.S. companies and examine the stock price reaction to earnings announcements in the five years following SEOs. On average, post-SEO announcements have a significantly negative abnormal stock price reaction. This finding is consistent with the hypothesis that firms issue equity when the market overestimates the firms' future earnings performance, which is consistent with the notion that managers are using private information to time the issuance of common stock.

Such behavior, however, might not be true for all firms. Recently, Korajczyk and Levy (2003) investigate how macroeconomic conditions affect capital structure choice. They model target capital structures as a function of macroeconomic conditions and firm-specific variables, splitting their U.S. sample based on a measure of financial constraints. They find that macroeconomic conditions are significant for issue choice for financially unconstrained firms but less so for financially constrained firms. Their conclusion is that financially unconstrained firms are able to time their issue choice to periods when macroeconomic conditions are favorable, but financially constrained firms have to go to the markets when they need funds.

If Korajczyk and Levy's (2003) conclusion is correct, then one should expect to observe a difference in the market's reaction to a firm's announcement of a plan to sell stock if the market recognizes that financially constrained firms are not timing the market's misvaluation of their stock. This argument leads us to conjecture that the market's response to the announcement of an SEO will be conditioned upon prior information about the firm's growth prospects and lack of financial resources.

In this connection, it is worth noting that prior literature suggests that the market does not condition on a firm's growth prospects alone. Brous and Kini (1992) examine whether revisions in analysts' earnings forecasts and abnormal stock returns associated with equity offering announcements are related to the issuing firm's Q ratio. They find an inverse relation between revisions in analysts' earnings forecasts and Q ratios, but no relation between announcement-period abnormal returns and Q ratios for their sample of U.S. firms. Denis (1994) also examines the relation between the market reaction to primary SEO announcements and alternative measures of the profitability of the issuing firm's growth opportunities and concludes that investment opportunities play, at best, a minor role in explaining the cross-sectional distribution of equity offering

announcement effects for his U.S. sample. Consequently, good investment prospects alone are not sufficient to shape the market's reaction to the announcement of a seasoned equity offering.

To test our hypothesis that the market's response to the announcement of an SEO will be conditioned upon prior information about the firm's growth prospects and lack of financial resources, we organize this paper as follows. Section II provides a description of the sample and sources of data on sample firms. Section III describes various ways of measuring an announcing firm's growth prospects and lack of financial resources. Section IV presents the analysis of the market's reaction to the announcement of an SEO conditional on proxies for a firm's growth prospects and lack of financial resources. Section V summarizes the paper and presents the conclusions. Consistent with our hypothesis, we find evidence that the market does condition its response to the announcement of an SEO on prior financial information about both the firm's growth prospects and its lack of financial resources. Our evidence, thereby, supplements the evidence provided in Korajczyk and Levy (2003) on the heterogeneity of firms issuing seasoned equity.

II. Sample and Data Sources

To obtain our sample, we first identify all sales of common stock in the United States from January 1990 through December 1998 in the Securities Data Corporation's (SDC) New Issues Database. We then delete from that list all initial public offerings of common stock to derive a list of seasoned common stock offerings. To be consistent with some prior research, we delete foreign firms, financial institutions, and regulated utilities from the sample. If there are multiple seasoned equity issues for a sample firm, we keep only the first offering as D'Mello, Tawatnuntachai, and Yaman (2003) show that the market reaction becomes less negative for successive issues of industrial firms. As a result, our final sample consists of 971 SEOs. We supplement the information from the SDC's New Issues Database with financial data from Compustat and stock price data from Center for Research in Security Prices (CRSP).

III. Measurement of a Firm's Growth Prospects and Lack of Financial Resources

Clearly, testing of our hypothesis depends on how one measures a firm's growth prospects and lack of financial resources. Unfortunately, there is no common agreement in the literature on how to measure either firm characteristic. Consequently, we start with Korajczyk and Levy's (2003)

method of identifying "financially constrained" firms and "growth" firms, and explore several alternative approaches to test the robustness of our results to the definitions employed.

(i) Method 1

Korajczyk and Levy (2003) define "financially constrained" firms as firms that (a) do not have net repurchases of debt or stock and do not pay cash dividends, and (b) have a Tobin's Q greater than one. They identify "growth" firms based on the level of capital expenditures as a fraction of assets, the level of selling expenses as a fraction of sales, and Tobin's Q. Therefore, our first method defines a "financially constrained" firm as one that (1) does not have a net repurchase of stock in the year preceding the event, (2) does not have a net repurchase of debt in the year preceding the event, (3) does not pay cash dividends in the year preceding the event, and (4) has a Tobin's Q greater than one, where Tobin's Q is defined as (Market Value of Equity + Book Value of Debt) / Book Value of Assets, following Korajczyk and Levy (2003). A "growth" firm, on the other hand, is one that (1) has capital expenditures as a fraction of assets greater than the mean of all firms, (2) has selling expenses as a fraction of sales greater than the mean of all firms, and (3) has a Tobin's Q greater than one.

(ii) Method 2

Method two is identical to method one except that instead of zero dividends, a low dividend payout is used, and the restriction concerning the repurchase of debt is eliminated. To be specific, our second method defines a "financially constrained" firm as one that (1) does not have a net repurchase of stock in the year preceding the event, (2) has a dividend payout less than ten percent of earnings, and (3) has a Tobin's Q greater than one. The identification of "growth" firms remains the same as in the first method. Effectively, method 2 relaxes the definition of "financially constrained."

(iii) Method 3

As a third approach, we use a "debt to assets" ratio and a "financing" ratio to identify "financially constrained" firms. The "debt to assets" ratio is defined as the sum of short-term debt and long-term debt divided by the firm's book value of assets. The "financing" ratio is defined as the difference between capital expenditures and retained earnings divided by the firm's book value of assets. A firm is "financially constrained" if it (1) does not have a net repurchase of stock in the year preceding the event, (2) does not pay

dividends in the year preceding the event, (3) has a "debt to assets" ratio greater than the median of all firms, and (4) has a "financing" ratio greater than the median of all firms. To identify firms with growth opportunities, a different estimate of the Q ratio is used. Specifically, we follow Smith and Watts (1992) and use their definition of Tobin's Q ratio: (Book value of assets – book value of common stock + market value of common stock) divided by the firm's book value of assets. We classify firms as "growth" firms if their Q ratio is greater than the mean of all the companies' Q ratios.

(iv) Method 4

Method four is a variation of method three in which the no net repurchase of stock requirement is dropped and the definition of "financing" ratio is altered. The "financing" ratio is now defined as [capital expenditures – (cash flow from operations - repurchases of stock)] / book value of assets. A firm has financial constraint if it (1) does not pay dividends in the year preceding the event, (2) has a "debt to assets" ratio greater than the median of all firms, and (3) has a "financing" ratio greater than the median of all firms. Classification of "growth" firms remains the same as in method three.

Table-1 summarizes the different criteria used to classify firms according to each method:

Table-1: Classification of Firms According to Different Methods

Method	With Financial Constraint	Without Financial Constraint	High Growth	Low Growth
1	(1) no net repurchase of stock in the year preceding the event, (2) no net repurchase of debt in the year preceding the event, (3) no dividend payment in the year preceding the event, and (4) Tobin's Q greater than one, where Tobin's Q is defined as (Market Value of Equity + Book Value of Debt) / Book Value of Assets	otherwise	(1) capital expenditures as a fraction of assets greater than the mean of all firms, (2) selling expenses as a fraction of sales greater than the mean of all firms, and (3) Tobin's Q greater than one	otherwise
2	(1) no net repurchase of stock in the year preceding the event, (2) dividend payment less than ten percent of earnings, and (3) Tobin's Q greater than one, where Tobin's Q is defined as (Market Value of Equity + Book Value of Debt) / Book Value of Assets	otherwise	(1) capital expenditures as a fraction of assets greater than the mean of all firms, (2) selling expenses as a fraction of sales greater than the mean of all firms, and (3) Tobin's Q greater than one	otherwise
3	(1) no net repurchase of stock in the year preceding the event, (2) no dividend payment in the year preceding the event, (3) debt to assets ratio greater than the median of all firms, and (4) financing ratio greater than the median of all firms, where debt to assets ratio is defined as the sum of short-term debt and long-term debt divided by the firm's book value of assets, and financing ratio is defined as the difference between capital expenditures and retained earnings divided by the firm's book value of assets	otherwise	Q ratio greater than the mean of all companies' Q ratios, where the Q ratio is defined as (book value of assets – book value of common stock + market value of common stock) divided by the firm's book value of assets following Smith and Watts (1992)	otherwise
4	(1) no dividend payment in the year preceding the event, (2) debt to assets ratio greater than the median of all firms, and (3) financing ratio greater than the median of all firms, where debt to assets ratio is defined as the sum of short-term debt and long-term debt divided by the firm's book value of assets, and financing ratio is defined as [capital expenditures – (cash flow from	otherwise	Q ratio greater than the mean of all companies' Q ratios, where the Q ratio is defined as (book value of assets – book value of common stock + market value of common stock) divided by the firm's book value of assets	otherwise

operations - repurchases of stock)] / book value of assets	following Smith and Watts (1992)

IV. Results

If our hypothesis is correct, then the market recognizes the differences between "growth" firms that are "financially constrained" and other firms in how it reacts to their announcement of the sale of seasoned equity. More specifically, the announcement period abnormal returns for firms classified as "financially constrained" and with "high growth" prospects should be insignificantly different from zero, while these same announcement period abnormal returns should be significantly negative for firms classified in the other categories, particularly those identified as "financially unconstrained" and with "low growth" prospects. To summarize our expectations, Table-2 presents the predicted market reaction to SEO announcements for firms according to their financial constraints and growth opportunities:

Table-2: Predicted Market Reaction to Seasoned Equity Offering Announcement

	Low Growth	High Growth
With Financial Constraint	Negative and Significant Effect	Insignificant Effect
Without Financial Constraint	Negative and Significant Effect	Negative and Significant Effect

To test these expectations, we investigate the market's reaction to the seasoned equity offering using a standard event study methodology. First, we identify as event date the announcement date of the seasoned equity offering. Second, we obtain daily returns for the sample firm and the S&P 500 Index. Third, we define the estimation period from 80 days prior to the announcement till 10 days prior to the announcement, and estimate the following market parameters for each firm during this period:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \qquad t = [-80, -10]$$

where R_{it} is the return on stock i for day t, α_i is the constant term for stock i, β_i is the beta for stock i, R_{mt} is the S&P 500 Index return on day t, and ε_{it} is the error term.

