

The logo for the Pakistan Development Review (PDR) features the letters 'PDR' in a bold, sans-serif font. The 'P' is blue, the 'D' is red, and the 'R' is blue. The letters are set against a white background within a square frame.

The PAKISTAN DEVELOPMENT REVIEW

ARTICLES

Shumaila Zeb and Abdul Sattar

Financial Regulations, Profit Efficiency, and Financial Soundness:
Empirical Evidence from Commercial Banks of Pakistan

Abdul Waheed

The Employment Effect of Innovation: Evidence from
Bangladesh and Pakistan

Muhammad Ashfaq Ahmed

Pakistan: State Autonomy, Extraction, and Elite Capture—
A Theoretical Configuration

Anwar Hussain and Rabia Bangash

Impact of Climate Change on Crops' Productivity across Selected
Agro-ecological Zones in Pakistan

BOOK REVIEW

Volume 56

Summer 2017

Number 2

www.pide.org.pk



C O N T E N T S

	<i>Pages</i>
ARTICLES	
Shumaila Zeb and Abdul Sattar , Financial Regulations, Profit Efficiency, and Financial Soundness: Empirical Evidence from Commercial Banks of Pakistan	85
Abdul Waheed , The Employment Effect of Innovation: Evidence from Bangladesh and Pakistan	105
Muhammad Ashfaq Ahmed , Pakistan: State Autonomy, Extraction, and Elite Capture—A Theoretical Configuration	127
Anwar Hussain and Rabia Bangash , Impact of Climate Change on Crops' Productivity across Selected Agro-ecological Zones in Pakistan	163
BOOK REVIEW	
<i>Nadeem Ul Haque</i> . Looking Back: How Pakistan Became an Asian Tiger by 2050 Idrees Khawaja	189
SHORTER NOTICE	191

Financial Regulations, Profit Efficiency, and Financial Soundness: Empirical Evidence from Commercial Banks of Pakistan

SHUMAILA ZEB and ABDUL SATTAR

The purpose of this paper is threefold. First, it measures profit efficiency and financial stability of commercial banks of Pakistan. Second, it empirically estimates the effect of the already implemented financial regulations on the profit efficiency and financial stability of banks. Third, it examines the differential effect of financial regulations on profitability and financial soundness across bank size. To carry out the empirical analysis, a balanced bank-level panel data covering the period 2008-2014 is used. To gauge the profit efficiency of commercial banks, Data Envelopment Analysis (DEA) is utilised, while, to proxy the financial soundness, the Z-score is calculated for each bank. The panel regression approach is used to examine the effects of financial regulations on the profit efficiency and financial soundness of banks. We find that the financial regulations enforced by State Bank of Pakistan (SBP) have significant impacts on the profit efficiency and financial stability of banks. The results indicate that the non-performance loans to assets ratio (NPLL) and the reserve ratio (RR) impact positively, whereas, the liquidity ratio (LIQR) and the loans to deposits ratio (LODEPOSIT), significantly and negatively affect the profit efficiency of banks. However, only LR and RR are positively and significant related to the financial stability. The results also suggest that the financial regulations have significant differential effects on the profit efficiency and financial soundness of banks across bank size.

JEL Classification: C23, E44, G21, G28

Keywords: Profit Efficiency, Financial Soundness, Financial Regulations, Data Envelopment Analysis, Z-Score, Differential Effects

1. INTRODUCTION

The recent global financial crisis has stimulated interest to recognise and improve financial regulations that would work best in the development, performance, and stabilisation of commercial banks. An efficient banking sector plays an important role in financial and economic stability of a country. The overall activities of banks are significantly influenced by financial regulations imposed by the central banks. Principally, financial regulations are directly related to the behaviour of commercial banks. Specifically, financial regulations mainly aim at enabling banks to improve their profitability and stability. However, whether their implementation enhances the efficiency or impedes it is an empirical question. Yet, when we look at empirical

Shumaila Zeb <shumaila.zeb@gmail.com> is Assistant Professor, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Islamabad campus, Islamabad. Abdul Sattar <abdulsattar77@yahoo.com> is Assistant Professor, Bahria University, Islamabad.

Authors' Note: We are grateful to Dr Abdul Rashid, Associate Professor, International Islamic University, Islamabad for his valuable comments and great support through out the research.

literature we find that there is very little evidence on the issue whether financial regulations really enhance or indeed slow down the profit efficiency of commercial banks.

Like many other developing countries, the banking sector of Pakistan contributes significantly to economic growth.¹ The banking sector functions within a certain regulatory framework laid down by the State Bank of Pakistan (SBP). The regulatory framework of SBP incorporates Basel Accords as well. These accords definitely help banks to improve their stability and risk management capabilities. Further, commercial banks cannot work in isolation. The banks need to integrate with international financial markets to expand their businesses. Therefore, the compliance with Basel Accords helps them to integrate into international financial markets more quickly. The Basel Accords also help banks to improve their capital requirement and strengthen their interconnectedness with foreign banks operating across the globe. The commercial banks of Pakistan are already following Basel II. The SBP is on its way to move to Basel III, which is an unimproved version of Basel II. The Basel III has more strict capital requirements for banks. As per SBP instructions, banks have to maintain a capital adequacy ratio (CAR) of 10 percent and Tier 1 capital of at least 6.0 percent of the total risk weighted assets (RWA). There is also additional capital conservation buffer (CCB) of 2.5 percent of total RWA. The SBP is giving ample time to the banks to prepare themselves for meeting the requirements of Basel III.

Reviewing the existing empirical literature, we observe that researchers have paid less attention to the efficacy of these implemented financial regulations with respect to profit efficiency and financial stability of banks operating in Pakistan. Yet, these financial regulations are definitely regulated and imposed not only to protect but also to improve the confidence level of both the consumers and the investors. The financial regulations are expected to directly affect the behaviour of commercial banks. The financial regulations are imposed with the aim of improving profitability and stability of commercial banks, which, in turn, increase the financial stability of the whole system. However, the question between the lines is that whether the implementation of these financial rules and regulations really improve profitability of banks. It would also be worth exploring whether the bank size matters in the effectiveness of financial regulations with regards to profitability and risk management. This study is an attempt to find the answer to these questions.

In particular, the study investigated how financial regulations affect profit efficiency and financial strength of commercial banks of Pakistan. The main purpose of this study is threefold. First, the study aims to calculate profit efficiency of commercial banks using DEA and the financial stability based on Z-score. Second, the study aims to explore the impact of financial regulations on the profit efficiency and risk taking behaviour of commercial banks of Pakistan. Third, it examines the differential effect of financial regulations on the profit efficiency and financial soundness across the bank size. To do this, we classify banks into three subgroups (large, medium, and small banks) as per their total assets. The main rationale behind this division is to see whether financial regulations have different effects for different size of banks. Examination of differential

¹As a component of services sector, financial sector contributes 6.6 percent into gross domestic product [Pakistan Economic Survey (2012-13)].

effects of financial regulations is also rationalised, based on very a well-know Finance theory, namely “Too Big to Fail”.

Our empirical investigation consists of two phases. In the first phase, we calculate profit efficiency by using Data Envelopment Analysis (DEA) and financial stability based on the Z-score. In the second phase, we empirically examine the impact of financial regulations on the profit efficiency and risk taking behaviour of banks. The study uses quarterly data covering the period 2008-2014 for all commercial banks operating in Pakistan during the examined period. The empirical models of profit efficiency and financial stability are estimated using the fixed effects estimator in a panel framework. The ratios that we use to proxy financial regulations are reserve ratio, provision coverage ratio, liquidity ratio, loan to deposit ratio, capital adequacy ratio, and leverage ratio. The leverage ratio is also being investigated because it is one of the requirements of Basel III. The choice of these ratios is based on prior literature and availability of data.

We find that the financial regulations enforced by SBP have significant impacts on the profit efficiency and financial stability of banks. Our results reveal that the non-performance loans to assets ratio (INPLL) and the reserve ratio (RR) positively, whereas, the liquidity ratio (LIQR) and the loans to deposits ratio (LODEPOSIT), significantly and negatively affect the profit efficiency of the banks. The results also suggest that the financial regulations have significant differential effects across bank size. For instance, although the capital adequacy ratio (CAR) has a positive and significant effect on the profit efficiency of medium and small banks, it does not significantly affect the profit efficiency of large banks. Likewise, large banks’ profit efficiency increases with the leverage ratio (LR), whereas, the LR has a negative impact on the profit efficiency in case of both the small and medium size banks. The RR has also differential effect across bank size, positively (negatively) affecting the profit efficiency of medium (small and large banks) banks.

The findings regarding the effects of financial regulations on financial soundness of banks suggest that in case of full sample, only LR and RR are positively and significant related to the financial stability. Estimating the differential effects of the financial regulations across bank size we show that the negative impact of CAR on the financial health of banks is statistically significant only in case of medium banks. However, LIQR, LODEPOSIT, NPLL deteriorate the financial soundness of all size of banks. In contrast, the financial stability of large banks decreases with LR, whereas, the financial stability of small and medium banks strengthens with LR.

The empirical findings of the paper are useful for policy-makers, regulators, and management of commercial banks. Specifically, the results help policy-makers and regulators to understand the impact of already implemented financial regulations on the profit efficiency and financial stability of commercial banks of Pakistan. Therefore, the policy-makers should design such policies that help the commercial banks to increase their profit efficiency and mitigate the excessive risk taken by them.

The rest of the paper is structured as follows. Section 2 reviews the existing literature. The methodology, data description, and variable construction are given in Section 3. Section 4 presents the empirical findings. Finally, Section 5 presents the conclusions of this study.

2. LITERATURE REVIEW

Depending upon the structure and functions of concerned economy, the efficiency of banking sector is of vital importance both in the developed and the developing economies. The SBP has imposed financial regulations on the commercial banks of Pakistan to improve the performance of commercial banks. These financial regulations relate to compliance with Basel Accords. This study is an attempt to empirically examine the impact of financial regulations on the profit efficiency and risk taking behaviour of commercial banks of Pakistan. Therefore, it would be useful to present a brief explanation of the banking regulations imposed by SBP and Basel III. Next, we review the studies that have focused on examining the efficiency of commercial banks. Finally, we present the summary of the literature on the influence of financial regulations on profit efficiency and bank risk.

2.1. Financial Regulations: A Brief History

The development of banking sector of any economy is closely linked with the development and growth of economy. No economy can increase its growth and well-being of its population without having a strong financial sector. The banks in Pakistan constitute 95 percent of the financial sector. All the financial regulations imposed by the SBP completely follow the Basel Accords. Currently Pakistan is following Basel II. The SBP has given clear instructions to the banks to start preparing themselves for Basel III. The risk management practices are being customised by the SBP in order to increase reliance on Basel II with an aim of moving towards Basel III.

The capital requirements have been made stringent for the banks in order to prepare banks for Basel III. As per the SBP instructions, all the commercial banks have to maintain a Carob 10 percent. In addition leverage ratio is also being introduced in Basel III. The required Leverage ratio as per Basel III is 3 percent. There is also additional capital conservation buffer (CCB) of 2.5 percent of total RWA. The SBP wants banks to comply with Basel III in phases, with an aim of full implementation by December 2019.

The provision coverage ratio requirement reflects how the regulators want the banks to set aside a certain portion of their assets as a preventive measure to be used in case of any emergency. The required ratio set by SBP is 14.3 percent. The required reserve ratio for the banks of Pakistan is 5 percent. This ratio is basically to secure the solvency of banks and drain out the excess money from the banks. This ratio helps to control money supply.

The SBP regulates the liquidity ratio to enable the banks to improve the short-term obligations of the banks. The SBP revised it from 15 percent to 18 percent since 2006 to enable the bank to advance more loans. Loans to deposit ratio declined to 60 percent in April 2012 from about 67 percent in April 2011. Banks invest about 44 percent more funds mostly in government treasury bills and bonds and also in stocks and other approved securities.

2.2. Efficiency and Financial Regulations

Depending upon the structure and functions of the concerned economy, the efficiency of the banking sector is quite important, both in the developed and the developing economies. The efficiency of the banking sector has emerged as a

multidimensional perception and is widely being explored in the literature, either being measured through data envelopment analysis (DEA) and stochastic frontier analysis (SFA) around the globe. The financial sector's efficiency and the strategies being followed can be noticed in their financial statements. However, there are differences between variable selections being used for analysing the relationship for banking efficiency at all levels.

When we review the literature on Pakistan, we find that there are several studies that examine the efficacy of commercial banks. Rizvi and Khan (2001) using the DEA method for analysing the efficiency of commercial banks of Pakistan found that the banks in the field of productivity and efficiency make no major improvements. The foreign banks are found to consume resources in a more effective and efficient manner [Burki and Niazi (2003)]. Yet, the empirical evidence suggests that the efficiency of commercial banks of Pakistan has improved since 2000. The foreign banks are found to be more efficient than the local commercial banks.

There is another study conducted by Ahmed (2008) using data on 37 commercial banks of Pakistan for the period 2001-2004. The findings of the study indicated that the banks included in the sample needs to improve asset structure and interest earnings to improve their efficiency. Further, the author argued that the government should not promote mergers of commercial banks. Rather, they should take steps to increase their profit efficiency.

Akhtar (2010) examined the efficiency of commercial banks in Pakistan. He used annual data covering the period 2001-2006 and employed the DEA to measure efficiency. The results indicated that the average efficiency scores of the banking sector of Pakistan have been very low. The study further explored that foreign banks operating in Pakistan perform better than the local banks.

Turning to the impact of financial regulations on profit efficiency, we find that relatively less work has been done to examine the impact of financial regulations on the efficiency of commercial banks around the globe. Hermes and Meesters (2015) investigated how financial liberalisation and regulations effect bank efficiency. The efficiency of public listed banks of 61 countries was calculated using SFA. They found that the profit efficiency of commercial banks was conditional on the extent of financial regulation and financial liberalisation. Similarly, Gaganis and Pasiouras (2013) investigated the relationship between profit efficiency of commercial banks and financial supervision of central banks. They found that the profit efficiency of the banks decreases with increases in a number of the financial institutions supervised by the central bank. The independence of central bank was found to be negatively and significantly related to the profit efficiency of banks.

Lee and Chih (2013) investigated the impact of already implemented financial regulations on Chinese banking efficiency and risk. Using bank total assets they categorised banks as large and small banks. Their findings suggested that the cost to income ratio and provision coverage ratio both were found to be more important for large banks, while the loans to deposits ratio, the capital adequacy ratio, and the leverage ratio are found to be more important for small banks. Their findings further suggested that the liquidity ratio did not affect commercial banks of China.

Barth, Lin, Seade, and Song (2013) investigated the relationship between bank regulations, supervision, and efficiency of banks. They used an unbalanced panel of 72 countries covering the period 1999–2007. They found that strict restrictions on bank activities had a negative and significant relationship with the efficiency of the bank. They further found that there is a positive and significant relationship between capital regulation and the bank efficiency. Moreover, they found a significant relationship between ‘efficiency’ and ‘experienced supervisory and market based monitoring’.

Pasiouras, Tanna, and Zopounidis (2009) used SFA approach to analyse the impact of regulatory and supervision framework on bank efficiency. They included 615 commercial banks operating in 74 countries in their sample for the period 2000-2004. The results suggested that there is a positive and significant relationship between supervisory power and profit efficiency. The strict capital requirements were found to have a positive and significant relationship with the cost efficiency, but a negative relationship with the profit efficiency. Furthermore, they found that high restrictions have negative and significant effects on the cost efficiency, whereas, positive and significant impacts on the profit efficiency.

Barth, Caprio, and Levine (2008) provided mixed results about the impact of financial regulations on the performance of commercial banks of 150 countries. They first highlighted the data insufficiency in order to calculate the impact of financial regulations on performance of the banks. Their empirical findings revealed that restricting banking activities can reduce the bank efficiency but it could also increase the probability of the bank default. They also found that stringent regulations are not significant for profit efficiency of the banks.

Naceur and Omran (2008) explored the influence of financial regulations, financial and institutional development on commercial bank profitability across Middle East and North Africa (MENA) countries. He used the panel data covering the period 1989–2005. He found that bank-specific characteristics positively and significantly impact banks’ net interest margin, cost efficiency, and profitability. The regulatory variables found to have a significant and positive impact on banks’ performance. His empirical results also demonstrated that the corruption increases the cost efficiency and net interest margins. Finally, he suggested that improvements in law and order cause variable decreases in the cost of efficiency without affecting the overall performance of the banks. Barth, Caprio, and Levine (2008) provided mixed results in the relationship between financial regulations and efficiency of commercial banks. They found that restricting banking activities can reduce bank efficiency, but it could also increase the probability of default of the bank. They also found that stringent regulations are not statistically significant for the profit efficiency.

2.2. Financial Regulations and Insolvency

In general, it is evident that various regulations and capital requirements positively affect performance and risk taking behaviour of the banking sector. In this subsection, we review the studies that have focused on analysing the effects of financial regulations on the financial soundness of banks.

Recently, Rashid and Yousaf (2016) examined the empirical determinants of financial strength of Islamic and conventional banks of Pakistan. They also investigated

how the competitive conduct of banking affects the banking system stability. They used quarterly data of 10 conventional banks, 4 full fledged Islamic banks, and 6 standalone Islamic branches of conventional banks of Pakistan. Their analysis covered the period 2006–2012. They found that Islamic banks are relatively more financially stable as they have a higher mean value of Z-score. Doing regression analysis, they found that several bank-specific variables, namely income diversity, loans to assets ratio, bank size, and market concentration ratio, are significant in determining the stability of banks of Pakistan. Finally, they have shown that, as compared with conventional banks, Islamic banks contributed more profoundly in the stability of financial sector during the examined period.

Fu, Lin, and Molyneux (2014) investigated 14 Asia Pacific economies for the time period 2003 to 2010 to explore the impact of national institutions, bank competition, regulation concentration, and on individual bank fragility. The bank's fragility was measured by probability of bankruptcy and the bank's Z-score. They found that the risk could be reduced for the commercial banks by controlling certain macroeconomic, bank-specific, and regulatory parameters. They also found that tougher entry restrictions are good for the stability of banks, but strong deposit insurance schemes are significantly related with fragility of the bank.

Alam (2013) investigated whether banking regulations, supervision, and monitoring enhance or impede the technical efficiency and risk taking behaviour of Islamic banks across the globe. He found that financial regulations, strict monitoring of operations, and advanced supervisory power of authorities help to increase the technical efficiency of Islamic banks. More strict financial regulations and supervision can affect banking efficiency. He also found that a powerful supervisory body can also increase inefficiency of banks.

Zhang, Wang, and Qu (2013) examined how law enforcement affects a bank's risk taking ability and efficiency. They used a sample of 133 commercial banks across 31 regions for the period from 1999 to 2008. They found that strong law enforcement leads to encourage larger bank risk taking behaviour in the region. Their findings suggested that Chinese commercial banks performance is greatly affected by law enforcement efficacy within the region. They concluded that regions having a better legal environment and protection of intellectual property rights have positive and significant impact on the efficiency of banks.

Murari (2012) examined insolvency risk for 80 public, private, and foreign Indian banks. He constructed the Z index for the period 2005-2009. He found that the probability of bankruptcy of Indian banks has declined over the years. Das (2012) examined insolvency risk of commercial banks in India for the period 1998–2007. He found that Indian private banks are most risky, whereas, the foreign banks are found to be least risky for their fat capital cushion.

Beck, Demirgüç-Kunt, and Maksimovic (2008) argued that countries that require banks to regularly report their financial data to regulators and market participants are financially stable. They emphasised the significance of transparency in making supervisory processes effective and strengthening market discipline. Lepetit, Nys, Rous, and Tarazi (2008) explored the impact of non-interest revenue on risk structure of banks. They used sample of 734 listed and non-listed banks in 14 European countries. The

insolvency risk was quantified by Z-score. They found that small banks were less risky while larger banks were less exposed to risk.

Laeven and Levine (2007) found that the financial regulations that encourage diversification help in reducing risk of the banks. Specifically, they showed that financial regulations encourage banks to be more diversified either by requiring them to expand their loan portfolios or by allowing them to engage in more lending and non-lending activities. They also found that banks' supervisory activities and regulatory restrictions increase bank risk. Their findings suggested that diversifying income reduces bank risk.

Altunbas, Carbo, Gardener, and Molyneux (2007) examined the relationship between capital, risk, and efficiency for European banks for the period 1992–2000. They found that inefficient European banks hold more capital and undertake less risk. However, they further noted that there exists a significant relationship between risk and capital for commercial banks. They also found that for cooperative banks, capital is inversely related to risk and that inefficient banks hold less capital.

Fell and Schinasi (2005) found that financial regulations, which restrict financial activity, can avert systemic problems and help banks in attaining financial stability. Barth, Caprio and Levine (2004) empirically examined bank regulation and supervision for 107 countries. They concluded that large banks with less supervisory activities tend to involve in more high risk taking activities. Banks would take benefit of great freedom to raise bank asset portfolio risk.

3. EMPIRICAL FRAMEWORK AND METHODOLOGY

3.1. Measuring Profit Efficiency

The three main approaches extensively used in the literature for the examining the profit efficiency of financial institutions are 'financial indicators analysis', 'stochastic frontier approach (SFA)' and 'data envelopment analysis (DEA)'. In this study, we employed the DEA method. The DEA approach is comparatively simple and provides more information regarding profit efficiency of banks as compared to other methods.

The DEA method needs banks' inputs and outputs, the choice of which is always arbitrary. Out of a vast range of the ways for defining and categorising input and output variables in banking literatures, we prefer the intermediation approach.² The previous studies have also applied this approach to gauge the profit efficiency [Das and Ghosh (2009) and Arif, Badar, Mohammad, and Hassan (2008)]. The intermediation approach is considered relatively better for the evaluation of frontier efficiency for the profitability of commercial banks [Iqbal and Molyneux (2005)]. In this study, funds and fixed assets with their respective prices are used as inputs while loans and investment with their respective prices are used as output. Table 1 lists the variables used in the DEA.

²The intermediation approach was suggested by Sealey and Lindley (1977). It views banks as an intermediary of financial services and assumes that banks collect funds (deposits) and transform them into loans and other assets. The intermediation approach is preferred over production approach, first proposed by Benston (1965) because it suits the nature of banking industry more than the production approach.

Table 1

Input and Output Variables for Calculating Efficiency

Variable Type	Variable Name	Description
Input	Fixed assets	Capital
	Funds	Total deposits plus total funds
Input Price	Price of fixed assets	Operating expenses to fixed assets
	Price of funds	Interest expenses to total funds
Output	Total loans	Total of short term and long term loans
	Investment	Total Investments
Output Price	Price of loans	Interest income on loans to total loans
	Price of investment	Operating income to investments

3.1.1. The Profit Efficiency Model

As in Lee and Chih (2013), consider a bank which produces m outputs using n inputs. If the bank can produce output bundle y by using input bundle x , then the input-output bundle (x, y) would be considered feasible. We can explain the technology used by the bank in production possibility framework.

$$T = \{(x, y): y \text{ bundle of output can be produced using } x \text{ bundle of inputs}\}$$

In case of single output, the production function can be expressed as follows:

$$f(x) = \max y: (x, y) \in T$$

However, in case of multiple output, the production possibility frontier set would be the production correspondence $F(x,y) = 1$.

The data envelopment analysis (DEA) was first introduced by Charnes, Cooper, and Rhodes in 1978 by assuming the constant return to scale. After that, Banker, Charnes, and Cooper (1984) extended the DEA by considering variable returns to scale. In the DEA framework, the production possibility set can be constructed based on observed input-output bundles, which does not require assuming a functional form of the production technology. Specifically, we assume that (x^j, y^j) is input output bundle which is observed for bank j ($j = 1, 2, \dots, N$). Obviously, all these input-output bundles are considered to be feasible. Then the smallest production possibility set that meets the assumptions of convexity and free disposability and includes all these observed bundles is defined as follows:

$$S = \{(x, y): x \geq \sum_{j=1}^N \lambda_j x^j; y \leq \sum_{j=1}^N \lambda_j y^j; \sum_{j=1}^N \lambda_j = 1; \lambda_j \geq 0 \dots \dots \dots (1)$$

where $j = 1, 2, \dots, N$

For a commercial bank/firm, both inputs and outputs are choice variables, the feasibility of input output bundle chosen would be the only constraint. In this scenario, the criterion of efficiency is profit maximisation. Given w and p input and output prices, respectively, the actual profit of the firm producing the output bundle y^0 from input bundle x^0 is

$$\Pi^0 = p'y^0 - w'x^0 \dots \dots \dots (2)$$

Therefore, the maximum feasible profit for the firm is

$$\Pi(w, p) = \max p'y - w'x : (x, y) \in T \quad \dots \quad \dots \quad \dots \quad (3)$$

For any empirical analysis, the maximum profit can be obtained as

$$\Pi^* = \max p'y - w'x \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

$$s.t. \sum_{j=1}^N \lambda_j y^j \geq y; \sum_{j=1}^N \lambda_j x^j \leq x; \sum_{j=1}^N \lambda_j = 1; \lambda_j \geq 0 \quad \dots \quad \dots \quad (5)$$

where $j = 1, 2, \dots, N$

Finally, the profit efficiency of the bank is defined as $\delta = \Pi^0 / \Pi^*$. The DEA score ranges between 0 and 1 except when the actual profit is negative while maximum profit is positive. In that case, δ is less than 0. However, the δ will exceed unity in the case when the maximum profit is negative.

3.2. Calculating Z-Score

The Z-score measures the stability of banks by indicating the distance from insolvency. The Z-score indicates the number of standard deviations that a bank's return on assets that drop below to its expected value before equity is depleted and the bank is insolvent [Roy (1952) and Boyd and De Nicolo (2005)].

The Z-score uses probability of default being extracted by Roy (1952) and developed by Goyeau and Tarazi (1992), which can be written as:

$$Probability\ of\ default = Prob(\pi < -E) \quad \dots \quad \dots \quad \dots \quad \dots \quad (6)$$

We divide it by total assets and obtain returns on assets as follows:

$$Prob\left(\frac{\pi}{A} \leq -\frac{E}{A}\right) = Prob\left(ROA < -\frac{E}{A}\right) \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

Where ROA is return on assets and A is total assets of bank. The above expression can be written as follows:

$$Prob\left[\frac{(ROA - \mu_{ROA})}{\sigma_{ROA}} \leq \frac{(-\lambda - \mu_{ROA})}{\sigma_{ROA}}\right] = Prob\left[\frac{(ROA - \mu_{ROA})}{\sigma_{ROA}} < -Z\right] \quad \dots \quad \dots \quad (8)$$

where μ_{ROA} and σ_{ROA} are mean and standard deviations of returns on assets, respectively. Thus, the Z-score can be defined as follows:

$$Z - score = \left(\frac{E}{A} + \mu_{ROA}\right) / \sigma_{ROA} \quad \dots \quad \dots \quad \dots \quad \dots \quad (9)$$

3.3. Data Description and Sample Selection

To carry out the empirical analysis, we use quarterly data covering the period 2008–2014. The data are collected from bank financial statements, various issues of International Financial Statistics (IFS), World Development Indicators (WDI), and State Bank of Pakistan (SBP). Islamic banks were excluded from the study because of the differences in their operations.

Since the main objective of the study is to examine the effect of financial regulations on the profit efficiency and financial stability of banks, we consider all those

financial regulations that have already been implemented by SBP. Moreover, we also investigated the effect of leverage ratio, which is introduced in Basel III. The explanatory variables used in the study are the provision coverage ratio, the reserve ratio, the liquidity ratio, the loans to deposits ratio, the capital adequacy ratio, and the leverage ratio. Further, the establishment year of the bank is taken as a control variable. The detailed description of variables used in the study is given in Table 2.

Table 2

Definition of Variables for Profit Efficiency and Financial Soundness

Variables	Variable Name	Description	Required Ratio
1. Asset Quality			
NPLL	Provision coverage ratio	Non-performing loans to loans outstanding	14.3%
RR	Reserve ratio	Cash to deposits	5%
2. Liquidity			
LIQR	Liquidity ratio	Current assets to current liabilities	18%
LODEPOSIT	Loan to deposit ratio	Total loans to deposits	18%
3. Capital Adequacy			
CAR	Capital adequacy ratio	Capital to risk weighted assets	10%
LR	Leverage ratio	Tier 1 capital to asset ratio	3%
4. Control Variable			
TIME	Established time of bank	Cumulative year of establishment of individual bank	

Source: SBP and WDI.

As one of the objectives of the study is to examine the differential effect of financial regulations on profit efficiency and financial stability of banks across the bank size, we classify banks into three groups according to their size. Specifically, the sample banks are classified as per their assets structure. Using KPMG Banking Survey 2013, we divide the sample banks into three main categories: large, medium, and small banks. Banks with total assets in excess of Rs 400 billion are categorised as “large banks”, banks with total assets from Rs 101 billion to Rs 400 billion are categorised as “medium size banks”, and banks with total assets up to Rs 100 billion are categorised as “small banks”. According to this classification scheme, we identify 6 banks as large banks, 8 banks as medium size banks, and remaining 7 banks as small banks. The list of banks according to their size is given in Table 3.

Table 3

List of Banks

Large Banks	Medium Banks	Small Banks
National Bank of Pakistan	National Investment Bank	Silk Bank
Muslim Commercial Bank	Askari Bank	Samba
Habib Bank	Habib Metropolitan Bank	Bank of Khyber
United Bank	Soneri Bank	JS Bank
Bank Alfalah	Bank of Punjab	Barclays
Allied Bank	Bank Al-Habib	First Women Bank
	Summit	KASB
	Standard Chartered Bank	

Note: Classifications of banks is based on existing assets of banks.

3.4. The Estimation Method

Following the previous study of [Lee and Chin (2013)], we estimate the following models to achieve the objectives of the study.

$$EFFCY_{it} = \beta_i + \beta_1 CAR_{it} + \beta_2 LR_{it} + \beta_3 LIQR_{it} + \beta_4 LODEPOSIT_{it} + \beta_5 NPLL_{it} + \beta_6 RR_{it} + \beta_7 TIME_{it} + \varepsilon_{it} \quad \dots \quad \dots \quad \dots \quad (10)$$

$$Z - score_{it} = \beta_i + \beta_1 CAR_{it} + \beta_2 LR_{it} + \beta_3 LIQR_{it} + \beta_4 LODEPOSIT_{it} + \beta_5 NPLL_{it} + \beta_6 RR_{it} + \beta_7 TIME_{it} + \varepsilon_{it} \quad \dots \quad \dots \quad \dots \quad (11)$$

where *EFFCY* and *Z-score* are dependent variables calculated from the *DEA* and *Z-score*, respectively for i^{th} bank in quarter t . *CAR* is the capital adequacy ratio, *LR* is the leverage ratio, *LIQR* denotes the liquidity ratio, *LODEPOSIT* is the loans to deposits ratio, *NPLL* denotes the provision coverage ratio, *RR* represents the reserve ratio, and *TIME* is the year of establishment. β_i is bank-specific fixed effects and ε_{it} is error term having zero mean and constant variance.

We applied fixed effects (*FE*) estimator to estimate Equations (10) and (11). To overcome the problem of heteroskedasticity of errors, we estimate robust standard errors. We prefer the use of fixed effects estimator as it helps in controlling for surreptitiously heterogeneity, particularly, when it is constant over time. The fixed effects model is based on the assumption that there is no correlation between the individual-specific effects and the independent variables included in the model. In contrast, for random effects (*RF*) model, it is assumed that the explanatory variables are totally uncorrelated with the individual fixed effects. However, one should note that the assumption of no interaction between the explanatory variables and the individual specific effects does not hold, the random effects model does not yield consistent estimates, whereas, the fixed effects model produces consistent results. In general, it is very likely that bank-specific fixed effects vary with the characteristics of banks. Hence, the fixed effects estimator seems more appropriate to examine the effects of financial regulations on profit efficiency and financial stability of banks. A brief description of the fixed effects model is given as follows. Suppose the following general form of the linear unobserved effect model for N observation and T time periods.

$$y_{it} = \alpha_i + X_{it}\beta + \omega_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (12)$$

where y_{it} is the dependent variable, which is observed at time t for individual i . X_{it} is the $1 \times K$ vector of the time-variant independent variables. α_i is the unobserved time-invariant individual-specific fixed effect and ω_{it} is the error term. Under the fixed effects model, α_i are allowed to be correlated with X_{it} . Yet, the assumption of strict exogeneity is required for consistent estimates. Unlike X_{it} , the economists cannot directly observe α_i , the time-invariant individual specific fixed effects cannot directly be controlled. Therefore, implementing the fixed effects model one can eliminate them by demeaning the variables included in the model, using within the transformation.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

We start our empirical analysis by presenting summary statistics in Table 4. It can be observed from the table that the mean of profit efficiency is higher for large banks as compared to both small and medium banks. This implies that the profit efficiency of banks increases with their size. The standard deviation value, however, indicates that the profit efficiency of large banks is slightly more volatile than the profit efficiency of both small and medium banks. The mean value of Z-score suggests that large banks are relatively more financially stable. In terms of financial soundness, small banks stand at second number. This implies that medium banks are financially less sound as compared to both large and small banks. Yet, variations in Z-score are higher for small banks as compared to their large and medium counterparts.

Table 4

Descriptive Statistics

Variable	Bank Type	Mean	Median	Max	Min	SD
EFFCY	Large Banks	0.921	1.00	1.001	0.942	0.071
	Medium Banks	0.731	0.750	0.872	0.451	0.052
	Small Banks	0.451	0.451	0.700	0.452	0.061
Z-score	Large Banks	62.70	19.20	182.00	6.70	89.01
	Medium Banks	80.23	24.13	200.2	5.31	98.01
	Small Banks	70.14	28.12	370.00	0.73	113.00
CAR	Large Banks	0.195	0.152	0.973	0.019	0.140
	Medium Banks	0.494	0.134	12.02	0.001	1.123
	Small Banks	0.160	0.131	1.535	0.017	0.150
LR	Large Banks	0.096	0.095	0.161	0.044	0.029
	Medium Banks	0.177	0.070	2.281	0.001	0.324
	Small Banks	0.145	0.131	0.853	0.025	0.093
LIQR	Large Banks	8.202	7.872	19.30	3.755	2.637
	Medium Banks	9.540	4.990	3.940	0.060	31.98
	Small Banks	6.700	6.377	18.86	0.106	3.409
LODEPOSIT	Large Banks	0.953	0.619	35.53	0.001	3.057
	Medium Banks	2.070	0.620	99.10	0.003	8.122
	Small Banks	11.5	0.5	831	0.001	12.1
NPLL	Large Banks	0.521	0.097	59.95	0.008	4.987
	Medium Banks	2.771	0.177	94.92	0.003	11.04
	Small Banks	4.820	0.176	220.75	0.011	28.54
RR	Large Banks	0.195	0.109	7.923	0.065	0.6915
	Medium Banks	4.070	0.080	712.68	0.007	51.425
	Small Banks	1.842	0.078	167.87	0.034	14.636

The mean value of CAR is larger for medium size banks as compared to large and small banks. This implies that the capital adequacy ratio for medium banks is higher. The standard deviation indicates that CAR is more volatile in case of large banks compared with small and medium banks. Similarly, the mean value of LR suggests that medium bank have, on average, more Tier 1 capital compared with large and small banks operating in Pakistan. The standard deviation of LR indicates that this ratio is more volatile for small banks compared with other banks.

Medium banks are also likely to keep more liquid assets, on average. The mean of NPLL indicates that small banks are more likely to issue non-performing loans compared with both medium and large banks. However, summary statistics suggests that medium size banks have higher reserve ratio than small and large banks during the examined period.

4.2. Regression Results

In this subsection, we present the fixed effects model estimation results for the effects of financial regulations on the profit efficiency. To examine the differential effect of financial regulations, we also estimate EFFCY regression for large, medium, and small banks, separately. The results are given in Table 5. The adjusted R-squared and calculated F-statistics indicate that all the estimated models are a good fit to the data and the estimated models explain a substantial variation in the dependent variable. Examining the estimated coefficient for a sample of all banks, we find that CAR, NPLL and RR are significantly and positively related to the profit efficiency of commercial banks operating in Pakistan. On the other hand, LIQR and LODEPOSIT are negatively and significantly related to the profit efficiency. Specifically, we find that the estimated of coefficient of CAR (coefficient = 0.13) suggests that the banks having higher capital adequacy ratio are more efficient in earning profits. Since the estimated coefficient of LIQR is negative (coefficient = 0.18) and statistically significant at the 5 percent level, we can say that banks with more liquid assets in their reserves have low profit efficiency.

Table 5

Fixed Effects Estimation for Financial Regulation Effects on Profit Efficiency

Dependent Variable: <i>EFFCY</i>								
Variable	All Banks		Large Banks		Medium Banks		Small Banks	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
CAR	0.13*	1.67	0.13	0.90	0.10*	1.70	0.58**	2.94
LR	0.11	0.81	0.37	1.05	0.06	0.43	0.64**	2.40
LIQR	-0.18**	-1.98	-0.45**	-2.33	-0.22*	-1.32	0.42**	2.60
LODEPOSIT	-0.22*	-1.67	3.74	1.20	-0.50*	-1.83	0.09**	2.42
NPLL	0.23**	2.17	0.55**	2.80	0.20	0.80	-0.07	-1.14
RR	0.15*	1.18	-5.13**	-2.55	0.54**	2.67	-0.11**	-1.92
TIME	0.11	0.42	5.86	0.84	0.68*	1.38	0.80**	3.25
Adjusted R ²	0.71		0.76		0.69		0.74	
Hausman Stat.	5.07		4.15		4.05		6.07	
F-statistics	23.86		7.33		43.60		40.07	
Prob (F-stat.)	0.00		0.00		0.00		0.00	

*, **, and *** indicate significant at the 10 percent, 5 percent, 1 percent level significance, respectively.