The three-day window (the day before, the event day, and the day after) surrounding the announcement day is considered as the event period. In order to find the abnormal returns during the event period, we utilize the estimated alpha and beta from the estimation period.

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}, \qquad t = -1, 0, 1$$

where AR_{it} is the abnormal return on stock i for day t. We then use the abnormal returns to compute the cumulative abnormal return over the event period:

$$CAR_i = \sum_{t=-1}^{1} AR_{it}.$$

Next, we examine the significance of these abnormal returns for each of the four groups identified according to the four methods introduced in the previous section. We use Brown and Warner (1980) to compute the t-statistics. Table-3 Panel A reports the results of using Korajczyk and Levy's (2003) identifications of "financially constrained" and with "good growth" prospects. The reported results are consistent with our hypothesis: the market does not react significantly negatively to the announcement of seasoned equity offerings by "financially constrained" firms with "good growth" prospects. Further, and just as importantly, the market reacts significantly negatively to the announcement of seasoned equity offerings by "financially unconstrained" firms with "poor growth" prospects.

Table-3: Market Reaction According to Different Groupings

Panel A: Method 1 Grouping		
	Low Growth	**High Growth**
With Financial Constraint	-0.044	-0.011
	(-5.36)**	(-0.28)
	n=75	n=7
Without Financial Constraint	-0.030	-0.040
	(-12.31)**	(-4.11)**
	n=862	n=27
Panel B: Method 2 Grouping		
	Low Growth	**High Growth**
With Financial Constraint	-0.031	-0.025
	(-10.01)**	(-1.87)*
	n=443	n=25
Without Financial Constraint	-0.031	-0.059
	(-9.02)**	(-3.50)**
	n=494	n=9
Panel C: Method 3 Grouping		
	Low Growth	**High Growth**
With Financial Constraint	-0.027	-0.024
	(-3.97)**	(-1.78)*
	n=137	n=19
Without Financial Constraint	-0.034	-0.028
	(-11.25)**	(-6.54)**
	n=589	n=226
Panel D: Method 4 Grouping		
	Low Growth	**High Growth**
With Financial Constraint	-0.028	-0.027
	(-5.52)**	(-2.01)*
	n=159	n=21
Without Financial Constraint	-0.033	-0.029
	(-10.52)**	(-6.45)**
	n=567	n=224

*Abnormal returns are reported with t-statistics in parenthesis followed by the number of observations for each group. * and ** indicate statistical significance at the 10 percent and 5 percent levels, respectively.*

To examine the robustness of these results we relax how we measure whether a firm has financial constraints and good growth prospects. First, in Table-3 Panel B we report the results of relaxing our definition of "financially constrained" to allow more firms to be identified as being such. As one might expect, the differences become less pronounced and the market reaction to the "financially constrained" group with "good growth" prospects is significantly negative at the 10 percent level, but not so at the 5 percent level.

Similarly, in Table-3 Panels C and D, we report results for when we relax first how we measure a firm's "growth" prospects, and then how "financially constrained" it is. Again, as in Panel B, the differences become less pronounced and the negative market reaction for the "financially constrained" group with "good growth" prospects is significant at the 10 percent level, but still not significant at the 5 percent level. Altogether the above reported results are consistent with our hypothesis that the market conditions its response to a firm's announcement of its intent to sell seasoned equity upon available information about the firm's lack of financial resources and possession of good growth opportunities.

V. Summary and Conclusions

Prior research has tended to find evidence consistent with the argument that firms time the secondary issuance of stock to take advantage of managers' private information. Korajczyk and Levy (2003), however, recently provide evidence that only some firms time their issuance of stock, while other firms are so "financially constrained" that they must issue stock in order to act on their growth options. We conjecture that the market recognizes these differences and reacts to seasoned equity announcements accordingly.

To test this conjecture, we identify a sample of 971 SEO announcements from the U.S. and allocate these firms to one of four groups according to whether they were "financially constrained" or not, and whether they possess "good growth" prospects or not. We find that the market's reaction to SEO announcements of those firms identified as being "financially constrained" and possessing "good growth" prospects is insignificantly different from zero, while the market's reaction to the same announcement by firms classified as "financially unconstrained" and lacking "good growth" prospects is significantly negative. These contrasting results are consistent with our hypothesis in that the market reacts differently to a firm's announcement of a seasoned equity offering based upon its growth prospects and the availability of financial resources.

Overall, our evidence not only supplements the evidence provided in Korajczyk and Levy (2003) on the heterogeneity of firms issuing seasoned equity but also contributes to the research investigating the factors that mitigate the negative market reaction to seasoned equity offerings announcements. For example, Hadlock, Ryngaert, and Thomas (2001) focus on a sample of 641 seasoned equity offerings in the U.S. during 1983-1994 and find that firm diversification is one such factor.

Daniel, Hirshleifer, and Subrahmanyam (1998) propose a theory of securities market under- and overreactions based on two psychological biases: investor overconfidence about the precision of private information and biased self-attribution. They show that overconfidence implies negative long-lag autocorrelations, excess volatility, and public-event-based return predictability especially when managerial actions are correlated with stock mispricing. Their theory implies that investors overreact to private information signals and underreact to public information signals. To the extent that the negative market reaction to seasoned equity offerings is an overreaction, the lack of such a reaction, as we observe for the "financially constrained" firms with "good growth" prospects, would be consistent with the heterogeneity of seasoned equity offerings in terms of the information content of their announcements.

Our evidence and the theory proposed by Daniel, Hirshleifer, and Subrahmanyam (1998) can also shed light on the differences in market reaction to SEO announcements in different markets across the world. The lack of negative market reaction to SEO announcements in emerging markets may be due to the fact that the firms performing these SEOs are usually not characterized as "financially unconstrained" and lacking "good growth" prospects by the investors in those markets. It could also be due to variations in the signaling effect of the information content of seasoned equity announcements across the world. Our findings highlight the need for future work that aims to better understand the determinants of market reaction to SEO or rights offering announcements in emerging markets taking into account the different institutional settings and the potentially different mix of companies coming back to these markets for raising more equity capital.

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Organizational Culture Assessment of Small & Medium-Sized Enterprises

Arshad Zaheer[*], Kashif ur Rehman[**] and Abrar Ahmad[***]

Abstract

This paper is an ethnographic study defining and assessing the organizational culture exhibited by Small and Medium Enterprises (SMEs). It primarily focuses on four cultural categories: clan, adhocracy, hierarchy and market-driven. These conceptual domains have been examined by the Organizational Culture Assessment Instrument. Results from a sample of 162 SMEs in the Rawalpindi/Islamabad area indicate that SME culture lacks creativity, innovation, freedom and risk taking. SMEs are not looking to change in the future, preferring the status quo. The most important finding is that SMEs exhibit a market- oriented culture focusing on results, competition and achievements.

Introduction

A single definition of organizational culture has proven to be very elusive. No one definition of organizational culture has emerged in the literature (Scholl, 2003). There is considerable agreement on the general definition of organizational culture and most questionnaires define culture as: "a set of cognitions shared by members of a social unit" (Reilly, Chatman, and Caldwell (1991)), or more fully: "a system of shared values and beliefs that produces norms of behavior and establishes an organizational way of life" (Koberg & Chusmir, 1987).

The latter definition is important because it pinpoints the fact that the culture construct can be unequivocally understood to deal with "major beliefs and values", or alternatively as "norms and patterns of behavior and

[*] HEC PhD Scholar, Foundation University, FUIMCS, FF Complex, New Lalazar, Rawalpindi Cantt.
[**] Assistant Professor, Iqra University, H-9, Islamabad.
[***] Associate Professor, Iqra University, H-9, Islamabad.

norms" (Gundry & Rousseau, 1994; Delobbe, Haccoun & Vandenberghe, 2002).

The cultural aspects of businesses are very complicated, but their importance cannot be overstated. Organizational culture is the personality of the organization. Trade experts at Moran, Stahl and Boyer International, an international consulting firm, said that culture has two components: surface culture (fads, styles, food and holidays) and deep culture (norms, attitudes, values and beliefs). According to the tip-of-the iceberg concept, many important cultural aspects are not easily seen. According to Berg and Harral (1998) certain resources, especially personnel, generally are not as available in smaller organizations. Also, overlapping responsibilities or assignments are uncommon because each person has defined activity areas or turf. Smaller firms maintain a more limited scope in terms of products or services, processes, customer base, geographic market and technology. Exceptions to this tendency include large scope/small organizations such as trading companies, independent manufacturers' representatives, internet sales firms and consortiums, or the opposite extreme of narrow scope/large organizations such as airlines and governmental agencies. Adding or letting go of a single person in a small company may create major change and chaos until everyone determines his or her new responsibilities.

Small firm culture is more informal, although not necessarily more relaxed. This translates into fewer written directions and records. People unfamiliar with small company culture often mistake informality for indifference. Nothing could be more erroneous. A small company owner casually requesting a subordinate to perform an activity may convey unmentioned dire consequences for nonperformance exceeding those of a registered letter of demand. A primary difference between large and small companies is the management's role and involvement. Typically, the top management of a small firm has greater interest and control of the firm through ownership. They are more involved with daily operations in all areas. They know all employees and their strengths and weaknesses. They understand, and can often perform, all activities or processes. They know the customer's representatives and understand customer needs and quirks. They are knowledgeable about the relative strengths and weaknesses of the firm's products/services as well as its competitors. Above all, top management is reflected as the firm's alter ego (Berg & Harral, 1998).

Cameron and Quinn (1999) have defined four types of culture, which are identifiable among small as well as large firms. These four classes include clan, adhocracy, market-driven culture and hierarchy. Organizational

performance and routines, and their responsiveness to change are believed to depend on the type of culture (Deshpande, Parley & Webster, 1993).

Although there are valuable contributions, there exists a lack of significant study of organizational culture in SMEs in Pakistan. This paper is an attempt to address this important issue of defining and identifying the particular components of organizational culture exhibited by SMEs.

Literature Review

Organizational culture is postulated to be one of the most important theoretical levers required for understanding organizations. Verifying and using those theories minimally requires comparisons between the cultures of different firms, which in turn implies the identification of common dimensions for assessing organizational culture (Delobbe, Haccoun & Vandenberghe, 2002).

Koley, Bernice, and Meredith (1997) addressed the importance of managerial values. They identified four clusters of firms that vary in terms of personal values (entrepreneurs-conservatives), strategies (proactive-reactive), and performance (above average-below average).

Pederson and Sorensen (1989) studied high technology small firms for the specific identification of shared values. Some shared values among the firms studied were: treat people with consideration, high education-high spirit, proper consultancy, do not brag, and get things done-the results count, were found to be some shared values among these firms. The findings, therefore, contributed to a relatively unexplored area of small business culture.

Jung (1923) developed a cultural paradigm and described several archetypes of culture, which were further developed by Quinn and McGrath (1985) and Deshpande, Parley, and Webster (1993). Two key dimensions were used to classify organizational culture: the continuum from organic to mechanistic processes and the relative emphasis on internal maintenance versus external.

Cameron and Quinn (1999) have developed an organizational culture framework built on a theoretical model called the "Competing Values Framework". This framework refers to whether an organization has a predominant internal or external focus and whether it strives for flexibility and individuality or stability and control. The framework is also based on six organizational cultural dimensions and four dominant culture types (i.e.

clan, adhocracy, market, hierarchy). In addition, the authors generated an `Organizational Cultural Assessment Instrument (OCAI)' which is used to identify the organizational culture profile based on core values, assumptions, interpretations, and approaches that characterize organizations. In this respect the overall culture profile can be identified as:

- ***Clan:*** an organization that concentrates on internal maintenance with flexibility, concern for people, and sensitivity for those it serves. Clan culture values cohesiveness, participation and teamwork. Employee commitment is achieved through participation. Personal satisfaction is more important than financial goals.

- ***Adhocracy:*** an organization that concentrates on external positioning with a high degree of flexibility and individuality. It centers on entrepreneurship, creativity and adaptability. Success means gaining unique and new products or services.

- ***Hierarchy:*** an organization that focuses on internal maintenance with a need for stability and control. Hierarchy culture stresses order and regulations. The leadership style is administrative. Tracking and control are emphasized relative to clearly stated goals. The management of employees is concerned with secure employment and predictability.

- ***Market:*** an organization that focuses on external maintenance with a need for stability and control. Market-driven culture focuses on competitiveness and goal achievement. Emphasis is on productivity and responsiveness to the market. It focuses on getting the job done. People are hard-driven, producers, tough and demanding.

Berrio (2001) described the dominant culture type of Ohio State University (OSU) Extension using the OCAI tool. They concluded that the clan culture classification applied to OSU Extension, portraying the institution as an organization that concentrates on internal maintenance with flexibility, concern for people, and sensitivity towards customers. The cultural profile of the University played an important role in the personnel plan, implementation, and evaluation of the educational programs.

Alley and Faubert (2005), institutional research analysts at the South Dakota School of Mines & Technology (SDSMT), articulated and appraised the organizational culture of SDSMT's campus for the reconsideration of organizational structure by applying the OCAI instrument in academic settings for the first time. They recognized the

hierarchical nature of culture with a strong shift toward "adhocracy" indicating that the campus community placed a higher value on responding effectively to change rather than maintaining a stable bureaucracy that produces a predictable output.

Methodology

The descriptive method of research was used because it facilitated the description of the prevailing culture type of selected SMEs. The descriptive method is also a logical approach because the data consisted of the perceptions of respondents, which were gathered through the survey questionnaire.

Sample

The sample was composed of the managers and owners of SMEs located in the Rawalpindi/Islamabad region. Data were collected from a range of firms pertaining to eleven different industries. A total of 250 questionnaires were distributed among the firms using the method of non-probability sampling. From a total of 250 personnel, the researcher was able to retrieve 162 questionnaires or 65% of total possible respondents.

Instrument and Measures

The 'Organizational Culture Assessment Instrument' developed by Cameron and Quinn (1999) was used to gather the data. This instrument has been found to be both useful and accurate in diagnosing important aspects of an organization's underlying culture.

The survey questionnaire constitutes two parts. The first part comprises demographic characteristics of the respondents such as industry, firm age, number of employees, location, and gender of the respondent. The second part of the questionnaire has six different categories which represent six key dimensions of organizational culture. These dimensions include dominant characteristics, organizational leadership, management of employees, organizational glue, strategic emphasis and criteria for success. Each of six categories consists of four alternatives which measure the four different types of culture.

For the purpose of the study, instrument reliability was established. In assessing the reliability of the scales used in the questionnaire a coefficient of internal consistency was calculated both for current and preferred situations using Cronbach's alpha methodology (Santos, 1999).

Table-1: Cronbach Alpha Reliability Coefficient

Type of Culture	Present or Current Situation	Future or Preferred Situation	Computed by Angel A. Berrio (2003)	
			Current Situation	Preferred Situation
Clan	0.62	0.78	0.80	0.77
Adhocracy	0.78	0.82	0.75	0.72
Market	0.75	0.84	0.90	0.84
Hierarchy	0.77	0.72	0.62	0.79

Table-1 computes the Cronbach's alpha coefficients for the survey as compared to the values worked out by Cameron and Quinn (1999) and Berrio (2003). The comparison revealed the construct validity of the instrument.

Procedure

The fixed or constant sum scale was used to gather data. The respondents were asked to spend 100 points to be divided among the four alternatives. Its intent was to help identify the organization's current culture (Step 1). The same instrument helped identify what the culture organization members think should be developed to match the future demands of the environment and the challenges to be faced by the company (Step 2).

Scores by participants were recorded and the average was computed for different alternatives representing the respective culture type both for current and future situations. Again the average for each alternative for all the participants was computed for current and future situations. The same procedure was adopted to compute relevant averages for various industry sectors, demographic characteristics, and culture dimensions by computing the relevant averages.

These averages for different categories were plotted in the graph constituting the four quadrants with a scale of 0-50, with intervals of 5. The four quadrants represent the clan, adhocracy, market and hierarchy culture types respectively. The scores plotted in each quadrant represent the strength of culture type for the present and future situations exhibited by SMEs for relevant categories.

Result & Discussion

Table-2 reveals the dominant culture type, as perceived by the respondents of SMEs with respect to various demographic characteristics. The dominant culture type of SMEs with the highest mean scores 38.29 and 40.85 respectively for current and preferred situations, is the market culture.