The estimated coefficient of *LODEPOSIT* suggests that the profit efficiency of banks decreases with the loans to deposits ratio. The estimated coefficient of *RR* suggests that if other things remain fixed, a one-unit increase in the reserve ratio will increase the profit efficiency by 0.15 units, on average. The estimation results also reveal that both *TIME* and *LR* are not significantly related to the profit efficiency of all banks. These results are largely in agreement with our hypotheses.

Turning to the differential effects of financial regulations on the profit efficiency across bank size, we observe that *CAR* is positively and significantly related to the profit efficiency of medium and small banks. Yet, based on the magnitude of the estimated coefficient, we find that compared with medium banks, the profit efficiency of small banks is more affected by *CAR*. In contrast, *CAR* does not have any statistically significant effect on the profit efficiency of large banks. The *LR* does not significantly affect the profit efficiency of large and medium banks, whereas, it significantly and positively affects small banks' profitability, although it was insignificant when we estimate the model for whole sample.

The estimated coefficient of *LIQR* reveals that it negatively and significantly affects the profit efficiency of banks at all levels. However, the negative effects of *LIQR* are larger for small banks than that for medium and large banks. This implies that the profit efficiency of small banks is more sensitive to *LIQR* compared with the large and medium banks. Interestingly, *LODEPOSIT* positively and significantly affects the profit efficiency of small banks, whereas, it is negatively and significantly related to the profit efficiency in case of medium banks. The results also suggest that *LODEPOSIT* does not play any significant role in determining the profit efficiency of large banks.

The results given in the table suggest that both *NPLL* and *RR* have also differential effects on the profit efficiency. For instance, *NPLL* is significantly and positively related only to the profit efficiency of large banks, although estimated coefficient of *NPLL* for both medium and small banks appears statistically insignificant. The effect of *RR* is statistically significant for large, medium, and small banks. However, this effect is negative for large and small banks, whereas, it is positive in case of medium banks. Finally, we can see from the table that the variable *TIME* is significantly and positively related with the profit efficiency of medium and small banks. In summation, the results presented in Table 5 provide strong evidence of the differential effects of financial regulations on the profit efficiency of large, medium, and small commercial banks operating in Pakistan.

After establishing the effects of the financial regulations on the profit efficiency of banks, we turn to examine the effects of these regulations on financial stability of the banks. Similar to Table 6, we estimate four different models to examine the effects of financial regulations on banks' financial stability. The financial stability of banks is proxied by *Z-score*, which is calculated using Equation (9). The higher value of *Z-score* for a bank implies that the bank is financial sound and has less of a chance of default. The empirical model presented in Equation (11) is estimated by employing the fixed effects estimator. The results are given in Table 6. The adjusted *R-squared* and *F-statistics* suggest that all the estimated models are a good fit to the data and explain a significant proportion of total variation in the dependent variable.

Table 6

Fixed Effects Estimation for Financial Regulation Effects on Financial Soundness

Dependent Variable: Z-score								
Variable	All Banks		Large Banks		Medium Banks		Small Banks	
	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.
CAR	-0.05	-0.80	0.52	0.71	-0.45***	-4.92	0.002	0.01
LR	0.25***	4.07	-7.82*	-1.67	0.70**	2.87	1.05***	4.85
LIQR	-0.14**	-1.98	-1.14***	-3.09	-0.60**	-2.01	-0.05	-0.59
LODEPOSIT	-0.23**	-2.58	-1.32***	-4.46	-1.30***	-3.48	-0.22	-1.54
NPLL	-0.38***	-5.51	-1.30***	-4.65	-1.04***	-3.04	-0.27**	-2.43
RR	0.18**	2.01	1.01***	3.23	0.70*	1.53	0.38**	2.55
TIME	1.22***	6.15	2.66*	1.60	4.50**	2.07	1.87***	8.30
Adjusted R ²	0.73		0.39		0.65		0.86	
Hausman Stat.	4.19		3.20		5.01		4.12	
F-statistics	52.43		8.34		7.03		82.10	
Prob. (F-stat.)	0.00		0.00		0.00		0.00	

*, ** and *** indicate significant at the 10 percent, 5 percent and 1 percent level, respectively.

First we interpret the results of the model estimated for a sample of all banks. The estimates indicate that except CAR, all other variables included in the model are significantly related to Z-score. Specifically, the results indicate that both LR and RR are positively, whereas, LIQR, LODEPOSIT, and NPLL are negatively related to financial soundness of commercial banks. However, the results indicate that CAR does not have any significant influence on banks' financial soundness. The estimated coefficient of LR (coefficient = 0.25) suggests that if other things are unchanged, a one-unit increase in LR leads to an increase in Z-score by 0.25 units. Similarly, the RR coefficient is positive, suggesting that the financial soundness of banks increases with RR. On the other hand, the financial soundness of banks decreases by 0.23 and 0.38 units, respectively, due to a one-unit increase in LODEPOSIT and NPLL. Year of incorporation is also significantly and positively related with the financial soundness of banks.

The estimated results for the sub-sample indicate that the financial regulations have differential effects on the financial health of banks across the bank size. In case of large banks, all the variables are significantly and negatively related to Z-score, except the CAR and LR. The estimated coefficient of CAR and LR indicate that CAR is statistically insignificant, whereas, LR is significantly and positively related to the financial soundness of large banks.

The effects of financial regulations on medium banks' financial soundness are similar to those for the full sample except for CAR. The effect of CAR is negative and significant for medium banks, which was insignificant in case of full sample. In case of small banks, we find that both LR and RR are significantly and positively related to Z-score. We also find that NPLL is negatively and significantly related to Z-score, suggesting that small banks' financial soundness decreases when they issue more non-performing loans. Thus, the results suggest that issuance of non-performing loans has a negative effect on the financial soundness of large, medium, and small banks. Finally, we find that CAR, LIQR and DEPOSIT are not significantly related to financial soundness in case of small banks. As a summary, the results suggest that the financial regulations have considerable differential effects on the financial soundness of large, medium, and small banks.

5. CONCLUSION

In this study, we examined the effects of financial regulations enforced by SBP on the profit efficiency and financial soundness of commercial banks operating in Pakistan. We also examine whether the financial regulations' effects differ across large, medium, and small banks. Using quarterly data covering the period 2008–2014 for a sample of 21 banks, we carry out the empirical analysis. The profit efficiency for each bank included in the sample is measured by using the DEA approach. The financial soundness is proxied by Z-score. To examine the differential effects of financial regulations, the sample banks are classified into large, medium, and small banks based on their assets. We use fixed effects estimator to estimate the empirical models.

Estimating the regression for the whole sample, we find that the financial regulations play a significant role in determining the profit efficiency of banks operating in Pakistan. Specifically, our results indicate that the financial regulations indicators viz. NPLL and RR positively, whereas, LIQR and LODEPOSIT, significantly and negatively affect the profit efficiency of banks. We also find that the financial regulations have significant differential effects across bank size. In particular, we observe that although CAR does not significantly affect the profit efficiency of large banks, it is positively and significantly related to both medium and small banks. Likewise, small banks' profit efficiency increases with LR, whereas, LR does not have any statistically significant impact on the profit efficiency in case of both large and medium size banks. The RR has also a differential effect across the bank size, positively (negatively) affecting the profit efficiency of medium (small and large banks) banks. Finally, the effects of LODEPOSIT are also conditional on bank size. The profit efficiency of large and small banks is positively associated with the loans to deposits ratio, whereas, the profit efficiency of medium banks decreases when they issue more loans relative to deposits.

The findings regarding the effects of financial regulations on financial soundness of banks suggest that in case of the full sample, only LR and RR are positively and significantly related to the financial stability. Other three indicators of financial regulations, namely, LIQR, LODEPOSIT, and NPLL negatively and significantly affect the financial soundness of banks. We also find that the impact of financial regulations on the financial stability varies with bank size. In particular, our findings suggest that the negative impact of CAR on the financial health of banks is statistically significant only in case of medium banks. However, both LIQR and LODEPOSIT deteriorate the financial soundness of all sizes of banks. In contrast, the financial stability of large banks decreases with LR, whereas, the financial stability of small and medium banks strengthens with LR. Finally, we find that RR has adverse effects on the financial soundness of all three categories of banks.

Our findings are useful for policy-makers, regulators, and management of commercial banks as they help them to understand the impact of each already implemented financial regulation on the profit efficiency and financial stability of banks of Pakistan. In particular, the findings suggest that almost all of the obligations enforced by SBP are essential for improving banking sector's profit efficiency and financial stability. Therefore, we highly recommend that banks operating in Pakistan should prioritise implementing effectively the existing financial obligations but also design strong internal audit procedure to ensure that implantation occurs without any hesitation.

Recently, SBP enforced a number of financial regulations for improving the overall performance and stability of the banking sector. A few regulations have been implemented taking into consideration the Basel Accords as well. Indeed, ardent implementation of financial regulations is of great significance to enhancing the profit efficiency and financial soundness of banks. Thus, it is a need of the hour to further strengthen the regulatory framework for mitigating the likelihood of financial insolvency, and, in turn, paving the way for well-functioning, efficient, and sound banking in Pakistan.

REFERENCES

- Ahmed, T. (2008) *Efficiency Analysis of Commercial Banks in Pakistan*. Doctoral Dissertation, University of Agriculture, Faisalabad.
- Akhtar, M. H. (2010) X-Efficiency Analysis of Pakistani Commercial Banks. *International Management Review* 6:1, 1–12.
- Alam, N. (2013) Impact of Banking Regulation on Risk and Efficiency in Islamic Banking. *Journal of Financial Reporting and Accounting* 11:1, 29–50.
- Altunbas, Y., S. Carbo, E. P. Gardener, and P. Molyneux (2007) Examining the Relationships between Capital, Risk and Efficiency in European Banking. *European Financial Management* 13:1, 49–70.
- Bader, M. K. I., S. Mohamad, M. Ariff, and T. Hassan (2008) Cost, Revenue and Profit Efficiency of Islamic versus Conventional Banks: International Evidence Using Data Envelopment Analysis. *Islamic Economic Studies* 15:2, 23–76.
- Barth, J. R., C. Lin, Y. Ma, J. Seade, and F. M. Song (2013) Do Bank Regulation, Supervision and Monitoring Enhance or Impede Bank Efficiency? *Journal of Banking and Finance* 37:8, 2879–2892.
- Barth, J. R., G. Caprio, and R. Levine (2004) Bank Regulation and Supervision: What Works Best? *Journal of Financial Intermediation* 13:2, 205–248.
- Barth, J. R., G. Caprio, and R. Levine (2008) Bank Regulations are Changing: For Better or Worse and Quest. *Comparative Economic Studies* 50:4, 537–563.
- Beck, T., A. Demirgüç-Kunt, and V. Maksimovic (2008) Financing Patterns Around the World: Are Small Firms Different? *Journal of Financial Economics* 89:3, 467–487.
- Benston, G. J. (1965) Branch Banking and Economies of Scale. *The Journal of Finance* 20:2, 312–331.
- Burki, A. A. and G. S. K. Niazi (2003) The Effects of Privatisation, Competition and Regulation on Banking Efficiency in Pakistan, 1991-2000. In *CRC Conference on: Regulatory Impact Assessment: Strengthening Regulation Policy and Practice*. Chancellors Conference Centre, 26–27.
- Das, A. and S. Ghosh (2009) Financial Deregulation And Profit Efficiency: A Nonparametric Analysis of Indian Banks. *Journal of Economics and Business* 61:6, 509–528.
- Das, K. C. (2012) Banking Sector Reform and Insolvency Risk of Commercial Banks in India *IUP Journal of Applied Finance* 18:1, 19–34.
- Fell, J. and G. Schinasi (2005) Assessing Financial Stability: Exploring the Boundaries of Analysis. *National Institute Economic Review* 192:1, 102–117.

- Fu, X. M., Y. R. Lin, and P. Molyneux (2014) Bank Competition and Financial Stability in Asia Pacific. *Journal of Banking and Finance* 38, 64–77.
- Gaganis, C. and F. Pasiouras (2013) Financial Supervision Regimes and Bank Efficiency: International Evidence. *Journal of Banking and Finance* 37:12, 5463–5475.
- Goyeau, D. and A. Tarazi (1992) Évaluation du risqué de défaillance bancaire en Europe/An Empirical Investigation of Bank Risk in Europe. *Revue d'économie politique*, 249–280.
- Hermes, N. and A. Meesters (2015) Financial Liberalisation, Financial Regulation and Bank Efficiency: A Multi-country Analysis. *Applied Economics* 47:21, 2154–2172.
- Iqbal, M. and P. Molyneux (2006) Thirty Years of Islamic Banking. History, Performance and Prospects. *Bankhistorisches Archiv* 32:2, 155.
- Laeven, L. and R. Levine (2007) Is there a Diversification Discount in Financial Conglomerates? *Journal of Financial Economics* 85:2, 331–367.
- Lee, T. H. and S. H. Chih (2013) Does Financial Regulation Affect the Profit Efficiency and Risk of Banks? Evidence from China's Commercial Banks. *The North American Journal of Economics and Finance* 26, 705–724.
- Lepetit, L., E. Nys, P. Rous, and A. Tarazi (2008) Bank Income Structure and Risk: An Empirical Analysis of European Banks. *Journal of Banking and Finance* 32:8, 1452–1467.
- Murari, K. (2012) Insolvency Risk and Z-Index for Indian Banks: A Probabilistic Interpretation of Bankruptcy. *The IUP Journal of Bank Management* 11:3, 7–21.
- Naceur, S. B. and M. Omran (2008) The Effects of Bank Regulations, Competition and Financial Reforms on Mena Banks' Profitability. In Economic Research Forum (Working Papers No. 449).
- Pasiouras, F., S. Tanna, and C. Zopounidis (2009) The Impact of Banking Regulations on Banks' Cost and Profit Efficiency: Cross-country Evidence. *International Review of Financial Analysis* 18:5, 294–302.
- Rashid, A. and S. Yousaf (2016) Does Islamic Banking Strengthen Financial Stability? Empirical Evidence from Pakistan. *International Journal of Islamic and Middle Eastern Finance and Management* (Forthcoming).
- Rizvi, S. F. A. and A. H. Khan (2001) Post-liberalisation Efficiency and Productivity of the Banking Sector in Pakistan. *The Pakistan Development Review* 40:4, 605–632.
- Rizvi, S. F. A. and A. H. Khan (2001) Post-liberalisation Efficiency and Productivity of the Banking Sector in Pakistan. *The Pakistan Development Review* 40:4, 605–632.
- Roy, A. D. (1952) Safety First and the Holding of Assets. *Econometrica: Journal of the Econometric Society*, 431–449.
- Sealey, C. W. and J. T. Lindley (1977) Inputs, Outputs, and a Theory of Production and Cost at Depository Financial Institutions. *The Journal of Finance* 32:4, 1251–1266.
- Zhang, J., P. Wang, and B. Qu (2013) Bank Risk Taking, Efficiency, and Law Enforcement: Evidence from Chinese City Commercial Banks. *China Economic Review* 23:2, 284–295.

The Employment Effect of Innovation: Evidence from Bangladesh and Pakistan

ABDUL WAHEED

The analysis of the impact of innovation on employment growth is an important topic for policy-makers. Unemployment is an important social topic, and the effects of innovation on employment are often poorly understood. Despite the significance of this relationship, very few studies on this topic are yet available for developing countries compared with the developed ones. This paper contributes to this scant literature by investigating the employment effects of innovation for two South Asian developing countries: Bangladesh and Pakistan. We further analyse whether this relationship shows country-specific and industry-specific differences.

Our analysis shows that both product and process innovation spur employment in this region as a whole, in both low-tech and high-tech industries, even after controlling for a number of firm-specific characteristics. Moreover, although both innovation types also have significant, positive impacts on employment growth of all Bangladeshi and of all Pakistani firms separately, they are important factors for employment growth of only high-tech Bangladeshi firms and of only low-tech Pakistani firms. Contrary to most previous studies, we witness an insignificant effect of growth of labour cost on employment growth, perhaps due to the availability of cheaper labour force compared with the developed countries. We notice that some of the innovation determinants exert different influences across industries and across both countries. The same holds true for the determinants of employment growth.

JEL Classification: J23, O31, O33

Keywords: Bangladesh, Employment Growth, Pakistan, Product Innovation, Process Innovation

1. INTRODUCTION

The impact of technological innovation on firm performance can primarily be observed in two ways: the productivity impact of innovation and the effect of innovation on employment.¹ The former is mainly an area of interest for managers/industrialists, while the latter is crucial for policy-makers. The effect of technology on firm productivity is a relatively straightforward phenomenon and often shows a positive link [Geroski, *et al.* (1993); Lööf and Heshmati (2006); Koellinger (2008); Hall, *et al.* (2009)], but the relationship between innovation and employment growth is a complex one.² One of the reasons for this complexity is the variety of channels through which both product and process innovation can affect employment growth. Although both types of innovations often coexist, the motivation and implication to have them in place are rather different.

Abdul Waheed <a.waheed@ucp.edu.pk> is Assistant Professor, University of Central Punjab, Lahore, Pakistan.

¹Innovation can affect both the quantity and quality of employment (skill-biased technical change paradigm). The latter is beyond the scope of this paper.

²A very good survey of studies on the innovation-employment relationship can be found in Pianta (2005), Vivarelli (2007), and Chennells and Van Reenen (1999).

One of the desired effects of product innovation is the market expansion³ (especially when the new product is not a direct substitute of an old one), demanding more labour force. If the innovating firm is a first-mover and launches a radically new product into the market, which is difficult to imitate by latecomers and if it also protects the product through exclusivity rights (e.g., patents, trademarks, etc.), the innovating firm can operate from a monopoly position. The employment effect of product innovation may then be negative, because the monopolist may restrict output and instead raise prices. Process innovations often reduce the amount of labour needed since they are operationalised to make more efficient production processes to obtain the same output with lower cost or less labour (per unit), suggesting a negative impact of process innovation on labour demand. The cost reduction may eventually translate into price reductions, especially in a competitive environment depending on the price elasticity of demand; this may cause an increase in product demand. This demand shift would induce the firm to expand its production which entails an increase in workforce, counterbalancing the “displacement effect” of process innovation. The expansion-related effect of product innovation (compensation effect) may dominate its “displacement effect”. This might be the reason why studies generally postulate a positive impact of product innovation on employment growth [Hall, *et al.* (2008); Harrison, *et al.* (2008), *inter alia*]. However, it is hard to determine unequivocally which effect of process innovation dominates; this explains the empirically mixed findings regarding the link between process innovation and employment.

Whether technology creates or destroys jobs is a highly investigated topic in the developed world, but very few studies on developing countries exist hitherto.⁴ The apparent differences among national innovation systems (NISs) of developed and developing countries and their different economic and societal paradigms assert that the sources, motivations, and implications of innovation (and/or of imitation) differ between both regions. Hence, it is not justifiable to derive conclusions for developing countries on the basis of the outcomes of studies on the innovation-employment relationship for developed countries. And the issue needs to be addressed in the particular context of the developing world. It is also important for developing countries’ policy principles to investigate thoroughly which effects innovations have on employment.⁵ Hence, this study contributes to this field by investigating whether innovation creates or destroys jobs in the developing countries.

More specifically, we investigated the employment effect of innovation on two South Asian developing economies (Bangladesh and Pakistan) by using the World Bank enterprise survey conducted in 2006-07. As Bogliacino and Pianta (2010) pointed out, one of the problems of the existing literature on innovation and employment is its reliance on the assumption that the employment effect of innovation is uniform across industries. We investigated this relationship for low- and high-tech industries separately,

³There are two sources of expansion: innovation may increase product demand in the same product market or may open entirely new markets for the innovator.

⁴One reason for this scarcity is data-driven.

⁵Unemployment, of course, is a problem which developed countries also face, and currently some of them have higher unemployment rates than developing countries. However, developed countries’ policy-makers can address this problem, in the short and long run, more aptly with the help of social security benefits, etc. Therefore, the societal problems related to unemployment are more severe in developing countries.

for all firms for each country, to ascertain whether disparities of the employment effect of innovation exist between the sectors.

In the empirical analysis we principally follow Van Reenen's (1997) model, with some modifications since he originally used it in a panel data setting, while we have a cross-sectional data set. We also expanded Van Reenen's specification by including control variables to disentangle the complexity of the innovation-employment relationship more aptly. While observing the relationship of innovation and employment, the endogeneity of innovation could distort the findings of the econometric analysis. We address this endogeneity by applying the appropriate estimation methods. Our results strongly indicate both product and process innovation as factors driving employment growth in Pakistan and Bangladesh as a whole. However, in the low and high tech sectors, we observed differences across the two countries.

This paper is organised as follows: Section 2 describes the findings of past studies. The model is specified in Section 3, while Section 4 discusses the dataset and descriptive statistics. The results of the empirical analysis are presented and discussed in Section 5. Section 6 concludes the paper.

2. LITERATURE REVIEW

The question whether technology creates or destroys jobs is not a new topic. At the beginning of the industrial revolution in the mid-18th century, it was feared that the introduction of machinery would be detrimental to employment.⁶ In the chapter "On Machinery" Ricardo (2001) retracted his previous position and propagated the negative effects of technology on employment. Further evolution of the theoretical and empirical framework led analysts to investigate the technology-employment connection more tightly focused, i.e., in terms of the innovation-employment nexus.

The effect of innovation on employment involves a plethora of intricacies, which makes this relationship difficult to understand unequivocally. However, it is not unreasonable to believe that technological innovation influences employment growth through its labour saving (displacement effect) and/or market expansion (compensation effect) effects. It is difficult to determine the dominance of one effect over the other, especially regarding process innovation because it heavily depends on the specific context in which it occurs. These complexities require more research to understand the innovation-employment connection thoroughly and establish a consensus. One possible method to resolve the disagreement is to disentangle the process and the product innovation and to define a clear distinction between them to investigate their impacts on employment [Smolny (1998); Edquist, *et al.* (2001), among others]. Although the relationship is complex, most empirical studies confirmed a significant, positive influence of product innovation on employment, whereas the link between process innovation and employment is observed to be varied. One strand of the literature showed a positive relationship, whereas the other argued a negative association. The studies have also found the relationship between process innovation and employment growth to be insignificant.

Using two consecutive waves of the Community Innovation Survey (CIS) (CIS2 and CIS3) for ten European countries, Mastrostefano and Pianta (2009) concluded that

⁶See Rothwell and Zegveld (1979) for industry-level case studies analysing the impact of mechanisation on employment.

new products' sales (both in levels and in percentage changes) are a significant, positive determinant of employment change, along with a positive (negative) influence of demand (wages). In addition, they found that the proportion of innovative firms (usually process innovation was dominant) has a significant, positive impact on employment change; however, increasing this share contributes nothing towards employment change. With data from four European countries, Harrison, *et al.* (2008) divided firms' sales into two mutually exclusive groups: sales of new products (product innovation) and of old ones and introduced a process innovation dummy. They proposed a model relating these innovation measures to employment growth. They found a strong, positive relationship between product innovation and employment, but the effect of process innovation was not as clear as the effect of product innovation. The study of Brouwer, *et al.* (1993) conducted on Dutch firms showed that R&D intensity has a negative (but insignificant) impact on employment growth between 1983 to 1988, while the effect of growth of R&D intensity for the same period is significant and negative. They further considered only product-related R&D and found a significant, positive influence on employment growth. Regarding firm-specific characteristics, the relationships between employment and sales growth (1982-1983) and between employment and firm size is significant and positive and significant and negative respectively.

Freel and Robson (2004) showed that the share of technologists/scientists has a positive influence on employment growth of manufacturing firms in Scotland and Northern England, whereas an increase of professionals/managers in service firms decreases their employment growth. Moreover, product innovation significantly increases employment in both sectors (manufacturing and service); however, the effect of process innovation is insignificant. The work of Antonucci and Pianta (2002) on eight main EU economies revealed that the effect of total innovation expenditure (per sales) on employment demand is negative and mixed in terms of significance (they analysed it in different specifications). Using different proxies for innovation, the general picture of the significance of product and process innovations that arises is that the former has a positive and the latter has a negative effect, although both are mostly insignificant. They further calculated that a positive change in demand (proxied by the value added) induces a positive employment change, while the effect of labour cost is significant and negative.

By utilising the data of 31 two-digit German manufacturing firms, Ross and Zimmermann (1993) reported labour saving technological progress as one of the significant determinants which hinder labour growth, alongside insufficient demand and labour costs. Smolny (1998) developed a theoretical model and applied it to West German manufacturing firms revealing that both product and process innovation are conducive to employment. Doms, *et al.* (1995) observed the effect of advanced manufacturing technologies (process innovations, e.g. computer-controlled machines, lasers, robots, etc.) on employment growth between 1987 to 1991 for firms in the United States, after correcting for the selectivity bias attributable to firms' exit. Their empirical findings suggest that the use of advanced technologies and capital intensity (measured by the capital-labour ratio) is significantly and positively correlated with employment growth and negatively associated with firm exit. Moreover, the effects of capital intensity are not affected by the inclusion of other controls, but the technology-related outcomes are sensitive to firm size. The positive effect of introduction of new technologies on

employment in case of Australia and the UK can be found in Blanchflower and Burgess (1998).

The study of Vivarelli, *et al.* (1996) for Italian manufacturers showed a modestly positive effect of total innovation costs on the use of labour. But their further split of innovation variable into different innovation characteristics revealed that R&D expenditure (design and engineering expenditure) has a significant, positive (negative) impact on employment. The effect of process innovations was found to be significant and negative.

The relationship between innovation and employment has been analysed extensively in developed economies, but we can only find very few studies on developing countries. Benavente and Lauterbach (2008) found a significant, positive impact of sales of new products (product innovation) on the employment growth of Chilean firms, but the effect of process innovation appeared to be insignificant. The study of Meriküll (2010) on Estonian enterprises revealed that innovation is an important determinant of employment, when he did not distinguish between product and process innovation. When he made that distinction, he found that both product and process innovation exert a positive effect on employment, but only the impact of process innovation is a significant one. A significant and positive influence of innovative activities (R&D and patents) on employment demand of Taiwanese manufacturing firms can be found in Yang and Lin (2008). Their analysis of splitting patents into both product and process patents showed that both can translate into significant employment growth. The analysis of employment effects of innovation of Costa Rican manufacturing firms conducted by Monge-González, *et al.* (2011) revealed that both product and process innovation are conducive to employment growth.

3. THE MODEL SPECIFICATION

In this section we propose a model to investigate the innovation-employment relationship strictly in a firm-level cross-sectional dataset.

Table 1 provides the definitions and notations of the variables used in this section and in our empirical analysis. To some extent, our model follows the specification of Van Reenen (1997) who derived a static panel data model of labour demand as:⁷

$$\log(\text{employment}_{it}) = \beta_1 \text{innovation}_{it} + \beta_2 \log(\text{wages}_{it}) + \beta_3 \log(\text{capital}_{it}) + \tau_t + e_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

Where τ_t is a vector of time dummies and e_{it} is a white noise error term. We modified Equation (1) according to the cross-sectional nature of our dataset. Firstly, our model does not include the term τ_t for obvious reasons. Moreover, the panel data structure of Equation (1) connotes employment on the left hand side in terms of employment growth.⁸ Hence, we defined employment growth in a traditional way and constructed our dependent variable as:⁹

⁷ He also used the dynamic panel structure to include a lagged dependent variable. See Van Reenen (1997) for the derivation of 1.

⁸In addition to using employment levels and a lagged dependent variable, Van Reenen (1997) also utilised first differences which define the dependent variable in terms of employment change.

⁹We used only growth in permanent employment due to the unavailability of information pertaining to temporary employment in 2002-2003.

Table 1

Variables and Their Description

Variables	Descriptions
EGROWTH	Change in employment of full-time permanent workers (2002/03 – 2005/06)
WGROWTH	Change in cost of labour (including wages, salaries, bonuses, allowances etc.): from 2002/03 to 2005/06 for Bangladesh and from 2004/05 to 2005/06 for Pakistan
SALES	Total annual sales of a firm in 2005/06 (in log.)
AGE	Age of a firm in years
MATERIAL	Total annual cost of raw material per employee in 2005/06 (in log.)
PRODIN	Ratio of permanent production workers in permanent employment
LBUY	Dummy if a firm's principal buyer is a large firm with more than 100 employees in 2005/06
EXP	Ratio of export sales to total annual sales in 2005/06
IMP	Ratio of imports in total annual purchase of material inputs and/or supplies in 2005/06
INDZONE	Dummy if a firm located in industrial zone (park)
ASSET	Dummy if a firm purchases fixed assets (machinery, vehicles, equipments, land, or buildings) in 2005/06
WEB	Dummy if a firm uses website to communicate with its clients or suppliers.
TRAIN	Dummy if a firm runs formal training programs for its permanent employees in 2005/06
UNION	Dummy if a worker union exists in the firm
PDINN	Dummy if a firm introduces into the market any new or significantly improved product during the last three fiscal years
PRINN	Dummy if a firm introduces into the market any new or significantly improved production process, including methods of supplying services and ways of delivering products, during the last three fiscal year
PAK	Dummy if country is Pakistan

$$EGROWTH = \frac{employment_{2005/06} - employment_{2002/03}}{employment_{2002/03}} \dots \dots \dots (2)$$

We replaced fixed capital with raw material cost since our dataset misses a lot of information for the former. Hence, our employment growth model for the i^{th} firm has the following form:

$$EGROWTH_i = \alpha_0 + \beta_0 innovation_i + \beta_1 WGROWTH_i + \beta_2 MATERIAL_i + \gamma Z_i + e_i \dots \dots \dots (3)$$

We used PDINN and PRINN as innovation variables. In order to address the complexities of the innovation-employment association more rigorously, we extended Van Reenen's model by including a vector of control variables z_i with the corresponding coefficients vector γ . Our vector of control variables includes the following entries:

$$z = (EXP, IMP, LBUY, UNION, AGE, TRAIN)$$

In addition, all regression analyses include industry intercepts and, whenever needed, a country intercept to control for heterogeneities attributable to the different industry paradigms and to the differences between NISs of both countries.

Endogeneity of the innovation variables could exist through various channels. For example, if a firm anticipates an upward demand shift, it will increase its employment and innovate simultaneously to cope with this market expansion [Van Reenen (1997)]. Van Reenen addressed endogeneity by instrumenting innovation variables and using their lagged values, but we have cross-section data. Therefore, we first predicted our innovation variables by using corresponding probit regressions (we have all innovation variables in qualitative form) and used them as instruments in the employment growth equations.

4. DATA AND SUMMARY STATISTICS

The World Bank investment climate survey (enterprise survey) for manufacturing firms of two developing countries (Pakistan and Bangladesh), conducted in 2006-2007, is used for the empirical analysis in this paper. The dataset presents information of firms' innovation activities (of both process and product innovation) as dichotomous variables, along with a large range of other firm-level characteristics important for our analysis. After cleaning for non-responses and potential outliers, we were left with 2,085 firms in total, 62 percent of these are Bangladeshi. Moreover, our data set includes nine manufacturing industries aggregated at a two-digit level.¹⁰

A divide between low-tech and high-tech industries¹¹ reveals that we have 1,715 (82 percent) for the former and 370 firms (18 percent) for the latter, suggesting that this region's industrial structure heavily depends on low-tech sector. The distribution of low- and high-tech industries across countries shows that 77 percent of the 1,301 Bangladeshi firms are low-tech firms, while 90 percent of the 784 Pakistani firms belong to this industrial sector. This means that, according to our sample, while low-tech industries abound, the prevalence of low technology firms is higher in Pakistan than in Bangladesh. The survey collected all pecuniary information in local currency units. To achieve homogeneity and acquire comparable results, we converted all monetary variables into a common currency unit: USD.

Table 2 presents the descriptive statistics (averages) of variables for all firms and for Bangladesh and Pakistan separately. According to these statistics, 24.9 percent firms are reported to be product innovators, while the share of process innovators is 31.03 percent. When we consider innovation statistics across countries, Bangladeshi firms have a high proportion of both types of innovations compared with Pakistan: 33.13 percent vs. 12.32 percent for product innovation and 44.96 percent vs. 9.6 percent for process innovation. Contrary to Bangladesh and the whole region, the share of product innovating firms is slightly higher than that of process innovators in Pakistan.

¹⁰The industries are food, chemicals, garments, non-metallic minerals, leather, textiles, machinery and equipment, electronics, and other manufacturing. Since only 11 firms in this dataset fall in the category of non-metallic minerals industry and none of them is in Bangladesh. Therefore, for computational purposes, we merged these 11 firms into a broader industrial sector: other manufacturing.

¹¹To split our sample into low- and high-tech industries, we followed the definition of the OECD. More specifically, chemicals, electronics, and machinery and equipment are categorised as high-tech, and the other industries fall into the low-tech sector.

Table 2
Summary Statistics

	All	Bangladesh	Pakistan
Product innovation (%)	24.9	33.13	12.32
Process innovation (%)	31.03	44.96	9.60
Employment growth (%)	16.24	22.54	10.02
Wage growth (%)	47.25	72.80	34.79
Permanent employment	199.12	264.39	90.38
Material cost per employee (000\$)	7.35	5.13	11.09
Net book value per employee (000\$)	10.78	28.94	5.93
Export intensity (%)	25.90	33.52	12.21
Import intensity (%)	25.78	34.97	11.69
Purchase of fixed assets (%)	39.27	52.11	17.90
Use of web (%)	25.24	26.13	23.75
Formal training (%)	16.15	21.07	8.59
Large buyer (%)	17.74	23.86	7.48
Workers' union (%)	9.10	11.09	5.79
Production workers intensity (%)	80.60	82.75	77.26

Change in cost of labour in Bangladesh is more than double that in Pakistan,¹² despite the fact that employment growth in Bangladesh at 22.54 percent is more than twice as high as the corresponding value of 10.02 percent in Pakistan. The cost of raw materials in Pakistan appears to be almost double than that of Bangladesh, suggesting that it is more likely to be a substitute than a complement of employment, especially in Pakistan. The average permanent employment in Bangladeshi firms is 264.39, which is considerably higher than the average employment of 90.38 in Pakistani firms. The average net book values show that on average Pakistani firms are worth \$28,940, while the corresponding value for Bangladesh is \$5,930. The descriptive statistics on human capital (employment and employment growth) and financial capital (raw material cost and net book value) reveal that Bangladeshi firms are more human capital-intensive, whereas Pakistani firms are far ahead in the latter category.

The proportion of Bangladeshi firms reported to purchase fixed assets is 52 percent, while only 18 percent Pakistani firms appear to conduct this kind of purchase. Bangladeshi firms are also more likely to use the internet, have workers' unions, run formal training programmes, and have large buyers than Pakistani ones; the disparities for the first two indicators are not as stark as the last two. The exports and imports are larger in Bangladesh than in Pakistan.

¹²Beware that these figures are not directly comparable, since time span for both countries are not same due to data limitations: wage change for Bangladesh was calculated from 2002-03 to 2005-06, while the values for Pakistan was calculated from 2004-05 to 2005-06.

Table 3 reports the descriptive statistics for low- and high-tech industries separately, for all firms and across both countries. For all firms taken together, both product innovation and process innovation occur more often in the high-tech than the low-tech sector. The wage growth and exports are higher in the low-tech than in the high-tech sector, whereas imports, firm age, material cost, and employment growth are higher in the high-tech than in the low-tech ones. Fixed asset purchase and internet usage are more likely in the high-tech sector, while the occurrence of workers' unions does not substantially differ between both industrial sectors. The descriptive statistics reveal that share of high-tech firms which run formal training programmes is 28 percent, which is almost twice as high as that of low-tech firms. The results for large buyers are the opposite: almost 20 percent low-tech and almost 10 percent high-tech firms have large buyers with more than 100 employees.

Table 3

Summary Statistics for Low-and High-tech Industries

Variables	All		Bangladesh		Pakistan	
	Low-tech	High-tech	Low-tech	High-tech	Low-tech	High-tech
Product innovation (%)	22.01	39.12	29.56	45.83	11.95	15.79
Process innovation (%)	28.14	45.00	42.58	53.41	8.94	15.79
Employment growth (%)	15.77	18.73	22.54	22.57	9.98	10.33
Wage growth (%)	47.81	43.15	80.36	36.79	33.33	48.88
Permanent employment	202.81	182	280.00	210.96	92.70	68.49
Age (years)	17.53	21.15	15.70	21.26	20.14	20.74
Material cost per employee (000\$)	6.35	11.87	4.62	6.79	8.80	32.42
Export intensity (%)	30.35	5.96	42.02	4.40	12.23	12.04
Import intensity (%)	22.29	41.90	30.92	48.66	10.94	18.42
Purchase of fixed assets (%)	37.30	48.38	51.04	55.78	38.20	19.74
Use of web (%)	23.74	32.16	24.03	33.33	23.34	27.63
Formal training (%)	13.65	28.24	17.93	32.20	7.95	14.47
Large buyer (%)	19.48	9.73	28.16	9.18	7.01	11.84
Workers union (%)	9.09	9.19	11.84	8.50	5.13	11.84
Production workers intensity (%)	81.43	76.57	84.39	76.94	77.47	75.27

The last four columns of Table 3 depict these descriptive statistics for both countries. The results of the innovation-related variables reveal the same pattern as that for all firms. In addition, wage growth is substantially higher in Bangladeshi low-tech firms than in Bangladeshi high-tech ones, whereas the results are opposite in Pakistan with relatively less significant difference. Firms are older in Bangladeshi high-tech industries than in its low-tech firms. The statistics of this variable shows that they are almost the same for both sectors in Pakistan. The cost of raw material is higher in the group of high-tech industries for both countries; however the difference is much bigger in Pakistan than Bangladesh. All firms taken together, we noticed that employment growth is slightly higher in high-technology firms, but the corresponding point estimates across countries disclose that both sectors have almost the same employment growth in Bangladesh, while the Pakistani high-tech sector has slightly higher employment growth.