Table-2: Dominant Culture of SMEs

		Present (Current) Situation					Future (Preferred) Situation				
Category	**n**	**Mean**	**S.D**	**Dominant Culture**	**F**	**P**	**Mean**	**S.D**	**Dominant Culture**	**F**	**P**
Overall Industry	162	38.29	10.74	Market			40.58	14.46	Market		
Industry					2.686	0.008*				1.570	0.134
Advertising	24	39.31	5.62	Market			38.06	8.94	Market		
Chipboard	4	33.75	8.84	Market			37.08	2.95	Market		
Engineering	24	40.35	8.66	Market			42.01	9.64	Market		
Food	26	46.79	12.77	Market			46.41	12.74	Market		
Glass	8	39.38	3.56	Market			48.54	14.62	Market		
Hotel	8	41.75	17.53	Market			46.92	16.71	Market		
IT	8	39.38	2.49	Market			49.17	0.68	Market		
Marbel	14	38.93	11.52	Market			41.43	17.86	Market		
Pharma	26	28.59	10.13	Clan			35.10	17.17	Clan		
Packaging	10	35.33	11.13	Market			43.17	5.01	Market		
Plastic	10	34.50	7.33	Market			37.00	23.29	Market		
Age					1.600	0.183				0.598	0.666
1-20	2	32.50	6.27	Clan			32.50	6.87	Clan		
21-35	82	37.76	10.53	Market			39.16	16.67	Market		
36-50	64	38.57	10.99	Market			42.04	12.12	Market		
51-60	10	46.17	7.28	Market			45.83	10.07	Market		
>60	2	34.17	7.55	Hierarchy			39.17	9.79	Market		
Gender					0.681	0.412				1.784	0.185
Male	144	39.00	10.53	Market			42.38	13.05	Market		
Female	18	32.59	11.34	Market			36.76	19.46	Clan		
Area					1.211	0.274				0.645	0.424
Urban	136	39.10	11.03	Market			41.77	13.90	Market		
Rural	26	34.04	8.12	Market			34.36	16.28	Market		

No. of employees					0.007	0.931				1.719	0.194
1-30	56	37.10	10.05	Market			38.67	12.17	Market		
>30	106	40.54	10.99	Market			44.20	15.30	Market		

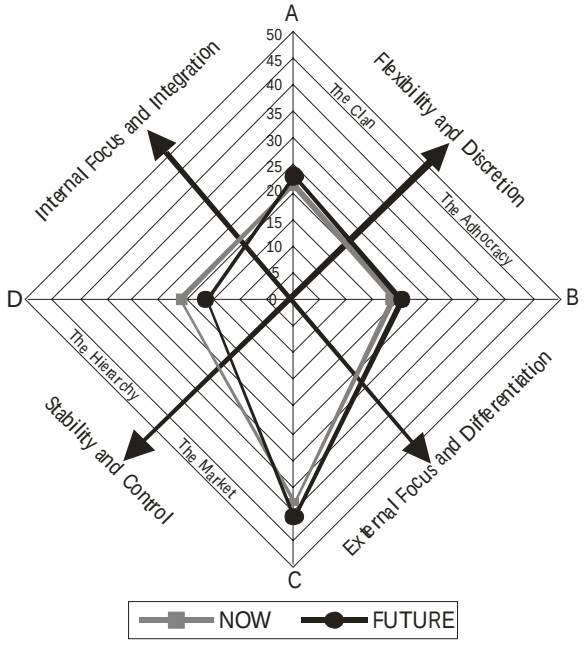
* $P < 0.05$

The dominant culture type exhibited by various industry categories is market culture except for the pharmaceutical industry where the clan culture is dominant. In the age category, the group from age 1-20 revealed the clan culture while the group older than 60 depicted hierarchy and market oriented as dominant cultures in the current and preferred situations respectively. However, the results for these age groups cannot be generalized due to the small sample size. Other demographic categories including gender, geographic area and number of employees had the market dominant culture. Only respondents older than 60 and female participants had a different dominant culture type for the current and preferred situations.

Generally, the dominant culture type among the various demographical variables is market culture both in the present and future situations.

There is no statistically significant difference between the various categories as revealed by the *post hoc* pair wise multiple comparison analysis.

Graph1: The Organizational Culture of Small Businesses (n=162



Graph-1 shows the mean scores in the relevant quadrants representing the four culture types for both current and future situations for SMEs. Only the hierarchy culture type is on a diminishing trend for the preferred situation. There is a moderate increasing trend in other culture types. The culture dominated in the SMEs is the market culture both for the current and future situation which is a strong indication of external focus and differentiation of SMEs.

Table-3: Dimensions of Organization Culture

	Current (Present) Situation			Future (Preferred) Situation		
Dimensions of Culture	**Mean**	**S.D.**	**Culture Type**	**Mean**	**S.D.**	**Culture Type**
Dominant Characteristics	39.72	14.43	Market	42.75	17.67	Market
Organizational Leadership	38.58	17.2	Market	39.81	21.57	Market
Management	38.15	16.69	Market	41.78	18.84	Market
Organizational Glue	37.35	17.47	Market	41.98	19.52	Market

Strategic Emphasis	37.84	14.21	Market	37.86	18.55	Market
Criteria for Success	38.09	16.67	Market	39.31	19.34	Market

Table-3 represents the highest mean scores for the six dimensions of the organizational culture as assessed by the 'Organizational Culture Assessment Instrument' in present and future situations. In the present situation, the highest mean score exhibited by SMEs is in the dominant characteristics criteria (Mean = 39.72), while the lowest mean score is in the criteria for organizational glue. In future situations, the highest mean score is recorded in the dominant characteristics criteria (Mean =42.75) and the lowest score is in strategic emphasis (Mean =37.86).

Table-3 clearly indicates cultural congruence as various aspects of organizational culture become increasingly aligned. The strategy, leadership style approach to managing employees and dominant characteristics, all tend to emphasize the market culture values.

The market culture exhibited by SMEs portrays the organizations that concentrate on the market orientated approach where people are competitive and goal oriented. Leaders are hard drivers, producers and competitors. They are tough and demanding. The glue that holds the organizations together is an emphasis on winning. The long-term concern is on competitive actions and achieving stretch goals and targets. Reputation and success are common concerns. Success is defined in terms of market share and penetration. Outpacing competition and market leadership are important. The organizational style is hard driving competitiveness. Productivity in the organizations is achieved through a strong emphasis on external positioning and control. (Cameron & Quinn, 1999)

The other three factors, clan, hierarchy and adhocracy have comparatively less consideration in their leadership style. A major difference was not found in the organizational culture that employers prefer in their organizations for the future. Organizations prefer the status quo and are not looking for "change". In the future, organizations prefer to minimize the impact of hierarchy culture by being less structured in terms of rules and regulations and polices to some extent.

Table-4: Strength of Dominant Culture

	Current (Present) Situation	**Future (Preferred) Situation**

Culture Type	Mean	S.D.	Mean	S.D.
Clan	21.35	8.76	22.95	12.28
Adhocracy	19.08	10.1	20.35	11.38
Market	38.29	10.74	40.58	14.46
Hierarchy	21.2	9.7	16.67	9.32

Table-4 describes the strength of the dominant culture type exhibited by SMEs in the present and preferred situations. Market culture is strong both in current and future situations with mean scores 38.29 and 40.58 respectively. Adhocracy culture is weak with mean score 19.08 in the present situation. In the future situation, hierarchal culture is weak with mean score 16.67.

Conclusion

The findings of the study are in consonance with the fact that adhocracy scores are generally rated the lowest and there is a strong association between market culture and the status quo (Cameron and Quinn, 1999). In this study, the association between market culture and the status quo is found to be even stronger.

Several management consultants and authors recently have equated "leadership" with clan and adhocracy culture, and management with hierarchy and market culture.

SMEs may not be regarded as high performing organizations strongly emphasizing only one culture type. Research has indicated that effective and high performing organizations were supportive of and developed their employees (Clan) but also demanded output and achievement from them (Market), so effective organizations are able to behave in flexible and sometimes contradictory ways (Cameron & Quinn, 1999). The same is not the case with the sampled SMEs, which is a point alerting policy makers.

A good point regarding the dominance of market culture prevailing in the sampled SMEs is a better match between culture and the environment to efficiently operate in a fiercely competitive industry.

The results provided another source of information about the discrepancies between the current SME culture and what they prefer it to be. In the opinion of the survey respondents, there does not exist a strong need for change.

The study revealed another important finding about the stronger or more dominant market culture of SMEs. Strong cultures are associated with homogeneity of effort, clear focus, and higher performance in environments where unity and common vision are required (Cameron & Quinn, 1999).

At the same time, the study indicates clear caution for managers and leaders that SMEs with strong market culture will find extreme difficulties in circumstances where survival depends on flexibility, innovation, creativity and entrepreneurship.

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Note:

Understanding on Rules and Procedures Governing the Settlement of Disputes: A Developing Countries Perspective[13]

Somesh K. Mathur*

Abstract

This note discusses the workings of the Dispute Settlement Process (DSP) of the WTO, and the major problems concerning the implementation of decisions in the DSP. It provides some suggestions in order for the DSP to work for the benefit of all. It maintains that the ability to extend dispute settlement across agreements is one of the strengths of the World Trade Organization. The author concludes that substantial reform can be undertaken in the DSP if concerted efforts are made to quantify economic damages for working out the suspension of concessions.

Introduction

Dispute resolution in the World Trade Organization (WTO) is carried out under the WTO Dispute Settlement Understanding (DSU), the rules and procedures of which apply to virtually all WTO agreements. The DSU provides for consultations between disputing parties, panels and appeals, and possible compensation or retaliation if a defending party does not comply with an adverse WTO decision by a given date. Automatic establishment of panels, adoption of reports, and authorization of requests to retaliate, along with deadlines for various stages of the dispute process and improved multilateral surveillance and enforcement of WTO obligations, are supposed to produce a more expeditious and effective system than that which existed under the General Agreement on Tariffs and Trade (GATT). Though the DSU mechanism has gained credibility among the Member Countries, only a few developed countries continue to be major users of the

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* Fellow, Research and Information System for Developing Countries, India Habitat Centre, Lodhi Road, Delhi, India.

system due to some existing lacunae in the current dispute settlement procedure. The participation of developing countries, especially the least-developed countries (LDCs), in the DSU has still not improved. For example, the lack of effective sanctions in the DSU system results in a complaining party being largely left alone in their struggle against a violator. Consequently countries that are economically and politically weak stand at a relatively disadvantageous position in the WTO. This note discusses the workings of the dispute settlement process (DSP) and its flaws, and gives some suggestions for making it work for the benefit of all.

Workings of the DSP

The dispute settlement mechanism of the WTO works as follows. First, when one country believes that another is violating any aspect of the agreement (including the General Agreement on Trade Services (GATS) and the Trade Related Intellectual Property Issues (TRIPs), as well as the General Agreement on Tariffs and Trade (GATT)), the complaining country first requests consultation with the offending country, and the two then seek to resolve the dispute on their own. If consultation fails, then the complaining country requests the establishment of a panel, consisting of three persons with appropriate expertise from countries not party to the dispute. These panels assess the evidence in the context of its interpretation of the WTO rules and issue a report. The DSU emphasizes the importance of consultations in securing dispute resolution, requiring a Member to enter into consultations within 30 days of a request for consultations from another Member. If after 60 days from the request for consultations there is no settlement, the complaining party may request the establishment of a panel. Where consultations are denied, the complaining party may move directly to request a panel. The parties may voluntarily agree to follow alternative means of dispute settlement, including good offices, conciliation, mediation and arbitration.

The panel report is automatically accepted unless all WTO members, acting through their Dispute Settlement Body (DSB), decide by consensus against its adoption, or if one of the parties to the dispute voices its intention to appeal. Therefore, the process requires unanimity among WTO members not to accept a panel report, in marked contrast to the procedures of the old GATT, where a panel report could be blocked by any one country, including the country that was the subject of the complaint. Panel procedures are set out in detail in the DSU. It is envisaged that a panel will normally complete its work within six months or, in cases of urgency, within three months. Panel reports may be considered by the DSB for adoption within 20 days after they are issued to Members. Within 60 days of

their issuance, they will be adopted, unless the DSB decides by consensus not to adopt the report or one of the parties notifies the DSB of its intention to appeal.

To hear appeals, the WTO has established an Appellate Body, composed of seven members, of which three will serve on any given case. The permanent seven-member Appellate Body is set up by the Dispute Settlement Body and broadly represents the range of WTO membership. They have to be individuals with recognized standing in the field of law and international trade, not affiliated with any government. The DSB established the Appellate Body in 1995, after which the seven first Appellate Body members were appointed. The DSB appoints the members by consensus (Article 2.4 of the DSU), for a four-year term and can reappoint a person once (Article 17.2 of the DSU). An Appellate Body member can, therefore, serve a maximum of eight years. On average, every two years a part of the Appellate Body membership changes. The purpose of this Appellate Body is to consider only issues of law and legal interpretations by the Panel, and it too issues a report which must be accepted by a unanimous decision of the DSB. An appeal will be limited to issues of law covered in the panel report and legal interpretations developed by the Panel. Appellate proceedings shall not exceed 60 days from the date a party formally notifies its decision to appeal. The resulting report shall be adopted by the DSB and unconditionally accepted by the parties within 30 days following its issuance to Members, unless the DSB decides by consensus against its adoption.

Once this process is completed, countries are expected to implement the recommendations of the Panel/Appellate Body reports. If they do not, then complaining countries are entitled for compensation from them, or to use suspension of concessions (usually increased trade barriers) against them. If suspension of concession occurs, it is to be done preferably in the same sector as the dispute, or failing that under the terms of the same Agreement (GATT, GATS or TRIPs). But if this too is impractical, suspension can come under another agreement. Thus, in particular, violations of the TRIPs agreement can lead to increased barriers to trade in goods if the violations are not corrected in accordance with the recommendations of a panel report.

Dispute Settlement Process: A Critical Evaluation

This ability to extend dispute settlement across agreements is one of the strengths of the WTO, and no doubt is one of the things that motivated advocates of extended intellectual property protection to incorporate it into the Uruguay Round negotiations (Deardorff, 1996). However, there is a possibility that countries retaliate by withdrawing concessions or

commitments even before the panel gives its report. This issue needs to be addressed under the dispute settlement mechanism of the WTO. Also, there is a possibility that ultimate reliance on suspension of concession by trading nations either (1) would be defeating the purpose of the WTO in case the cases do not get settled either by implementing the panel recommendations or by compensation, or (2) expedite the rest of the process work and lead to cooperation if there is a threat of suspension. Deardorff (1996) notes that the threat of expulsion from WTO membership in case of violation of rules will not be effective because members will be reluctant to set a precedent by expelling another lest the same thing later happen to them.

It is to be noted that most developing countries, partly because they are small and partly due to lack of experience, are finding it difficult to cope with the WTO's new dispute settlement mechanisms. Blackhurst (1997) points out that two-thirds of the least developed countries in the WTO have no representation. For the other third, there is typically only one person covering all the international organizations. Given the active participation of members in the work of the WTO, this inevitably leads to under representation of their interests and their inability to participate and exercise any influence on WTO decisions. An enlargement of the WTO Secretariat to permit the establishment of a service which could provide legal advice on procedures and other aspects of dispute settlement would benefit not only the least developed countries but also some of the smaller developing countries[14].

[14]While some subsidized legal assistance can be accessed by developing countries through the independent, Geneva-based, Advisory Centre on WTO Law (ACWL) the assistance is limited. Because of the membership fee, a developing country (other than a least developed country) may wait to join the Centre until it believes that it can benefit meaningfully from WTO litigation. The United States is not a member of the Centre and provides no funding for this initiative. Canada is the only non-European developed country member of the Centre. The other nine are Denmark, Finland, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland and the United Kingdom. The term "least developed country" (LDC) is clearly defined according to United Nations criteria based on per capita income and related development indicators. The criteria used in the triennial review in 2003 were based on domestic gross domestic product (under $900 average over three years), a human resource weakness index and an economic vulnerability index. Under the annexes to the agreement establishing the Centre, developing countries are divided into three categories, A, B and C, with least developed countries (as defined by UN rules) constituting a fourth category. As of August 2002, hourly rates for the Centre's members for WTO litigation support were set at $200 for category A countries, $150 for category B countries and $100 for category C countries. Least developed countries hourly rates are set at $25. Non-member developing country rates are set at $350 for category A countries, $300 for category B countries, and $250 for category C countries (See The Agreement Establishing the Advisory Centre on WTO Law, Annex II, Nov. 13, 1999, available at http://www.acwl.ch/Docs/ACWLAgreementEnglish.htm.)

The DSU system has experienced growing pains due to major problems so far as the implementation of decisions is concerned (Mercurio, 2004). Mexico had raised concerns over non-compliance with panel rulings as one of the problems within the DSU (paper submitted to the WTO, TN/DS/W/23, November 4, 2002). It noted that losses caused by non-compliance with rulings and procedural delays amounted to hundreds of millions of dollars each year. According to this paper, non-compliance problems occurred both when members failed to ensure the conformity of their laws, regulations and administrative procedures with WTO obligations (compliance *a priori*), and when members failed to withdraw measures found to be inconsistent with WTO provisions (compliance *a posteriori*). On procedural time frames, the study noted that out of 77 cases where the WTO had found a Member to be in violation of WTO rules, immediate compliance had been secured only five times, with five cases being settled mutually. The average 'reasonable period of time' (RPT) to comply ran to 292 days. The study (Mexican paper) also pointed out that the average period of time between the establishment of a panel and the expiry of the reasonable period of time was 775 days, or over two years, which grew to 1507 days or over 4 years once the consultation period was included.

Part of the above problem lies in procedural flaws in the dispute settlement process. Those are reflected in the members' proposals to the WTO (see section below). We give an account of two such inherent problems with the articles of the DSP.

In many municipal legal systems, an appellate court that reverses a finding of a court of first instance may remand the case back to the lower court for further proceedings consistent with the appellate court's decision. This is an efficient and expeditious way of handling cases at that stage. But the WTO Appellate Body lacks this authority, and this lack can result in a complaining Member going through the entire dispute settlement process without receiving a decision on its claim.

The problem, that has become known as **"**sequencing"**,** results from a conflict in the provisions of the DSU dealing with the time available to a Member, whose measure has been found to be inconsistent, to bring that measure into conformity – and with the time within which the successful complaining Member must act to secure its remedy if the measure is not brought into conformity.

Developing countries face at least three major problems as far as the implementation of decisions in the DSP is concerned (RIS, World Trade and Development Report 2003):

(i) It may take up to three years from the start of the dispute settlement process until the withdrawal of the offending measure. Meanwhile, the export opportunities for the complaining developing country in the developed country concerned may suffer irreparably during this time. Indeed, there is no retrospective relief from the time the incorrect measure was applied by the respondent Member country. In the case of a developing country as a complainant, this gap of time-period in relief may be very costly.