5. MICROECONOMETRIC ANALYSIS

As mentioned already, we used the predicted values of the innovation variables as instruments in the employment growth equations to avoid endogeneity problems. These predicted values were obtained from separate probit regressions of both product and process innovation.

5.1. Determinants of Innovation

Although the primary objective of the probit regressions is to obtain innovation instruments, the results are helpful, to acquire an insight into the innovation determinants in this region as well.

Table 4 shows the results of probit regressions of both types of innovations separately, for all firms and after splitting the dataset into low-tech and high-tech industries. For all firms taken together (reported in the first two columns), it is observed that firm size (sales) appears to be an insignificant determinant of product innovation and a significant, positive factor for process innovation. The exports significantly decrease the chance of product innovation and do not have an effect on process innovation. The variable capturing the import intensity is a significant, positive determinant for both innovation types. The factors captured by WEB (which could be a proxy for a firm's international exposure, especially in developing countries and a measure of internet use), purchase of fixed assets, and whether or not the firm is located in an industrial zone are important indicators of both types of innovations. Older firms are less likely to be process innovators than younger ones, whereas the effect of age on product innovation is statistically insignificant. Our results also disclose that an increase of production workers' share of the workforce decreases the likelihood of product innovation. Production workers are, in principle, hired for production purposes, not for innovation. The relative increase of production workers implies a relative decrease of non-production workers, e.g. administrators, managers, R&D personnel, etc., which are more responsible for innovation. Hence, the results that a decrease in non-production workers reduces the chances of product innovation are quite intuitive. Production workers' share of the workforce has an insignificant, negative impact on the occurrence of process innovation.

The demand side variable measured by LBUY¹³ does not contribute to either product or process innovation. Recall that the descriptive statistics showed that Pakistani firms are less frequently innovators than Bangladeshi ones; this is confirmed econometrically since we obtained statistically significant and negative signs for the coefficients of the Pakistan dummy (PAK), for both types of innovations. A further split into low and high technology firms reveals more interesting results.

The findings of the low-tech sector almost follow the pattern we discussed above in the context of all firms. Two differences are as follows. The significant (although at 10 percent), positive (negative) impact of import (age) on process innovation vanishes. Recall that firm size (sales) does not contribute to low-tech firms' likelihood of product innovation, but it is an important determinant in the case of high-tech industries. One reason for this difference may be that high-tech firms are more R&D-intensive by

¹³Of course, our variable LBUY does not capture the "demand-pull" indicator used in the innovation literature. Hence, we cannot interpret the results of LBUY as an innovation effect of the demand-pull.

Table 4
Probit Regressions of PDINN and PRINN for All Firms
Robust SEs are in Parentheses

Independent Variables	All		Low-tech		High-tech	
	PDINN	PRINN	PDINN	PRINN	PDINN	PRINN
SALES	0.030 (0.024)	0.094* (0.025)	0.007 (0.027)	0.072# (0.029)	0.139* (0.048)	0.203* (0.054)
EXP	-0.398* (0.122)	-0.162 (0.120)	-0.395* (0.130)	-0.129 (0.127)	0.592 (0.500)	0.660 (0.592)
IMP	0.372* (0.110)	0.193† (0.109)	0.320# (0.128)	0.205 (0.125)	0.351 (0.230)	0.011 (0.237)
WEB	0.514* (0.091)	0.405* (0.091)	0.536* (0.105)	0.373* (0.104)	0.406# (0.192)	0.486# (0.197)
ASSET	0.350* (0.078)	0.410* (0.076)	0.356* (0.089)	0.421* (0.086)	0.381# (0.170)	0.465* (0.170)
PRODIN	-0.404† (0.238)	-0.307 (0.239)	-0.473† (0.279)	-0.446 (0.275)	-0.046 (0.467)	0.400 (0.487)
INDZONE	0.355* (0.084)	0.447* (0.086)	0.350* (0.095)	0.401* (0.096)	0.475# (0.192)	0.749* (0.199)
AGE	-0.004 (0.003)	-0.005† (0.003)	-0.005 (0.003)	-0.004 (0.003)	-0.002 (0.005)	-0.003 (0.006)
LBUY	-0.038 (0.101)	0.110 (0.098)	-0.028 (0.110)	0.063 (0.105)	0.080 (0.300)	0.625† (0.333)
PAK	-0.619* (0.110)	-1.195* (0.118)	-0.594* (0.121)	-1.224* (0.130)	-1.034* (0.244)	-1.416* (0.285)
Intercept	-0.887* (0.337)	-1.456* (0.351)	-0.552 (0.380)	-1.021* (0.390)	-2.652* (0.709)	-3.453* (0.782)
No. of obs.	1825	1826	1492	1493	333	333
Pseudo R ²	0.164	0.239	0.127	0.213	0.273	0.337

* Significance at 1 percent level # Significance at 5 percent level † Significance at 10 percent level.

Note: All regressions include industry dummies.

definition; it is generally believed that R&D induces innovation and that large firms undertake more formal R&D activities (through their R&D departments). There is a possibility that large firms' formal R&D activities translate more aptly into product innovations compared to small firms' R&D activities. Similar to low technology industries, firm size is beneficial for process innovation.

The results of WEB, ASSET, and INDZONE, follow the same pattern in low and high technology sectors, and showing significant, positive effects of these indicators on both types of innovations. The negative significance of PRODIN for low-tech industries' product innovation disappears in the high-tech sector, although the coefficient still has a negative sign. This means that the previously found effect of the production workers' share is not as strong in the high-tech as is in the low-tech sector. The insignificant, negative impact of firm age on both product and process innovation for low-tech firms also prevail for the group of high-tech firms, meaning that in both sectors firms innovate regardless of their age. Large buyers appear to be an influential determinant of high-tech firms' inclination towards process innovation, while these have no impact on their product innovation efforts.

The results of the probit regressions on PDINN and PRINN, for all Bangladeshi firms and for low and high technology Bangladeshi firms, are depicted in Table 5. Most of the results for all Bangladeshi firms are similar to those that were obtained for all Bangladeshi and Pakistani firms taken together (compare the first two columns of Table 4 with the respective columns of Table 5). We do not discuss the same findings but shed some light on the differences. The significance of imports as a predictor of process innovation of all firms disappears when we consider only Bangladeshi firms' process innovation. The significant, negative effect of the share of production workers in total permanent employment is also vanished. The negative effect of age is more prominent in case of Bangladesh than all firms taken together.

Table 5
Probit Regressions of PDINN and PRINN for Bangladesh
Robust SEs are in Parentheses

Independent Variables	All		Low-tech		High-tech	
	PDINN	PRINN	PDINN	PRINN	PDINN	PRINN
SALES	0.037 (0.029)	0.113* (0.028)	-0.014 (0.037)	0.064† (0.034)	0.155* (0.053)	0.248* (0.058)
EXP	-0.443* (0.148)	-0.173 (0.139)	-0.308† (0.164)	-0.003 (0.151)	0.076 (0.557)	-0.138 (0.600)
IMP	0.343* (0.123)	0.105 (0.117)	0.274† (0.145)	0.105 (0.136)	0.330 (0.246)	-0.043 (0.259)
WEB	0.465* (0.106)	0.326* (0.101)	0.504* (0.125)	0.257# (0.117)	0.361† (0.203)	0.532# (0.207)
ASSET	0.250* (0.087)	0.302* (0.083)	0.236# (0.102)	0.295* (0.095)	0.332† (0.179)	0.431# (0.183)
PRODIN	-0.341 (0.286)	-0.231 (0.281)	-0.475 (0.355)	-0.442 (0.346)	0.214 (0.484)	0.740 (0.499)
INDZONE	0.396* (0.105)	0.454* (0.103)	0.376* (0.121)	0.395* (0.117)	0.403† (0.221)	0.656* (0.226)
AGE	-0.011* (0.003)	-0.010* (0.003)	-0.016* (0.005)	-0.011# (0.004)	-0.003 (0.006)	-0.008 (0.006)
LBUY	-0.169 (0.112)	0.056 (0.107)	-0.161 (0.120)	0.033 (0.113)	-0.053 (0.329)	0.450 (0.364)
Intercept	-0.858† (0.515)	-1.586* (0.509)	-0.073 (0.580)	-0.810 (0.553)	-2.928* (0.741)	-4.073* (0.826)
No. of obs.	1152	1152	889	889	263	263
Pseudo R ²	0.102	0.092	0.074	0.054	0.189	0.258

* Significance at 1 percent level # Significance at 5 percent level † Significance at 10 percent level.

Note: All regressions include industry dummies.

Comparing the first two columns of Table 5 (all Bangladeshi firms) with the subsequent two columns of Table 5 (low-tech Bangladeshi firms), we notice that all determinants of both innovation types of all Bangladeshi firms (column 1 and 2 of Table 5) and of low technology Bangladeshi firms (columns 3 and 4 of Table 5) are the same with respect to their coefficients' signs and statistical significance. Similar to the full dataset (Table 4), we discover some differences between the outcomes of high-tech and low-tech Bangladeshi firms and between high-tech and all Bangladeshi firms.

Contrary to low-tech Bangladeshi firms and similar to all high-tech firms, firm size (sales) increases the likelihood of product innovation. The significant, negative (positive) effect of exports (imports) on product innovation of all Bangladeshi firms and low-tech Bangladeshi firms becomes insignificant in case of high-tech firms. The factors captured by WEB, ASSET, and INDZONE increase the chance of both types of innovation activities for both low and high technology Bangladeshi firms, showing that the effects of these three determinants are similar to those that were observed for the low-tech and high-tech pool of both Bangladeshi and Pakistani firms.

The significance of the negative effect of low tech firms' age on innovations dissipates in the high-tech sector, though the coefficients are still negative. Large buyers exert a negative impact on product innovation in all and in low-tech Bangladeshi firms, and their relationship with process innovation is statistically insignificant in both cases. The previously found insignificant effect of large buyers is again established for the high-tech Bangladeshi firms. Our interpretation of this insignificant relationship is that the innovation in Bangladeshi firms is not large buyer demand-driven. A firm primarily sells products rather than processes to its buyers and large buyers provide an important boost for product demand. The negative coefficient of LBUY for product innovation as compared to positive coefficient for process innovation, although both are insignificant, might hint that this relatively large demand, in comparison with small buyers' demands, is mostly for non-innovating products.

The empirical findings of Pakistani firms are reported in Table 6. Because of the econometric issues, we were unable to carry out the analysis for high-tech firms by using trade orientation (exports and imports) as the predictor of process innovation. Hence, we skipped both exports and imports while performing the above mentioned analysis.

A comparison of these results with Bangladesh's results unveils some interesting differences. We fail to find a significant, positive relationship between firm size (sales) and both innovation types for all Pakistani firms and for both low- and high-tech Pakistani firms. Similar to Bangladesh, the significance of ASSET as an explanatory factor of both types of innovation is established for all Pakistani firms and for low-tech Pakistani industries but, differing from Bangladesh, Pakistani high-tech firms' purchases of fixed assets do not contribute to their innovations (neither product nor process). Throughout the results of Bangladesh PRODIN appears to be an unimportant factor for both types of innovation, but we observe that it substantially decreases the likelihoods of product and process innovation in high-tech Pakistani firms. Use of internet has a positive influence on PDINN and PRINN in all cases (i.e. all and low and high technology Pakistani firms), except for high-tech firms' product innovation. The empirical findings of Bangladesh reveal that firms located in industrial zones enjoy the benefits of a more formally embedded infrastructure and translate it into product and process innovation regardless which industrial sector they belong to. However, in the case of Pakistan this particular variable induces innovations only in the high-tech sector.

Another contradiction is that throughout Table 6 firm age appears to be an insignificant determinant of both product and process innovation. The only exception is for all firms' process innovation. Finally, contrary to Bangladesh, large buyers mostly (a possible proxy of firms' demand) encourage innovation in Pakistani firms, whether they are low-tech or high-tech.

Table 6
Probit Regressions of PDINN and PRINN for Pakistan
Robust SEs are in Parentheses.

Independent Variables	All		Low-tech		High-tech	
	PDINN	PRINN	PDINN	PRINN	PDINN	PRINN
SALES	0.043 (0.045)	0.023 (0.055)	0.050 (0.048)	0.041 (0.060)	0.633 (0.425)	0.068 (0.120)
EXP	0.246 (0.228)	0.214 (0.270)	0.147 (0.241)	-0.004 (0.286)	5.398* (1.608)	
IMP	0.723* (0.248)	1.017* (0.266)	0.625# (0.267)	0.968* (0.284)	2.510† (1.432)	
WEB	0.539* (0.205)	0.654* (0.235)	0.488# (0.223)	0.697* (0.251)	2.816 (1.722)	2.611# (1.190)
ASSET	0.681* (0.177)	0.915* (0.193)	0.674* (0.184)	0.944* (0.199)	-1.114 (2.069)	-0.781 (0.836)
PRODIN	-0.143 (0.275)	-0.110 (0.354)	-0.074 (0.162)	-0.023 (0.186)	-10.269# (4.788)	-3.636# (1.685)
INDZONE	-0.155 (0.171)	0.067 (0.186)	-0.183 (0.183)	0.004 (0.193)	3.138* (0.991)	1.708# (0.862)
AGE	0.007 (0.006)	0.010† (0.006)	0.007 (0.006)	0.006 (0.006)	-0.037 (0.047)	0.014 (0.022)
LBUY	0.771* (0.225)	0.538# (0.241)	0.797* (0.244)	0.381 (0.254)	4.272* (1.413)	2.229# (0.935)
Intercept	-2.221* (0.509)	-2.664* (0.671)	-2.310* (0.514)	-2.793* (0.671)	-8.037† (4.296)	-1.189 (2.623)
No. of obs.	670	664	603	594	67	71
Pseudo R ²	0.269	0.391	0.243	0.364	0.786	0.635

* Significance at 1 percent level # Significance at 5 percent level † Significance at 10 percent level.

Note: All regressions include industry dummies.

5.2. Innovation as a Determinant of Employment Growth

The primary objective of this paper is to investigate the innovation-employment connection. Before going further, it is worthwhile to note that, especially to enable comparisons with similar studies that our dependent variable is the employment growth of permanent employees instead of an employment growth of the whole labour force since our dataset does not have the information on the latter. However, we argue that our results might be more precise because innovation is a long term process, which requires the labour force on a permanent basis to carry out and take care of the innovative activities of a firm or which requires members of the permanent labour force to be dismissed/made redundant after innovation activities have been completed. We do not discard the fact that innovation may generate/destroy temporary employment, but we believe that this effect is significantly lower than the effect on permanent employment.

It is important to note that both innovation types are endogenous in employment growth equation and need to be instrumented. In the all subsequent regression analyses, the corresponding predicted values obtained from the regressions using both product and process innovation as dependent variables (results are discussed in the section 5.1) are used to proxy actual innovation variables, to address the problem of endogeneity.

Table 7 depicts the regression results of the analysis of employment growth determinants of all firms (both Pakistan and Bangladesh), for the full sample and for the low-and high-tech sector separately. We first inserted (the predicted values of) both PDINN and PRINN in a single employment equation and tested for multicollinearity, which was found at a significant level.¹⁴ Hence, we entered these variables in separate employment equations to avoid collinearity.

Table 7
Employment Growth Equation for All Firms
Bootstrapped S.E.s. are in Parentheses. Dep. var: EGROWTH

Independent Variables	All		Low-tech		High-tech	
	(1)	(1)	(2)	(2)	(3)	(3)
PDINN	0.337 [*] (0.111)		0.244 [†] (0.132)		0.507 (0.338)	
PRINN		0.334 [#] (0.133)		0.306 [#] (0.146)		0.583 [#] (0.237)
MATERIAL	-0.014 [#] (0.007)	-0.016 [#] (0.007)	-0.010 (0.007)	-0.013 [†] (0.007)	-0.027 (0.034)	-0.033 (0.029)
WGROWTH	0.003 (0.007)	0.003 (0.006)	0.004 (0.006)	0.004 (0.007)	0.001 (0.053)	0.000 (0.101)
EXP	0.112 [*] (0.040)	0.087 [†] (0.046)	0.092 [#] (0.036)	0.072 [†] (0.037)	0.284 (0.317)	0.276 (0.303)
IMP	-0.106 [#] (0.043)	-0.090 [†] (0.050)	-0.073 (0.052)	-0.076 (0.055)	-0.203 (0.129)	-0.161 (0.131)
Y	0.095 [*] (0.032)	0.077 [#] (0.039)	0.107 [*] (0.036)	0.094 [#] (0.039)	0.027 (0.166)	-0.040 (0.162)
AGE	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.003)	0.000 (0.003)
UNION	-0.085 [*] (0.032)	-0.088 [#] (0.034)	-0.066 [†] (0.034)	-0.071 [#] (0.030)	-0.134 (0.157)	-0.165 (0.135)
TRAIN	-0.030 (0.032)	-0.032 (0.037)	-0.019 (0.035)	-0.023 (0.033)	-0.086 (0.120)	-0.114 (0.110)
PAK	-0.079 [#] (0.037)	-0.025 (0.044)	-0.068 [†] (0.037)	-0.004 (0.052)	-0.152 (0.109)	-0.092 (0.103)
Intercept	0.207 [*] (0.059)	0.185 [*] (0.058)	0.173 [*] (0.061)	0.140 [*] (0.051)	0.402 (0.292)	0.346 (0.274)
No. of obs.	954	954	833	833	121	121
coeff. of det.	0.114	0.115	0.114	0.117	0.148	0.166

^{*} Significance at 1 percent level [#] Significance at 5 percent level [†] Significance at 10 percent level.

Note: All regressions include industry dummies.

If we consider all firms, the result is that both types of innovation have a significant, positive influence on employment growth, even after controlling for a number of firm-specific characteristics. The coefficients of cost of raw materials have negative signs with a statistical significance effect on employment growth. According to our results for all firms, wage growth does not have any effect on employment growth,

¹⁴ It is observed that both types of innovations are often carried out simultaneously, and one of the primary reasons of this collinearity also is that PDINN and PRINN are predicted values obtained from the same model specification.

contrary to a negative effect often observed in the literature. Firms' export induces employment growth, whereas import has a significant, negative effect. This means that to fulfil export requirements, the companies need to hire more people. On the other hand, import of raw material does not complement, in fact substitute, employment. The likely explanation of this result coupled with the negative effect of material on employment growth is that when firms use their financial resources to arrange material inputs, they are reluctant to finance hiring of more people.

The literature often argues that an increase in demand for a firm's products translates into an increase in employment [Ross and Zimmermann (1993); Pianta (2001)]. Our demand side variable (LBUY), although is not a direct indicator of demand for firms' products but denotes that large buyers generate more demand than small ones, also shows a significant and positive influence on employment growth. A negative relationship of employment growth with firm age and with unionization was found by Variyam and Kraybill (1992) and by Blanchflower, *et al.* (1991) respectively. Long (1993), for Canadian firms, and Leonard (1992), for Californian manufacturing plants, also found that these factors hinder employment growth, especially in large firms. According to our results, it appears that the firm age does not have an effect on employment growth, whereas workers' union membership reduces employment growth. The possible reason for the negative impact of unionisation on employment growth could be that a firm's workers primarily take care of their own interest and have a fear of job losses or wage losses due to new employees, and exert pressure through the union to discourage job creation. A union's power to negotiate better conditions for workers (high wages, job security, high severance payments, etc.) may instigate a firm to be hesitant to increase employment.¹⁵ The results for formal training show that it does not contribute to employment growth in our sample, contrary to the findings of Cosh, *et al.* (2000) who found a positive effect of training on employment growth.

Finally, the coefficients of the Pakistan dummy for both PDINN-included (the regression using PDINN as one of the determinants of employment growth) and PRINN-included (the regression using PRINN as one of the determinants of employment growth) equations are negative but the standard errors render them insignificant in case of PRINN-included equation and significant in the other equation. This result might be a hint for higher employment growth in Bangladesh which can also be observed by looking at descriptive statistics.¹⁶

A further analysis with the sample split into low- and high-tech firms shows that both innovation types are significant, positive predictors of employment growth for both industrial sectors, except for insignificance of product innovation for high-tech sector. The result patterns of wage growth, firm age, and training do not vary between both industrial sectors, and also follow the pattern of all firms taken together. Raw material cost is almost an insignificant determinant for both sectors. The effect of export is significant on low-tech firms' employment growth and insignificant for high-tech sector. The significant, negative effect of import for all firms taken together disappears in separate analyses on both sectors. The effects of large buyers and unionisation in the low-tech sector differ from those of the high-tech sector: large buyer is a significant, positive

¹⁵See Long (1993) for a number of arguments which shapes the union-employment relationship.

¹⁶However, more rigorous statistical analysis is needed to conclude this relationship.

The findings of the employment growth analysis for Pakistani firms are reported in Table 9. Similar to the previously observed findings of both countries together and of Bangladeshi firms only, both product and process innovation appear to be conducive and important determinants of employment growth of all Pakistani firms. However, we witness some differences between both countries regarding the industrial sectors: both innovation types are significant (insignificant) determinants of low-tech (high-tech) Pakistani firms' employment growth, exactly the opposite of the result pattern of Bangladesh. This means that the effect of innovation on industry-specific employment growth largely depends on the prevailing national innovation systems (NISs), but inter-country differences are less important when we consider the employment effect of innovation as a whole.

Table 9
Employment Growth Equation for Pakistan
Bootstrapped S.E.s. are in Parentheses. Dep. var: EGROWTH

Independent Variables	All		Low-tech		High-tech	
	(1)	(2)	(3)	(4)	(5)	(6)
PDINN	0.255 [#] (0.106)		0.255 [#] (0.114)		0.811 (0.567)	
PRINN		0.157 [†] (0.091)		0.170 [†] (0.088)		-0.150 (0.432)
MATERIAL	-0.014 [†] (0.007)	-0.015 [†] (0.008)	-0.014 [†] (0.008)	-0.015 [†] (0.008)	0.008 (0.039)	0.010 (0.035)
WGROWTH	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.004)	-0.001 (0.004)	-0.005 (0.190)	-0.001 (0.206)
EXP	0.094 [†] (0.052)	0.126 [#] (0.059)	0.043 (0.042)	0.072 [†] (0.041)	0.298 (0.199)	0.567 (0.362)
IMP	-0.064 (0.048)	-0.041 (0.043)	-0.023 (0.041)	-0.010 (0.044)	-0.428 (0.293)	-0.206 (0.188)
Y	0.063 (0.063)	0.102 (0.070)	0.017 (0.038)	0.063 (0.039)	0.186 (0.336)	0.388 (0.451)
AGE	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	-0.006 (0.005)	-0.005 (0.005)
UNION	-0.108* (0.041)	-0.118* (0.044)	-0.101 [#] (0.041)	-0.098 [#] (0.041)	-0.057 (0.199)	-0.178 (0.185)
TRAIN	0.042 (0.042)	0.061 (0.042)	0.045 (0.041)	0.052 (0.045)	-0.277 (0.372)	0.273 (0.245)
Intercept	0.142 [#] (0.059)	0.151 [#] (0.063)	0.142 [#] (0.060)	0.148 [#] (0.064)	0.090 (0.317)	-0.093 (0.393)
No. of obs.	627	621	563	554	64	67
coeff. of det.	0.062	0.073	0.048	0.051	0.416	0.332

* Significance at 1 percent level # Significance at 5 percent level † Significance at 10 percent level.

Note: All regressions include industry dummies.

Higher material costs exhibit less employment growth in all Pakistani firms, meaning that in Pakistan human capital and raw material are substitutes rather than complements. This variable also has a significant, negative effect on low-tech firms' employment growth but is insignificant for the high-tech sector. Throughout Table 9 we can see that wage growth do not contribute to employment growth.

Export by a firm contributes positively towards the employment growth of all firm taken together and does not have any effect for high-tech sector. The relationship of export with low-tech employment growth is somewhat significant. Surprisingly, in all cases large buyers (our crude proxy of product demand) are unable to stimulate employment, though the coefficients signs are positive. One reason might be that the percentage of large buyers in Pakistan is only 7.48, which is quite low compared to 23.86 percent in Bangladesh, suggesting that Pakistani firms have lower product demand than Bangladeshi ones at an aggregate level. Moreover, firm age appears to be an insignificant predictor throughout Pakistan's results. Unlike the insignificant unionisation effect seen in Bangladesh, unionised Pakistani firms show significantly less employment growth than those with a non-unionised workforce in case of all firms taken together and of low-tech industries. The insignificant relationship between unionisation and employment growth in Bangladeshi high-tech firms can also be found in the corresponding group in Pakistan. In all Pakistani cases (all firms and low- and high-tech sector) training and import are inconsequential predictors of employment growth.

6. CONCLUSIONS AND POLICY DISCUSSION

Albeit knowing whether innovation is conducive or detrimental to job creation in developing countries and is of paramount importance to policy making, very few studies have tried to explore this relationship. This paper contributes to this by analysing the phenomenon in two developing countries: Pakistan and Bangladesh. We examined if this relationship differs across countries or across low-tech and high-tech industries. In our empirical analysis, we took care of the endogeneity of innovation in the employment equation by using its predicted values as an instrument.

Firm size (sales) appears to induce process innovation in the region of analysis as a whole and for Bangladesh separately; however, it does not have an effect for Pakistan. Schumpeter's hypothesis that large firms are more likely to be product innovators is rejected for both countries combined as well as individually. High-tech firms' sales induce product innovation in both countries together and in Bangladesh, while this effect is neither industry-specific nor significant in Pakistan, suggesting a complementarity between large firm size and R&D activities (high-tech firms are more R&D-intensive by definition) in two former cases. The export in this region as a whole and for low-tech sector does not induce product innovation. Similar findings are obtained for Bangladesh. However, this negative effect is diminished for high-tech sector and for all cases in Pakistan. General impression is that import induces innovation, especially process innovation. We find evidence of a negative effect of production workers' share of a firm's workforce on product innovation of all firms which do not apply to the high-tech sector. Our interpretation is that a relative decrease in non-production workers (who are more likely to be responsible for innovation than production workers) implies a relative decrease of innovation activities. According to our results, the effects of the innovation determinants analysed show some disparities across the low and high technology sector as well as across countries.

The innovation-employment analysis reveals that innovation (both product and process) encourages employment growth, even after controlling for a number of firm

specific characteristics.¹⁷ This means that the “compensation effect” of innovation dominates its “displacement effect”. For product innovation these results are in line with the literature. Our results corroborate the arguments of those who assert a positive effect of process innovation on employment growth instead of a negative influence; the latter may be more dominant, but our empirical analysis validates the former. This means that the short-term “displacement effect” of the labour saving characteristics of process innovation is weaker than the long-term “compensation effect” which works through price reduction and in turn demand expansion. These positive effects of both innovation types are not altered by the geographical locations of firms; they remain significant and positive across countries.

Innovation is also conducive to employment growth in low-tech sector of the region combined. Analysing sectors across countries, the positive effect of innovation on employment growth is confirmed only in high-tech Bangladeshi firms and low-tech Pakistani firms. Due to this disparity we argue that both countries have specific circumstances such as policies (of course, according to their own circumstances) regarding innovation pursuance, labour expertise, societal know how of novelties, etc., which favor one industrial sector or the other. Recall that 90 percent Pakistani firms compared with 77 percent of Bangladeshi ones are low-tech firms, and the very nature of the high-tech sector might lead policies to favour this sector more in Bangladesh than in Pakistan.

In addition, we observed an insignificant impact of growth of labour cost on employment growth throughout; this is contrary to the widely observed significant, negative effect in previous studies. One reason might be that labour in these countries is cheaper than in the developed ones, hence firms’ cost-related reluctance to hire new labour may not be significant enough to suppress employment growth.

The intermediate input of productivity (raw material) has a significant and negative effect on employment growth in all firms taken together and in Pakistan, in both sectors combined and in low-tech firms, suggesting substitutability with labour. The effect of material in high-tech firms is insignificant. This might be because of the complex nature of the high-tech sector’s production processes which does not allow firms to enhance one production factor while sacrificing the other. We do not find this significant, negative effect in Bangladesh but high-tech firms. The descriptive statistics on raw material and employment, coupled with above mentioned relationships of material and employment, suggest that Pakistani firms rely more on material input while Bangladeshi firms rely more on employment for their productivity.

We find differences between the performance of other control variables across countries and across industries, suggesting that the complex nature of the employment effect is sensitive to the NISs of different countries and to different industrial paradigms.

Based on our empirical analysis, we suggest the initiation of new and further development of ongoing innovation projects on the micro level and the rectification of the problems of NISs on the macro level to reduce unemployment in this region.

¹⁷This positive relationship between employment quantity and innovation, however, does not indicate the sign of inclusive growth. Innovation may increase employment on one hand but substitute unskilled workers by the skilled ones on the other, suppressing opportunities for unskilled employees. There are no employment quality variables in our dataset to explore this question.

REFERENCES

- Antonucci, T. and M. Pianta (2002) Employment Effects of Product and Process Innovation in Europe. *International Review of Applied Economics* 16:3, 295–307.
- Benavente, J. M. and R. Lauterbach (2008) Technological Innovation and Employment: Complements or Substitutes? *The European Journal of Development Research* 20:2, 318–329.
- Blanchflower, D. G. and S. M. Burgess (1998) New Technology and Jobs: Comparative Evidence from a Two Country Study. *Economics of Innovation and New Technology* 5:2-4, 109–138.
- Blanchflower, D. G., N. Millward, and A. J. Oswald (1991) Unionism and Employment behaviour. *The Economic Journal* 101:407, 815–834.
- Bogliacino, F. and M. Pianta (2010) Innovation and Employment: A Reinvestigation Using Revised Pavitt Classes. *Research Policy* 39:6, 799–809.
- Brouwer, E., A. Kleinknecht, and J. O. N. Reijnen (1993) Employment Growth and Innovation at the Firm Level. *Journal of Evolutionary Economics* 3:2, 153–159.
- Chennells, L. and J. Van Reenen (1999) Has Technology Hurt Less Skilled Workers? An Econometric Survey of the Effects of Technical Change on the Structure of Pay and Jobs. (Institute for Fiscal Studies Working Paper No. 99/27).
- Collin, S. M. (2007) Economic Growth in South Asia: A Growth Accounting Perspective. In A. Ahmed and E. Ghani (eds.) *South Asia: Growth and Regional Integration*. Macmillan India Ltd.
- Cosh, A. D., A. Hughes, and M. Weeks (2000) The Relationship between Training and Employment Growth in Small and Medium-Sized Enterprises. (Department for Education and Employment Research Report No. 245).
- Dahlman, C. J. (2007) Improving Technology, Skills and Innovation in South Asia. In A. Ahmed and E. Ghani (eds.) *South Asia: Growth and Regional Integration*. Macmillan India Ltd.
- Doms, M., T. Dunne, and M. J. Roberts (1995) The Role of Technology Use in the Survival and Growth of Manufacturing Plants. *International Journal of Industrial Organisation* 13:4, 523–542.
- Edquist, C., L. Hommen, and M. McKelvey (2001) *Innovation and Employment: Process versus Product Innovation*. Cheltenham, UK and Northampton, USA: Edward Elgar.
- Freel, M. S. and P. J. A. Robson (2004) Small Firm Innovation, Growth and Performance: Evidence from Scotland and Northern England. *International Small Business Journal* 22:6, 561–575.
- Geroski, P., S. Machin, and J. Van Reenen (1993) The Profitability of Innovating Firms. *The RAND Journal of Economics* 24:2, 198–211.
- Hall, B. H., F. Lotti, and J. Mairesse (2008) Employment, Innovation, and Productivity: Evidence from Italian Microdata. *Industrial and Corporate Change* 17:4, 813–839.
- Hall, B. H., F. Lotti, and J. Mairesse (2009) Innovation and Productivity in SMEs: Empirical Evidence for Italy. *Small Business Economics* 33:1, 13–33.
- Harrison, R., J. Jaumandreu, J. Mairesse, and B. Peters (2008) Does Innovation Stimulate Employment? A Firm-level Analysis Using Comparable Micro-data from Four European Countries. (NBER Working Paper No. 14216).

- Koellinger, P. (2008) The Relationship between Technology, Innovation, and Firm Performance—Empirical Evidence from e-business in Europe. *Research Policy* 37:8, 1317–1328.
- Leonard, J. S. (1992) Unions and Employment Growth. *Industrial Relations* 31:1, 80–94.
- Long, R. J. (1993) The Effect of Unionization on Employment Growth of Canadian Companies. *Indus. and Lab. Rel. Rev.* 46:4, 691.
- Lööf, H. and A. Heshmati (2006) On the Relationship between Innovation and Performance: A Sensitivity Analysis. *Economics of Innovation and New Technology* 15:4-5, 317–344.
- Mastrostefano, V. and M. Pianta (2009) Technology and Jobs. *Economics of Innovation and New Technology* 18:8, 729–741.
- Meriküll, J. (2010) The Impact of Innovation on Employment. *Eastern European Economics* 48:2, 25–38.
- Monge-González, R., J. A. Rodríguez-Alvarez, J. Hewitt, J. Orozco, and K. Ruiz (2011) Innovation and Employment Growth in Costa Rica: A Firm-level Analysis. (IDB Publications No.54278).
- Pianta, M. (2001) Innovation, Demand and Employment. In L. Soete and P. Petit (eds.) *Technology and the Future of European Employment*. Aldershot: Edward Elgar.
- Pianta, M. (2005) Innovation and Employment. In J. Fagerberg, D. Mowery, and R. R. Nelson (eds.) *The Handbook of Innovation*. Oxford: Oxford University Press.
- Ricardo, D. (2001) *On the Principles of Political Economy and Taxation* (3rd ed.). Kitchener, Ontario, Canada: Batoche Books.
- Ross, D. R. and K. F. Zimmermann (1993) Evaluating Reported Determinants of Labour Demand. *Labour Economics* 1:1, 71–84.
- Rothwell, R. and W. Zegveld (1979) *Technical Change and Employment*. London: Frances Printer.
- Smolny, W. (1998) Innovations, Prices and Employment: A Theoretical Model and an Empirical Application for West German Manufacturing Firms. *The Journal of Industrial Economics* 46:3, 359–381.
- Van Reenen, J. (1997) Employment and Technological Innovation: Evidence from UK Manufacturing Firms. *Journal of Labour Economics* 15:2, 255–284.
- Variyam, J. N. and D. S. Kraybill (1992) Empirical Evidence on Determinants of Firm Growth. *Economics Letters* 38:1, 31–36.
- Vivarelli, M. (2007) Innovation and Employment: A Survey. (IZA Discussion Paper No. 2621).
- Vivarelli, M., Evangelista, R. and Pianta M. (1996) Innovation and Employment in Italian Manufacturing Industry. *Research Policy* 25:7, 1013–1026.
- Yang, C. H. and Lin, C. H. A. (2008) Developing Employment Effects of Innovations: Microeconomic Evidence from Taiwan. *The Developing Economies* 46:2, 109–134.

Pakistan: State Autonomy, Extraction, and Elite Capture—A Theoretical Configuration

MUHAMMAD ASHFAQ AHMED

“When groups are adequately stated, everything is stated!”¹

Management of actions and interest groups has historically been sovereign’s existentialist imperative. The paper revitalizes philosophical state autonomy debate and then narrows down its focus to capture extractive antics of as erratic a state as Pakistan. A typology of factions – captioned as Elites – operative in extractive realm of Pakistan is developed to round them in theory, identify their properties, and lay bare mechanics of intra-elite and elite-non-elite transactions. The paper seminally develops the rational actor dilemma confronting Pakistani elites and identifies the modes through which the dilemma plausibly resolves itself. The transactional engagement between Pakistan’s internal and external rational actors is dissected to theorize that Pakistan essentially is an equilibrium consensus subsistence state thereby opening up vast vistas for future research. The paper concludes with the glum finding that Pakistan in its current essence and manifestation is fundamentally a captive state – beholden to elites of Pakistan.

JEL Classification: H1

Keywords: State Autonomy; Elite Capture; Pakistan’s Tax System; Pakistani Elites; Elites’ Rational Actor Dilemma; Equilibrium Consensus Subsistence State; Captive State

I. INTRODUCTION

One of the most perennial questions that all regime types have historically encountered is the management of factions—that is, their expectations, interests, interplay, and ambitions—operating in the polity. In spite of the fact that factions and interest groups have always been extant in all states—totalitarian or democratic—at the other end of the interaction between the government and the governed—yet at a theoretical-philosophical level their operation and even presence has mostly been discounted. Rousseau found interest articulation by factions “as inimical to the general will.”² Although Madison reckoned factions to be the supporters of liberty, yet viewed the ones “actuated by some common impulse of passion, or of interest” as a threat to the

Muhammad Ashfaq Ahmed <muhammad.ashfaq@fbr.gov.pk> is a Member of Pakistan Inland Revenue Service, and is currently posted as Commissioner IRS, Regional Tax Office, Rawalpindi.

¹A. F. Bentley, *The Process of Government: A Study of Social Pressures* (New York: Transaction, 1995).

²Rousseau, “Introduction,” in *Political Writings*, (ed.) F. M. Watkins (New York: Nelson, 1953).

“permanent and aggregate interests of the community.”³ In fact, factions and interest groups have found little sympathy in democratic traditions of all shades and hues. In the U.S., for instance, many States had laws in place prescribing fines and penalties on lobbying activities. Likewise, and understandably so, totalitarian regimes have tended to deny factions any right to collective interest articulation and autonomous action,⁴ though Article 126 of the Soviet Constitution specifically affirmed citizenry’s right to form groups and alliances with common goals. Factions “represent the interest of the sections into which a society divides,”⁵ but they must be able to articulate those interests and make an effort to pursue them by aligning and engaging themselves with the political process. Once it is decided that it is the factions with stakes in political bargaining and having both the will and the capacity to go in pursuit of their stakes belong to the universe that has interchangeably been captioned as “power elite,” “elite(s),”⁶ “pressure groups,” “lobbies,” “interest groups,” and “power groups,” etc.⁷

Notwithstanding a pronounced dislike for their very existence and a socio-legal sanction of their operations, factions could be taken to perform important role towards socio-political development of states. It has convincingly been argued that factions—in the form of non-voluntary and obligatory collectivisms of controlled polities or voluntary formations of democratic dispensations—do facilitate identification of the individual with the political system; such identification being critically important towards state-building and cementing state-society relations. “In the nexus between economic, social and political power, interest groups translate economic power into social power and share with parties the function of transforming social power into political decisions.”⁸ Factions, at least theoretically, are expected to articulate to the regime apparatus, demands of a purportedly homogeneous clientele, which political parties then aggregate, consume, and transform into public policy outputs. Since factions, under normal circumstances, generate demands on existing politico-governance structures, and are, therefore, bound by rules of the game set by the system, in actuality pressure and power move in cadence. Although pressure—“continuation of bargaining by other means—denotes only one form of influence.”⁹ Contrarily, the density level of group activity could be taken for a reliable barometer of bargaining pressure on a political system at a given point in time.¹⁰

Now, until factions or groups continue to articulate their interests to state apparatus—being subsidiary and external to state apparatus, policy outputs are likely to be those of an *autonomous state*. However, as soon as factions pitch up their articulation

³A. Hamilton, J. Madison, and J. Jay, *The Federalist Papers* (Minneapolis: Filiquarian Publishing, LLC, 2007).

⁴Encyclopedia, “Interest Groups,” in *International Encyclopedia of the Social Sciences* (Encyclopedia.com, 1968).

⁵Ibid.

⁶In the paper, the term “Elite” denotes a single elite group, and the term “Elites” denotes all elite groups conceptualised together and operating collectively.

⁷Encyclopedia, “Interest Groups.”

⁸Franz L. Neumann, “Approaches to the Study of Political Power,” in *The Democratic and the Authoritarian State: Essays in Political and Legal Theory*, ed. Herbert Marcuse and Ill Glencose (London: Free Press, 1957), 3–21.

⁹Graham Wootton, *The Politics of Influence: British Ex-Servicemen, Cabinet Decisions and Cultural Change, 1917-1957* (Cambridge, Massachusetts: Harvard University Press, 1963).

¹⁰Ibid.

effort—either out of frustration of gaining less than their expectations or out of their expectation to gain more than what they have gained or are set to gain through set patterns of articulation—and infiltrate into or make an attempt to infiltrate into state apparatus itself—the scenario is dubbed as *state captivity* or *elite capture*. This study is an attempt to lay bare and explore into these competing concepts of autonomy and capture within the spatial dimension of the state of Pakistan. In between these opposing pulls of state autonomy and state captivity, stands Elites Ltd—a convenient conceptual-cum-operational vehicle of loosely organised interest groups—to dissect Pakistan’s extractive function¹¹ with a view to answering the cardinal question as to why Pakistan’s extractive function has adjusted to historically embedded low performance levels.

The paper is divided into VI sections each one dealing with a different dimension of the subject. After introduction in Section I, Sections II and III deal with theory and literature review on power and state autonomy, and elites, respectively. While Section IV propounds and attempts to resolve rational actor dilemma with regard to the state of Pakistan, Section V extends the rational actor framework to the international stakeholders as external rational actors and seminally argues that sustained intense engagement between internal and external stakeholders on who picks and how much of the total cost of keeping Pakistani state afloat is essentially what renders Pakistan an equilibrium consensus subsistence state. Section VI concludes the discussion.

II. STATE AUTONOMY

In spite of the fact that, though in a negative connotation, the question of faction management has historically found place in most literature on political philosophy starting with Aristotle,¹² its corresponding term “state autonomy” made into the lexicon of the discipline relatively recently. A consensus appears to be emerging on Nicos Poulantzas¹³ for coining the expression “state autonomy” in 1960s,¹⁴ developing its formulation that has remained at the centre of all relevant debate over the past half century—including its various dimensions, e.g. “‘relative’ autonomy of the state.”¹⁵

State autonomy could operationally imply a given state’s “ability to act and formulate interests of its own independently of and even against dominant groups (classes) and societal interests.”¹⁶ It thus follows that a state whose throw up in terms of policy formulation is larger than the sum of all interest group demand articulations could be dubbed an autonomous state. Contrarily, if a state’s aggregate policy outputs over a period of time are equal to or are less than the sum of polity’s interest group demand

¹¹Although the terms “extraction” and “extractive” have been used to denote state’s total resource generation processes yet the major concern of the paper remains the study of the tax system and its various underlying socio-political triggers and dynamics.

¹²See, in particular, Chapter V and VI, Aristotle, T. Sinclair, and T. J. Saunders, *The Politics* (New York: Penguin Books Ltd., 1981).

¹³See, for instance, N. Poulantzas, “The Problem of the Capitalist State,” *New Left Review* 58 (1969); Nicos Poulantzas, *Political Power and Social Class* (London: New Left Books, 1973); N. Poulantzas, *The Crisis of Dictatorships* (London: New Left Books, 1976); *State, Power, and Socialism* (London: New Left Books, 1978).

¹⁴The entire debate on state autonomy in this paper and mostly elsewhere, too, is with reference to capitalist state alone.

¹⁵Ralph Miliband, “State Power and Class Interests,” *New Left Review*, No. 138 (1983).

¹⁶Diamantino P. Machado, “On the Autonomy of the State and the Case of the Portuguese Estado Nova,” <http://www.pages.drexel.edu/~machadod/autonomy.html>.

articulations, it could be referred to as an un-autonomous or a captive state—shorn of all additives, a state in elite capture.¹⁷ A state could further be classified as a relatively autonomous or captive state depending on the size and significance of various variables extant in the equation. Scholars have leveraged the state autonomy analytical framework to interpret the behaviour, composition and character of all types of states—totalitarian, democratic, hybrid, peripheral or dependent states.

A very important debate is, whether one could answer the critical question of a state's autonomy merely by dint of its ability to formulate policies independent of the influence of polity's legitimate classes and interest groups (neutral policy formulation), that is, without gauging its ability to implement its policies independent of the influence of classes and interest groups (neutral policy implementation).¹⁸ This is simply because even a most neutrally formulated policy, if hijacked by factions and thus not neutrally implemented, will come to a naught or end up achieving sub-optimal outcomes. Like in Pakistan, where Elites Ltd, in addition to rigging policy formulation process thereby compelling the state to deliver below-par policy outputs, decisively ventures to infiltrate into and manipulate state's policy implementation apparatus, too—again forcing it to deliver below par policy outcomes. The paper posits that a state's ability to neutrally implement its policies is an equally important variable in the equation.

Problem of Power

The problem of state autonomy, essentially boils down to as to who exercises power in the decision-making processes and structures of the state. A significant amount of scholarship has been created on the concept of power and its plausible facets and dimensions. The foremost and simplest dimension of power is best derived from Dahl's illustrative definition: "A has power over B to the extent that he can get B to do something that B would not otherwise do."¹⁹ This particular dimension of power may manifest itself through physical restraint, persuasion, inducement, commitment activation, and coercion,²⁰ and does imply latent conflict of interests between the parties concerned.²¹ Bachrach and Baratz tended to broaden Dahl's rather simpler configuration of power and suggested to include the confining of "the scope of decision-making to relatively 'safe' issues," into the concept of power and its exercise.²² While disagreeing

¹⁷The terms "outputs" and "outcomes" have been interchangeably used in the literature. However, for clarity's sake, the paper uses the term "outputs" with reference to policy formulation process, and the term "outcomes" with reference to policy implementation process, and assumes that conversion of outputs into outcomes could be a function of various complex and intricate variables and their interplay, and that although measurement and quantification of "outputs" could be easier and simpler than that of "outcomes," yet both of the concepts connote different phenomena which justifies their parallel use depending on contextual requirements.

¹⁸At certain level, this might appear to be a question of state capacity rather than that of state autonomy, but this is an important concept in the context of the theoretical framework being developed in that the paper posits that even if a particular policy gets formulated neutrally of the influence of the elitist juggernaut, it could still be tinkered with by the elites through the generalist bureaucratic machine, at the implementation stage.

¹⁹Robert A. Dahl, "The Concept of Power," *Behavioral Science* 2, No. 3 (1957): 203.

²⁰Brian Barry, "Power: An Economic Analysis," in *Democracy, Power, and Justice: Essays in Political Theory*, ed. Brian Barry (Oxford: Oxford University Press, 1989), 223.

²¹Colin Hay, *Political Analysis: A Critical Introduction* (Basinstoke: Palgrave, 2002), 172.

²²Peter Bachrach and Morton Baratz, "Two Faces of Power," *The American Political Science Review* 56, No. 4 (1962): 948.

with Dahl's definition of a key political issue that it "should involve actual disagreement in preferences among two or more groups,"²³ Bachrach and Baratz strongly argued that this was not good enough a conceptualisation of a key issue because people could disagree on all types of issues—important and unimportant,²⁴ and that a real important issue would be the one that challenged the predominant values,²⁵ and it were these kinds of issues that the dominant actor would be attempting to keep off the agenda.²⁶

Lukes, in turn, criticised Bachrach and Baratz and suggested that agenda-setting, which, in fact, was nothing more than a system of bias, was sustained by an underlying socio-cultural environment and not by a sequence of individual acts, which would render a group susceptible to the systemic effects of mobilisation of bias primarily stemming from the form of the organisation.²⁷ Lukes believed although power was all about observable conflicts yet all power might not involve observable conflicts. He also posited the power need not be exercised only in situations of conflict since the dominant player could exercise power on the weaker player through reshaping of the latter's set of wants,²⁸ which entailed a semantic control of some order as a natural corollary in terms of suspension of belief of the wronged that he was entitled to have a legitimate grievance.²⁹ Thus, Lukes comes up with a third dimension of power, "which consists in a contradiction between the interests of those exercising power and the real interests of those they exclude."³⁰ It follows that actual conflict could be pushed to the sub-surface if power were exploited to blind a weaker player from being able to see his real interests. "Indeed, is it not the supreme exercise of power to get another or others to have the desires you want them to have," Lukes argues, "that is to secure their compliance by controlling their thoughts and desires."³¹

Peter Digeser, exploiting Michel Foucault's conceptual framework, comes up with the fourth dimension of power and contends that "the nature of obligation, the capacity of individuals to act freely ... all of our political, economic, legal, and religious practices are planted in a social context governed by various rules and discourses forged by relations of power."³² Digeser believes that the pre-existing socio-cultural facts including legal-cum-governance milieu facilitates exercise of power by the dominant group on the weaker one in a subtle and pre-ordained manner. Although, academically significant yet contextually less important is the typology of power developed by French and Raven, which includes five bases of power, namely, reward, coercion, legitimate, expert and referent.³³ Subsequently, Raven added 'informational power' to the model to make it stand on six bases.³⁴ Etzioni focuses is on the study and exercise of power through the

²³Robert A. Dahl, "A Critique of the Rule Elite Model," *ibid.* 52, No. 2 (1958): 467.

²⁴Peter Bachrach and Morton Baratz, "Two Faces of Power," *ibid.* 56, No. 4 (1962): 950.

²⁵*Ibid.*

²⁶*Ibid.*

²⁷Steven Lukes, *Power: A Radical View*, 2nd Edition ed. (Basingstoke: Palgrave Macmillan, 2005), 25.

²⁸*Ibid.*, 27.

²⁹*Ibid.*, 28.

³⁰ *Ibid.*

³¹*Ibid.*, 27.

³²Peter Digeser, "The Fourth Face of Power," *The Journal of Politics* 54, No. 4 (1992): 981.

³³J. R. P. French and B. H. Raven (ed.) "The Bases of Social Power," in *Group Dynamics*, D. Cartwright and A. Zander (New York: Harper and Row, 1959).

³⁴B. H. Raven, "Social Influence and Power," in *Current Studies in Social Psychology*, ed. I. D. Steiner and M. Fishbein (New York: Holt, Rinehard, Winston, 1965).

vehicle of the organisation to famously herald that “we are born in organisations, educated by organisations, and most of us spend much of our lives working for organisations.”³⁵ Etzioni classifies organisations by the type of power they use to direct the behaviour of their members and the type of involvement of their people, and goes on to identify three types of organisational power: coercive, utilitarian and normative, and relates these to three types of involvement: alternative, calculative, and moral.³⁶ Etzioni’s influence on the scholarship on organisation remains formidable.

Parsons, after dilating upon various dimensions of power, settles on the basic consensus view of power as having to do with the ability of people or social groups (“collectivities”) “to get things done”—especially when there is some type of resistance present.³⁷ He looks to examine power within the context of societies with special attention being paid to the role that coercive measures can play in relation to “the voluntary and consensual aspects of power systems.” By juxtaposing money in an economic system to the use of power in a political system, Parsons shows similarities and dissimilarities in the use of both in the “collectivities.” Parsons finds problems with the existing literature majorly in three areas. One, he rejects the view that power is simply the “generalised capacity to attain ends or goals in social relations, independently of the media employed or of the status of ‘authorisation’ to make decision or impose obligations.” On the contrary, Parsons argues that power requires to be understood as a “specific mechanism operating to bring about changes in the action of other units, individual or collective, in the process of social interaction.”³⁸ Two, picking on the theorists who view power only in terms of being coercive or consensual, Parsons argues that, in fact, both attributes are ‘essential’ to the concept of political power and that they could not be viewed independent of each other. “It is both,” Parsons held, “precisely because it is a phenomenon which integrates a plurality of factors and outputs of political effectiveness and is not to be identified with any one of them.”³⁹ Three, Parsons fell out with his peers on power for their almost linear belief that the imposing of power resulted in a zero-sum outcome, and that any increase in power of one necessarily means a decrease in the power of the other. Parsons, on the contrary believed that a zero-sum outcome was possible and it often occurred too, but it was just not always the case.

It would be seen that, in the case of Pakistan, exercise of power by the oligarchs on the citizenry occurs through a variety of ways ranging from the most naked i.e. direct coercion to the most subtle i.e. agenda-manipulation and semantic occupation. The debate on the complexities of power and the ways in which it was exercised, would underpin and illuminate an extensive survey of the wide-ranging literature on state autonomy in the broader realm of political economy created over the past half century, which can be analysed and reviewed by dividing and classifying into two competing strands: (a) society-centric strand; and (b) state-centric strand.

³⁵A. Etzioni, *A Comprehensive Analysis of Complex Organisations* (New York: Free Press, 1975).

³⁶Fred C. Lunenburg, “Compliance Theory and Organisational Effectiveness.” *International Journal of Scholarly Academic Intellectual Diversity* 14, No. 1 (2012).

³⁷Talcott Parsons, “On the Concept of Political Power,” *Proceedings of the American Philosophical Society* 107, No. 3 (1963).

³⁸*Ibid.*, 232.

³⁹*Ibid.*, 258.

(a) Society-centric Strand

For society-centric theorists, the starting point of inquiry in comprehending the state and its conduct is the understanding of social functions underlying it. Thus, the proper explanatory direction, society-centric thinkers believe, is from the society to the state. “Thus, the analysis of the forms of the capitalist state can only be made when the causal necessity of the emergence and existence of the state, and its organisational apparatus, derives from the nexus of individual relationships (liberal state theory, pluralism) or the nexus of class relationships (Marxian state theory).”⁴⁰ Marx believed that “forms of state are to be grasped neither from themselves...but rather have their roots in the material conditions of life...,” and that “anatomy of civil society is to be sought in political economy.”⁴¹ Engels, too, thinks that “state is...by no means a power forced on society from without...rather it is a product of society at a certain stage of development...this power, arisen out of society, but placing itself above it...is the state.”⁴² Then both thinkers collaboratively took the position that “only political superstition today imagines that social life must be held together by the state, whereas in reality the state is held together by civil life.”⁴³

To them and their intellectual progeny (neo-Marxists), the state is nothing more than an extension of civil society, and a self-propelled process, which reproduces normative social order exclusively geared to protect particular and not general interests and maintain the status quo. It has, therefore, been argued that for Marx, Engels and their followers to a good extent “state and its bureaucratic organisation constitute ‘parasitic’ entities.”⁴⁴ Thus, the capitalist state, irrespective of the level of economic development of its underlying society, professes unto itself, as its *raison d’être*, the protection of particular interests of the capital-owning class, and is given to maintaining “general conditions for the reproduction of the wage labour/capital relation which is at the heart of bourgeois societies.”⁴⁵ The ontological primacy, which the duo—Marx and Engels—appears associating to civil society, leads them to further theorise that “capitalist state is, and can only be, relatively autonomous.”⁴⁶

In fact, this very Marxian position, that the capitalist state is nothing more than a bourgeoisie tool tailor-made and unleashed to dominate the proletariat and advance the bourgeois class interests, has tended to develop a subsidiary view i.e. relative state autonomy. Marx, illustratively talking about the Second French Empire remarked that “in reality, it was the only form of government possible at a time when the bourgeoisie had already lost, and the working class had not yet acquired, the faculty of ruling the nation.”⁴⁷ Engels, echoing Marx, also observed that “by way of exception, however,

⁴⁰Machado, “On the Autonomy of the State and the Case of the Portuguse Estado Nova”.

⁴¹K. Marx, *Preface to a Critique of Political Economy* (London: Electric Books, 2001).

⁴²Friedrich Engels, *The Origin of the Family, Private Property and the State* (New York: New International Publishers, 1972).

⁴³K. Marx and F. Engels, *The Holy Family* (Honolulu: University Press of the Pacific, 2002).

⁴⁴D. Held, *Political Theory and the Modern State: Essays on State, Power, and Democracy* (Stanford: Stanford University Press, 1989), 39.

⁴⁵Ronaldo Munck, *Politics and Dependency in the Third World: The Case of Latin America* (London: Zed Books, 1984), 206.

⁴⁶Machado, “On the Autonomy of the State and the Case of the Portuguse Estado Nova” 2.

⁴⁷K. Marx and L.H. Simon, *Marx: Selected Writings* (Hackett, 1994), 304.

periods occur in which the warring classes balance each other so nearly that the state power, as ostensible mediator, acquires, for the moment, a certain degree of independence of both,” and that such “was the Bonapartism of the First, and still more of the Second French Empire, which played off the proletariat against the bourgeoisie and the bourgeoisie against the proletariat.”⁴⁸ Thus, while both Marx and Engels posit that all capitalist states continue to remain class states in essential composition and character, they might starkly differ in degree and level of autonomy.⁴⁹

Subsequent thinkers could be classified into two separate streams of scholarship, that is, the Instrumentalists and the Structuralists. Neo-Marxists, who agree on the basic premise that capitalist state is nothing more than a tool at the command of capital-owning classes tasked to promoting and advancing their politico-economic agenda, but differs in the ways it achieves its objectives, are loosely dubbed as Instrumentalists. The substantial amount of Instrumentalist knowledge created during the second half of the twentieth century, is dedicated to exploring various ways through which the institution of the state can be leveraged, by capital-owning classes, to maintain and maximise the economic status quo.⁵⁰ The Instrumentalists, broadly speaking, take the position that the state, in effect, is an “instrument for the domination of society,”⁵¹ which seeks to perform its avowed functions in deliberate subservience to the “instrumental exercise of power by people in strategic positions.” When such strategically placed people exploit the state structure directly, the scenario is referred to as direct instrumentality; and when they exert pressure on the polity indirectly, the scenario is dubbed as indirect instrumentality.⁵² But in either case, the overarching objective of state exploitation remains the optimisation of the capitalist class’s interests. Instrumentalists further contend that in order for the capitalist state to promote capital-owning class’s interest, it has to be relatively autonomous. “Its relative independence makes it possible for the state to play its class role in an approximately flexible manner. If it really was the simple ‘instrument’ of the ‘ruling class’, it would be fatally inhibited in the performance of its role. Its agents absolutely need a measure of freedom in deciding how best to serve the existing social order.”⁵³ It has been remarked that within the Marxist school of thought there are “a variety of theoretical perspectives which co-exist in an uneasy and unstable relation.”⁵⁴

⁴⁸Engels, *The Origin of the Family, Private Property and the State*, 160-61.

⁴⁹Machado, “On the Autonomy of the State and the Case of the Portuguese Estado Nova” 3.

⁵⁰See, for instance, Ralph Miliband, *The State in Capitalist Society* (London: Winfield and Nelson, 1969); “The Capitalist State—Reply to Poulantzas,” *New Left Review*, No. 59 (1970); “Poulantzas and the Capitalist State,” *New Left Review*, No. 82 (1973); *Marxism and Politics* (New York: Oxford University Press, 1977); *Class Power and State Power* (London: Verso, 1983); W. Domhoff, *Who Rules America Now?* (Englewood Cliffs, NJ: Prentice Hall, 1983); G. William Domhoff and Thomas R. Dye, *Power Elites and Organisations* (Newbury Park, Calif.: Sage Publications, 1987); W. Domhoff, *The Power Elite and the State* (New York: Aldine de Gruyter, 1990); M. Useem, “The Social Organisation of the American Business Elite and Participation of Corporate Directors in the Governance of American Institutions,” *American Sociological Review*, no. 44 (1979); *The Inner Circle* (New York: Oxford University Press, 1984); D. A. Gold, “Recent Developments in Marxist Theory of the State,” *Monthly Review* 27, No. 5 (1975); “Recent Developments in Marxist Theory of the State,” *Monthly Review* 27, No. 6 (1975).

⁵¹Miliband, *The State in Capitalist Society*, 22.

⁵²Gold, “Recent Developments in Marxist Theory of the State.”

⁵³Miliband, *Marxism and Politics*, 87.

⁵⁴B. Jessop, *The Capitalist State: Marxist Theories and Method* (New York: New York University Press, 1982), xii.

Neo-Marxists⁵⁵ who assert that it is not possible to understand state and its conduct through “behaviorist/empiricist observations of instrumental exercise of power by the ruling class, because the class composition of those running the state apparatuses is of no importance to the nature of the state in capitalist societies,”⁵⁶ are referred to as Structuralists. Contrarily, Structuralists argue that “it is the structure of these societies that makes the state serve the capitalist class that is causal significant.”⁵⁷ Poulantzas suggests that both social class and the state are “objective structures,” and their interplay and mutual relationship ought to be “taken as an objective system of regular connections.”⁵⁸ He avers that since the state is essentially a product and outcome of interactions, it must intrinsically and essentially be a “condensation of class-based relations.”⁵⁹ Furthermore, since the state is reflective of objective power structures, it cannot be taken to be autonomous; it can be taken to be relatively autonomous only—perhaps, to the extent that the state is not able to broker deals and come up with the win-win (intra-class) inter-group bargains and has to assume the role of the final arbiter of disputes and power. Thus, the relative autonomy of the state would be equal to the capacity it obtains to operate autonomously of the capitalist class while continuing to be essentially a capitalist state. Althusser, leading proponent of French Structuralist Neo-Marxism, argued that it was a cardinal mistake to read Marxism in terms of historicism, idealism, economism or even phenomenological Marxism. He explained that this mistake was being made by Marxian interpreters’ who were caught in “pre-historic humanistic ideology” and were obsessed with his early works. Instead, Althusser stressed that Marx presented an outright epistemological break with the pre-existing scholarship traditions, and that his work bordered on science.⁶⁰ Kolakowski came down hard on Althusser being near-totally off-mark arguing that the Structuralist analysis of Marx was unfalsifiable; hence, unscientific.⁶¹

(b) *State-centric Strand*

The state-centric strand scholars argue that the state is an entity whose action bits constitute the primary unit of analysis for any further inquiry. The causal direction, according to state-centric strand scholars, is from the state structure to the society, and not the other way round. “To state-centred theorists the state is at the same time embedded in the structural relations of capitalistic social formation, and an independent organisation which has a monopoly on coercive power, and a life and form of its own.”⁶² Amongst the state-centric theorists, Weber is the first one to argue that states “are compulsory associations claiming control over territories and the people over them.”⁶³

⁵⁵Neo-Marxist Structuralists e.g. Poulantzas develop a Marxist theory of the capitalist state from the logic of capitalism—using Althusser’s structuralist epistemology.

⁵⁶Machado, “On the Autonomy of the State and the Case of the Portuguese Estado Nova”.

⁵⁷Ibid.

⁵⁸Poulantzas, “The Problem of the Capitalist State.”

⁵⁹Poulantzas, *Political Power and Social Class*.

⁶⁰Louis Althusser, *For Marx* (London: Verso, 2005).

⁶¹Leszek Kolakowski, “Althusser’s Marx,” *Socialist Register* (1971).

⁶²Machado, “On the Autonomy of the State and the Case of the Portuguese Estado Nova” 4.

⁶³Cited in Dietrich Rueschemeyer Peter B. Evans, Theda Skocpol., ed. *Bringing the State Back In* (London: Cambridge University Press, 1985), 7.

Weber and his disciples,⁶⁴ firmly suggest that the state can pursue objectives or targets, which do not, necessarily, echo the demand articulations of power-wielding factions vying to maximise their gains in the state. In a clear-cut departure from Marxists and Neo-Marxists, Weber was not able to agree to the notion that the state was “parasitic” in its very nature and properties, and a “direct product of the activities of classes.” The “modern state is not, Weber contended, an effect of capitalism; it preceded and helped promote capitalist development.”⁶⁵

In a Weberian vein, Block takes an outright position that the institution of the state does not possess the property of reducibility to mere class interests and struggles, and avers that “State power is *sui generis*, not reducible to class power,” and that “each social formation determines that particular way in which state power will be exercised within that society.”⁶⁶ Block brings in a new theoretical construct, “state managers,” and argues that the state managers “are individuals not involved in the relations of production and are, therefore, independent from the capitalist class, even if they were proper members of that class before they became state managers.”⁶⁷ The “State managers” appears to be Block’s answer to the question of “relative state autonomy,” which he finds to be “a slightly more sophisticated version of the instrumental view it attacks.”⁶⁸ Block’s disambiguation helps convincingly argue that since the “state managers”—whose primary mandate is to facilitate contract enforcement, provide enabling environment, keep “business confidence,” and maintain law and order—get remunerated from the state exchequer and are governed by rules and regulations laid down by the state, and therefore, they cannot be taken as mechanical agents promoting class interests, nor “reduction of state power to class power implied in the qualification “relative” as a natural corollary.⁶⁹ Thus, on the one hand, Block’s state is inherently organisationally autonomous of the ruling classes, and on the other, does function, on its own, to guarantee capital accumulation and maintain the all-important class domination.

Skocpol’s contribution to the state autonomy project is rather a robust defense of the state as a “structural” organisation. She strongly believes that the state is essentially irreducible to inter-class relations or struggles; that the state, too, is an organisation with a persona capable of independent decision-making just like any other ordinary organisation with a structure, functional mechanisms, and having objectives to pursue.⁷⁰ Skocpol castigates Marxists (and neo-Marxist Structuralists) for assuming that “states are inherently shaped by classes or class struggles” and exclusively given “to preserve and expand modes of production.”⁷¹ She also attacks them for making it “virtually impossible even to raise the possibility that fundamental conflicts of interest might arise between the existing dominant class, or set of groups on the one hand, and the state rulers on the

⁶⁴Also styled as “Neo-Weberians.”

⁶⁵Held, *Political Theory and the Modern State: Essays on State, Power, and Democracy*, 41.

⁶⁶Fred Block, “Beyond Relative Autonomy: State Managers as Historical Subjects,” in *Socialist Register*, ed. Ralph Miliband and J. Saville (London: Merlin Press, 1980), 229.

⁶⁷Machado, “On the Autonomy of the State and the Case of the Portuguse Estado Nova”.

⁶⁸Fred Block, “Beyond Corporate Liberalism,” *Social Problems* 24 (1977): 7.

⁶⁹“Beyond Relative Autonomy: State Managers as Historical Subjects,” 230.

⁷⁰This is the position which is also taken by Weber and Block.

⁷¹Peter B. Evans, *Bringing the State Back In*, 4.

other.⁷² She critiqued Poulantzas' approach as she found it very frustrating because he simply posited the "relative autonomy of the capitalist state" as an indispensable element and attribute of capitalist production mode.⁷³ The state, Skocpol points out, is to be seen "as an organisation for itself."⁷⁴ She also takes to task "virtually all neo-Marxist writers of the state" for retaining "deeply embedded society-centered assumptions,"⁷⁵ and overlooking the fact that all "important social change is a consequence of autonomous state activity."⁷⁶

While a substantial amount of literature has evolved on state autonomy and its various dimensions, hardly anything has been written on state captivity—a plausible antonym of state autonomy.⁷⁷ May be it has just been assumed that mere absence of state autonomy is tantamount to state captivity; maybe not; maybe it is more than that, needing corresponding and independent theorisation. Nonetheless, the dissection of influence of factions on state or its conduct under Marxist, Neo-Marxist or even state-centric traditions, illuminates the succeeding debate in the particular context of Pakistan.

III. ELITE CAPTURE IN PAKISTAN

Since C. Wright Mills published his path-breaking work "The Power Elite" in 1956 to propound his thesis that America was in an effective control of the military, economic, and political elites,⁷⁸ a large number of scholars have applied his analytical framework to examine politico-economic structures of a number of countries. Some expanded it to include certain other elite (groups) into the framework to fit a certain peculiar situation, and still others have channeled energies to prove him right or wrong. Mills argues "that these men of the Power Elite now occupy the strategic places in the structure of American society; that they command the dominant institutions of the dominant nation; that as a set of men, they are in a position to make decisions with terrible consequences for the underlying populations of the world."⁷⁹

What are main features of the Millsian power elite? Broadly speaking Mills' power elite are at the pinnacle of economic, military, and political institutions—more as types and functions than as individuals. Since their positions of power are interchangeable across domains, they do shuffle their positions that inevitably results in an institutionally-developed near-uniform worldview. They share a clear-cut "class consciousness" and a unique image of themselves as a social fact—regardless of their ostensible party affiliations and popularly ascribed ideological labelling, which effectively manifests itself in their aggressive policy posturing as—they ruthlessly

⁷²Theda Skocpol, *States and Social Revolutions: A Comparative Analysis of France, Russian and China* (London: Cambridge University Press, 1975), 27.

⁷³Peter B. Evans, *Bringing the State Back In*, 33.

⁷⁴Theda Skocpol, "The Broken Wave," *Journal of Development Studies* 15, No. 4 (1979): 27.

⁷⁵Peter B. Evans, *Bringing the State Back In*, 5-9.

⁷⁶R. F. Levine, "Bringing Class Back In: State Theory and Theories of the State," in *Recapturing Marxism, an Appraisal of Recent Trends in Sociological Theory*, ed. R. F. Levine and J. Lembecke (New York: Praeger, 1987), 97.

⁷⁷On Pakistan, an academic dissertation, not of much significance though, has been attempted. See Oskar Verkaaik, "The Captive State: Corruption, Intelligence Agencies, and Ethnicity in Pakistan," ed. Amsterdam School for Social Science Research (2006).

⁷⁸C. Wright Mills, *The Power Elite* (New York: Oxford University Press, 1956).

⁷⁹*Ibid.*, 286.

venture to pursue their goals at the cost of the underlying millions with impunity and, in fact, quite impersonally. The power elite do not necessarily hail from a common privileged origin. However, their selection, grooming and promotion through an institutionally evolved process, guarantees an identical worldview, regardless of the commonality of origin. The commonality of origin can under-write a completely uniform worldview as variances in the background, even if moulded by elitist institutional conditioning, can result in divergences in the worldview. There might be factions amongst power elite but their over-arching commonality of interests breeds an inner discipline that binds them together.⁸⁰ Millsian power elite do not conspire in a coordinated fashion—not for any petty self-interest, but for dominant positions in the dominant institutional orders of the most dominant state in the world. Due to the fact that during the length of their careers at top positions, and that hardly any fundamental variation in overarching world vision is possible, they do what is expected and required of them to sustain integrity of the benefactor system. These traits, Mills thought, create a class of individuals who effectively controlled America—and by implication—the world.

Pakistani Elites

In order to expand the elitist model to explain the domination of Pakistan's polity, economy, and extractive function, it needs to be seen if the elitist factor is at work in the first place? Hamza Alavi, was by far the first scholar of renown to have tried explaining the structural construction and mechanics of the state of Pakistan from the perspective of its oligarchical control.⁸¹ In a clear-cut departure from the traditional scholarship that argued that Pakistan's creation was due to a movement for an independent state that was triggered and sustained by a religiously motivated passion, Alavi posited that it was, instead, led by salary-dependent class of Muslim government servants—"Salariat."⁸² Alavi thought that "Having seen a diminution in its share of jobs in pre-partition India, this "Salariat" saw that it stood to gain most from the creation of a new state."⁸³ Alavi developed his concept and built it on the premise that since (a) none of the dominant social classes in the post-colonial Pakistan were powerful enough to control the state; and (b) the bureaucratic-military complex brutally controlled its inner core and very operational mechanics, and hence, Pakistan was an "over-developed state." Alavi influenced a whole generation of scholars and "has been the basis for countless formulations on the state—not always in agreement with Alavi—both in South Asia as well as other developing countries."⁸⁴

Asaf Hussain, next in line, applied the elitist framework to analyse the power dynamics of the Pakistani politics. Hussain posits that "An analysis of the political structure of Pakistan can be approached from a number of perspectives, but it is from an approach to elitism that the greatest insights into this complex cultural system can be

⁸⁰Ibid., 283.

⁸¹Hamza Alavi, "The State in Post-Colonial Societies: Pakistan and Bangladesh" *New Left Review* 1, No. 74 (1972).

⁸²"Pakistan and Islam: Ethnicity and Ideology," in *State and Ideology in the Middle East and Pakistan*, ed. Fred Halliday and Hamza Alavi (Hong Kong: Macmillan Education Ltd., 1988).

⁸³Arif Azad, "Hamza Alavi," *The Guardian*, December 19, 2003.

⁸⁴Asad Sayeed, "Hamza Alavi: An Obituary," *Herald*, February 12, 2004.

gained,” and that “Such an approach encompasses the most significant political, social, and economic factors relevant to the state’s political development.”⁸⁵ Hussain’s “primary focus is upon distinct elite groups extant in Pakistan, their institutional derivation, and, most importantly, the competition and conflict among them that has so completely dominated political development,”⁸⁶ in Pakistan. His elites are engaged in an arduous struggle to first shape the state according to their ideological leanings resulting into a polity torn and fractured against itself. “Thus, the [Military Elites] ME was solely interested in rendering Pakistan a “praetorian state,” and [Bureaucratic Elites] BE an “administrative state,” the [Landowning Elites] LE a “feudal state,” the [Industrial Elites] IE a “bourgeoisie state,” the [Political Elites] PE a “democratic state,” and the [Religious Elites] RE an “Islamic state.” The net result of these diverse self-fulfilling political strategies was that the political elites and the state suffered from inadequate institutionalisation of infrastructures such as political parties. To worsen the situation, elites were alienated from masses, leaving political culture fragmented, not integrated.”⁸⁷ He concludes that in a praetorian system “only the strong survive” with each elite group using “any means available to maximise its power.”⁸⁸

Shafqat, using Flanagan’s model of crisis and structural change, designed in the broader framework of system’s paradigm, also attempted to explain the dynamics of Pakistan’s political system from 1947 till 1989.⁸⁹ Flanagan’s model suggests that changes in the international environment and the performance of government generate systemic crisis which leads to structural change.⁹⁰ In order to operationalise the model, Shafqat recognises “military, bureaucracy, industrial-merchant classes, political elites, and religious elites” as four structural components of Pakistan’s political system.⁹¹ Shafqat’s “model identifies four phases of crisis and change: (i) the antecedent system; (ii) environmental performance changes; (iii) coalition formation and crisis resolution; and (iv) developmental linkage and the resultant system,”⁹² and then detects certain mechanisms that “became a standard procedure of coalition formation and structural alternation in the political system of Pakistan” which “have been used by successive regimes to formulate a ruling coalition.”⁹³ The identified mechanisms are: (a) selective co-option; (b) collateralisation; (c) containment; and (d) economic policies and changes in international environment.⁹⁴ Shafqat believes that out of his elites “military, bureaucracy and industrial-merchant classes are structural components with greater “durability,” and therefore, these particular components exhibit “the propensity to impede

⁸⁵Asaf Hussain, “Elites and Political Development in Pakistan,” *The Developing Economies* 14, No. 3 (1976): 224.