(ii) There is substantial export loss to the developing country during the dispute settlement period, but there is hardly any provision for compensation for this loss even when the measure in question is found to be in contravention of the WTO rules or frivolous. This can be particularly damaging for smaller developing countries which are highly dependent on a limited number of export products/markets.

(iii) Retaliation is the final remedy to allow the complaining country to take action against the defending country. As for developing countries, it is difficult to take any retaliatory action against a developed country. This is owing not only to political considerations but also to the unequal economic relationship with developing countries being more dependant on continuing the relationship with developed countries for their economic growth and development.

In November 2001, at the Doha Ministerial Conference, member governments agreed to negotiate to improve and clarify the DSU. These negotiations take place in special sessions of the Dispute Settlement Body (DSB). The Doha Declaration mandates negotiations and states (in para 47) that these will not be part of the single undertaking — i.e. that they will not be tied to the overall success or failure of the other negotiations mandated by the declaration. Originally set to conclude by May 2003, the negotiations are still continuing without a deadline.

The Chair's text of May 28, 2003, otherwise known as the Balas text after the then-Chair Ambassador Peter Balas of Hungary, contained a large number of issues, including, inter *alia* sequencing of retaliation and

compliance procedures, remand authority for the Appellate Body, compensation for litigation costs, third party rights, consultation proceedings, as well as various elements of special and differential treatment for developing countries. Since the Balas text, members have submitted approximately 50 proposals. In light of the broad scope of the review in terms of the proposals to be considered, the sense among some WTO members is that ample opportunities exist for reforms in the dispute settlement process of the WTO, both procedurally and justice specific. The challenge, however, lies in finding common ground on existing proposals contained in the Balas text. It becomes altogether important because at the recently concluded Hong Kong Ministerial Conference, Ministers agreed to conclude DSU negotiations rapidly.

Number and Nature of Disputes

The latest available data show that 376 cases were brought to the WTO dispute settlement procedure till August 30, 2006. Table-I, by breaking down these figures by category of country (developed/developing), shows that out of 376 cases for resolution, 228 were presented by developed countries (145 against other developed WTO Members and 83 against developing Members). The developing countries filed 148 claims, with 90 against developed country members and 58 against developing countries. An agreement-wise break-up reveals another interesting dimension of the dispute settlement process: The largest share of maximum cases that have been registered, measured by the obligation enforceable by the DSU, pertain to industrial products. This is followed by anti-dumping cases and subsequently followed by cases in agriculture.

In addition, there has been an increase in the number of disputes involving developing country Members (complainant/respondent or third party) during the last five years. The question arises that despite the increase in the number of cases involving developing countries, they are still skeptical about the use of DSU. The observed asymmetries are also indicative of gaps in legal power and economic capacities of developed and developing countries.

By July 2005, only about 130 of the nearly 332 cases then had reached the full panel process. Most of the rest have either been notified as settled "out of court" or remain in a prolonged consultation phase — some since 1995 (WTO website, www.wto.org).

Table I: Comparison of Participation by Developed and Developing Countries in the WTO Dispute Settlement Process up to August 30, 2006

Cases Filed by Developed Countries		Cases Filed by Developing Countries	
Total	Against Developing Countries	Total	Against Developed Countries
228	83	148	90

Source: Based on information posted on the WTO website (www.wto.org)

Concerns and Proposals Put Forward by Developing Countries to Improve Dispute Settlement Process in the World Trade Organization: Making Them Work

Formal submissions at the ongoing post-Doha DSU review negotiations could be put under the broad categories given below. These revolve around the following themes: transparency, security and predictability, special and differential treatment, and implementation issues. Although all proposals are still on the table, during the last year or so, active negotiations have centered on the following issues:

Access to Legal Assistance: The membership- based Advisory Centre on WTO Law which has been set up recently in Geneva (by virtue of the Agreement establishing the Advisory Centre on WTO Law which came into force on June 15, 2001) provides legal assistance to developing country Members and LDCs in dispute settlement, on a sliding-scale fee basis. It is an independent inter-governmental organization and provides legal services and training to all developing countries. Although it is a step in the right direction, it alone cannot meet the needs of all the developing country Members and LDCs for legal support.

Several proposals have also been tabled for the payment of litigation costs to developing country Members or LDCs where in any action involving such a Member and a developed country Member, if the dispute does not end with a Panel or the Appellate Body finding against the former, then it should be awarded litigation costs to the tune of US$500,000 or actual expenses, whichever is higher. The litigation costs should include lawyers' fees, charges and all other expenses for the preparation of necessary documentation and participation in the consultations, Panel and Appellate Body proceedings, including travel and other logistics for a reasonable

number of capital-based officials. There is also a proposal which is being considered sympathetically for holding consultations in the capitals of LDCs where possible for a developing country and because an enormous amount of ground work is required to be done when bringing a dispute to the DSB. There is a need to have ongoing research into trade matters, involving collection and analysis of trade data across the board, and using the research to identify and establish a violation which may be litigated. There is the cost of maintaining the presence in Geneva of the officials concerned of disputant LDCs as may be required during the course of the dispute. Developing country members and LDCs have taken the position that they will need supplementary resources and means to be provided to develop both the institutional and human capacity for using the Dispute Settlement.

Currently, Article 27 mandates the WTO Secretariat to make a qualified legal expert available from the WTO technical services to any developing country member which so requests. This expert shall assist the developing country member in a manner ensuring the continued impartiality of the Secretariat. The restriction in the last sentence often restricts the legal expert in fully discharging the functions of counsel to the developing or least-developed country Member. The extent of the assistance is also restricted by the lack of manpower. Another issue with the Secretariat is that the inputs it provides to the Panels or the Appellate Body in the course of adjudication of a dispute are not available to the parties, whereas these inputs may crucially influence the decisions made. It has been proposed that the Secretariat should provide all relevant legal, historical and procedural material relating to a dispute to the developing and least-developed country Members that are parties or third parties in the dispute. Additionally, any document, notes, information, etc. submitted by the Secretariat to a Panel should be given promptly to the parties to the dispute, whose views on these shall be taken into consideration by the Panel.

Amicus Curiae Briefs: *Amicus curiae* means "friend of the court" or "disinterested adviser". This issue has been discussed in detail in the Proposals on DSU by Cuba, Honduras, India, Indonesia, Malaysia, Pakistan, Sri Lanka, Tanzania and Zimbabwe (TN/DS/W/19 dated October 9, 2002), in which they come to the conclusion that the dispute settlement system of the WTO being of an intergovernmental character, allowing non-members to participate and submit *amicus curiae* briefs would undermine this character, and these non-member entities would seek to represent and advance their own sectoral interests, rather than the overall interests of the territories concerned.

Non-State Access: Access to the DS is restricted to WTO Members, who are largely states, but entities such as the European Community and certain Customs Unions are also Members. In one sense, the door has been opened to certain forms of access by non-state entities. However, the emerging issue is that of corporate entities having access to the DS to litigate cross-border disputes, particularly if and when agreement is reached within the WTO framework, on trade and investment, for example. The DSU would have to be radically restructured to enable such litigation to take place within its compasses. This would once again place developing countries at a huge disadvantage as large and well-organized commercial enterprises would be much more able to commit the resources required to litigate issues in Geneva over a length of time.

Special and Differential (S&D) Treatment: Developing countries have sought to make mandatory for the developed country member to explain in the panel request or in its submission to the panel as to how it has taken or paid special attention to the particular problems and interests of developing countries.

Developing countries and LDCs have submitted that they attach great importance to the provisions of Article 24 of the DSU which requires Members to exercise "due restraint" in matters involving an LDC. There is a need for clarification in terms of how to determine whether such restraint was exercised and what the consequence would be if it is established that such restraint was not exercised. It is proposed that Article 24.2 should also be amended by removing "upon request by a least-developed country Member" to make it incumbent upon the complaining party to seek the good offices of the Director General before a request for the establishment of a Panel is made.

Further proposals have been tabled, to make it mandatory to give special attention to developing country Members' particular problems and interests during consultations (Article 4.10), and also to amend Article 12.10 to provide developing country Members sufficient time to prepare and present their arguments before Panels.

China has proposed that explicit provisions applicable to all developing country Members (and by extensions all LDCs) be established in the DSU in order to strengthen the S&D provisions. Such provisions may include that in the exercise of due restraint, developed country Members shall not bring more than two cases to the DSB against a particular developing country Member within a calendar year. Further, if a developed country Member brings a case against a developing country

member, if the Panel or Appellate Body finds in favour of the latter, the former should bear the legal costs of the latter incurred in defending the proceedings. The LDC Group may consider adopting these or placing similar proposals before the DSB.

Third-party Rights: Under the current DSU rules, it is possible for members, under certain conditions, to join in consultations in a dispute in which they are not the complaining or responding party, to become third-parties at the panel stage, and to become third-participants in the appellate stage. Members are generally supportive of enhanced third-party rights, provided that an adequate balance between the rights of main parties and third-parties is maintained.