⁸⁶Ibid.

⁸⁷Ibid., 233.

⁸⁸Ibid.

⁸⁹Saeed Shafqat, *Political System of Pakistan and Public Policy : Essays in Interpretation* (Lahore: Progressive Publishers, 1989).

⁹⁰Scott C. Flanagan, “Models and Methods of Analysis,” in *Crisis, Choice, and Change; Historical Studies of Political Development*, ed. Scott C. Flanagan Gabriel A. Almond, Robert J. Mundt, (Boston: Little Brown, 1973).

⁹¹Shafqat, *Political System of Pakistan and Public Policy : Essays in Interpretation*, 24.

⁹²Ibid.

⁹³Ibid., 30.

⁹⁴Ibid.

the growth of the other relatively weak components,” and that “Whereas the weak components remain weak or decay, these components acquire greater strength over a period of time.”⁹⁵ He dubs “these three components i.e. military, bureaucracy, and merchant-industrial classes...the parameters of Pakistan’s political system” since in “the ruling coalition making process, they emerge as the critical components,”⁹⁶ and concludes that in societies “where structural imbalance does exist...relatively ‘durable,’ ‘structures’ reveal propensity to dominate the political system.”⁹⁷

The most significant attempt to interpret and analyse the structure and performance of Pakistan’s political economy has been Ishrat Husain’s “Pakistan: The Economy of an Elitist State.”⁹⁸ This is an incisive attempt to explain Pakistan’s economic development during the first fifty years of its history, and to demonstrate that the benefits of whatever semblance of development that took place predominantly affected the elites of the country, while the majority of population remained unaffected. Husain situates Pakistan against “economic development of more than a hundred low-income countries struggling to improve the living standards of their population,”⁹⁹ and draws out patterns of progress. He argues that the “record of development experience has been mixed,” and that a “very small group of countries has been able to achieve success in graduating from the ranks of poor countries within a generation.”¹⁰⁰ Husain avers that there is another group of countries, which is quickly moving towards that end provided there are no major setbacks. Simultaneously, Husain goes on to posit that there still is a large number of countries that “have suffered reversals and are worse off today than they were at the time of their independence from colonial rule.”¹⁰¹ Finally, Husain hammers home the point that there are countries, “which are muddling through and moving forward with hiccups, but where the benefits of development are unevenly distributed and are highly concentrated in a small segment of the population.”¹⁰² He then moves on to explain the variances in economic development mainly centred on “the dichotomous roles of the state vs. the market.”¹⁰³

Husain broadly identifies five patterns of state-society interactions to grasp and explain the process of economic development in various countries and regions. Firstly, the one that remained popular during 1950s and 1960s revolved around the notion “that the state through a strong interventionist and directive role, using the instruments of central planning and big-push, state-led industrialisation, would break the low-level equilibrium trap of poverty in which developing countries were caught.”¹⁰⁴ Secondly, the predatory state “guided by the narrow and selfish interests of those in power,” supplanted “a benign and benevolent state acting in the larger interests of the population,” as the lateral experience of a number of states pursuing the interventionist model exposed its

⁹⁵Ibid., 24.

⁹⁶Ibid.

⁹⁷Ibid., 72.

⁹⁸Ishrat Husain, *Pakistan: The Economy of an Elitist State* (Karachi; New York: Oxford University Press, 1999).

⁹⁹Ibid., xi.

¹⁰⁰Ibid.

¹⁰¹Ibid.

¹⁰²Ibid.

¹⁰³Ibid.

¹⁰⁴Ibid.

weaknesses.¹⁰⁵ Thirdly, in the wake of dissolution of the Soviet Union “‘Free enterprise’ and ‘deregulation’ became the new buzzwords” as “‘Government failure’ was found to be greater evil than ‘Market failure.’”¹⁰⁶ Fourthly, the model of shared growth as successfully followed and exhibited by East Asian economies. Fifthly, Husain posits that in stark contrast to the model “of shared growth, there is an equally powerful model of elitist growth which characterises a number of developing countries.”¹⁰⁷ According to him “Brazil, Mexico, Kenya, Nigeria, and Pakistan are leading examples of this particular mode of development.”¹⁰⁸

What is the elitist growth model? Husain explains the elitist growth model in the following manner:

“Under this model, there is a complete reversal of the traditional roles of the market and the state. Markets are normally associated with efficiency and are found to be impervious to the considerations of equity and distribution. The state is usually thought of in terms of ensuring equity and access to opportunities. But under an elitist model, where both economic and political power are held by a small coterie of elites, the market is rigged and state is hijacked in order to deliver most of the benefits of economic growth to this small group. The markets therefore produce inefficient outcomes that are detrimental to the long-term sustainability of growth, and the state, through its actions, exacerbates the inequities in the system.”¹⁰⁹

Husain then goes on to provide “an overview of the performance of the economy of Pakistan” as a whole and by dividing it in “five sub-periods which correspond to different economic and political eras,” he “lays down the production structure—mainly those of the agricultural and industrial sectors—and outlines the changes which have occurred” during Pakistan’s history, and “summarises the developments and outcomes in macroeconomic policies—Fiscal, Monetary, and Exchange rate; other complementary policies—Trade, Debt, and Investment” and other important areas like Human Capital, poverty, unemployment, Physical Capital, and finally “attempts to present a cogent political economy explanation of the paradoxes exhibited by the Pakistani economy” by drawing upon the findings—though not explicitly and directly—to substantiate the main hypothesis advanced.¹¹⁰

Husain’s Critique

It is argued that despite being a substantially meaningful contribution towards explaining the structure of Pakistan’s political economy, Husain’s model suffers from serious limitations and infirmities. While his model does explain monopolisation of the *Infrastructure* by Pakistani elites, it does not elitist *Superstructure* i.e. bureaucracy, politics, law, judiciary, clergy, and media, and its exploitation by the elites to achieve

¹⁰⁵Ibid.

¹⁰⁶Ibid., xii.

¹⁰⁷Ibid.

¹⁰⁸Ibid.

¹⁰⁹Ibid.

¹¹⁰Ibid., xv.

their agenda. How an economy which promised so much in the first half of its life spanning over six decades lost its way through the second? How the society at large has been semantically occupied, religiously opiated, socially alienated, economically rattled, and politically controlled, do not appear to be Husain's concerns. His main preoccupation remains an overall data-based analysis and assessment of the economy from an economist's perspective. There are more specific problems as well. The model highlights *causal correlations* between the variables, but falls short of identifying, establishing, and elaborating *causal mechanisms* at work in the correlations. How did the elites hijack the state? Do elites compete or cooperate amongst themselves? How are they able to sustain their domination on the state, polity and society over time? How do elites reap benefits of economic growth? How do they actually cause to rig public policy in different domains of economic life? Similarly, the main concepts and relationships have not been defined. Who are elites? Are elites an identifiable, clearly demarcated, and monolithic water-tight entity? How, when disaggregated, intra-elite transactions take place? What are the determinants of elite-non-elite relations? Furthermore, since Husain does not circumscribe and delimit his variables, they constantly mutate, and assume an amorphous character to fit the line, need and size of the argument, reducing it to a tautology. These and other gaps in the model necessitate development and extension upon Husain's model—with primary objective of explaining elites' domination of Pakistan's economic system and its fall out for marginalised masses. Some scholars, in addition to Husain, have also used the elitist jargon to identify and explain Pakistan's economic problems.¹¹¹

Gaps in Research

Since Alavi, Hussain, and Shafqat are predominantly political in approach and Husain offers insight into the elitist control of Pakistan economy's productive function only, all of them appear a vast expanse of intellectual territory yet to be chartered. The paper thus makes a significant departure with Alavi, Hussain, Shafqat, and Husain, and builds upon them so as to purposely reduce focus from an outright control of the state (political power) or even the economy's productive function by elites to primarily the control of its *extractive function*, and to further develop the theoretical framework by linking it with the superior intellectual debate centred around the state autonomy.

The paper takes Pakistani elites as an eclectic conglomerate of vested interests that systematically cooperate and enter into non-zero-sum exchanges aimed at optimising group gains by mounting pressure on the state to exercise sub-optimal (fiscal) policy options. It further postulates that while the Pakistani elites enter into zero-sum exchanges with competing rival groups for political gains—the control of governance structures, they take a complete volte face to enter into non-zero-sum transactions for economic gains—(through) control of extractive function—with confrontation giving way to cooperation, exclusion to inclusion, and monopolisation to quid pro quos, which could

¹¹¹See, for example, Farhan Zainulabideen and Zafar Iqbal, "Taxation and Good Governance and the Influence of Non-Tax Revenues on a Polity" *Policy Perspectives* Volume 6, No. July–December (2009); S. Akbar Zaidi, "Pakistan's Roller-Coaster Economy: Tax Evasion Stifles Growth," (Carnegie Endowment for International Peace, Policy Brief No. 88, 2010); M. Abdul Mateen Khan, "Political Economy of Fiscal Policy in Pakistan," *Lahore Journal of Economics* 8, No. January-June 1 (2003); Kaiser Bengali, "Contradictory Monetary and Fiscal Policies," *Dawn*, October 10, 2002.

either be immediate or deferred; articulated or understood; systematic or automatic.¹¹² It would therefore, for good reason, be quite a misnomer to call Pakistani elites “elites.” However, for want of a better construct, these interest groups are referred to as elites—to be more precise, effective elites—in recognition of their inexorable effectiveness exhibited over time towards achievement of their not too hidden an agenda, maintenance and enhancement of the economic status quo.

This over-arching conglomerate of Pakistani elites, it is argued, is fundamentally composed of: (i) industrial elite; (ii) business elite; (iii) religious elite; (iv) military elite; (v) feudal elite; and (vi) sundry (non-profit sector, media, judicial and professional) elite. Not recognising the politicians and the bureaucrats as separate elite groups on Pakistan’s power drawing board is a fundamental deviation from the traditional typologies. It is simply because the bureaucracy (primarily generalists) exists as a sine qua non in the ever-existing framework of the state which under-grades the ruling coalitions to help the latter rig the public policy formulation process and occupy the state and its extractive system. After playing an active lead role in governing the state during the first decade of her existence, since the imposition of martial law in 1958, the bureaucracy had opted to (or was forced to) play a back-end subordinate role—pre-dominantly subservient and non-Weberian in nature. The mere fact that the paper inducts the generalist mandarins into the model as proxies and not as rational actor per se, does not mean that they do not operate as rational actors; they do, but in a basely and pecuniary way, and in utter subservience to the ruling masters—not at par with them.¹¹³ Similarly, the political elite do not exist as a separate entity in the model. They are rather composed of representatives of one of the six elite groups the primary objective of whom is not to dominate power structures per se, but to intrude into them so as to maintain and enhance the economic status quo. While industrial, business, religious, military, and feudal elite may be common constructs in Pakistan’s public policy discourse, the so-called non-profit, media, judicial and professional elite are a new trigger in the polity who now exhibit good grit not only to rig public policy formulation, but also its implementation in their favour—like their pre-existing peer groups.¹¹⁴ The subtraction of mandarins and politicians from the traditional typologies of Pakistani elites is potentially a new vista for future reflection, research and debate.

Properties of Pakistani Elites

It is interesting to note that Pakistani elites do not possess and reflect, if not all, most of the properties of Millsian power elite. Pakistani elites neither necessarily reflect any “class consciousness,” nor any similarities of “origin,” nor are they driven by a lust for power to control and shape the world according to their own higher peculiar ideal worldview—with probably notable exception of the religious elite. They also do not want

¹¹²Later in the study it will be delineated as to how the non-zero-sum transactions between the elites take place to control the tax policy formulation and enforcement of the fiscal codes.

¹¹³For a further and detailed elaboration of this point, see Muhammad Ashfaq Ahmed, “Pakistan’s Governance Goliath: The Case of Non-Professional Chairman, F.B.R.,” *Pakistan Development Review* IV, No. 72 (2016).

¹¹⁴Hussain calls Feudal elites “Landowning elites”, and classifies Professional elites as “Emerging elites.” Shafiqat clubs industrial and business elites under common rubric “Industrial-merchant class.”

to dominate the world in the sense of its being a manifestation of an a-priori human faculty of acquisitiveness, excellence, and an extreme urge to prevail. Instead, they are motivated and driven by mundane, at times, lowly group-centric economic ambitions. In order to pursue their economic agenda they do not form any permanent alliances nor do they enter into any ideological battle-grounds. They quickly shuffle and change their positions from moment to moment and on issue to issue frantically looking to optimise their economic gains ruthlessly—at all costs, and at all times. In Pakistan, economic group-interest is the only permanent and defining factor in the formation and deformation of elite alliances—including ruling coalitions. They want, neither to rule nor be ruled, if it could in any manner, potentially jeopardise the economic status quo. But Pakistani elites are effective to the kill, go-getters of the highest order, and top performers when it comes to achievement of their own agenda. They have, over time, exhibited tremendous efficacy to put together ruling alliances which could under-write the economic-political status quo; which would not pose taxing questions; which would guarantee provision of subsidies, exemptions, and a dysfunctional extractive system. Husain accentuates this point by stating that the “hold of a narrow, self-centred elite on the economy ... is much stronger than in some other countries in the region.”¹¹⁵ Their focus and limited objectives (above-par economic gains) have earned them unparalleled success. Mumtaz, *et al.* provide interesting insight into inter-elite struggles and tactical ploys: “Given these proclivities of the business elite, the smaller scale and informal sectors have, in turn, responded to secure their own segmented territories. They have exploited institutional weaknesses by resisting documentation, and regulatory provisions, and even more tellingly by successfully evading state taxation, thereby leading to major revenue shortfalls.”¹¹⁶ While there could be haggling—at times, really fierce—on the size of the share that a particular group gets, but generally a consensus on the internalisation of struggle for a larger share prevails. Pakistani elites always like to play on “no holds barred” basis. They mount pressure on the polity’s policy formulation mechanics through back-door manipulation, lobbying, street-agitation, threat, strikes, and even violence, to achieve their economic agenda. They can even go to the extent of deforming and dismantling ruling coalitions and toppling governments if they perceive their economic interests to be in any kind of jeopardy—without much regard to the implications of their actions for the state; the masses—in combine with ignominious help from their foot-soldiers—generalist lackeys.

Elites’ Configuration

Illustratively, the control of Pakistan’s economic polity by elites can be equated with a minority-held corporation, that is, an entity in which minority shares-holders (elites) control the management—say, Elites Ltd. The majority share-holders—the people of Pakistan—sit on the margins sans any say in the management and decision-making of the corporation. A minority management, in theoretical terms, tends to get into rent-seeking, ad-hocist decision-making ignoring long-term sustainability imperatives and

¹¹⁵Husain, *Pakistan: The Economy of an Elitist State*, 339.

¹¹⁶Soofia Mumtaz, Jean-Luc Racine, and Imran Ali, *Pakistan : The Contours of State and Society* (Oxford; New York: Oxford University Press, 2002), xxiii.

attempting a reverse squeeze out¹¹⁷ on majority shareholders, a scenario that could potentially harm not only the silent majority but the corporation itself.¹¹⁸ The expected cumulative outcomes in terms of mismanagement arising from “minority control” of a corporation is almost comparable to the current state of affairs of Pakistan’s economy.

What is the predictable intra-elites pattern of influence over body polity of Pakistan in historical context? The intra-elites shareholding in Elites Ltd., over time has been changing, influencing each group’s ability to lead, co-opt, and pressurise the ruling coalitions into exercising suboptimal policy choices particular in the arena of tax policy. Military elite have consistently held a major share in Elites Ltd. Their influence has seen ups and downs but they continue to play the single most dominant role in the polity. The riches that the military elite have amassed over time, the specific exemptions that their corporations got during various periods of history, the special reduced tax rates, the complicated corporate structures, the clandestinely contrived economic transactions,¹¹⁹ and their defiance to submit to state authority in various realms of governance—particularly fiscal policy—all bear vivid witness to their ability to maneuver public policy and pursue their economic agenda with focus and single-mindedness. Religious elite, although driven chiefly by an ideological worldview, have not been oblivious of ferociously pursuing and protecting their economic interests. A virtually non-existent fiscal regulatory regime for non-profits is not only their forte but also their biggest camouflaged gain in the struggle for economic power in Pakistan. Industrial elite and business elite have most of the times operated in with each other except with regards to rare issues like imposition of Value Added Tax (VAT) etc. Feudal elite have seen their importance in Elites Ltd nosedive over time but nonetheless they have been successful in holding on to their assets which necessarily appreciate in value with time leaving them in a permanently advantaged position. Their single most notable gain has been to keep agricultural real estate and incomes arising there from insulated from any effective taxation. Their ability to diversify and swap the sources of income has also reaped optimal gains in that they are able to report their taxable incomes tax-exempt by claiming them from agricultural sources.

Sundry elite, a conglomerate of disparate sub-elite groups, that is, media elite—electronic media outlet proprietors, TV talk-show anchors, print-media journalists and op-ed columnists; professional elite i.e. chartered accountants, independent consultants with varying professional backgrounds; judicial elite i.e. superior court judges and lawyers; and the so-called non-profit organisations (NPO) professionals, passionately grounded in their libertarian worldview, are a relatively new phenomenon, but with good ability to effectively protect their economic interests. An exceedingly lax fiscal regulatory regime in respect of all sub-groups of sundry elite being overly facilitative in an

¹¹⁷In a plain sense, “squeeze out” refers to a situation wherein majority share-holders look to eliminate minority shareholders from the business of the corporation or even the corporation itself.

¹¹⁸David R. Meinster and Elyas Elyasiani, “The Performance of Foreign Owned, Minority Owned, and Holding Company Owned Banks in the U.S.,” *Journal of Banking and Finance* 12, No. 2 (1988).

¹¹⁹ While all interest incomes howsoever originating undergo inevitable axe of withholding tax, retired servicemen have the luxury to invest in a clandestine Army Welfare Trust scheme the yeild of which does not attract any withholding tax at source. Tax departments' efforts to get access to particulars of investors with corresponding quantum of investments, and have at-source taxation enforced as in case of other ordinary citizens, spanning over past three decades have never even come close to a success.

international comparison is an evidence of the fact that sundry elite have exerted significant amount of influence on the polity in recent years.

Media elite's ability to have near-complete monopoly over the ways and means of influencing public opinion gives them unmatched access and intrusion into the policy-making process i.e. by exerting pressure on the political structures. Their grit to take on a particular party, a group, or a government and cow it down through launching of frantic targeted campaigns speaks volumes about their recent rise and success. Understandably, there is absolutely no comparison between the quantum of business that the media industry generates annually and the collective revenue that it contributes to the national exchequer. Pakistani media elite, barring a few exceptions, betray a paradox in terms of their approach in that they are predominantly right-wing in a religious sense, and centrifugal in a political sense. They are perennially prone to sensationalisation,¹²⁰ and tend to take a secretive, socially fissured, and politically torn polity as a gaming zone. Media elite, as a class, are more interested in political instability as it lays them tremendous financial gains, and as soon as the new political dispensation takes its seat, media elite move quickly to draw fresh battle-lines and starkly divergent positions—one section launching an outright servile campaign in favour of the government relishing on the induced government-spending on its image-building, and the other against the government cashing in on the opposition's impatience to pull down the incumbent regime; either way, media's group gains continue to soar with time. Although, Barney has pertinently argued that information revolution supported and sustained by technological advancements, more often than not, is attended by "an explosion of diverse means and practices for engaging in public life," which, in turn, increases "the possibility of an invigorated and improved democratic politics,"¹²¹ the process does not appear to have set in Pakistan—at least, at the moment.

Likewise, professional elite have their own particularistic gains to their credit to prove they have the requisite ability to influence both formulation and implementation of policy in the country. The mere fact that they are generally well-educated and professionally trained helps them conveniently penetrate into ruling structures and influence policy decisions.¹²² Professional elite's ability to affect country's public policy in their favor gets a boost by their ability to be hired by international organisations, bilateral socio-economic assistance arms of various developed countries to carry out various studies and write reports cross-cutting all arenas of governance. Non-profit elite with close cooperation and support of religious elite have deftly guarded their turf and

¹²⁰There is evidence to indicate media elite's penchant to sensationalize and blow out of proportion any incident that would "sell," and lose interest in it as soon as actual facts concerning it come to light. See, for instance, Usman Manzoor, "Media Mum over Murree Girl's Death Case," *The News*, July 2, 2016.

¹²¹Darin Barney, "Plitical Communication in Canada: The Revenge of Publicity," *Global Media Journal—Canadian Edition* I, No. (1) (2008).

¹²²In 2013, one rare well-coordinated effort was made by FBR, Ministry of Foreign Affairs, and Economic Affairs Division to engage UN system in Pakistan to extract information about salary and consultancy incomes of their local employees and other consultants numbering about 500, who were not covered under the standard host-country exemption extended to qualified UN personnel, so as to enforce domestic tax laws on par with all other salaried taxpayers. Prolonged consultations, however, bore no fruit as under mounting internal pressure Douglas Hageman, Deputy Country Director, UNDP, chose not to divulge the critical information (FBR File No.F.3(32-A) Int.Taxes.05). One wonders if such brute informational iron-curtaining would have been possible in any other country.

interests—including but not limited to—a completely dishevelled non-profits tax regime. Judicial elite, a perceptibly maverick-like phenomenon evolved and developed around the judicial activism initiated and carried forward by the Chief Justice, Iftikhar Muhammad Chaudhry. The judicial activism gained momentum on Justice Chaudhry's removal by General Pervez Musharraf eventually transforming it into the so-called Lawyers' Movement. Judicial elite now exhibit exceptionally potent force to influence public policy formulation in Pakistan in their favour.

The capacity of an elite group to play a more dominant role than the other elite groups within Elites Ltd at different periods has had a direct correlation with (a) a group's ability to organise, clamour and exert pressure on the ruling coalitions directly or indirectly, and (b) its achievements in terms of the economic gains which when ploughed back in, increase its capacity manifold to exert more pressure on the state for favourable policy choices that can facilitate above-par economic gains as well as those that can ensure holding on to the riches that have already been stockpiled. The six key values as pointed out by Hyden, *et al.* namely, participation, fairness, decency, accountability, transparency and efficiency,¹²³ inter-relatedly undergrid quality and level of governance in a society. The perversely intra-elites wrangling for above-normal economic group gains undermines the very efforts of the state to perform its functions.

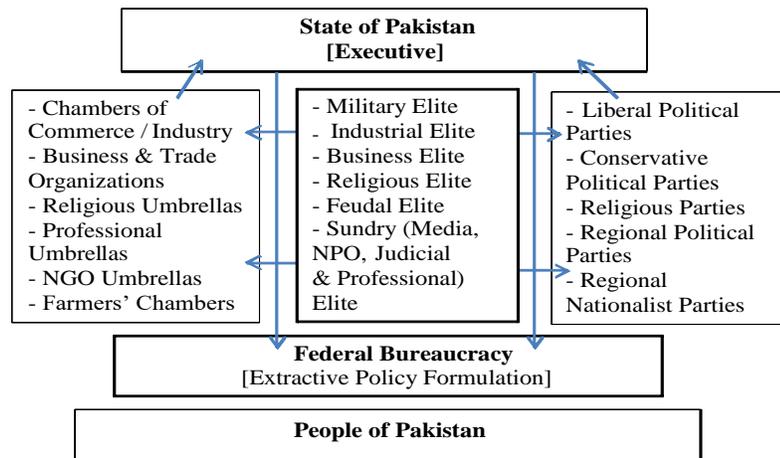
Elites' Policy Formulation Grid

How do elites operate and mount pressure on the polity to manipulate the extractive system through coercing it into exercising sub-optimal policy choices, and weakening of its enforcement arms, can also be depicted pictorially. In the figure below the elites positioned in central column articulate their interests to the state through political parties (right column) as well as through their umbrella representative organisations (left column). Political parties and umbrella representative organisations further articulate their interests at governmental level where, in theoretical terms, national interest aggregation takes place. Since ruling coalitions are essentially composed of elites' agents themselves, it does not take much (effort and time) reducing articulated interests into policy bits.

Any resistance from a rival group, if at all, is either fleeting or put up for public consumption, is overcome through pressure tactics, that is, through threat of withdrawal of support for the ruling coalition, exit from the cooperative framework, or of resorting to strikes, street agitations, and even low-grade violence. Historically, cooperation has come to prevail at all times and in all situations. Finally, the so called aggregated national interest trickles down to the bureaucratic organisation, where policy directives are processed and formulated into implementable policy pronouncements. At tactical level, this is achieved with the all-willing help of a generalist lackey already placed as head of state's extractive function. Intriguingly, elites perched in the state's heart of policy formulation process get heard and rewarded—almost invariably.

¹²³J. Court G. Hyden, and K. Mease, *Making Sense of Governance* (Boulder: Lynne Reiner, 2004).

Elitist Extractive Policy Formulation Grid



The grid further signifies that the elites control extractive function and successfully undertake to manipulate the tax policy through their generalist collaborators and conveniently shift fiscal burden from their own shoulders to those already marginalised and impoverished masses. The generalist cadres—lacking in skill and professional niche—enter into a symbiotic relationship with the elites through systematically orchestrated mutually self-serving transactional arrangements. The elites help the generalist mandarins monopolise important state institutions like FBR in return for favourable policies and their lax implementation. The end result of this symbiotic collusive elites-generalist relationship is that the entire fiscal policy formulation process is completely divorced from the citizenry of Pakistan.

The state's pronounced and exaggerated predilection to engage with only select factions, lends ears only to their interest articulation, and reflect only their demands in public policy outputs—leaving out the unorganised and marginalised millions—may be indicative of the fact that the state of Pakistan is in complete captivity, beholden to Elites Ltd. This is what Mushtaq Khan calls “political settlement (that) emerges when the distribution of benefits supported by its institutions is consistent with the distribution of power in society, and the economic and political outcomes of these institutions are sustainable over time.”¹²⁴ Jonathan et al, in the same vein, have argued that “Developing the capacity of the state to increase taxation is centrally determined by the balance of power, or political settlement, on which the state rests.”¹²⁵ A perversely contrived political settlement, as in the case of Pakistan, not only adversely impacts the masses but also their perception of the state, leading to further weakening of the state-society relations and impeding the process of state-building.¹²⁶

¹²⁴M. Khan, “Political Settlements and Governance of the Growth-Enhancing Institutions—Working Paper,” ed. School of Asian and African Studies (London: School of Oriental and African Studies, 2010), 1.

¹²⁵Jonathan Di John and James Putzel, “Political Settlements,” in *Issue Papers* (Birmingham: Governance and Social Development Resource Centre, 2009), 13.

¹²⁶For an in-depth analysis of the relationship between state-building and extraction within the context of Pakistan, see Muhammad Ashfaq Ahmed, “Pakistan: State-Building, Extraction, and (Misplaced) Societal Preferences,” *Journal of International Stability Studies* 2, No. 1 (2016).

IV. ELITES' RATIONAL ACTOR DILEMMA

The paper posits that the foremost tool and target of domination for Pakistani elites has been the state's extractive system. This is simply because a functional extractive system—depending on both the base and the rate applicable—could, on the average, cost elites up to 40 percent of their riches on an on-going basis; it is a substantial chunk.¹²⁷ Moreover, a strong tax system is difficult to hijack to obtain engineered exemptions and amnesties. So, the extractive system's domination becomes pivotal within the given framework of an elite-held captive state. This is where the elites get to confront a serious dilemma: they need to ensure *protection of their riches* but they also *need a state* to govern. Why would elites need a state to govern when the assumption is that they are not power hungry—megalomaniacs?¹²⁸ This is for two reasons. Firstly, state structure—if they could control, is per se a source of power, which could then be remodeled and re-employed to generate more riches. Secondly, prevailing pro-elite dispensation provides a robust certainty factor, which in an altered state-structure could not potentially be ensured and guaranteed. Now, sustaining of the state has a price-tag; it requires resources. Since elites have a vested interest in sustaining the state, and which is not possible without lining up definite amount of resources on an on-going basis; being rational actors they choose to sustain it at the least cost to themselves.¹²⁹

How then does the dilemma resolve itself? Or even does it? The elites venture to sustain the state for a conduit to amassing more wealth and underwriting already amassed wealth through two methods. Firstly, elitist state, should it be possible, prefers to extract internationally by selling whatever it could—security concerns, poverty, low human development indices, geo-strategic location, depleting natural resource base, degrading ecosystem, natural disasters, humanitarian crises, state-sponsored international mercenary services—to induce international rents-in-aid, grants, discount-credits, and even overpriced loans. Pakistan's role in the Afghan conflict of 1980s, deploying military detachments in Middle Eastern sheikhdoms and its ever-readiness to offer military and police personnel for peace-keeping missions all over the globe under the UN umbrella are ostensible legitimate ploys of international extraction. The phenomenon is so embedded within the psyche of the polity, and wide-spread and grounded in its history that Pakistan could very well be called a rentier state of sorts.

The seeds of this trend could be traced back to the very inception years of the Pakistani state. Jalal explicating Pakistan's efforts in F/Y 1949-50 to generate the U.S. dollars to ensure uninterrupted purchases of defense-related hardware laconically observed: "This is why officials in the ministries of finance and commerce were busy working out strategies to increase Pakistan's availability of dollars. They had begun learning the ropes of the international financial system even if in the process they neglected to refine the art of domestic economic management."¹³⁰ In the same vein,

¹²⁷In a standard manifestation, an adequately functional tax system's impact could even be far more pinching when viewed in the context of proper application of Wealth Tax, Gift Tax, Estate Duty (Inheritance Tax), and Capital Gains Tax on real estate.

¹²⁸This point has been deliberated upon in the preceding section of the paper.

¹²⁹A "rational actor" is an agent who strategically weighs costs and benefits of alternative courses of action and chooses best course of action which is most likely to maximise his gains and utility.

¹³⁰Ayesha Jalal, *The State of Martial Rule : The Origins of Pakistan's Political Economy of Defence* (Cambridge [England]; New York: Cambridge University Press, 1990), 96.

Husain argues that “Russian invasion of Afghanistan in 1979 propelled Pakistan to the forefront of international political attention,” and that “Not only did it give political legitimacy to a regime which was facing credibility problems of its own, it also set the way for substantial infusions of foreign aid and war-related assistance that would...provide a safety valve for the Pakistani economy.”¹³¹ Khan confirms the view that “Afghan war...increased the level of foreign aid.”¹³² Although the proportion of grants increased from around 12 percent in late 1970s to around 25 percent in 1980s, mainly because of food aid and other funds intended for Afghan refugees, yet most aid was in the form of loans. It is significant that till late 1980s, international lenders and donors did not have too significant a role in the policy formulation process in Pakistan. However, the crucial role of IMF started to become more and more visible within the mechanics of policy formulation after 1988, when Pakistan conveniently graduated to the position of a country heavily dependent on foreign assistance. The backdrop, of course, was the reduction of Pakistan’s geo-strategic importance in the wake of Soviet withdrawal from Afghanistan that saw the era of rents-in-aid coming to an abrupt and being replaced by an epoch of lending-in-aid.

Nonetheless, Pakistan has been at the forefront, and quite deftly too, always trying to diversify modes of international extraction, particularly, in harvesting international assistance under IDA and ADF soft windows of the World Bank and the Asian Development Bank, respectively. It may, therefore, be not all that baseless if Pakistan’s public policy formulation process is generally regarded as donor-driven. Pakistan’s penchant for extraction at international level can, at times, take raw and bizarre turns. In 2009, Government of Pakistan approached the Government of Kuwait to open a donation-seeking charity account therein in the Prime Minister’s own name for relief and rehabilitation of internally displaced persons uprooted because of the Swat operation launched against the terrorists.¹³³ While effort was obviously aimed at harvesting Kuwaiti dinars over and above what Kuwaiti Government had officially committed, the request, per se, remained subject of varied interpretations. There is also a general perception that “most of the well-intended foreign aid is looted by corrupt governments and their politicians to fill their own personal coffers and hence augment their rule, and not to improve living conditions of all the citizens.”¹³⁴ Resultantly, patterns of economic growth of Pakistan is a patent graphic representation of “boom-bust cycles, where foreign injections led to sharp upward spikes”¹³⁵ but then since “resources were not channelled into high-impact investments, the GDP would plummet to a low equilibrium, where it stayed until the next round of conducive external facilitation.”¹³⁶ It has also been argued “that foreign aid in Pakistan was negatively associated with the long run GDP growth in

¹³¹Husain, *Pakistan : The Economy of an Elitist State*, 29.

¹³²Mohsin S. Khan in William E. James and Subroto Roy, eds., *Foundations of Pakistan's Political Economy : Towards an Agenda for the 1990s* (New Delhi; Newbury Park, Calif.: Sage, 1992), 175.

¹³³ Idrees Bakhtiar, “Relief Account in P.M’s Name Arouses Suspicion,” *Dawn*, June 10 2011.

¹³⁴Somar Wijayadasa, “Good Bye to Foreign Aid,” *Z-Communications* (2011), <http://www.zcommunications.org/good-bye-to-foreign-aid-by-somar-wijayadasa>.

¹³⁵GOP, “Pakistan: New Growth Framework,” ed. Planning Commission (Islamabad: Plannin Commission, 2011), 3.

¹³⁶Vaqar Ahmed and O’Donoghue, “Redistributive Effect of Personal Income Taxation in Pakistan,” *Pakistan Economic and Social Review* 47, No. 1 (2009): 45.

the absence of macroeconomic fundamentals.”¹³⁷ It has been argued, and not without good reason, that over-dependence on international extraction at the expense of domestic extraction has rendered Pakistan addicted to Western aid—allowing, facilitating and leveraging global games.¹³⁸

Secondly, since the international extraction is not possible indefinitely and without a definite degree of domestic resource-match, the elites compulsively need to undertake domestic extraction. Being rational actors they have to achieve it at the least cost to themselves. They achieve it through six modes.

One, the elites effectively exploiting their control of tax policy formulation as explained earlier, get to introduce an elaborate indirect taxes system so as to shift the maximum revenue burden onto the unrepresented and already marginalised sections of the society. The polity’s proclivity to resort to indirect taxes to generate requisite amount of revenues from domestic sources has even been propagated by a number of reform initiatives instituted by Government over the past seven decades.¹³⁹ It was argued that “The role of sales tax should be enlarged and the function of generating a very large proportion of revenue from indirect taxes should be assigned to the sales tax which should eventually move towards the direction of Value Added Tax.”¹⁴⁰ Likewise, “In the context of the development programmes in Pakistan,” it was noted as far back as 1960, that “emphasis in the case of indirect taxes is being shifted...to central excises.”¹⁴¹ Despite there being theoretical and empirically proven exhortations to the contrary, Elites Ltd has kept on pushing tax policy choices which suited them most and promoted their own economic agenda. Thus, it is not surprising if the indirect inland taxes coupled with the withholding-cum-presumptive taxes constitute about 80 percent of the total domestic resource base of the state.

Two, the elites effectively transform the state’s direct taxes system into a quasi-direct one through the implantation of an extended withholding-cum-presumptive tax regime thereby conveniently allowing their own liability to be transferred to the socio-economic sediments and in the process getting a brute legal protection against preparation and audit of their financial accounts, and even filing of annual tax returns. It goes without saying that a quasi-direct taxation can have spurious impact on the economy in the long run as it does carry definite potential to interfere negatively with the distribution of wealth and proper functioning of the market. Khan has argued that “introduction of presumptive taxes in all forms—fixed, minimum tax or withholding tax as discharge of final tax liabilities” doing “away with the requirement of filing of tax return,” and a “need to get registered with the

¹³⁷A. W. Farooq and Vaqar Ahmed, “Nexus between Aid and Security: The Case of Pakistan,” in *Country Paper for Policy Reforms and Aid Effectiveness* (Colombo: Institute of Policy Studies, 2010).

¹³⁸Raza Rumi, “Wikileaks and Pakistan’s Dysfunctional State,” *The Express Tribune*, December, 3 2010.

¹³⁹For an in-depth and elaborate analysis of all the tax reform commissions constituted so far and how those were elitist initiatives in their conception, formation, composition, proceedings, outputs and outcomes, see Muhammad Ashfaq Ahmed, “Elites, Extraction, and State Autonomy: Pakistan and U.S in Comparison,” Area Study Centre for Africa, North and South America (Islamabad: Quaid-i-Azam University, 2015).

¹⁴⁰GOP, “The National Taxation Reform Commission Report (Part 1),” (Islamabad: Ministry of Finance, 1986), 164.

¹⁴¹Abdur Rab, “Pakistan Taxation Enquiry Committee Report,” *The Pakistan Development Review* 2, No. 2 (1962): 203.