On a number of occasions a Member' s request to be joined in the consultations has been refused on the ground that the Member concerned does not have substantial trade interests in the consultations being held. Thus one problem area is the use of two different phrases, namely "substantial trade interest" and "substantial interest" in the same article namely, Article 4.11 of the DSU. It should be recognized that the interests of LDCs and developing country members in a case may include gaining legal experience in procedural, substantive, systemic or other issues, gaining insight into the workings of the WTO, and protecting long-term development interests and prospects that any findings and recommendations could adversely affect. Accordingly, provision should be made for third party developing country members and LDCs to have the right to all the documents and information, and to fully participate in all the proceedings. Developing countries have often been a third party. Experience calls for making third party rights in the appellate proceedings analogous to the panel proceedings.

Remand authority: Given the number of disputes being raised before the DSB in contrast to other international tribunals, the Appellate Body may soon become the foremost interpreter of a number of principles of international law. At present, the Appellate Body's function is limited to the examination of issues of law and legal interpretation developed by panels, and it is not empowered to make factual findings. This can lead to difficulties if a factual issue arises at the appellate stage which had not been examined by the Panel. The issue therefore arises as to whether the Appellate Body should have the possibility to remand the case back to the panel or should put its final judgment based on facts and figures. The latter development would require enhancing the resources and strength of the Appellate Bodies to deal with the factual cases and its judgment should be considered final, subject to contradictions if any with the constitution and

in accordance with the customary rule of interpretation of public international law. This also calls for strengthening the quality of Panel rulings based on facts and figures. Ideally, an appellate court that reverses a finding of a court of first instance may remand the case back to the lower court for further proceedings consistent with the appellate court's decision. This is an efficient and expeditious way of handling cases.

Several questions are raised by the concerned member countries. First, how far is the Appellate Body (and consequently, WTO) aware of and concerned about the systematic consequences of its decisions in relation to international mandates on the environment, health, human rights, labor standards and other like issues? What happens if there are contradictory findings in similar matters under dispute settlement provisions in different multilateral or regional agreements? This will become increasingly important in relation to investment disputes as and when these are covered by the DSU.

Sequencing, Retaliation and Development Concerns: The word "sequencing" is shorthand for the procedural steps and time periods needed to deal with a situation where the complaining country claims that the defending country has not implemented the rulings.

- Article 21.5 states that where the two parties disagree whether the rulings have been implemented or not, a Panel examines the dispute and reports within 90 days.

- Article 22.2 states that if the defending country fails to implement the ruling, the complaining country can ask the Dispute Settlement Body to authorize it to retaliate. Article 22.6 states that, within 30 days from the end of the reasonable period of time for implementation, the Dispute Settlement Body authorizes the complaining country to retaliate. So, there are two key steps with their own time-periods: 90 days for a Panel to examine whether a ruling has been implemented; and 30 days for the Dispute Settlement Body to authorize retaliation. The wording of the Dispute Settlement Understanding does not specify whether these steps have to come one after the other. Hence, according to the current wording of the agreement, it seems that the 30-day period for the Dispute Settlement Body to authorize retaliation runs out before the Panel has examined whether the defending country has implemented or not.

In relation to strengthening the provisions of Article 21 (*Surveillance of Implementation of Recommendations and Rulings*) members have proposed the following:

(a) A footnote should be appended to Article 21.2 to the effect that Article 21.1 is qualified by Article 21.2, in order to clarify that matters affecting the interests of developing country members and LDCs must be borne in mind in ensuring prompt compliance with recommendations or rulings of the DSB.

(b) Article 21.7 should be amended to read as below:

"If a matter is one that has been raised by a developing country member or a least developed country member, the DSB *shall take any further [appropriate] action in the circumstances*."

(c) Article 21.8 should be amended to read as below:

"If the case is one brought by a developing-country Member or a least-developed country Member, in considering what appropriate action *to take*, the DSB shall take into account not only the trade coverage of measures complained of, but also their impact on the economy and the *development prospects* of the developing-country Members *or least developed country Members* concerned."

It has been generally proposed that the terms of reference of the Panels should include the requirement to evaluate the development implications of any findings and recommendations.

It may be stated that prompt compliance with recommendations and rulings of the DSB is essential to ensure the effective resolution of disputes to the benefit of all Members. Enhanced market access to the complaining party may in fact be of limited use, especially if it is an LDC or even a developing country Member. Retaliation is the least preferred solution for an LDC or most of the developing country members because (i) to undertake retaliation in view of the negative effect it may have on the retaliating country's economy (ii) or the possibly much less significant impact it will have on the economy of the offending state and (iii) primarily because retaliation as a preferred option simply brings back the specter of trade wars. Because of the significant potential for disputes that go to the Panel and Appellate Body stage to result in a modification of WTO Members' rights and obligations, greater attention ought to be paid to procedures for

consultations between WTO Members, as well as good offices, conciliation and mediation.

However, if at all retaliation becomes a necessity, a developing country should have the ability to suspend concessions in the 'other' sector or agreement (Mathur, 2001) and the same Member should be exempted from proving the DSU requirements that it was not practicable or effective to suspend concessions in the same sector or agreement where the violation was found. A significant proposal made by the developing country Members relates to the concept of collective retaliation. The members consider that one solution to the well documented lack of an effective enforcement mechanism and the potential negative impact of retaliatory measures for poor economies is to adopt a "principle of collective responsibility" similar to that in the United Nations Charter. Under this principle, all WTO members collectively would have the right and responsibility to enforce the recommendations of the DSB. In a case where a developing or least developed country Member is a successful complainant, collective retaliation should be available automatically, as a matter of special and differential treatment.

Mutually Agreed Solution and Post-retaliation: Many of the member countries have raised the pertinent question as to what would happen if parties choose not to notify a mutually agreed solution. According to Article 3.5 of the DSU it is specifically provided that all solutions "... shall not nullify or impair benefits accruing to any member under those agreements, nor impede the attainment of any objective of those agreements." There is nothing in the DSU to suggest that the expression 'all solutions' necessarily excludes mutually agreed upon solutions. There is a need to clarify the extent to which a prior notified mutually agreed upon solution would bar a subsequent panel request by the parties.

The post retaliation issue arises from the fact that the DSU does not provide any specific procedure for the removal of an authorization to retaliate, once the Member concerned has complied, or claims to have complied, with the rulings.

Composition of Panels: The DSU currently provides for disputes to be examined by panelists selected on an *ad hoc* basis for each case, in consultation with the parties. This process can often cause delay. Negotiators are discussing the possibility of geographical balance in selecting panelists, as also whether enough panelists would be available in a permanent roster with experience in all the issues which arise to speed up the process and to reinforce the independence of panels and quality of their reports.

Panel members should be chosen through a rigorous procedure (taking into account the interest of all developing countries) and then from this permanent panel a Panel can be chosen randomly. The only concern is to keep the influence of the Secretariat away from the whole process. Also, in order to facilitate negotiations and speed up the entire implementation process, the task of determining the level of nullification and impairment should be made part of the Article 21 compliance review. Such a change would not overly burden the compliance panel and would further clarify the amount of nullification or impairment at a much earlier stage in the process, allowing both the complaining members and Member concerned to better address the situation and provide more time to negotiate a settlement between the parties.

Time Savings: At present, the period between the start of a dispute and its final determination may be up to three years. This period is too long for complainant developing countries, as their capacity to absorb the adverse effects of measures taken against them is considerably low. This can be improved by making suitable amendments in the time-frame of the relevant provisions of Articles 4, 5, 6 and 12 of the DSU, especially in all the complaints brought by a developing country against a developed country.

In summary, substantial reform can be undertaken in the DSB if concerted efforts are made to quantify the impairments for working out suspension of concessions so that proposed countermeasures are appropriate and also not in contradiction with other provisions of the WTO.

Quantification of the Impairment or Nullification that has arisen from the breach of WTO obligations

There is a need to quantify the above to estimate the retaliation measures required by the defendant under Article 22. In other words, in arbitration cases under Article 22.6 of the Dispute Settlement Understanding (DSU), a quantification of counterfactual trade effects has been a key device for some arbitrators to fulfill their mandate – namely, to determine the level of nullification or impairment of benefits suffered by a complaining Member, which the requested suspension of concessions or other obligations must not exceed. The key challenge for arbitrators usually lies in determining what trade flows would have been in the absence of the unlawful measure. So far, this so-called "trade effects approach" that equates nullification or impairment with the value of trade foregone has been the principal tool used to determine the final arbitration award. Closest to describing this type of analysis are probably

Sumner *et al.* (2003), Malashevich (2004), Keck (2004) and aspects of Horn and Mavroidis (2003).

Conclusions and Some Suggestions

It is a recognized fact that the current system of DSU is a rule-based multilateral trading procedure and is a principal tool which can help developing countries protect and promote their interests. However, doubts have emerged regarding the possibility of the developing countries to use the system effectively. The issue is the effective participation of all the developing countries in the DSU. This seems to be the fundamental problem with the dispute settlement process of the WTO. Also, the delay in the whole process of the DSU lies inherently with some articles of the DSP. This note has reviewed the articles of the DSU in order to make them work in the better interest of all.