Tax Administration,” could have serious far-reaching implications for the country as “such a simplistic approach in the background, the Government’s efforts to build a comprehensive data base with the National Tax Number serving as the focal reference point may not materialise.”¹⁴² It was further argued that Government’s efforts in mopping up true revenue potential could, in the long run, come to naught, as once accustomed to a simple and generous tax regime, process would be difficult to reverse for determining accurate income for tax purposes.¹⁴³ “Thus, the short-run gains in revenue, if any, will be more than offset by the huge revenue losses in future.”¹⁴⁴ This is exactly what has happened. Extended withholding taxes regime with a PTR topping results in indiscriminate taxation as against targeted taxation, which is the hallmark of all good direct taxation. Indiscriminate taxation suits elites in a number of ways. It thwarts any chances of taxing various economic agents according to their true potential. Moreover, indiscriminate taxation propels and eggs economic agents in similar commercial conditions to form groups so as to be able to effectively articulate and protect their interests, a phenomenon that perpetuates the elitist operational paradigm and provides it with a moral justification. “Indiscriminate stepping up of tax rates with a view to raising the ratio of tax proceeds to G.N.P. can cause more harm than good and may even prove self-defeating.”¹⁴⁵ There is no doubt that PTR, apart from introducing a convenient under-regulation into the overall management and governance of the country, has also fomented “groupness” in almost all spheres of economic life.

Three, the elites choose to shift to non-tax revenues when matching share of domestic revenues falls short of desired levels. It has been averred that the Government’s “inability to raise the overall tax-to-GDP ratio was compensated by surcharges from natural gas’ and petroleum products’ sales,” whereby the “highest contribution from surcharges at 2.49 percent of GDP came in FY1999 when the tax-to-GDP ratio was at its lowest at 10.48 percent.”¹⁴⁶ In fact, non-tax revenues grew at a faster pace than tax revenues, that is, annually 15 and 14 percent in FY 1999-00 and in FY 2007-08, respectively, constituting about 1/3rd of the total government revenues.¹⁴⁷ Absence of a decent balance between the direct and the indirect taxes, an excessive withholding regime, and an aggressive imposition of “petroleum development surcharge pushed an overwhelming majority of Pakistanis towards, and a substantial number of them, below the poverty line.”¹⁴⁸ The prevailing tax policy matrix and the resultant perverse tax-mix

¹⁴²Ahmad Khan, “Presumptive Tax as an Alternate Income Tax Base: A Case Study of Pakistan,” *ibid.* 32, No. 4 (1993): 1001.

¹⁴³*Ibid.*

¹⁴⁴*Ibid.*

¹⁴⁵GOP, “The Commission on Taxation and Tariff (First Report),” (Islamabad: Ministry of Finance, 1965), 7.

¹⁴⁶Mahnaz Fatima and Q. Masood Ahmed, “Political Economy of Fiscal Reforms in the 1990s,” *The Pakistan Development Review* 40, No. 4 (2001).

¹⁴⁷Kasper Richtor Jorge Martinez-Vazquez, “Pakistan Tax Policy Report: Tapping Tax Bases for Development,” in *International Studies Programme, Andrew Young School of Policy Studies, Georgia State University, International Studies Program Working Paper Series at AYSP, GSU* (Georgia State University, 2009), 7.

¹⁴⁸Huzaima Bukhari and Ikramul Haq, “Oppressive Taxation and Poverty,” <http://thebeautifulpakistan.blogspot.com/2011/02/oppressive-taxation-and-poverty.html>.

may be clearly indicative of the state's insensitivity to the rising poverty, soaring inflation, a distorted Gini-coefficient, a flatter Lorenz Curve, and an unsustainable fiscal deficit—but still insufficient to alarm Elites Ltd in their cozy comfort zone.

Four, under an overwhelming domination of elites, the polity exhibits an ambiguous and pronounced tendency to promote charity not only under its own direct auspices, but also by keeping legal-cum-regulatory framework of charity-soliciting organisations lax and deficient for adventurers of all shades and hues. The exercise of such a policy has two distinct features: (a) At time of every crisis—big or small, natural or man-made—the state has scrambled to set up a charity account in the name of President or Prime Minister and heave an emotive appeal to the people for donations and contributions without realising that charities beg, states do not; states tax. (b) The non-profits regulatory framework, be it in the sense of registration laws, recurring reporting requirements, or fiscal regime, has been kept too lax, flexible, and riddled with loopholes—by design. This way the elitist state was conveniently able to shift a good part of its functions and responsibilities of providing public goods like education, health, and human rights to charitable organisations. Thus, it is not surprising that libertarian forces under the influence of mis-guided and half-baked notions nurtured by the sundry (NPO) elite have taken strong roots in the society, promoting all kinds of extremist views on both sides of the divide, obfuscating national policies thereby snatching initiative from the government and undermining the writ of state.

Five, the elitist state chooses to raise their loans to make up for the shortfalls in domestic extraction whereby elites are able to defer their tax payment indefinitely. The polity started resorting to this option full well from the very beginning as “Within a period of thirteen months between September 1948 and end of March of 1949, the Government of Pakistan were able to borrow about Rs 70 crores from the market, which may be contrasted with Rs 40 crores borrowed by the Government of India during the financial year 1949-50.”¹⁴⁹ This gave traction to efforts on international extraction. “When the revenue expenditure gap increased in the early 1980s, authoritarian governments at the time did not apply restrictions on borrowing, rather signed hefty loan deals with the U.S. and IFIs, which were possible in the wake of Afghanistan crisis.”¹⁵⁰ The propensity to borrow without due diligence was not confined to international sources; domestic sources were exploited ruthlessly, too. It was noted as far back as 1960 that “economy is burdened with a great deal of excess liquidity as a result of the unrestricted deficit resorted to by the previous governments.”¹⁵¹ The state's demand for dimes from borrowed sources continues to remain insatiated even today.

Six, for a last resort, the elitist state gets into extortion of no moral standing through multiple means. On each single occasion of national distress or calamity, a day or two's salary is subtracted from the paycheck of all government servants; at times even three or four days salary has also been deducted. It is done through a simple notification issued by the executive. On the other hand, fiscally vibrant states, whenever required,

¹⁴⁹C. N. Vakil, *Economic Consequences of Divided India; a Study of the Economy of India and Pakistan* (Bombay: Vora, 1950), 492.

¹⁵⁰Khan, “Political Economy of Fiscal Policy in Pakistan,” 19.

¹⁵¹GOP, “The Taxation Enquiry Committee Report (Volume 1),” (Karachi: Ministry of Finance, 1960),

impose discriminate additional taxes on the persons who possess determinable capacity to pay on top of what they have already paid for the year. Likewise, extraction of money through National Accountability Bureau under “Plea bargain” mechanism, and indiscriminate collection of TV surcharge in utility (electricity) bills can be dubbed as direct extortion by the state. The advance Neelum-Jhelum (Hydropower Project) Surcharge is yet another trite example of state-sponsored extortion. It has been posited that none of the relevant laws provide for the imposition of a surcharge on an under-construction power project.¹⁵² Although Article 77 of the Constitution provided that taxability was essentially to be determined by the legislature and that the executive authorities had no power to impose any such tax, and Article 157(2)(b) stipulating that a tax on consumption of electricity could only be imposed through a law and that too by a provincial assembly, clearly stand in the way of Neelum-Jhelum (Hydropower Project) Surcharge,¹⁵³ yet the elitist state’s relentless insistence on imposition and collection could only be characterised as elitist state-sponsored extortion.

Thus, not surprisingly, in the recent past, public policy debate, almost entirely, both in and outside Pakistan has primarily revolved around either introduction of VAT (or any of its variants) or maximisation of international extraction through an increase in aid, loans or even foreign remittances, and to a lesser degree, around the rest of the aforementioned modes of domestic resource match. The polity’s total silence with regard to the two well-established theories that (a) a sustained inflow of international resources crowds out domestic extraction, and (b) direct taxes are far more equitable than indirect taxes—is intriguing. More intriguing may be the silence of the populace—the victims of their own silence. Gramsci has argued that over time the ruling classes develop a hegemonic culture that invents and promotes its own values, which surreptitiously and imperceptibly become ‘common sense’ values for all. This way the ruling elites could control the cognitive abilities of the society whereby the working class starts to identify their own good with the good of the ruling class, and thus helps the latter maintain the status quo rather than dismantle it.¹⁵⁴ One can perhaps read a lot of relevance in Gramsci for the present day Pakistan.

V. EQUILIBRIUM CONSENSUS SUBSISTENCE STATE

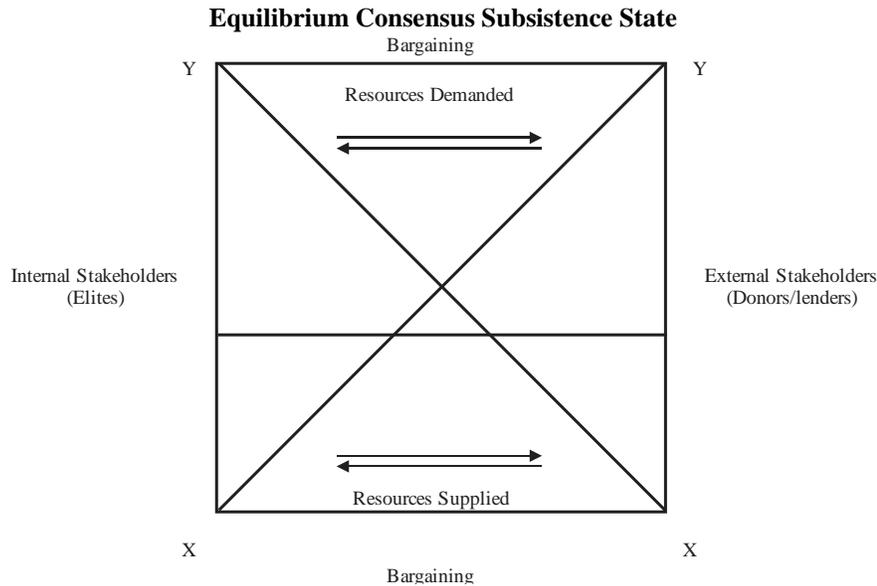
This is where the plot thickens; First prong of the rational actor dilemma i.e. international extraction brings chickens home to roost. Understandably, since Pakistan has to survive not in isolation but in a geopolitical environment, it finds its international stakeholders having vested interest in it for multiple overt and covert reasons. The mere fact that international stakeholders dole out money to Pakistan regularly, gives them some sort of legitimacy to contribute to the its decision-making process—cost of its running being no exception. While internal stakeholders (elites) acting as rational actors choose to contribute the minimum possible and attempt to extract the rest (maximum) from international sources, the external stakeholder also acting as rational actors prefer to

¹⁵²The relevant laws, in this particular case, are the Electricity Act, 1910; the Water and Power Development Authority Act, 1858; and the National Electric Power Regulatory Authority Act, 1997.

¹⁵³Faisal Kamal Pasha, “Neelum-Jhelum Surcharge in Power Bills Challenged in I.H.C.,” *Dawn*, November 23, 2014.

¹⁵⁴Antonio Gramsci, *Selections from the Prison Notebooks* (London: Lawrence and Wishart, 1971).

contribute the minimum, and exert pressure on the internal stakeholders to contribute the maximum by way of a domestic resource-match. Thus, Pakistan's both internal and external stakeholders get into bargaining and transactions on an annual formula to line up enough resources to keep the state afloat. Soon the equilibrium point is achieved through transactional playoffs between competing actors at which each side is happy with the level of its contribution—though in a dynamic setting.



The picture is a graphic representation of an equilibrium state depicting a consensus between internal and external stakeholders on contribution of each required to run it—not perhaps as a fully functional state but as a minimalist subsistence state. At the entry point, Elites Ltd wants to maximise on international extraction so that its contribution, i.e. domestic resource-match is minimal. In turn, the external rational actors also want to contribute the minimum and pressurise internal stakeholders to chip in the maximum. The equilibrium point is arrived at through gaming, bargaining, negotiations, and continuous engagements between the two competing rational actors. While on the one hand, it may now be understandable as to why Pakistan's tax collection is consistently running between 8-9 percent of GDP, and domestic borrowing coupled with international resource inflows make do annual budgets—barely sufficient to perform its avowed functions as a state in an insufficient manner, and on the other, it may be indicative of a consensus between internal and external stakeholders that Pakistan has to be kept going as a state—but perhaps at a bare subsistence level.

Although the elitist framework, as heretofore explicated culminating into equilibrium consensus subsistence state model, needs amplification through operationalisation and rigorous empirical testing, yet an irresistible question that flows out of the preceding debate is whether Pakistan is a rentier state? A state could be classified as rentier if (a) rents situations predominate; (b) the economy relies on substantial external rent and does not require a strong domestic productive sector and a

corresponding extractive function; (c) only a small proportion of the working population is actually involved in the generation and utilisation of rents; and (d) the state's government is the principal recipient of external rents.¹⁵⁵ It may, thus, not be coincidental and surprising that in Pakistan everything tends to be “international”—not so in substance as in nomenclature and denomination. Nomenclatures like Pakistan International Airlines, International Islamic University, Islamic International Medical Complex, and Multan International Airport, etc. may have something to do with the very psychic bent of the society which finds its moorings in international extraction. This trend is not limited to the public sector only; the private sector, non-profits and the clergy are also increasingly getting sucked into pseudo-internationalisation e.g. Shifa International Hospital, Quaid-i-Azam International Hospital, International Church of Karachi, International Islamic Relief, and International Gospel Mission Church etc. This is yet not all. Every other event in Pakistan of some or no semblance is international in style and nomenclature be it a flower, an arts, or a photography exhibition, a sports tournament, or a drama festival. It looks like that “becoming” international adds to legitimation and social acceptability of the entity or activity.

The facts that Pakistan has been at the forefront of two proxy wars in its neighbourhood over the past three decades; it is the single largest contributor of army and police personnel to UN peacekeeping missions abroad; it is one of the top exporters of labour force—both legally and illegally, educated and uneducated, trained and untrained; it is dependent on foreign aid and loans; it assumes the role of an international watchman particularly in the Middle East; it chooses to keep its domestic extractive system dysfunctional; and that majorly its governments—by implication elitist clique that historically forms and deforms governments—have been prime beneficiary of all international extraction, renders it pretty much a rentier state. In this respect, Wallerstein's influential World System Theory, adopting a multidisciplinary macro-analytical approach to the study of world history and social change and taking the entire international state system as the unit of analysis as against the classes in Marxist and the nation-states in the classical and realist schools of thought, can beneficially be put to use.¹⁵⁶ Wallerstein divides the world into core, semi-peripheral and peripheral states, and posits that while core states focus on highly skilled labour, capital-intensive production processes and sophisticated management controls, the production systems of semi-peripheral and peripheral states are significantly dependent on unskilled labour, extraction of raw materials and labour-intensiveness,¹⁵⁷ which technical advancement of the former (core country) production systems inevitably generates, secures and reinforces dominance of the peripheral world by the core world.¹⁵⁸ The core-state-peripheral-state framework when applied to Pakistan with particular reference to the performance of its extractive function and its resultant over-dependence on external resources to minimally maintain itself not only galvanizes but also justifies its dubbing as an equilibrium consensus subsistence state.

¹⁵⁵Giacomo Luciani Hazem Beblawi, ed. *The Rentier State*, Vol. II, (Nation, State, and Integration in the Arab World) (New York: Croom Helm, 1987).

¹⁵⁶Immanuel Maurice Wallerstein, *The Modern World System* (New York: Academic Press, 1974).

¹⁵⁷Ibid.

¹⁵⁸Ibid.

VI. CONCLUSION

In all fairness, Neo-Marxist Structuralism, and to an extent, state-centric scholarship did illuminate the debate upfront, but eventually it is the Neo-Marxist Instrumentalism that fits Pakistan in terms of the elitist framework developed and elucidated in the preceding sections. It may be, in fact, Instrumentalism-plus that near-fully captures phenomenon of the elite capture in Pakistan, which implies that the state of Pakistan is theoretically reducible to class act—contextually elites. When the status quo—system structure—is disaggregated into parts, that is, policy formulation processes with particular reference to state’s extractive system, one finds that the sub-system is thoroughly dominated and conveniently rigged by class-representing elites or their proxies—generalist bureaucratic cadres. Although the theoretical configuration of Pakistan’s elitist state as conceived in the paper is sufficiently empirical and elaborate, yet its further extension and build-up would certainly help define and explicate Pakistan with a greater degree of exactitude.

One of the core reasons for governance under-supply could be under-extraction by the state feeding into under-performance of its other critical functions e.g. coercion, redistribution, regulation—and simply put, supply of necessary public goods like education, and health. In turn, under-extraction may have been caused by below-par policy prescriptions and deficient enforcement handles handed down to an incapacitated administrative structure for implementation, for which arrangement is further exacerbated by incriminating absence of a holistic national level information aggregation system—sustained by Instrumentalism-plus unleashed with vengeance by an elite capture of an unparalleled intensity and gravity. What is obvious is that in Pakistan governance under-supply on part of the civil government institutions created large swathe of strategic space to be readily filled up by non-governmental and non-state actors to scramble, fill-in the vacuum, and promote their own agenda—theocratic, fundamentalist, ultra-modernist, anarchist—on the people and the polity alike.

Pakistan’s political leadership, in fact, could never really decide the “important question whether societies of men are really capable of establishing good government, or not. From reflection and choice, or whether they are forever destined to depend for their political constitutions on accident and force.”¹⁵⁹ Many countries have done that and many more are in the process of doing it. Illustratively, the U.S. political leadership, undertook a preemptive strike to co-opt factions and suck them into the system¹⁶⁰ by providing them a channel of interest articulation¹⁶¹ and by assigning the state an elevated role of an ultimate arbiter of (supposedly) just economic order and a harmonious society. Such rigorous reflection and its actualisation in the arena of state-building and governance, unfortunately, did not occur in Pakistan. The elite capture model does indicate that Pakistan may no more be an autonomous state; nor even a relatively autonomous state—it may never have been; hence, a captive state. Pakistan’s political oligarchs may have missed the bus to streamline and legally authorise the role of factions and groups in the polity by providing a system-sanctioned mechanism of transparent and across-the-board interaction between homogenous sectional clientele into which the society divides itself

¹⁵⁹Hamilton, Madison, and Jay, *The Federalist Papers*.

¹⁶⁰See, for instance, *ibid*.

¹⁶¹*The Federal Regulation of Lobbying Act*.

and the government-sponsored politico-bureaucratic channels for above par policy outputs. The strategic vacuum so created induced a scramble for the state to be taken over that stands taken over full well as far as its extractive function is concerned.

REFERENCES

- Ahmed, Mahnaz Fatima and Q. Masood (2001) Political Economy of Fiscal Reforms in the 1990s. *The Pakistan Development Review* 40:4.
- Ahmed, Muhammad Ashfaq (2016) Pakistan's Governance Goliath: The Case of Non-Professional Chairman, F.B.R. *The Pakistan Development Review* 55:4, 621–656.
- Ahmed, Muhammad Ashfaq (2015) *Elites, Extraction, and State Autonomy: Pakistan and U.S in Comparison*. Islamabad: Quaid-i-Azam University.
- Ahmed, Muhammad Ashfaq (2016) Pakistan: State-Building, Extraction, and (Misplaced) Societal Preferences. *Journal of International Stability Studies* 2:1, 65–99.
- Alavi, Hamza (1972) The State in Post-Colonial Societies: Pakistan and Bangladesh. *New Left Review* 1: 74.
- Alavi, Hamza (1988) Pakistan and Islam: Ethnicity and Ideology. In Fred Halliday and Hamza Alavi (eds) *State and Ideology in the Middle East and Pakistan* 64–111. Hong Kong: Macmillan Education Ltd.
- Althusser, Louis (2005) *For Marx*. London: Verso.
- Aristotle, T. Sinclair, and T. J. Saunders (1981) *The Politics*. New York: Penguin Books Ltd.
- Azad, Arif (2003) Hamza Alavi. *The Guardian*, December 19.
- Bakhtiar, Idrees (2011) Relief Account in P.M's Name Arouses Suspicion. *Dawn*, June 10.
- Baratz, Peter Bachrach and Morton (1962) Two Faces of Power. *The American Political Science Review* 56:4, 947–52.
- Barney, Darin (2008) Plitical Communication in Canada: The Revenge of Publicity. *Global Media Journal—Canadian Edition* I:1, 89–106.
- Barry, Brian (1989) Power: An Economic Analysis. In Brian Barry (ed.) *Democracy, Power, and Justice: Essays in Political Theory*. 222–69. Oxford: Oxford University Press.
- Bengali, Kaiser (2002) Contradictory Monetary and Fiscal Policies. *Dawn*, October 10.
- Bentley, A. F. (1995) *The Process of Government: A Study of Social Pressures*. New York: Transaction.
- Block, Fred (1977) Beyond Corporate Liberalism. *Social Problems* 24, 353–61.
- Block, Fred (1980) Beyond Relative Autonomy: State Managers as Historical Subjects. In Ralph Miliband and J. Saville (ed.) *Socialist Register*. London: Merlin Press.
- Dahl, Robert A. (1957) The Concept of Power. *Behavioral Science* 2: 3, 201–15.
- Dahl, Robert A. (1958) A Critique of the Rule Elite Model. *The American Political Science Review* 52:2, 463–69.
- Digester, Peter (1992) The Fourth Face of Power. *The Journal of Politics* 54: 4, 977–1007.
- Domhoff, G. William, and R. Thomas Dye (1987) *Power Elites and Organizations* [in English]. Newbury Park, Calif.: Sage Publications.

- Domhoff, W. (1983) *Who Rules America Now?* Englewood Cliffs, NJ: Prentice Hall.
- Domhoff, W. (1990) *The Power Elite and the State*. New York: Aldine de Gruyter.
- Encyclopedia (1968) Interest Groups. In *International Encyclopedia of the Social Sciences*: Encyclopedia.com.
- Engels, Friedrich (1972) *The Origin of the Family, Private Property and the State*. New York: New International Publishers.
- Etzioni, A. (1975) *A Comprehensive Analysis of Complex Organizations*. New York: Free Press.
- Flanagan, Scott C. (1973) Models and Methods of Analysis. In Scott C. Flanagan Gabriel A. Almond, Robert J. Mundt (eds.) *Crisis, Choice, and Change; Historical Studies of Political Development*. Boston: Little Brown.
- Gold, D. A. (1975) Recent Developments in Marxist Theory of the State. *Monthly Review* 27: 6, 36–51.
- Gramsci, Antonio (1971) *Selections from the Prison Notebooks*. London: Lawrence and Wishart.
- Hamilton, A., J. Madison, and J. Jay. (2007) *The Federalist Papers*. Minneapolis: Filiquarian Publishing, LLC.
- Haq, Huzaima Bukhari and Ikramul (2011) Oppressive Taxation and Poverty. <http://thebeautifulpakistan.blogspot.com/2011/02/oppressive-taxation-and-poverty.html>.
- Hay, Colin (2002) *Political Analysis: A Critical Introduction*. Basinstoke: Palgrave.
- Hazem, Beblawi, and Giacomo Luciani (1987) *The Rentier State* Vol. II (Nation, State, and Integration in the Arab World). New York: Croom Helm.
- Held, D. (1989) *Political Theory and the Modern State: Essays on State, Power, and Democracy*. Stanford: Stanford University Press.
- Husain, Ishrat (1999) *Pakistan: The Economy of an Elitist State* [in English]. Karachi; New York: Oxford University Press.
- Hussain, Asaf (1976) Elites and Political Development in Pakistan. *The Developing Economies* 14:3, 224–38.
- Hyden, G., J. Court, and K. Mease (2004) *Making Sense of Governance*. Boulder: Lynne Reiner.
- Iqbal, Farhan Zainulabideen and Zafar (2011) Taxation and Good Governance and the Influence of Non-Tax Revenues on a Polity. *Policy Perspectives* 6: July - December (February 7, 2011, 2009): 1–10.
- Jalal, Ayesha (1990) *The State of Martial Rule: The Origins of Pakistan's Political Economy of Defence* [in English]. Cambridge [England]; New York: Cambridge University Press.
- James, William E. and Subroto Roy (eds) (1992) *Foundations of Pakistan's Political Economy: Towards an Agenda for the 1990s*. New Delhi; Newbury Park, Calif.: Sage.
- Jessop, B. (1982) *The Capitalist State: Marxist Theories and Method*. New York: New York University Press.
- Jorge, Martinez-Vazquez, and Kasper Richtor (2009) Pakistan Tax Policy Report: Tapping Tax Bases for Development. In *International Studies Programme, Andrew Young School of Policy Studies, Georgia State University, International Studies Program Working Paper Series at AYSP, GSU* 181: Georgia State University.

- Khan, Ahmad (1993) Presumptive Tax as an Alternate Income Tax Base: A Case Study of Pakistan. [In English]. *The Pakistan Development Review* 32: 4, 991–1003.
- Khan, M. (2010) Political Settlements and Governance of the Growth-Enhancing Institutions—Working Paper. School of Asian and African Studies. London: School of Oriental and African Studies.
- Khan, M. Abdul Mateen (2011) Political Economy of Fiscal Policy in Pakistan. *Lahore Journal of Economics* 8: January-June 1 (February 7, 2011 2003): 25.
- Kolakowski, Leszek (1971) Althusser's Marx. *Socialist Register*, 111–28.
- Levine, R. F. (1987) Bringing Class Back In: State Theory and Theories of the State. In R. F. Levine and J. Lembecke *Recapturing Marxism, an Appraisal of Recent Trends in Sociological Theory*. New York: Praeger.
- Lukes, Steven (2005) *Power: A Radical View*. 2nd Edition. Basingstoke: Palgrave Macmillan.
- Lunenburg, Fred C. (2012) Compliance Theory and Organisational Effectiveness. *International Journal of Scholarly Academic Intellectual Diversity* 14:1.
- Machado, Diamantino P. (n.d.) On the Autonomy of the State and the Case of the Portuguese Estado Nova. <http://www.pages.drexel.edu/~machadod/autonomy.html>.
- Manzoor, Usman (2016) Media Mum over Murree Girl's Death Case. *The News*, July 2.
- Marx, K. (2001) *Preface to a Critique of Political Economy*. London: Electric Books.
- Marx, K. and F. Engels (2002) *The Holy Family*. Honolulu: University Press of the Pacific.
- Marx, K. and L. H. Simon (1994) *Marx: Selected Writings*. Hackett.
- Meinster, David R. and Elyas Elyasiani (1988) The Performance of Foreign Owned, Minority Owned, and Holding Company Owned Banks in the U.S. *Journal of Banking and Finance* 12: 2, 293–313.
- Miliband, Ralph (1969) *The State in Capitalist Society*. London: Winfield and Nelson.
- Miliband, Ralph (1977) *Marxism and Politics*. New York: Oxford University Press.
- Miliband, Ralph (1983) *Class Power and State Power* [in English]. London: Verso.
- Miliband, Ralph (1970) The Capitalist State—Reply to Poulantzas. *New Left Review* 59, 53–60.
- Miliband, Ralph (1973) Poulantzas and the Capitalist State. *New Left Review* 82, 83–92.
- Miliband, Ralph (1983) State Power and Class Interests. *New Left Review* 138, 19–36.
- Mills, C. Wright. (1956) *The Power Elite* [in English]. New York: Oxford University Press.
- Mumtaz, Soofia, Jean-Luc Racine, and Imran Ali (2002) *Pakistan: The Contours of State and Society* [in English]. Oxford; New York: Oxford University Press.
- Munck, Ronaldo (1984) *Politics and Dependency in the Third World: The Case of Latin America*. London: Zed Books.
- Neumann, Franz L. (1957) Approaches to the Study of Political Power. In *The Democratic and the Authoritarian State: Essays in Political and Legal Theory*. Herbert Marcuse and Ill Glencose, 3–12. London: Free Press.
- O'Donoghue, and Vaqar Ahmed (2009) Redistributive Effect of Personal Income Taxation in Pakistan. *Pakistan Economic and Social Review* 47:1, 1–17.

- Pakistan, Government of (1960) The Taxation Enquiry Committee Report (Volume 1). Karachi: Ministry of Finance.
- Pakistan, Government of (1965) The Commission on Taxation and Tariff (First Report). Islamabad: Ministry of Finance.
- Pakistan, Government of (1986) The National Taxation Reform Commission Report (Part 1). Islamabad: Ministry of Finance.
- Pakistan, Government of (2011) Pakistan: New Growth Framework. Islamabad: Planning Commission.
- Parsons, Tallcott (1963) On the Concept of Political Power. *Proceedings of the American Philosophical Society* 107:3, 232–62.
- Pasha, Faisal Kamal (2014) Neelum-Jhelum Surcharge in Power Bills Challenged in I.H.C. *Dawn* November 23.
- Peter, B. Evans, Dietrich Rueschemeyer, and Theda Skocpol (ed.) (1985) *Bringing the State Back In*. London: Cambridge University Press.
- Poulantzas, N. (1969) The Problem of the Capitalist State. *New Left Review* 58, 67–78.
- Poulantzas, N. (1976) *The Crisis of Dictatorships*. London: New Left Books.
- Poulantzas, N. (1978) *State, Power, and Socialism*. London: New Left Books.
- Poulantzas, Nicos (1973) *Political Power and Social Class*. London: New Left Books.
- Putzel, Jonathan Di John and James (2009) Political Settlements. In *Issue Papers*. Birmingham: Governance and Social Development Resource Centre.
- Rab, Abdur (1962) Pakistan Taxation Enquiry Committee Report. *The Pakistan Development Review* 2: 2, 278–90.
- Raven, B. H. (1965) Social Influence and Power. In I. D. Steiner and M. Fishbein (ed.) *Current Studies in Social Psychology* 371–82. New York: Holt, Rinehard, Winston.
- Raven, B. H. and J. R. P. French (1959) The Bases of Social Power. In D. Cartwright and A. Zander (ed.) *Group Dynamics*. New York: Harper and Row.
- Rousseau (1953) Introduction. In F. M. Watkins (ed.) *Political Writings*. New York: Nelson.
- Rumi, Raza (2010) Wikileaks and Pakistan's Dysfunctional State. *The Express Tribune*, December 3.
- Sayeed, Asad (2004) Hamza Alavi: An Obituary. *Herald*, February 12.
- Shafiqat, Saeed (1989) *Political System of Pakistan and Public Policy: Essays in Interpretation* [in English]. Lahore: Progressive Publishers.
- Skocpol, Theda (1975) *States and Social Revolutions: A Comparative Analysis of France, Russian and China*. London: Cambridge University Press.
- Skocpol, Theda (1979) The Broken Wave. [In No Linguistic Content]. *Journal of Development Studies* 15: 4.
- Useem, M. (1979) The Social Organisation of the American Business Elite and Participation of Corporate Directors in the Governance of American Institutions. *American Sociological Review* 44, 553–72.
- Useem, M. (1984) *The Inner Circle*. New York: Oxford University Press.
- Vakil, C. N. (1950) *Economic Consequences of Divided India; A Study of the Economy of India and Pakistan* [in English]. Bombay: Vora.
- Vaqar, Ahmed, and A. W. Farooq (2010) Nexus between Aid and Security: The Case of Pakistan. In *Country Paper for Policy Reforms and Aid Effectiveness*. Colombo: Institute of Policy Studies.

- Verkaaik, Oskar (2006) *The Capitive State: Corruption, Intelligence Agencies, and Ethnicity in Pakistan*. Amsterdam School for Social Science Research.
- Wallerstein, Immanuel Maurice (1974) *The Modern World System*. New York: Academic Press.
- Wijayadasa, Somar (2011) Good Bye to Foreign Aid. *Z-Communications* (2011). Published electronically July 10. <http://www.zcommunications.org/good-bye-to-foreign-aid-by-somar-wijayadasa>.
- Wootton, Graham (1963) *The Politics of Influence: British Ex-Servicemen, Cabinet Decisions and Cultural Change, 1917–1957*. Cambridge, Massachusetts: Harvard University Press.
- Zaidi, S. Akbar (2010) Pakistan's Roller-Coaster Economy: Tax Evasion Stifles Growth. Carnegie Endowment for International Peace. (Policy Brief No. 88).

Impact of Climate Change on Crops' Productivity across Selected Agro-ecological Zones in Pakistan

ANWAR HUSSAIN and RABIA BANGASH

This study estimates the impact of major climate variables (temperature and rainfall) on crops' productivity across four agro-ecological zones of Pakistan. The crops selected were rice, wheat, maize, cotton and sugarcane. The study used panel data from 1991 to 2010 and applied panel least square techniques. The results revealed that the effect of climatic variables on crops yield varied across agro climatic zone due to differences in their climate conditions. Temperature and rainfall were the important determinants affecting crops productivity across agro climatic zones of Pakistan. Wheat productivity has been impacted more in Northern Irrigated Plain-a by average temperature and in Northern Dry Mountains by rainfall than the other zones. Rice productivity has been impacted more in Dry Mountains by average temperature and in the Indus Delta by rainfall than other zones. Sugarcane productivity has been impacted more by average temperature and rainfall in Indus Delta than zone IV. Maize productivity has been impacted more by average temperature and rainfall in Northern Dry Mountains than other zones. Finally the study recommends proper mitigative and adaptative strategies to enhance the positive and lessen the adverse impact of climate change on crops productivity across agro climatic zones of Pakistan.

JEL Classifications: Q15, Q54, Q57

Keywords: Climate Change, Agro-ecological Zones, Rainfall, Temperature, Productivity

INTRODUCTION

Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity [IPCC (2007)]. Climate change defines changes in the variability or average state of the atmosphere over time scales ranging from a decade to millions of years or “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” [UNFCCC (1992)].

In the South Asian Regions climate change is a serious challenge for human societies and economies due to their ecological and geographical variations. Countries with large population are living along river deltas and coastal lines are more prone to the adverse impact of the climate change. There are certain clear evidences of climate changes in these countries like, recession of Himalayan glaciers, changes in marine ecosystems and rainfall variability [Mustafa (2011)].

Anwar Hussain, <anwar@pide.org.pk> is Assistant Professor, Pakistan Institute of Development Economics (PIDE), Islamabad. Rabia Bangash is M.Phil in Environmental Economics, PIDE, Islamabad.

Like in other developing countries, climate change in Pakistan is a serious concern with its tremendous environmental, social and economic impacts. Pakistan has a diverse climate ranges from mild winters and hot, dry summers in the north to semi-arid and arid zones in the west and the south. Annual rainfall in the country varies from 50mm in arid and semi-arid areas to 2000mm in moist forests. The temperature varies by altitude to below freezing in northern mountains during winter to 35–50°C in central and southern plains during summer [Ahmad, *et al.* (2007)]. The country's mean annual temperature and precipitation increased by 0.6°C and 25 percent during the previous century (1901-2000) respectively [Sheikh, *et al.* (2009)]. IPCC Fourth Assessment Report (2007) revealed that in the northern region of Pakistan rains would increase. So due to changes in climatic parameters (rainfall and temperature), the country is exposed to natural threats like droughts, floods, intense rains and cyclones. When these hazards combine with the vulnerabilities in the form of exclusion, poverty and incongruous political decisions and actions, then it makes people more vulnerable to the impacts of the climate change [Mustafa (2011)]. Pakistan is at 28th place among the countries which are highly vulnerable to the adverse impact of climate change. Pakistan is also included in World Bank's list of 12 highly exposed countries to climate change [Shakoor, *et al.* (2011)]. Such high degree of vulnerability of the country to climate change is due to resource, technological and institutional constraints.

Climate Change and Agriculture Sector of Pakistan

Global climate change affect all economic sectors to some degree, but agricultural sector is the most sensitive and vulnerable to the adverse effect of the climate change as world agriculture, whether in developing or developed countries, remains very dependent on climatic resources. Agriculture productivity is associated with various factors of climate change including temperature hike, changes in rainfall pattern, changes in sowing and harvesting dates, evapo-transpiration, water availability, high concentration of CO₂ and land suitability [Alexandrov, *et al.* (2000)]. In poor parts of the world agriculture sector is more vulnerable to the effects of climate change because crops production in these parts of the world is low technology based, current information about agriculture is poor and the domestic economies are heavily depends on the agriculture for their livelihoods. The impact of climate change on agricultural sector varies from region to region. Countries which are lying in the temperate regions would take advantages of the climatic changes, while tropical and sub-tropical regions would face opposing results [Janjua, *et al.* (2011)].

Pakistan's status as a developing country is dependent mainly on the agriculture sector. Agriculture contributes 21 percent to the GDP and employs 44 percent of workforce. More than two-third (62 percent) of the country's population lives in rural areas and their livelihood depends on agricultural and agro-based activities [Government of Pakistan (2010)]. Two types of crops are grown in a year in Pakistan i.e. Rabi crops (Oct-April) which includes wheat, barley, Gram and Oil seeds and Khraif crops (May-Oct) include Rice, Maize, Sorghum, Millets, cotton, sugarcane. As the country is lying in an arid and semi-arid region and is heavily dependent on irrigated agriculture and is facing the adverse impact of climate change with higher glacial melt, prolonged droughts, hot winters and early summers. The effects of climate change are relatively more

pronounced in Pakistan due to its over-reliance on the environment for basic survival, high population growth rate and density, low capacity to mitigate the negative impacts of climate change, and poverty. These long term impacts of climate change are expected to threaten our biodiversity (loss of species and their habitats), water availability, food security, human health and overall well-being. In spite of such a high degree of vulnerability of agriculture to climate change in developing countries, little research work has been done and very limited in case of Pakistan.

In the past some researchers worked on the impact of climate change on farm revenue such as Shakoor, *et al.* (2011) and Tunde, *et al.* (2011) while some worked on the impact of climate change on the agricultural production in Pakistan such as Lee, *et al.* (2012), Ayinde, *et al.* (2010) and Chaga (2002). Many studies also focused on the impact of climate change on the specific crop productivity in various countries such as Sarker, *et al.* (2012); Siddiqui, *et al.* (2012), Janjua, *et al.* (2011), Ashfaq, *et al.* (2011), Prakash, *et al.* (2011), Nwajiuba and Onyeneke (2010), Chaudhari, *et al.* (2009), Kalra, *et al.* (2008), Tao, *et al.* (2008), Kaul (2007), Hussain and Mudasser (2006), Binbol, *et al.* (2006), Peng, *et al.* (2004), Gbetibouo and Hassan (2004), Torvanger, *et al.* (2004), Ozkan and Akcaoz (2002) and Alexandrov, *et al.* (2002). Some of the researchers such as Li, *et al.* (2015), Asseng, *et al.* (2015) and Burke, Hsiang and Miguel (2015) found that climatic variability affects crops yield.

It is also a fact that the climatic effects cannot be bound to specific districts and these effects are also not drastically different within same district/locality. Their effects vary, mainly across ecological zones of the region. Looking at this perspective, this study answers whether the climate variables i.e. rainfall and temperature affect productivity of major agricultural crops (wheat, rice, maize, sugarcane and cotton) across the agro climatic zones in Pakistan.

Theoretical Background

In the past researchers used various approaches to estimate the relationship between crop productivity and climate change. Ricardian approach was used by Mendelsohn and Dinar (1999), Seo and Mendelsohn (2008). Agronomic crop simulation model was used by Reddy, *et al.* (2002). The production function approach was proposed by many researchers such as Mundlak, (1978), Mundlak, *et al.* (1999), Cabas, *et al.* (2010). The production function approach is easy to apply [Haim, Shechter, and Berliner (2008)] and also minimise the chance of endogeneity [Holst, Yu, and Grun (2010)], therefore, in present study this approach is followed.

This model basically predicts two phenomenon production (Q_i) and inputs (K_i). On the basis of previous research [Rosenzweg and Iglesias (1994)] yield per hectare of each crop is a function of climate, soils and other inputs which can be written as,

$$Q = Q_i(K_i, E) + u_i$$

Where $i = 1, \dots, n$ and

Q = a vector of production

K_i = a vector of all inputs in the production of good i .

E = a vector of exogenous environmental inputs like precipitation, temperature and soil condition.

u_i = an error term.

Different studies have estimated the production function approach by including environmental variables such as temperature and rainfall. On the basis of estimated production function, change in production due to climate variables was analysed [Alexandrov and Hoogenboom (2000); Olsen (2000)]. The estimated change in production due to climate variables either aggregated to capture the overall national impact or integrated into an economic model to estimate the welfare impacts climate change on yield [Olsen, Jensen, and Petersen (2000); Chang (2002)].

Total factor productivity (TFP) and Partial factor productivity (PFP) are the important concepts of production function. TFP accounts for the effects in total output which is not caused by the traditionally measured inputs like labor, land or capital. TFP growth measures the increase in production due to technological and institutional changes rather than increased by the use of inputs. PFP refers to the average productivity of a single factor which can be measured by the output divided by the quantity of that applied factor. The current study uses the PFP of crops across selected zones where the crop productivity is obtained by dividing the total production by the area which is covered by that crop. The current study used yield as a dependent variable to measure the potential impacts of climatic variables (temperature and rainfall) on crops productivity. This study used the historical data of crop yields and climatic variables while the other inputs are not included in the model due to non-availability of data across districts in agro climatic zones of Pakistan.

The study includes separately maximum temperature, minimum temperature, average temperature and precipitation. As minimum temperature refers to the lowest night-time temperature while maximum temperature represents the day time highest temperature [Rasul, *et al.* (2012)]. Mean air temperature is widely used to evaluate the effects of global warming on grain yield. But the use of only mean air temperature assumes no difference in the impact of day versus night temperature. So the inclusion of maximum and minimum temperatures will capture differential effects of day and night temperature [Peng, *et al.* (2004)].

MATERIALS AND METHODS

Nature of Data and its Sources

To assess the impact of climate change (rainfall and temperature) on yield of crops in the selected agro-ecological zones of Pakistan, balanced panel data has been used, covering time period ranging from 1990-91 to 2009- 10. Major variables which are used in the study are crops yield, three different temperature ranges (minimum, maximum temperatures and average temperature) and precipitation. Yield of major crops such as wheat, rice, maize, cotton and sugarcane measured in kilograms per hectare (kgs/hect) is considered for the study. In the Indus Delta (Zone I) the crops yield data is used from 1990-91 to 2008-09 on the basis of its availability. In case of Lahore, cotton is excluded due to its low production in the region. District wise yield data of each crop is taken from Federal Bureau of Statistics (1982–2009), Khyber Pakhtunkhwa Development Statistics (2010), Punjab Development Statistics (2011) and Statistical Pocket Book of the Punjab (2011). District level climate data is taken from Pakistan Meteorological Department, Islamabad.

Description of Selected Agro-ecological Zones

In Pakistan, variations exist in climate, altitude, geography, soil, season and culture. The country has ten agro-ecological zones/regions divided on the basis of variations in physiographic, soil composition, climate, agriculture land use and many other factors that affect agriculture [PARC (1980); Muhammad (1986)]. These main agro-ecological zones of Pakistan are Indus Delta, Southern Irrigated Plain, Sandy Desert, Northern irrigated Plain, Barani (rainfall), Wet Mountains, Northern dry mountains, Western Dry Mountains, Dry western Plateau and Suleiman Piedmont.

This study is confined to four agro climatic zones of Pakistan namely, Indus Delta, Northern irrigated plains (a) and (b), Wet Mountains and Northern Dry Mountains. The selection of the region is subject to the availability of the data.

To evaluate the impact of climate change on crops productivity the following four agro-ecological zones of Pakistan are selected for the study namely,

- (i) Indus Delta (Zone I).
- (ii) Northern irrigated plains (a) and (b) (Zone IV).
- (iii) Wet Mountains (Zone VI) and
- (iv) Northern Dry Mountains (Zone VII).

Northern irrigated plains (a) and (b) (Zone IV) have been selected as these are the major crops growing zones. As far as Wet Mountains (Zone VI) and Northern Dry Mountains (Zone VII) regions are concerned, these regions are more prone to small changes in climatic variables (rainfall and temperature) due to their fragile nature, steep gradient, topography and diversity of environment [Hussain, *et al.* (2005)]. As a rise in temperature in such regions leads to glacial run off and melts permafrost that accelerates soil erosion, landslides and floods etc. The Indus Delta (Zone I) is a large area of fertile land feeding a large proportion of population and already facing the impacts of climate change in the form of prolonged heat waves, high frequency of torrential rains, persistent drought and flooding [Rasul, *et al.* (2012)]. The melting of glaciers in the North also results in raising of sea level that leads to intrusion of saline sea water that can affect the fertile agricultural land of Indus Delta.

The production of major crops varies across zones because of the differences in their climate conditions as well as crops cultivation pattern. Major crops from each region are selected on the basis of percentage share of area covered by each crop and production in the region. Only those regions are selected from each zone where the meteorological observatory stations (climate stations) are available. In Indus Delta (Zone I) two regions i.e. Badin and Hyderabad are selected on the basis of the availability of climate observatory stations. Three main crops namely, wheat, rice and sugarcane are chosen from Indus Delta (Zone I) because these are the major crops on the basis of production (sugarcane 85.1 percent, rice 8.7 percent and wheat 3.4 percent) and area (rice 47.8 percent, sugarcane 27.5 percent and wheat 18.2 percent) covered by the crops. The selected crops, their percent share with respect to area and production and the selected regions from each zone are detailed in Table 1. For robust analysis, the average crop water requirements of major crops along with the required temperature are also given in Table 2. Deviation from the required level of water and temperature will adversely affect

Table 1

Selection of Study Area, Crops and Its Share

Zone	Crops included	Selected Regions	% Share of Crops with Respect to Area	% Share of Crops with Respect to Production
Indus Delta (Zone I)	Wheat, Rice, Sugarcane	Badin, Hyderabad	Rice 47.8	Sugarcane 85.1
			Sugarcane 27.5	Rice 8.7
			Wheat 18.2	Wheat 3.4
Northern Irrigated Plains (a)(Zone IV)	Wheat, Rice, Maize, Cotton, Sugarcane	Multan, Lahore, Bahawalnagar, Faisalabad	Wheat 51.1	Sugarcane 42.2
			Cotton 20.2	wheat 29.7
			Rice 17.8	Cotton 14
			Maize 5.9	Rice 7.3
			Sugarcane 4.3	Maize 6.9
Northern Irrigated Plains(b)	Wheat, Maize, Sugarcane	Peshawar, Nowshera	Wheat 40.7	Sugarcane 81.5
			Maize 29.1	Wheat 8.7
			Sugarcane 22.4	Maize 7.7
Wet Mountains (Zone VI)	Wheat, Maize	Abbottabad, Mansehra	Maize 56.9	Wheat 46.7
			Wheat 41.6	Maize 51.7
Northern Dry Mountains (Zone VII)	Wheat, Maize, Rice	Chitral, Swat	Wheat 65.1	Wheat 62.8
			Maize 29.2	Maize 28.5
			Rice 5.5	Rice 8.6

Table 2

Temperature Thresholds and Average Crop Water Requirements

Crop	Temperature/Water Requirements		
Wheat	Temperature	Minimum	3-4 °C
		Optimum	25°C
		Maximum	30-34°C
Rice	Crop Water requirement Temperature		480 mm
		Minimum	10-12°C
		Optimum	30-32°C
Cotton	Crop Water requirement Temperature	Maximum	36-38°C
			1500 mm
		Minimum	20 °C
Maize	Crop Water requirement Temperature	Optimum	27-35°C
		Maximum	42-45°C
			620 mm
	Crop Water requirement Temperature	Minimum	16.7 - 23.3 °C
		Optimum	20- 22.7 °C
		Maximum	22 – 32 °C
	Crop Water requirement		550 mm

Source: Riaz (2001); Siddiqui, *et al.* (2011).

crops productivity. Sugarcane Research Institute Faisalabad divided the sugarcane production into four stages of production. Each stage requires specific temperature level during the development.

- First stage: Optimum temperature for sowing: 20-32 °C
Optimum temperature for germination: 32-28 °C
- Second stage: Maximum temperature decreasing tillering: 30°C
- Third stage: Optimum temperature for sugarcane: 28-38°C
- Fourth stage: Temperature for good sugar production: 10° C

The optimum rainfall for sugarcane is 1250-2500 mm.

Analytical Techniques

Panel Least Square Estimation Techniques

Fixed effect and random effect models are generally used for a panel data analysis [Baltagi (2008)]. This study is based on the balanced panel data and therefore, used Fixed Effect Model (FEM) and Random Effect Model (REM) detailed as under:

Fixed Effect Model (FEM)

Fixed Effect Model (FEM) using dummy variables is also known as the least square dummy variable model. FEM have constant slopes but different intercept according to time. In FEM the intercept is a group specific which means that the model allows for different intercepts for each group. The variation in the intercept may be due to unobserved factors. These unobserved factors vary across entities but are constant over time [Stock and Watson (2003)]. The time invariant characteristics (like gender, race, culture etc.) of the cross sections are perfectly collinear with other cross sections dummies. The FEM model controls all the time invariant differences between the individuals, therefore due to omitted time invariant factors the estimated coefficients of FEM cannot be biased. Basically fixed effect model are design to study the causes of changes within entities. As the time invariant factor is constant for each entity so it cannot cause such a change. The applied form of FEM for the study taken the form:

$$Y_{it} = \alpha_i + \beta_1(RF)_{it} + \beta_2(Tem)_{it} + u_{it}$$

Where

α_i = Constant term

Y_{it} = Yield per hectare in i_{th} district for time period t (yield in kgs/hect).

RF_{it} = Average Rabi (October-March) and Khraif (April-September) precipitation in i_{th} district for time period t . The total monthly rainfall data is grouped into crops seasonal average on the basis of their sowing and harvesting periods. Both the Kharif and Rabi seasons rainfall is measured in millimetre (mm).

$Temp_{it}$ = Average Rabi (October-March), Khraif (April-September) temperatures and the average of maximum and minimum Rabi and Khraif temperatures in the i_{th} district for the time period t . Monthly temperatures data is also converted into crops seasonal average on basis of growing and harvesting period of crops. Average temperature, mean of maximum and minimum

temperatures for both the Kharif and Rabi seasons are measured in degree Celsius ($^{\circ}\text{C}$).

Random Effect Model (REM)

The basic logic of random effect model is that the variation across entities is supposed to be random and not correlated with those independent or predictor variables which are included in the model. It assumes that the entity's error term is uncorrelated with the explanatory variables which allows for time invariant variables to act as explanatory variables. The basic advantage of REM is that it includes time invariant variables while FEM absorbed these variables by the intercept. In REM there is a need to specify those individual features that may or may not affect the predictor variables. Some variables may be available or not therefore it leads to the problem of omitted variable bias in the model.

For the study the applied form of REM is,

$$Y_{it} = \alpha_i + \beta_1(RF)_{it} + \beta_2(Tem)_{it} + \varepsilon_{it}$$

While $\varepsilon_{it} = \lambda_i + u_{it}$ is now part of error term

As u_{it} is between entity error and ε_{it} is within entity error term.

α_i = Constant term

Y_{it} = Yield per hectare in i^{th} district for time period t (yield in kgs/hect).

RF_{it} = Average Rabi (October-March) and Khraif (April-September) precipitation in i^{th} district for time period t (in mm).

$Temp_{it}$ = Average Rabi and Khraif temperature and the average of maximum and minimum Rabi and Khraif temperatures in the i^{th} district for the time period t (in Degree Celsius = $^{\circ}\text{C}$).

To select the appropriate model out of FEM and REM, Hausman test is used. The basic assumption of this test is that the preferred model is random effects over the fixed effects [Green (2008)]. It basically tests whether the error term (u_i) are correlated with the regressors or not. The null hypothesis for this test is that the Random Effects model coefficients are consistent and efficient. The Hausman test statistics is:

$$H = (\hat{\beta}^{\text{FE}} - \hat{\beta}^{\text{RE}}) [\text{var}(\hat{\beta}^{\text{FE}}) - \text{var}(\hat{\beta}^{\text{RE}})]^{-1} (\hat{\beta}^{\text{FE}} - \hat{\beta}^{\text{RE}}) \sim \chi^2_k$$

H = Hausman test

$\hat{\beta}^{\text{FE}}$ = Coefficient of determination of the fixed effect

$\hat{\beta}^{\text{RE}}$ = Coefficient of determination of the random effect

χ^2 = Chi square statistic

k = degree of freedom.

The above models applied separately for each crop i.e. wheat, rice, maize, cotton and sugarcane. However, the appropriate model was selected on the basis of Hausman test results. In this study different panels based on each agro climatic zones have been made. The inclusion of the districts in each panel is subject to availability of data in that particular zone. It is important to mention that REM is applied only for Northern irrigated plain a (Zone IV) because this zone included four cross sections and the estimation of random effects model requires that number of cross section should be greater than the number of coefficients for between estimators for estimate of RE innovation variance.

The results of Housman test suggested that REM is the appropriate model only for rice and maize crops and FEM is the suitable model for wheat, cotton and sugarcane crops in Northern irrigated plain a (Zone IV). For Indus Delta (Zone I), Northern Irrigated plain b (Zone IV), Wet Mountains (Zone VI) and Northern Dry Mountains (Zone VII) only FEM is applied because each zone includes only two regions.

RESULTS AND DISCUSSION

Climate–Yield Relationship in Indus Delta (Zone I)

The results in Table 3 show that seasonal mean minimum temperature (Tn) is positively related to rice, wheat and sugarcane yield. As Tn increases, rice and wheat yield also increases. More specifically one degree (1°C) rise in Tn increases rice and wheat yield by 76.25 kgs/hect and 143.7 kg/hect respectively. The relationship is also in line with the study of Tao, *et al.* (2008). Similarly 1°C increase in minimum temperature increases sugarcane yield by 1207.9 kgs/hect. For rice, wheat and sugarcane, the minimum temperature is statistically significant.

Table 3

Regression Results of the Impact of Temperature and Rainfall on Crops Productivity in Indus Delta (Zone I)

Variables	Coefficients with Average Minimum Temperature and Rainfall			Coefficients with Average Maximum Temperature and Rainfall			Coefficients with Average Temperature and Rainfall		
	Rice	Sugarcane	Wheat	Rice	Sugarcane	Wheat	Rice	Sugarcane	Wheat
Constant	-11.002	-11.942	-5.208	3.190	38.145	-2.067	-3.134	12.668	-4.965
Temperature	76.258***	1207.932***	143.745***	51.282***	1452.006***	75.019***	61.719***	1719.998***	98.786***
Rainfall	5.212***	68.614**	-12.385	5.589***	77.387**	-9.570	5.433***	73.657**	-10.752
Diagnostics									
R-squared	0.889	0.958	0.863	0.884	0.954	0.855	0.886	0.956	0.859
Adj- Rsq	0.888	0.956	0.858	0.877	0.953	0.849	0.879	0.954	0.853
F-statistic	134.402	545.176	151.502	127.931	508.006	142.069	133.549	524.638	146.854
Prob(F-stat)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

The coefficient of rainfall shows that there is a positive and significant relationship between rice, sugarcane yield and rainfall. As rainfall increases the productivity of these two mention crops also increases. More specifically 1mm (millimetre) increase in rainfall increases rice and sugarcane yield by 5.21 kgs/hect and 68.61 kgs/hect respectively. The results further reveal that wheat productivity responds negatively to the increase in rainfall but its coefficient is statistically insignificant. A significant increase in rainfall may result in lower wheat productivity but at this point of time a marginal increase in rainfall is not going to affect the productivity of wheat considerably. Similar findings were also derived by Tao, *et al.* (2008) while analysing the impact of seasonal precipitation on wheat yield.

Furthermore, mean Maximum Temperature (Tm) is positively related to the yield of major food crops i.e. wheat, rice and sugarcane. More specifically, 1°C increase in maximum temperature increases wheat yield by 75.01 kgs/hect. The positive result for wheat yield and Tm is quite consistent with the findings of Prakash, *et al.* (2011). Similarly 1°C increase in Tm increases rice and sugarcane yield by the amount of 51.28

kgs/hect and 1452 kgs/hect respectively which is in line with the study of Sarker, *et al.* (2012). For these three major crops (rice, wheat, sugarcane) maximum temperature is statistically significant. The recommended maximum temperature limit for wheat and rice is 30–34°C and 36–38°C respectively [Siddiqui, *et al.* (2012)]. In the study area the average maximum temperature for wheat and rice ranges from 29.3 to 31.4 °C and 35.5–38.7 °C respectively. So average maximum temperature data from 1991–2010 is in line with the recommended ranges, therefore increase in T_m during the study period is not affecting crops productivity adversely.

The results in Table 3 show that the coefficient of rainfall has a positive impact on the yield of rice and sugarcane. More specifically 1 mm (millimeter) increase in rainfall increases rice and sugarcane yields by 5.58 kgs/hect and 77.3 kgs/hect respectively. The positive response of rice yield to increase in T_m and rainfall is in line with the findings of Sarker, *et al.* (2012) and Prakash, *et al.* (2011). The coefficient of rainfall is statistically significant for sugarcane and rice yield. The results also reveal that rainfall is negatively related to wheat yield but its coefficient is statistically insignificant.

Besides, Table 3 show that there is a positive and significant relationship between average temperature and yield of the three crops i.e. rice, sugarcane and wheat, as average temperature increase yield of the respective crops also increases. More specifically, 1°C increase in average temperature increase wheat yield by 98.78 kg/ hect which is similar to the findings of Janjua, *et al.* (2011). They found a positive response of wheat yield to increase in average temperature in Pakistan. Similarly 1°C increase in average temperature increases the rice and sugarcane yield by 61.71 kg/hect, and 1719.9 kg/hect respectively. This effect is statistically significant for these three crops. The recommended optimum temperature for wheat and rice are 25°C and 30–32°C respectively [Siddiqui, *et al.* (2012)]. In the study area the average temperature during wheat and rice growing seasons in the last 20 years ranged from 22 to 23.8 °C and 30–32.3 °C respectively. So the metrological data for last 20 years lies within the optimum temperature limits, therefore it effects crops yield positively.

The sign of rainfall coefficient shows that it has positive effect on rice and sugarcane yield. As rainfall increases yield of these two crops increases. For rice and sugarcane, the rainfall coefficient is statistically significant. The results show that seasonal rainfall has negative impact on wheat yield followed by statistically insignificant coefficient. The diagnostics derived also favour the model estimated.

In case of all three different temperature ranges (minimum, maximum and average) in Indus Delta, increase in summer rainfall favors both rice and sugarcane crops because both are water demanding crops and need more water. The recommended water requirements of rice and sugarcane is 1500 mm and 1800 mm respectively [Riaz (2001)] which is very high while climate of the region is arid where summer mean monthly rainfall is about 75 mm. Therefore, increase in summer rainfall is beneficial for the productivity of aforementioned crops. There is negative relationship between wheat yield and Rabi rainfall. It may be due to the fact that in these regions a strong and supplementary irrigation system is available which can meet the water requirement of wheat crop. Therefore increase in Rabi rainfall may not have favoured wheat productivity in Indus Delta during the last 20 years.

As Indus Delta is located in climatically arid zone of extreme heat and highly variable rainfall therefore vulnerable to the problems related to climate change like droughts and floods, saline water intrusion, increased crop water requirements [Rasul, *et al.* (2012)]. Being nearer to the sea all the phenomenal changes due to global warming over the sea and land can affect it in future. The results of the study showed that during last twenty years (1990-91 to 2009-10) there is no negative impact of the increased temperature on crops yield in Indus Delta. In order to enhance the positive impact of climate change on crops productivity in the future in such warmer areas proper adaptation techniques must be considered like developing new heat and drought resistant crop varieties, shifting in sowing and harvesting dates to avoid intense heat.

Climate Yield Relationship in Northern Irrigated Plain a (Zone IV)

The results in Table 4 indicates that mean minimum temperature (Tn) has a positive and statistically significant impact on major crops such as rice, Sugarcane, Cotton and Wheat while affects maize yield negatively, in the Northern Irrigated plain regions of Punjab. More specifically, 1 °C increase in Tn increases yield of rice, Sugarcane, Cotton, and Wheat by 58.6 kgs/hect, 1719.25 kgs/hect, 19.94 kgs/hect and 208.73 kgs/hect respectively. Some crops like sugarcane, cotton and rice are tropical crops that require a warm and humid climate for different stages of growth and development. Wheat crop requires optimal temperature for germination and it take place between 4-37°C, optimal temperature starts from 12–25 °C [Spilde (1989)]. In the study area the average minimum temperature during rabi season ranges from 8.3- 13.6 °C in last 20 years. Therefore increase in Tn during last 20 years (1991-2010) is not effecting aforementioned crops yield adversely. The result further explores that increase in Tn affects maize yield adversely. More specifically, 1 °C increase in Tn reduces maize yield by 98.25 kgs/hect. The optimal night temperature for maize plant ranges from 16.7 to 23.3°C [Khaliq (2008)] while the average minimum temperature of the study area during maize growing season ranges from 24.2- 27.2 °C in 1991-2010. This show divergence from the critical limit therefore reduces maize yield.

The sign of rainfall coefficient show that it has a positive effect on rice, sugarcane, cotton, maize and wheat yield. As rainfall increases yield of these aforementioned crops also increases. More specifically, 1 mm increase in rainfall increases maize yield by 0.69 kgs/hect which is in line with the study of Tunde, *et al.* (2011). The results also show that 1 mm increase in rainfall, increases wheat yield by 6.37 kgs/hect. Prakash, *et al.* (2011) also obtained similar positive impact of winter rain and minimum temperature on wheat yield. Ashfaq, *et al.* (2011) also concluded that the adequate amount of rainfall increased wheat productivity by 275.77 kg ha⁻¹ in Punjab. Similarly 1 mm increase in rainfall increases rice, sugarcane and cotton yields by 0.92 kgs/hect, 6.0kgs/hect and 0.73 kgs/hect respectively. The positive impact of Tn and rainfall on rice crop is in line with the results of Sarker, *et al.* (2012). For cotton, maize and wheat rainfall is statistically significant while for rice and sugarcane crops the rainfall coefficient is insignificant. The diagnostics derived also favoured the model estimated.

Table 4

Regression Results of the Impact of Average Minimum Temperature and Rainfall on Crops Yield in Northern Irrigated Plain a (Zone IV)

Variables	Coefficient of				
	Rice	Sugarcane	Maize	Cotton	Wheat
Constant	6.182	14.618	-186.760	0.146	84.264*
Minimum temperature	58.652***	1719.254***	-98.251*	19.942***	208.760***
Rainfall	0.926	6.087	0.699*	0.734*	6.379***
Diagnostics					
R-squared	0.963	0.966514	0.945921	0.91179	0.976684
Adj- Rsq	0.963	0.979581	0.944766	0.90978	0.976186
F-statistic	1659.195	1812.366	819.1808	473.731	1961.799
Prob(F-stat)	0.000	0.00000	0.00000	0.00000	0.00000
Chi sq.stat	0.46849	Chi sq stat 24.173	Chi sq stat 0.846	Chi.sq.stat 16.661	Chi sq.stat. 48.565
Prob.	0.7912	Prob. 0.000	Prob 0.654	Prob.0.000	Prob.0.000

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

The results reported in Table 5 indicate that maximum temperature (Tm) has a positive effect on major crops (Rice, Sugarcane, cotton, and Wheat), as Tm increase yield of these major crops increases as well. More specifically, 1°C increase in Tm increases rice, sugarcane, cotton and wheat yield by 38.35 kgs/hect, 1152.59 kgs/hect, 1.64 kgs/hect and 92.1 kgs/hect respectively. Hanif, *et al.* (2010) also found that increase in Rabi mean maximum temperature increased wheat yield in Punjab because wheat crop need heat for maturation. The results further show that maize yield is negatively related to Tm i.e. 1°C increase in Tm decreases maize yield by 87.23 kgs/hect. The adverse impact of Tm on maize yield is in line with the findings of Prakash, *et al.* (2011). The negative relationship can be justified on the grounds that maize crop requires optimal day temperature from 22 to 32°C [Khaliq (2008)] while the average maximum temperature (day temperature) of the study area during maize growing season ranges from 36.6 to 39.9 °C in last twenty years which shows larger deviation from the recommended threshold level. Temperature falls to 5°C or above 32°C can affect yield of maize adversely. Maize crop growth enhanced at the temperature from 22–32°C because at this temperature, rate of photosynthesis is higher than losses due to respiration. So Tm above 32°C may affect maize crop yield negatively in these plain areas of Punjab. As increase in temperature affected maize productivity adversely in the last 20 years so there is a need to introduce high temperature tolerant maize cultivars.

The required maximum temperature for wheat, rice and cotton are in ranges from 30-34°C, 36-38°C, and 42-45°C respectively [Siddiqui, *et al.* (2012)]. The average maximum temperature of the study area during Rabi and Kharif growing seasons in last 20 years are ranges from 24.1-27.5 °C and 35.9-40.6°C respectively which show that the data is within the recommended threshold. Therefore not effecting wheat, rice, cotton and sugarcane crops yield adversely. For these aforementioned crops the coefficient of Tm is also statistically significant. The sign of rainfall coefficients show that the productivity of major crops (rice, cotton, sugarcane, maize and wheat) responds positively to changes in rainfall. For wheat, maize and cotton the rainfall coefficient is statistically significant while for rice and sugarcane crops its coefficient is statistically insignificant. The diagnostics derived also favour the model estimated.

Table 5

Regression Results of the Impact of Average Maximum Temperature and Rainfall on Crops Yield in Northern Irrigated Plain a (Zone IV)

Variables	Coefficients of				
	Rice	Sugarcane	Maize	Cotton	Wheat
Constant	13.339	4.658	-143.897	444.216	7.911
Maximum Temperature	38.351***	1152.596***	-87.238**	1.648***	92.107***
Rainfall	1.281	5.166	0.331	0.887**	0.923**
Diagnostics					
R-squared	0.960	0.968	0.946	0.984	0.987
Adj- Rsq	0.959	0.967	0.945	0.983	0.986
F-statistic	1510.670	1896.222	827.940	9.346	3511.725
Prob(F-stat)	0.000	0.000	0.000	0.000	0.000
Chi sq. stat 0.447	Chi sq. stat 2.756	Chi sq. stat 0.203	Chi sq. stat 26.023	Chi sq. stat 21.174	
Prob. 0.799	Prob. 0.252	Prob. 0.903	Prob. 0.000	Prob. 0.000	

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

The results reported in Table 6 indicate that average temperature has a positive influence on the yield of major crops (Rice, Sugarcane, Cotton and Wheat) in Northern Irrigated plain areas of Punjab. As average temperature increases, yield of these major crops increases as well. More specifically, 1°C increase in average temperature increases rice, sugarcane, cotton and wheat yield by 46.5 kgs/hect, 1381.3 kgs/hect, 15.9 kgs/hect and 133.6 kgs/hect respectively. The result revealed that an increase in average temperature effects maize yield negatively and reduces it by 109.46 kgs/hect. According to Wiatrak, *et al.* (2006) the optimal average temperatures for maize growth ranges from 20 to 22.7 °C while the average temperature of the study area in last 20 years ranges from 30 to 34.2 °C which shows clear deviation from the recommended limit. As this zone includes plain area from Punjab where irrigation water is already in stress condition and increase in temperature above 32°C is harmful for maize yield especially during tasseling, silking and grain filing stages. Therefore increase in average temperature affected maize yield adversely.

Table 6

Regression Results of the Impact of Average Temperature and Rainfall on Crops Yields in Northern Irrigated Plain a (Zone IV)

Variables	Coefficients of				
	Rice	Sugarcane	Maize	Cotton	Wheat
Constant	9.246	1.179	-154.237	-0.042	-7.393
Average Temperature	46.577***	1381.392***	-109.469**	15.901***	133.674***
Rainfall	1.136	0.359	0.140*	0.805**	1.424**
Diagnostics					
R-squared	0.961	0.980	0.946	0.955	0.975
Adj- Rsq	0.960	0.979	0.945	0.953	0.974
F-statistic	1575.248	2444.429	826.795	476.191	1867.659
Prob(F-stat)	0.000	0.000	0.000	0.000	0.000
Chi Sq. stat 0.563	Chi Sq. stat 19.800	Chi Sq. stat 0.354	Chi Sq. stat 17.685	Chi Sq. stat 6.961	
Prob.0.754	Prob. 0.000	Prob. 0.837	Prob. 0.000	Prob. 0.0308	

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

The sign of rainfall coefficient show that it is positively related to wheat, rice, sugarcane, cotton yield and maize yield. More specifically, 1mm increase in rainfall increases rice, sugarcane, cotton, wheat and maize yield by 1.1 kgs/hect, 0.35 kgs/hect, 0.80 kgs/hect, 1.42kgs/hect and 0.14kgs/hect respectively. The results for wheat and average rainfall is in line with the finding of Janjua, *et al.* (2011) also found a significant positive impact of average temperature and rainfall on wheat productivity in Pakistan. For wheat, maize and cotton crops the rainfall variable is statistically significant while for sugarcane and rice its coefficient is insignificant.

Thus in case of three different temperatures ranges (minimum, maximum and average) the impact of rainfall on rice and sugarcane yield is positive but statistically insignificant. As both rice and sugarcane are water intensive crops and require sufficient amount of rainfall during growing season. These crops can be grown in the regions where annual rainfall is more than 40 inches while in Pakistan annual average rainfall is less than 20 inches [Siddiqui, *et al.* (2010)] which is insufficient. Cotton requires about 620 mm [Riaz (2001)] while maize requires up to 700 mm [Rasul (2010)] of water during the whole growing period which is high. In plain areas of Punjab annual rainfall ranges from 300-500 mm in the south west and 200-300 mm in the east [PARC (1980); Muhammad (1986)] which is very low as compared to the actual water requirements of major crops. Therefore the area which has little or no rainfall during the growing period, irrigation is crucial for agricultural crops. Therefore the deficiency of rainfall can be met by means of artificial irrigation arrangements like tube wells and canals. So increase in rainfall favors crops productivity in such areas.

As Northern irrigated plain a (Zone IV) which are included regions from Punjab having arid to semi-arid type of climate with the highest summer temperature (40-43 °C). Therefore there is need to cultivate high yielding crop varieties to cope with the expected increase in temperature in future.

Climate—Yield Relationship in Northern Irrigated Plain b (Zone IV)

The results given in Table 7 show that minimum temperature (T_n) is positively related to wheat, maize and sugarcane yields. As T_n increases yield of these three major crops also increases. More specifically 1°C rise in T_n increases wheat, sugarcane and maize yield by 234.26 kgs/hect, 1247 kgs/hect and 74 kg/hect respectively. The positive relationship for wheat and maize yield is also in line with the study of Tao, *et al.* (2008). The coefficient of T_n is also statistically significant for these three crops. The required minimum temperature for wheat and maize ranges from 3-4°C and 16-23.3°C respectively [Siddiqui, *et al.* (2012)]. The temperature data in last twenty years shows that the average minimum temperatures of the study area during Rabi and Kharif seasons ranges from 5.8-10.8 °C and 21.8–24.5 °C respectively which show very little deviation from the recommended limits. It is due to the semi-arid and continental type climate of the regions, therefore slight increase in T_n is not affecting the crops productivity adversely. As for as sugarcane is concerned, which is a tropical crop, requires warm climate during the entire growth period. So temperature below 15°C and 40 °C are harmful the crop. The average minimum temperature of the study area is 21.8–24.5 °C during sugarcane growing season therefore T_n is not affecting cane productivity adversely.

Table 7

Regression Results of the Impact of Temperature and Rainfall on Crops Yields in Northern Irrigated Plain b (Zone IV)

Variables	Coefficients with Average Minimum Temperature and Rainfall			Coefficients with Average Maximum Temperature and Rainfall			Coefficients with Average Temperature and Rainfall		
	Wheat	Sugarcane	Maize	Wheat	Sugarcane	Maize	Wheat	Sugarcane	Maize
Constant	26.829	30.229	2.592	-1.471	29.728	-0.379	119.000*	12.340	0.171
Temperature	234.261***	1247.252***	74.042***	81.901***	1373.842***	47.917***	116.474***	1679.553***	58.320***
Rainfall	0.327	18.7630***	3.314***	1.462	9.327*	2.782***	0.334	11.786**	2.948***
Diagnosics									
R-squared	0.942	0.998	0.968	0.966	0.967	0.972	0.841	0.998	0.971
Adj- Rsq	0.939	0.997	0.966	0.964	0.966	0.971	0.834	0.997	0.970
F-statistic	390.510	12416.87	760.740	677.079	9399.528	893.525	126.941	15590.71	853.194
Prob(F-stat)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

The sign of rainfall coefficients show that there is a positive relationship between rainfall and yield of maize and sugarcane crops. One mm (millimetre) increase in rainfall increases maize and sugarcane yield by 3.31 kg/hect and 18.76307 kg/hect respectively. The results further reveal that rainfall is positively related to wheat yield but its coefficient is statistically insignificant. Torvanger, *et al.* (2004) also obtained similar positive and insignificant results for wheat yield and rainfall. For maize and sugarcane rainfall coefficient is statistically significant.

The results reported in Table 7 further show that maximum temperature (T_m) is positively related to wheat, maize and sugarcane yield. As T_m increases yields of all these three crops increases. More specifically, 1°C increase in T_m increases wheat, maize and sugarcane yield by 81.9 kg/hect, 47.9 kg/hect and 1373.842 kg/hect respectively. The coefficient of maximum temperature is statistically significant for wheat, maize and sugarcane. The average maximum temperature of the study area during Rabi and Kharif growing seasons ranges from 21.6–24.6 °C and 34.7–37.5°C respectively. These ranges are consistent with the required maximum temperature level of aforementioned crops therefore increase in T_m during the year 1991-2010 is not affecting the productivity of crops negatively. To enhance the positive impact of climate change on crops productivity, technology adoption and modification to farm management are also important aspects to reduce the losses due to climate change in such warmer areas.

The coefficient of rainfall shows that it is positively related with the yield of maize, sugarcane and wheat as rainfall increases yield of these three crops also increases. More specifically, 1 mm increase in rainfall increases maize and sugarcane yield by 2.78 kgs/hect and 9.32 kgs/hect respectively. Tunde, *et al.* (2011) also obtained similar positive results for rainfall and T_m on maize yield. For maize and sugarcane yield rainfall coefficient is statistically significant while it is insignificant for wheat yield.

Furthermore, average temperature is positively related to wheat, maize and sugarcane yield. As average temperature increases yield of these three aforementioned crops also increases. More specifically, 1°C increase in average temperature increases wheat, sugarcane and maize yield by 116.47 kgs/hect, 1679.55 kgs/hect and 58.32 kgs/hect respectively. The coefficient of average temperature is statistically significant for these three major crops (Table 7).

The coefficient of precipitation shows that it is positively related to the yield of these three major crops as precipitation increases yield of these crops increases as well.