Most of the developing member countries objectively fail to engage as either complainants or interested third parties in formal dispute settlement activity related to their market access interests. It has been proposed in addition to the provisions for technical assistance in the DSU, a new Article should be introduced for the creation of a fund for dispute settlement to facilitate the effective utilization by developing and least-developed country Members of the DSU. The fund is proposed to be financed from the regular WTO budget or a small cess on Membership contributions or otherwise within the framework of the Doha Development Round. We see a role of research organizations, legal service centres, development organizations, international trade litigators, economists, consumer organizations, and law schools to provide poor countries with the services needed at critical stages of the WTO's extended litigation process.

The WTO cannot force the country losing an arbitration case to change the domestic laws and regulations that do not comply with WTO obligations; neither can the WTO impose "stiff financial penalties" for noncompliance. Disputes arise when countries differ on the application of the WTO legal framework. In such cases, members should agree that the WTO dispute settlement mechanism will resolve disagreements. As with other international arbitration systems, the WTO mechanism is placed outside the domestic institutions of any of the parties to the dispute—no country wants to have its differences with another nation decided by domestic institutions of the other party. Once the Dispute Settlement Body, which is made up of all WTO Members, has adopted a decision that finds a member country not in compliance with some aspect of the WTO

agreement, there are three alternatives. First, the Member country can change its offending practice, but the WTO cannot force it to do so. Second, the country at fault could offer the complaining country market access in a different product that would be equivalent to the value of trade lost because of the offending practice. These compensations are defined and accepted by the countries in dispute. If they still cannot reach an agreement, the alternative left is for the complaining country to withdraw equivalent trade concessions from the country found at fault. These trade sanctions should be defined and administered by the complaining country. Moreover, the sanctions are not "stiff financial penalties," but are simply the withdrawal of trade concessions previously agreed upon.

In response to criticism being leveled against the dispute settlement understandings (DSUs) own rules and procedures from NGOs, former President Clinton[15] has proposed that "hearings by the WTO be open to the public, and all briefs by the parties be made publicly available and that the WTO provides the opportunity for stakeholders to convey their views... to help inform the panels in their deliberations." Most WTO members, are expected to resist such a proposal of transparency in the dispute settlement process on the grounds that NGOs should not interfere in the policy decisions of the member states. However, now South Asia's position has moved from the prohibition of consideration to the prohibition of acceptance of unsolicited information, notwithstanding the concern of the lack of equality of parties at all stages of the DSU. This latter step by the developing nations may prompt developed nations to offer some leverage in S & D treatment in the DSU.

Open proceedings and public access to submissions would help private parties with an interest in a dispute to play a more active role in support of the government officials engaged in the litigation. It is important to note here that many trade disputes are at their heart not disputes between governments, but rather disputes between private parties with competing economic interests. The greater the role that the real parties in interest can play, especially in fact-intensive cases like trade remedy disputes, the easier it will be for governments to focus on the larger policy questions at issue.

Quantification of dispute cases will be an aid to the legal proceedings of the Dispute Settlement process. Multilateral trade rules reflect key economic principles such as comparative advantage, and that

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[15] Speech by President Clinton at WTO Ministerial Conference 18 May, 1998. Detailed proposals were tabled by the US and the EU in the General Council on 22 July, 1998.

many of the terms in WTO Agreements, which are important in the resolution of disputes, have an economic basis. It may also have to do with the fact that increasing numbers of disputes are reaching the implementation phase, in which arbitrators need to quantify the allowable level of retaliation.

More importantly, developing and least developed nations instead of necessarily insisting on the S & D treatment for costs of litigation, and non compliance, must seize the opportunity to strengthen their cases by garnering support from every member state of the WTO.

The panel should be mandated to determine the amount of compensation in all cases where measures by developed countries against developing countries are found to violate the WTO rules. This will help prevent the initiation of trade-related measures on frivolous grounds by developed countries, and hence will serve an important objective of the dispute settlement process, that is, the prevention of trade disputes. Owing to the asymmetric legal powers and economic capacities of developed and developing countries, the former may bring a large number of disputes, some even on frivolous grounds, against the latter. There have also been instances where developed countries brought repeated cases, on the same grounds, against developing countries.

The proposals to address these issues should include:

(i) The complainant developed country may be asked to pay the cost of the dispute incurred by the defendant developing country, if the case brought by the former is not maintained by the Panel/Appellate Body.

(ii) WTO members may be prohibited from bringing cases against a developing country member once a case on similar grounds involving the same developing country has been decided by a Panel/Appellate Body.

(iii) The panels and the Appellate Body should be directed to give, to the extent possible, transparent and clear rulings that are less prone to conflicting legalistic interpretations so that once the case is decided it should not be appealed against on similar grounds again.

The United States, the European Union, and other larger trading entities, to be sure, have some flexibility in ignoring some aspects of WTO law in a particular case. They can delay compliance; they can compensate

indefinitely; they can shrug off or suspend concessions. They can get away with quite a bit. But the extent to which they can do so is not unlimited. Every step they take in the direction of non-compliance does some damage, however minor, to the dispute settlement system and to the WTO. Since developed country members have an interest in preserving that system, they have a strong incentive to limit the use of the extra-legal flexibility they may enjoy by virtue of their size and wealth. As long as this is the case, the comparative inability of developing country members to impose sanctions will not be a major impediment to their ability to benefit from the dispute settlement system.

It seems that the Balas text on reforming the dispute settlement process needs further strengthening to make it work for the interest of all; not least of all, the developing countries.

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Book Review

Levitt, Steven D., and Stephen J. Dubner, *Freakonomics: A Rogue Economist Explores the Hidden Side of Everything*, Harper Collins Publishers, New York, NY, 2005, pp 356, Price: Hardback $ 27.95.

Ever wondered why drug dealers still live with their mothers? Why the United States' crime rate plummeted to new lows in the 90s? Why did the racist hate group the Ku Klux Klan (KKK) falter as an organized unit in America? What do school teachers and sumo wrestlers have in common? "Why" is something Steven D. Levitt does not cease to question. Levitt along with his amanuensis, Stephen Dubner has written a classic titled, *Freakonomics*.

His is a simple two pronged formula: Fielding questions few people dare to ask, followed by mountains of data and rigorous statistical analysis which seem second nature to even those who consider economics a 'dismal science'. The book deals with economics at the street level and with popular culture. Deceptively easy to read, its style so lucid and succinct, its tone so humorous, that it is hard to realize that this book attacks some basic assumptions in life, and in turn raises eyebrows.

Levitt graduated from Harvard in 1989 *summa cum laude* and received a Ph.D. in economics from MIT in 1994. Now a chaired professor at the University of Chicago, he recently won the John Bates Clark medal, which is awarded every two years to America's most promising economist under the age of 40, and is often considered a precursor of a potential Nobel laureate. Levitt says that he still can't understand why he won the medal. "I was always puzzled by that. I really was. I've always thought of myself as a kind of a freak, of a dilettante, operating at the fringes of the profession."

The entire purpose of *Freakonomics* is to reveal counterintuitive and often disturbing truths. Levitt puts forward a true picture of the world, and does not care what we want to see in that picture. Imparting truth throughout the book, the economist goes on to propound that people respond to economic incentives, which is fairly rational, and that incentives

predict human behavior. Both Levitt and Dubner go against the one-dimensional theory, so near and dear to purist economists and orthodox social scientists alike – that profit maximization is the sole motivating factor for humankind.

Giving the concept of incentives a rather out-of-the-ordinary tinge, the authors observe that in cities with high murder rates, having more police officers does not mean that the officers are causing murders. This leads us to further, less intuitive examples. For instance, the presence of books in a household seems to be an effect of educated and motivated parents, and thus a good predictor of how their children will perform in school. Steven Levitt has something else in store for you: the presence of books he concludes is not a cause; therefore, asking your child to read will not necessarily enhance his/her test score.

The authors show the precariousness of the drug trade by pointing out that the fatality rate for street dealers is greater than that of inmates on death row in Texas. They also demonstrate the power of information, and pay tribute to the internet which has eroded the pricing power of realtors and automobile dealers alike. They relate this quality of the internet to the Ku Klux Klan's demise, which was brought about by an infiltrator who broadcast the group's secrets, thus making information easy-to-get.

Levitt not only crusades against conventional wisdom, he violates expert wisdom as well, and at times makes our common sense seem nonsense. Levitt and Dubner try to demolish the common misperception that money leads to success in politics by arguing that, in fact, success attracts money, and not the other way round. They say that when big-spending politicians run for re-election against repeat opponents, the results usually reflect those of the previous election. As evidence he puts forward Thomas Golisano as an example who has spent $93 million in trying to become Governor of New York, but has never captured more than 14 percent of the vote.

There is yet another surprise: Swimming pools are much more dangerous to children than guns! In the Unites States, 175 children under 10 got shot and killed each year, whereas around 550 children under 10 drown in their parent's pool every year, which accounts for one child drowned for 11,000 homes with a pool (there are a lot of residential swimming pools in the US).

If there is a flaw, it is the awkward co-authorship of the book and the profuse promotion of Levitt throughout much of the text. The book

tilts heavily on the article written by Levitt, and every chapter starts with an italicized excerpt from the article, which often raises Levitt to an exalted status.

This book is not a political or moral philippic. Nor does it ask the same questions that your professor at college would ask. But caution: Readers might start viewing the world with much more skepticism than before.

Lahore School of Economics **Sohaib Shahid**
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