More specifically, 1 mm increase in rainfall increases maize and sugarcane yield by 2.9 kgs/hect and 11.7 kgs/hect respectively. For maize and sugarcane rainfall, coefficient is statistically significant while for wheat it is insignificant. For maize yield the positive and statistically significant effect of temperature and rainfall is in line with the study of Nwajiuba and Onyeneke (2010).

Thus in case of the three different temperatures ranges (maximum, minimum and average) the impact of rainfall is positive and significant on maize and sugarcane yield. Maize is the crop that requires moderate amount of water therefore it can be grown in the areas with moderate rainfall even without irrigation [Sánchez-Cortés and Chavero (2011)]. As climate of the regions like Peshawar and Nowshera is semi-arid subtropical continental type where the monthly rainfall ranges from 20-32 mm both in winter and summer [PARC (1980); Muhammad (1986)], therefore increase in rainfall favours crops yield.

Climate–Yield Relationship in Wet Mountains (Zone VI)

The results reported in Table 8 show that the mean minimum temperature (Tn) is positively related with wheat and maize yield. As Tn increases yield of these two crops in these regions also increases and vice versa. One degree (°C) rise in Tn increases wheat and maize yield by 181.75 kgs/hect and 116.59 kgs/hect respectively. These results are in line with the findings of Tao *et al* (2008). The relationship between Tn and yield of these two crops is statistically significant. As these are the mountains regions with mild summer and cold winter so slight increase in Tn is beneficial for the growth of wheat and maize crops. The increase in crops yield is due the fact that the average minimum temperature of the study area is laying within the require temperatures limits for both the crops. The recommended minimum temperature for wheat crop is about 3-4°C [Siddiqui, *et al*. (2012)] which is in line with the metrological data for these last 20 years which show that in Rabi season the average minimum temperature of the study area ranges from 3.9- 6.7 °C. The optimal night temperature (Tn) for maize plant ranges from 16.7 to 23.3°C [Khaliq (2008)] and average minimum temperature of the study area during maize growing season ranges from 15.7 to 18.7°C. Any change in recommended minimum temperature below threshold level may affect the productivity of wheat and maize adversely.

Table 8

Regression Results of the Impact of Temperature and Rainfall on Crops Yields in Wet Mountains (Zone VI)

Variables	Coefficients with Average Minimum Temperature and Rainfall		Coefficients with Average Maximum Temperature and Rainfall		Coefficients with Average Temperature and Rainfall	
	Wheat	Maize	Wheat	Maize	Wheat	Maize
Constant	17.054	-0.310	0.512	-1.316	-1.323	-1.887
Temperature	181.752***	116.598***	53.921***	67.875***	87.955***	86.516***
Rainfall	7.020***	-3.139***	6.220***	-3.123***	5.650***	-3.227***
Diagnostics						
R-squared	0.896	0.949	0.906	0.946	0.909	0.949
Adj- Rsq	0.892	0.946	0.902	0.944	0.905	0.946
F-statistic	208.760	469.864	232.312	447.927	241.843	470.206
Prob(F-stat)	0.000	0.000	0.000	0.000	0.000	0.000

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

Furthermore, there is a positive and significant relationship between wheat yield and rainfall. One mm increase in rainfall increases wheat yield by 7.0kgs/hect. Janjua, *et al.* (2010) also obtained similar positive results for wheat production and average precipitation in Pakistan while analysing the impact of climate change on wheat productivity. The results also show that precipitation is negatively related to maize yield in Abbottabad and Mansehra and its coefficient is also statistically significant. More specifically, 1 mm increase in rainfall decreases maize yield by 3.139kgs/hect. This is in line with the findings of Prakash, *et al.* (2011) who found that increase in summer rain adversely affected the yield of maize.

The results derived in Table 8 show that maximum temperature (T_m) is positively related to wheat and maize yield. As T_m increases yield of both the crops also increases and vice versa. More specifically, one degree rise in T_m increases wheat yield by 53.92 kgs/hect and maize yield by 67.87 kgs/hect which is in line with the study of Tunde, *et al.* (2011). The coefficients of maximum temperature for these two crops are also statistically significant. Hussain, *et al.* (2005) also concluded that there is an increase in maximum temperature in the mountainous regions of Pakistan. This increase in T_m may have some positive influences on area and yield of different crops in such areas. Rise in T_m during winter season is significant for winter crops like wheat as increase in T_m lead to earlier maturity of such crops and raises the overall productivity. The required maximum temperature (day temperature) for maize crop ranges from 22 to 32 °C [Khalik (2008)] which is laying within the range of last 20 years data which show that during maize growing season the average maximum temperature of the area ranges from 27.6 – 31.6°C, so increase in T_m is not affecting maize yield adversely.

The sign of rainfall coefficient shows that there is a positive relationship between wheat yield and rainfall while the relationship for maize is negative. More specifically, 1 mm increase in rainfall increases wheat yield by 6.22 kgs/hect. This type of relationship is also found by Tao, *et al.* (2008). Similarly 1 mm increase in rainfall decreases maize yield by 3.1 kgs/hect. The coefficients of maximum temperature and rainfall are also statistically significant for both maize and wheat crops. The results given in Table 8 show positive relationship between average temperature and yield of maize and wheat crops. More specifically, 1°C increase in average temperature increases wheat yield by 87.95 kgs/hect. The results further show that 1°C increase in average temperature increases maize yield by 86.51 kgs/hect. According to Ozkan and Akcaoz (2002) maize is a crop that requires hot environment to grow and the difference between day and night should be low. So this increase in average temperature is favorable for the crops production from mid to high altitude regions. The positive impact of average temperature on maize yield is in line with the results of Nwajiuba and Onyeneke (2010). The coefficient of the average temperature is statistically significant for these two crops. The coefficient of rainfall shows that it has a positive impact on wheat yield and a negative impact on maize yield. More specifically, one mm increase in rainfall increases wheat yield by 5.65 kgs/hect and decreases maize yield by 3.2kgs/hect. The coefficient of rainfall is statistically significant for these two major crops. Similar positive and significant impact of rainfall and average temperature on wheat yield in Pakistan is shown by Janjua, *et al.* (2010).

In case of all three different temperature ranges (minimum, maximum and average), the impact of rainfall is negative on maize yield. This is also consistent with the actual status of the mountains regions that receive higher rainfall throughout the year especially in the summer. These are summer rain dominated regions receive about 235 mm monthly rainfall in summer season while the actual water requirements of maize crop is 550 mm [Riaz (2001)]. The growing season for maize is highly vulnerable to any change in rainfall pattern. So excessive rain in summer is harmful for the land fertility as it can lead to reduce water recharge by accelerating runoff and causes floods that may lead to the reduction of maize yield in the zone. It may also affect the initial stages of crop development that lead to yield reduction. It is necessary to cultivate such crop varieties which are resistant to drought and heavy spell of rain in such regions. The results further show a positive relationship between wheat yield and rainfall. As wheat requires 480 mm water [Riaz (2001)] for growth and development during the whole period while the average rainfall in the study area during the year 1991-2010 ranges from 38–147 mm, which is not sufficient. Therefore increase in rainfall favours wheat yield in these regions.

Planting of early maturing crop varieties such as wheat in mountains regions is another step to reduce yield losses due to climate change. In this way the crops can reach to their full maturity before the frost kill them during the initial stages of development in such cold regions.

Climate–Yield Relationship in Northern Dry Mountains (Zone VII)

The results reported in Table 9 show that mean minimum temperature (T_n) is positively related to wheat, rice and maize yield. As T_n increases, yield of these three major crops also increases and vice versa. 1°C rise in T_n increases wheat, rice and maize yield by 150.86 kgs/hect, 146.32 kgs/ hect and 168.9 kgs/hect respectively. These results are in line with the findings of Tao *et al* (2008). The relationship between T_n and yield of these three major crops is statistically significant. Cheema, *et al.* (2011) also analysed that there is a considerable increase in the night temperature (T_n) in the Northern Areas of Pakistan during 1991 to 2009. So increase in T_n in hilly areas may be useful for the growth of all crops particularly for winter season crops like wheat. In these areas night temperature is mostly low sometime below freezing point especially in winter season which can damage the crop in the initial stages of development. Therefore increase in winter temperatures may reduce the risk of crops damages and raise the overall productivity. The recommended minimum temperature for wheat and rice ranges from 3-4 °C and 10-12°C respectively [Siddiqui, *et al.* (2012)]. Although the average minimum temperature of last 20 years data of the study area is showing deviation from the recommended minimum temperature ranges specially in case of rice (13.6–18.8 °C) but not to a greater extent, therefore increase in T_n is not effecting productivity adversely.

Precipitation is positively related to wheat and rice yield while it has significant negative relationship with maize yield in these two regions. One mm increase in rainfall increases wheat and rice yields by 13.16 kgs/hect and 2.65 kgs/ hect respectively. Khan, *et al.* (2003) also found that 1 percent increase in water availability increases the wheat production by 0.68 percent. Similarly maize yield decreased by the amount of 11.5 kgs/hect with a unit increases in precipitation which is in line with the findings of

Prakash, *et al.* (2011). The value of F-statistic favors the overall significance of the explanatory variables. For wheat and maize the effect is statistically significant while for rice the effect is insignificant.

The results which are given in Table 9 shows that maximum temperature (Tm) is positively related to the yield of major food crops i.e. wheat, rice and maize and their coefficients are also statistically significant. 1°C increase in maximum temperature increases rice, maize and wheat yield by 66.49 kgs/hect, 76.76 kgs/hect and 70.78 kgs/hect respectively. In the mountainous regions increase in Tm is beneficial for the growth of major crops by limiting the number of days with extreme cold. Secondly it speeds up the process of photosynthesis as well as increases the amount of arable land by melting of ice and glaciers so provides favourable conditions for yield of the crops. The maximum temperature data for the last 20 years is not showing too much deviation from the recommended maximum temperature for these crops. For these three aforementioned major crops maximum temperature is statistically significant.

The coefficients of rainfall indicate that it is positively related to wheat and rice yield. More specifically, 1mm (millimetre) increase in rainfall increases rice and wheat yield by 1.15 kgs/hect and 4.34 kgs/hect respectively. The effect of increase in Tm and rainfall on rice yield is in line with the findings of Sarker, *et al.* (2012). Prakash, *et al.* (2011) also obtained similar results for wheat yield in case of increase in rainfall and Tm. Maize yield shows negative relationship with rainfall which is in line with the results of Tao, *et al.* (2008). The coefficient of rainfall is statistically significant for wheat and maize yield while it is insignificant for rice yield.

Table 9

Regression Results of the Impact of Average Minimum Temperature and Rainfall on Crops Productivity in Northern Dry Mountains (Zone VII)

Variables	Coefficients with Average Minimum Temperature and Rainfall			Coefficients with Average Maximum Temperature and Rainfall			Coefficients with Average Temperature and Rainfall		
	Wheat	Rice	Maize	Wheat	Rice	Maize	Wheat	Rice	Maize
Constant	144.759**	14.587	30.398	11.814	1.911	2.492	27.169	4.186	13.037
Temperature	150.869***	146.320***	168.977***	70.784***	66.490***	76.766***	114.213***	91.844***	107.373***
Rainfall	13.166***	2.653	-11.533***	4.345**	1.156	-6.734***	4.528**	0.130	-8.928***
Diagnostics									
R-squared	0.743	0.961	0.898	0.889	0.975	0.943	0.868	0.972	0.924
Adj- Rsq	0.732	0.960	0.894	0.884	0.973	0.942	0.863	0.971	0.921
F-statistic	69.396	635.020	223.411	193.138	986.785	425.780	0.863	887.634	309.441
Prob(F-stat)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: ***, **, * represents 1 percent, 5 percent and 10 percent level of significance respectively.

The results given in Table 9 shows that there is a positive relationship between yield of maize, wheat, rice crops and average temperature. More specifically, 1°C increase in average temperature increases wheat, rice and maize yield by 114.21 kgs/hect, 91.84 kgs/hect and 107.37 kgs/hect respectively. Their coefficients are also statistically significant for these three crops. Malla (2008) also concluded that the yield of wheat, rice and maize crops are supposed to increase with the rise of temperature in the hill and mountains regions. So rising temperatures may have a positive effect on crops productivity in the mountain areas, like shortening of the growing season length for the winter season crops. The shrinking of the growing season period in the high mountains regions due to increase in temperature might be beneficial in such areas as it would help

the winter crops to reach its maturity level within the optimal time period and also positively influencing the overall crop yield. This zone included (Chitral, Swat, Malakand, and Dir), the northern mountains regions of Pakistan where temperature is already low. So most of the winter crops like wheat do not reach to maturity due to low temperature and harvested premature as fodder. But this increase in temperature is not productive in southern parts of the country where high temperature increases the crop water requirement due to which most of crops are suffering adversely. Hussain and Mudasser (2004) also concluded from the past temperature trends that there is an increase in the temperature in the high mountains regions, (Swat and Chitral) where it has already reduced the length of the growing season. This increase in temperature is helpful for wheat yield and area in such regions like in district Chitral. The coefficient of rainfall shows that it has a positive impact on wheat and rice yields while shows negative impact on maize yield. The coefficient of rainfall is statistically significant for wheat and maize yield while for rice rainfall is statistically insignificant. In case of all these three different temperatures (minimum, maximum and average) in the dry mountains regions the effect of rainfall on rice is statistically insignificant. It might be due its less dependency on rainfall because it is a water intensive crop requires about 1500 mm [Riaz (2001)] water for normal growth, while the average summer rainfall in the zone is about 10-20 mm which is insufficient. In these areas rice crop is cultivated in irrigated areas in order to meet the water requirement by means of artificial irrigation system. Similarly in case of minimum, maximum and average temperature ranges the effect of rainfall on wheat crop is positive and statistically significant for these dry mountainous regions. Wheat crop requires 480 mm [Riaz (2001)] water during growing season while in winter monthly rainfall in the study area is about 25-75 mm therefore increase in rainfall in winter effect wheat crop positively. The results show that there is a negative relationship between maize yield and rainfall. According to Sánchez-Cortés and Chavero (2011), maize is the crop that requires moderate water during entire growth period and can be grown in the regions with moderate rainfall without irrigation. As these are the hilly areas (Chitral, Swat) with abundant rainfall that may lead to excessive soil moisture. There is also a positive correlation between increased rainfall and cloud cover. Therefore increased rainfall means reduced radiation from the sun that leads to reduce the process of photosynthesis so decreases crop yield. So agricultural research need to develop such crop varieties that are appropriate for the mountain regions under the changing climate condition.

Comparison of the Impact of Climate Change on Crops Productivity across Agro Climatic Zones of Pakistan

The effect of climate change on crop productivity across agro-ecological zone is not uniform and the results show that the impact of average temperature is positive on wheat productivity across four selected agro climatic zones and this effect is more pronounced in Northern Irrigated Plain a (Zone IV) than the other zones. The effect of rainfall on wheat productivity is negative in Indus Delta (Zone I) and positive in the remaining zones. The effect of rainfall is high on wheat yield in Northern Dry Mountains (Zone VII). Similarly, the impact of average temperature and rainfall is positive on rice yield across Northern Irrigated Plain a (Zone IV), Indus Delta (Zone I) and Dry

Mountains (Zone VII). The results showed that the impact of average temperature on rice yield is high in Dry Mountains (Zone VII) while the effect of rainfall is high in Indus Delta (Zone I). There is positive impact of average temperature and rainfall on sugarcane yield in Indus Delta (Zone I) and Northern irrigated plain a and b (Zone IV). The effect of both temperature and rainfall on sugarcane yield is high in Indus Delta (Zone I) than Zone IV. The impact of average temperature is negative on maize yield in Northern irrigated plain a (Zone IV) while it is positive in plain b, Northern Dry Mountains (Zone VII) and Wet Mountains (VII). The effect of average temperature on maize yield is high in Northern Dry Mountains (Zone VII). The effect of rainfall on maize yield is negative in Northern Dry Mountains (Zone VII) and Wet Mountains (VII) and this effect is more prominent in Dry Mountains (Zone VII) while the positive impact of rainfall is high in Northern irrigated plain b (Zone IV). Similarly, cotton is the crop that only grown in Northern irrigated plain a (Zone IV) due to its major share. The impact of rainfall of average temperature is positive on cotton yield in that zone.

CONCLUSION AND POLICY IMPLICATION

To analyse the impact of climate change on agriculture crops this study basically focused on the impact of major climate variables (rainfall and temperature) on major crops yield i.e. wheat, maize, rice, sugarcane and cotton across four agro climatic zones of Pakistan. The empirical results of the study show that the two major climatic variables have significant impact on major crops yield in the selected regions. The study concluded that the increase in major climate variable i.e. temperature (maximum, minimum and average temperatures) has a positive impact on major crops yield in all four selected agro zones except for maize in Zone IV a. Any change in temperature beyond optimum or far below optimum level is disastrous for crops yield. Rainfall shows positive impact on all major crops in the selected zones of Pakistan except for maize both in Wet Mountains (Zone VI) and Northern Dry Mountains (Zone VII) where an increase in rainfall effects maize yield adversely. Also the impact of rainfall is negative on wheat productivity in the Indus Delta (Zone I). The impact of climate change varies across agro climatic zones due to differences in their climatic conditions. So the impact of average temperature is positive on wheat productivity across four selected agro climatic zones and this effect is more pronounced in Northern Irrigated Plain a (Zone IV) than the other zones while the effect of rainfall on wheat yield is high in Northern Dry Mountains (Zone VII). The impact of average temperature on rice yield is high in Dry Mountains (Zone VII) and the effect of rainfall is high in Indus Delta (Zone I) than other zones. The effect of both temperature and rainfall on sugarcane yield is high in Indus Delta (Zone I) than zone IV. The effect of average temperature and rainfall on maize yield is high in Northern Dry Mountains (Zone VII) than other zones. This panel study confirms that climate change has significant impact on crops yield.

Based on the findings the study recommends adaptation options like cultivation of heat and drought resistant crop varieties and planting of early maturing crop varieties in such regions. Further, the agricultural research organisations should develop such crop varieties which are appropriate for the mountainous regions under changing climate conditions.

The main shortcoming of this study is that it only considers two climatic variables i.e. rainfall and temperature as explanatory variables while the other explanatory variables like fog, pesticides consumption, technology and water availability are not included due to non-availability of data at districts level. Crop wise consumption of fertilizer and labor force employed data is not available at districts level therefore not included in the study. The distribution of fog varies across regions so due lack of systematic data across study area the impact of fog is not included. The effect of geographic variables such as soil type and altitude are not included because panel data has the special features to absorb the effect of unobservable factors. Climate change may affect crops productivity at different stages which may affect yield because each and every stage requires specific temperature and rainfall. This study considers only the impact of average rainfall and temperature on average crops yield for the whole season and does not consider the impact of climate change on different stages of each crop. Over the time, cropping pattern also changed across agro climatic zone altering the sowing and harvesting period of crops. The present study does not capture these variations. The study considers the impact of climate change on crops productivity only in irrigated areas and does not consider the rain-fed areas which are more vulnerable to the impact of climate change due to their dependency on rain.

REFERENCES

- Ahmad, Z. (2007) *Country Report on Plant Genetic Resources for Food and Agriculture Pakistan*. Islamabad: Pakistan Agricultural Research Council, 86 pp.
- Alexandrov, V. A. and G. Hoogenboom (2000) The Impact of Climate Variability and Change on Crop Yield in Bulgaria. *Agricultural and Forest Meteorology* 104:4, 315–327.
- Alexandrov, V., J. Eitzinger, V. Cajic, and M. Obersorster (2002) Potential Impact of Climate Change on Selected Agricultural Crops in North Eastern Austria (2002). *Global Change Biology* 8:4, 372–389.
- Ashfaq, M., F. Zulfiqar, I. Sarwar, M. A. Quddus, and I. A. Baig (2011) Impact of Climate Change on Wheat Productivity in Mixed Cropping System of Punjab. *Soil and Environment* 30:2, 110–114.
- Asseng, S., F. Ewert, P. Martre, R. Rötter, D. Lobell, D. Cammarano, B. Kimball, M. J. Ottman, G. Wall, and J. White (2015) Rising Temperatures Reduce Global Wheat Production. *Nature Climate Change* 5, 143.
- Ayinde, O. E., O. O. Ajewole, I. Ogunlade, and M. O. Adewumi (2010) Empirical Analysis of Agricultural Production and Climate Change: A Case Study of Nigeria. *Journal of Sustainable Development in Africa* 12:6, 275–283.
- Baltagi, B. (2008) *Econometric Analysis of Panel Data*. John Wiley & Sons.
- Binbol, N. L., A. A. Adebayo, and E. H. Kwon-Ndung (2006) Influence of Climatic Factors on the Growth and Yield of Sugarcane at Numan, Nigeria. *Climate Research* 32:3, 247–252.
- Burke M., S. M. Hsiang and E. Miguel (2015) Global Non-linear Effect of Temperature on Economic Production. *Nature* 527, 235–239.
- Cabas, J., A. Weersink, and E. Olale (2010) Crop Yield Response to Economic, Site and Climatic Variables. *Climatic Change* 101: (3-4), 599–616.

- Changa, C. C. (2002) The Potential Impact of Climate Change on Taiwan's Agriculture. *Agricultural Economics* 27, 51–64.
- Chaudhari, K. N., M. P. Oza and S. S. Ray (2009) Impact of Climate Change on Yields of Major Food Crops in India. *ISPRS Archives* 38:8, W3.
- Cheema, S. B., G. Rasul, and D. H. Kazmi (2011) Evaluation of Projected Minimum Temperatures for Northern Pakistan. *Pakistan Journal of Meteorology* 7:14, 63–70.
- Gbetibouo, G. A. and R. M. Hassan (2004) Measuring the Economic Impact of Climate Change on Major South African Field Crops. *Global and Planetary Change* 47:2, 143–152.
- Greene, W. H. (2008) *Econometric Analysis*. New Jersey: Pearson Prentice Hall.
- Guajarati, D. N. and D. C. Porter (2009) *Basic Econometrics*, McGraw-Hill, New York.
- Haim, D., M. Shechter, and P. Berliner (2008) Assessing the Impact of Climate Change on Representative Field Crops in Israeli Agriculture: A Case Study of Wheat and Cotton. *Climatic Change* 86:3-4, 425–440.
- Hanif, U., S. H. Syed, R. Ahmad, K. A. Malik, and M. Nasir (2010) Economic Impact of Climate Change on the Agricultural Sector of Punjab. *The Pakistan Development Review* 49:4, 771–798.
- Holst, R., X. Yu, and C. Grun (2010) *Climate Change, Risk and Grain Production in China*. In 2010 Annual Meeting, July 25-27, 2010, Denver, Colorado (No. 61177). Agricultural and Applied Economics Association.
- Hussain, S. S., and M. Mudasser (2007) Prospects for Wheat Production under Changing Climate in Mountain Areas of Pakistan—An Econometric Analysis. *Agricultural Systems* 94:(2), 494–501.
- Hussain, S. S., M. Mudasser, M. M. Sheikh, and N. Manzoor (2005) Climate Change and Variability in Mountain Regions of Pakistan Implication for Water and Agriculture. *Pakistan Journal of Meteorology* 2:4, 75–90.
- IPCC (2007) Climate Change 2007 Synthesis Report. In R. K. Pachauri and A. Reisinger (eds.) *Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: IPCC, 104 pp.
- Janjua, P. Z., G. Samad, and N. U. Khan (2011) Impact of Climate Change on Wheat Production A Case Study of Pakistan. *The Pakistan Development Review* 49:4, 799–822.
- Kalra, N., D. Chakraborty, A. Sharma, H. K. Rai, M. Jolly, S. Chander, P. R. Kumar, S. Bhadraray, D. B., R. B. Mittal, M. Lal, and M. Sehgal (2008) Effect of Increasing Temperature on Yield of Some Winter Crops in Northwest India. *Current Science* 94:1, 82–88.
- Kaul, S. (2007) *Bio-Economic Modelling of Climate Change on Crop Production in India*. New Delhi, India: Indian Agricultural Statistics Research Institute.
- Khalique, T. (2008) *Modelling the Impact of Climate Change on Maize (Zea Mays L.) Productivity in Punjab*. PhD thesis, University of Agriculture, Faisalabad.
- Khan, A. G. (2004) Technical Report on The Characteristics of the Agro-ecological Context in which FAnGR(Farm Animal Genetic Resource) are Found. Nairobi, Kenya.
- Khan, N. Z., M. Ahmad, and A. Rasheed (2003) Wheat Production in Pakistan: Saga of Policy Disincentives. Available Online: <http://www.scribd.com/doc/30555593/Naheed-Zia-Khan-Munir-Ahmed-and-Asia-Rasheed> [Accessed 14/12/2010].

- Li, T., T. Hasegawa, X. Yin, Y. Zhu, K. Boote, M. Adam, S. Bregaglio, S. Buis, R. Confalonieri, and T. Fumoto (2015) Uncertainties in Predicting Rice Yield by Current Crop Models under a Wide Range of Climatic Conditions. *Global Change Biology* 21, 1328.
- Malla, G. (2008) Climate Change and its Impact on Nepalese Agriculture. *Journal of Agriculture and Environment* 9, 62–71.
- Mendelsohn, R. and A. Dinar (1999) Climate Change, Agriculture, and Developing Countries: Does Adaptation Matter? *World Bank Research Observer* (1999) 14:2, 277–293.
- Mendelsohn, R., W. Nordhaus, and D. Shaw (1994) The Impact of Global Warming on Agriculture: A Ricardian Analysis. *The American Economic Review* 84, 753–771.
- Muhammad, A. (1986) *Cropping Pattern in Different Ecological Zones of Pakistan*. Islamabad: Pakistan Agriculture Research Council.
- Mundlak, Y. (1978) On the Pooling of Time Series and Cross Section Data. *Econometrica: Journal of the Econometric Society* 46, 69–85.
- Mundlak, Y., D. F. Larson, and R. Butzer (1999) Rethinking within and between Regressions: The Case of Agricultural Production Functions. *Annales d'Economie et de Statistique*, 475–501.
- Mustafa, Z. (2011) Climate Change and Its Impact with Special Focus in Pakistan. *Pakistan Engineering Congress, Symposium* 33, 290.
- Nwajiuba, Chinedum and Robert Onyeneke (2010) Effects of Climate on the Agriculture of Sub-Saharan Africa: Lessons from Southeast Rainforest Zone of Nigeria. Oxford Business and Economic Conference Programme, ISBN.
- Olesen, J. E., T. Jensen, and J. Petersen (2000) Sensitivity of Field-scale Winter Wheat Production in Denmark to Climate Variability and Climate Change. *Climate Research* 15:3, 221–238.
- Ozkan, B. and H. Akcaoz (2002) Impact of Climate Factors on Yield for Selected Crops in Southern Turkey. *Mitigation and Adaptation Strategies for Global Change* 7:4, 367–380.
- Pakistan Agriculture Research Council (PARC) (1980) *Crop Ecological Regions in Pakistan*. (Mimeographed). Islamabad.
- Peng, S., J. Huang, J. E. Sheehy, R. C. Laza, R. M. Visperas, X. Zhong, G. S. Centeno, G. S. Khush and K.G. Cassman (2004) Rice Yields Decline with Higher Night Temperature from Global Warming. *Proceedings of the National Academy of Sciences of the United States of America* 101:27, 9971–9975.
- Prakash, J. N., M. K. Lall, and P. Luni (2011) Effect of Climate Variables on Yield of Major Food-Crops in Nepal—A Time-series Analysis. *Journal of Contemporary India Studies* 1, 19–26.
- Rasul, G., A. Mahmood, A. Sadiq, and S. I. Khan (2012) Vulnerability of the Indus Delta to Climate Change in Pakistan. *Pakistan Journal of Meteorology* 8:16, 89–107.
- Reddy, K. R., P. R. Doma, L. O. Mearns, M. Y. Boone, H. F. Hodges, A. G. Richardson, and V. G. Kakani (2002) Simulating the Impacts of Climate Change on Cotton Production in the Mississippi Delta. *Climate Research* 22:3, 271–281.
- Riaz, A. (2001) *Crop Management in Pakistan*. Government of Punjab, Agriculture Department, 280p.

- Sánchez-Cortés, M. S. and E. L. Chavero (2011) Indigenous Perception of Changes in Climate Variability and Its Relationship with Agriculture in a Zoque Community of Chiapas, Mexico. *Climatic Change* 107:3, 363–389.
- Sarker, Md. A. R., K. Alam and J. Gow (2012) Exploring the Relationship between Climate Change and Rice Yield in Bangladesh: An Analysis of Time Series Data. *Agricultural Systems* 112,11–16.
- Seo, S. N. and R. Mendelsohn (2008) A Ricardian Analysis of the Impact of Climate Change on South American farms. . *Chilean Journal of Agricultural Research Research* 68:1, 69–79.
- Shakoor, U., A. Saboor, I. Ali, and A. Q. Mohsin (2011) Impact of Climate Change on Agriculture: Empirical Evidence from Arid Region. *Pakistan Journal of Agricultural Sciences* 48:4, 327–333.
- Sheikh, M. M., N. Manzoor, M. Adnan, J. Ashraf, and A. M. Khan (2009) Climate Profile and Past Climate Changes in Pakistan, Global Change Impact Studies Center (GCISC)-RR-01.
- Siddiqui, R., G. Samad, M. Nasir, and H. H. Jalil (2012) The Impact of Climate Change on Major Agricultural Crops: Evidence from Punjab, Pakistan. Presented in 28th AGM and Conference, 13-15 November.
- Stock, J. H. and M. W. Watson (2003)) *Introduction to Econometrics*. Addison Wesley, Boston.
- Tao, F., M. Yokozawa, J. Liu, and Z. Zhang (2008) Climate–Crop Yield Relationships at Provincial Scales in China and the Impacts of Recent Climate Trends. *Climate Research* 38:1, 83–94.
- Torvanger, A., M. Twena, and B. Romstad (2004) Climate Change Impacts on Agricultural Productivity in Norway. (CICERO Working Paper: 10).
- Tunde, A. M., B. A. Usman and V. O. Olawepo (2011) Effects of Climatic Variables on Crop Production in Patigi L. G. A., Kwara State Nigeria. *Journal of Geography and Regional Planning* 4:14, 695–700.
- United Nations Framework Convention on Climate Change (UNFCCC) (1992) New York: United Nations, 1992. <http://unfccc.int/resource/docs/convkp/conveng.pdf> (accessed July 16, 2017).
- Wiatrak, P. J., D. L. Wright, and J. J. Marois (2006) The Impact of Tillage and Residual Nitrogen on Wheat. *Soil and Tillage Research* 91, 150–156.

Book Review

Nadeem Ul Haque. *Looking Back: How Pakistan Became an Asian Tiger by 2050.* Karachi, Pakistan: Kitab (Pvt.) Limited. 2017. 193 pages. Amazon Kindle edition.

“Looking Back: How Pakistan Became an Asian Tiger by 2050” is Nadeem Ul Haque’s latest book. The Kindle edition of the book is available from Amazon. The book, while dismissing the notion of ‘development first’, argues for ‘reforming the system first’ to make the ground conducive for sustainable development. The book, written as semi-fiction, imagines Pakistan as a developed country by year 2050. The United Nations, which sets up a commission in the year 2051 to understand Pakistan’s development model, narrates the development story.

The UN Commission tells that till the year 2020 Pakistan was a centralised elitist state, marked by high inequality and low social mobility. Grave problems like the loss of country’s eastern wing in 1971 and the Baloch issue that haunted the country till 2020, were attributed to the elitist state. Businessmen and public servants accumulated rents in this society by way of tax and tariff exemptions, subsidies, perks, plots, privileges, and bank loans that did not need to be repaid. Meritocracy was unthinkable in such a country. Finally, the elitist hold broke down and the country stood reformed. In the reformed country, the federal cabinet comprises only 15 persons, the finance ministry only manages the budget and the government expenditures remain within the budgeted amount, which are used only for the purposes approved by the parliament in advance. The ministry of economy reviews the state of markets but does not intervene in functioning of the markets. The ministry of strategy and reforms develops the country’s long term strategy, while the ministry of institutional development frames regulations.

In the Pakistan of 2050, key decisions, including electricity production and supply contracts require parliamentary approval. The judicial reforms ensure that judges retire at the age of 75, with no re-employment elsewhere. To counter the problem of inefficiency in institutions, civil and military bureaucracy is paid handsomely, but only in cash; privileges and perks such as plots and government housing are history.

Preempting questions like ‘who will do it’ and ‘how will this happen’ the book answers that no recognisable agent is behind the change. The people at the helm in the pre-reform Pakistan who facilitated the change, in fact bowed to the wishes of the electorate, implying that the electorate had turned pro-reform before the reform happened.

How people became pro-reform? The narrative on this aspect is the book’s key message, which emphasises the role of (research) networks in laying the foundation of reforms. The book tells that a quiet revolution of thought began before the reform happened. Somehow, the government funded independent research. The then limping think tanks stood up and academics formed partnerships and ‘networks’ to aid reform

through research. These locally funded ‘networks’ relying on bottom up approach flourished or died depending on their ability to generate ideas. These networks, which were not centrally controlled, recommended solutions that suited local culture and ground realities. After a decade or two, the parliament took these networks seriously; the policy guidelines coming from the parliament are now rooted in what the ‘networks’ recommend.

Using this narrative, the book seeks to tell that reforms, and hence development, will come about only if the fermentation, outlined above, happens. Reference to the emergence of human philosophy and political democracy in Greece and the fermentation contained in the Renaissance and European Enlightenment, believed to be at the root of West’s development, makes the author’s case convincing. The book’s bottom line is that for reform and development to come about in Pakistan a ‘Pakistani renaissance’ is called for and world history tells that this is not impossible.

The author blames bureaucracy for much of what ails the governance and the economy in Pakistan. While this might be true for a part of Pakistan’s history, for around last 30 years, politicians and the military have been in the driving seat and the bureaucracy has been coopted or tamed using the carrot of prized postings and the stick of transfers. The book emphasises that research is the starting point of reform. While this is generally true, in many cases, the flawed systems provide evidence that research is unable to progress matters further. For example, the transgender only recently started getting national ID cards in Pakistan and are being counted for the first time in the national census, which is owed to advocacy rather than research. Similarly, even without research we know that reserving sanitation tasks for non-Muslims is bad. We also know that corruption, plea bargain and using taxpayers’ money to advertise achievements of the government is bad. In such cases, advocacy or public pressure may help reform.

The book pins hopes on the academia to play a larger role in the reformation. To me it seems that the academia, at best, can point a finger at what is wrong but to make reform happen, opposition of the would-be-losers will have to be overcome and for this I would bet on the social media, which is bottom-up, is not centrally controlled, and is not opinionated – the characteristics that the author yearns for, for reforms to happen.

The book is a must read for anyone who wants to understand the process of reform and hence the process of development, especially how to kick start the two.

Idrees Khawaja

Air University,
Islamabad.

Shorter Notice

The Shahid Javed Burki Institute of Public Policy. The State of the Economy Annual Report. *Agriculture and Water* (Ninth Annual Report). Lahore, Pakistan: The Shahid Javed Burki Institute of Public Policy. 2016. xiv+135 pages.

In its ninth annual report on the state of Pakistan's economy, the Shahid Javed Burki Institute of Public Policy has presented an in-depth analysis of agriculture and water in Pakistan. According to the report, although the economy of Pakistan on the whole has performed well over the last few years, the agriculture sector has been disappointing. The report holds both random shocks and structural weaknesses responsible for the disappointing performance. Although the focus of the report is on agriculture and water, the report presents an overview of Pakistan's overall economy in the first part. In analysing the problems faced by the agriculture sector currently, the report presents an historical overview of the agriculture sector's performance and the policies adopted for the sector, which is very informative. It is argued that the structural problems are a result of path dependence in forming and implementing the agriculture policy. As per the authors of the report, the path dependence has led to heavy state involvement and failure to make policy changes to meet demands of changing times. The report has identified key areas of concern that have hindered the progress in Pakistan's agriculture sector. These areas of concern are procurement and pricing policies, seed policy, water pricing, research and extension, marketing, and financial services. The report rightly points out that Pakistan is facing a serious water scarcity problem, because of growing demand and limited supply of water. The usage of water resources in Pakistan is not efficient and the governments at the provincial and federal levels do not have adequate asset management plans. As for the demand side issues, the report identifies two main sources of concern, namely wastage of water in conveyance to the farms and wasteful use within farms. The report also highlights the decline in agricultural exports. The revealed comparative advantage methodology shows that the competitiveness of Pakistan's agricultural export commodities is declining. The report also suggests some remedies for the challenges facing the agriculture sector. For example, the report argues that over-generous support prices for wheat and sugarcane should be withdrawn as it prevents diversification of the cropping pattern into higher value-added items like horticulture. Pricing reform is particularly important in the case of water because low price of water leads to its wasteful use. The report advocates increase in R&D expenditures, along with the capacity building of the government bodies that undertake R&D. The report also suggests some out-of-the-box solutions to rejuvenate Pakistan's agriculture sector, which include the use of mobile phones in disbursing finance to the farmers, agri-malls as one-stop shops for farmers, and the development of marketing intelligence and information systems. Overall, BIPP's ninth annual report on the state of Pakistan's economy is a useful overview of the situation of agriculture and water in Pakistan. The report not only identifies problems that the agriculture sector of Pakistan is facing but it also suggests some innovative solutions to these problems. [*Omer Siddique*].