



The PAKISTAN DEVELOPMENT REVIEW

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Role of Growth and Inequality in Explaining Changes in Poverty in Pakistan

TALAT ANWAR

Changes in the extent of poverty are affected not only by growth in the mean income but also by changes in the distribution of income. The effect of these two factors can be separately measured by decomposing the total change in poverty. In this context, this paper uses new tools to quantify relative contribution of growth and inequality using the latest available household survey data. The findings of this paper suggest that the role of inequality remained important in mitigating the adverse effects of growth on poverty during the first period, 1998-99 to 2001-02. Alternatively, the role of growth has been fundamental in reducing absolute poverty in the second period, 2001-02 to 2004-05. Poverty would have been further reduced, had the distribution not worsened during this period. The policy implication is that while pursuit of growth as a strategy is important for poverty reduction in Pakistan, the contribution of redistribution in favour of the poor should not be ignored if the effect of growth on poverty reduction is to be enhanced. Thus, the major challenge is to pursue a poverty reduction strategy that is based on growth with redistribution.

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1. INTRODUCTION

Pakistan's economy maintained its growth momentum in fiscal year 2004-05 with GDP registering its fastest growth rate of 9.0 percent for the last two decades. The economy has grown at an average rate of almost 6.9 percent per annum during 2003-04 and 2005-06. This fast sustained pace of expansion has enabled Pakistan to achieve place among the fastest growing economies of the Asian region. This growth pattern is strengthened by vigorous performance in industry, agriculture and services, together with expansion in domestic demand resulting from as a new investment cycle. Official poverty estimates demonstrate that this sectoral confluence of growth contributed to a substantial decline of 10.6 percentage points in absolute poverty in Pakistan, from 34.4 percent in 2001-02 to 23.9 percent in 2004-05 [Pakistan (2006)]. Conversely, the trend in inequality as measured by the Gini coefficient shows that distribution of consumption expenditure has worsened during this period. It emerges that while rapid economic growth seems to have reduced the poverty level, it appears to have increased inequality during this period. However, in determining the role of growth and inequality in poverty level changes, the available measures, such as the Gini coefficient, may not be particularly useful. The paper illustrates how changes in poverty measures can be decomposed into growth and distributional effects. The growth component of poverty change

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measures how much of the change in poverty is due to the variation in mean expenditure over time, holding the distribution constant, while the redistribution component evaluates how much of the variation in poverty is due to a change in the distribution of expenditure, holding the mean expenditure constant. The objective of the study is to analyse the role of growth and inequality in explaining increase or decline in poverty in Pakistan. To assess the contribution of growth and redistribution three large household survey data sets PIHS 1998-99, PIHS 2001-02 and PSLM 2004-05 have been used.

The organisation of this report is as follows: Section 2 presents a review of recent studies on poverty and inequality in Pakistan. Section 3 discusses household data sets and outlines the methodology that has been used to decompose poverty into growth and redistribution effects. Section 4 presents results of decomposition of poverty. Finally, Section 5 draws some conclusions from the analysis.

2. REVIEW OF POVERTY AND INCOME DISTRIBUTION IN PAKISTAN

A number of attempts have been made to examine the extent of poverty and inequality in Pakistan. The earlier work is based on grouped data of Household Income and Expenditure Survey (HIES) conducted by the Federal Bureau of Statistics, Government of Pakistan. The unit record data have, however, been made available on computer data files since the late 1980s which has enabled analysts/institutions to use this primary source in estimation work. However, most of these studies examined the issue of poverty and inequality separately. It is, therefore, important to review the poverty studies first and then present a review of inequality studies in the next sub-section.

2.1. Review of Poverty

A review of the existing work on poverty shows that a number of authors/institutions have made attempts to examine this issue in Pakistan during the last four decades. The earlier work on measurement of poverty included Naseem (1973, 1979); Alauddin (1975); Mujahid (1978); Irfan and Amjad (1984); Kruik and Leeuwen (1985); Malik (1988); Ahmad and Ludlow (1989); Ercelawn (1990); Malik (1994); Anwar (1996, 1998); Amjad and Kemal (1997); Bhatti, *et al.* (1999); Jafri (1999); Arif, *et al.* (2000). These studies define individuals as poor when their income is not sufficient to obtain the minimum necessities of life such as food, clothing, housing etc., for the maintenance of physical efficiency. Most of these studies derived absolute poverty lines in terms of cost of food requirements consistent with 2550 calories per day per adult equivalent recommended by Planning Commission (1985). These studies suggest that poverty declined in the 1970s and 1980s after witnessing a rise in the late 1960s.

Recent work on poverty includes FBS (2001); World Bank (1995, 2002); Arif (2002); Anwar and Qureshi (2002); Anwar, Qureshi, and Ali (2004); Planning Commission (2003) and Planning Commission/CRPRID (2006). Planning Commission in 2002-03 defined and recommended poverty norm as shortfall from minimum 2350 calories per person per day required for physical functioning and daily activities. Based on this poverty norm, Planning Commission notified the estimated official poverty line at Rs 748 per capita per month in 2001-02 prices. The poverty estimate implied by the above official poverty line suggests that 32 percent of the population were poor in Pakistan whereas 38.9 percent and 22.6 percent were poor respectively in rural and urban areas in 2001-02. It is noteworthy that Anwar and

Qureshi (2002) using the lower poverty line of consumption expenditure of Rs 735 per adult per month in 2001-02 prices estimated a headcount of 35.6 percent for the country as a whole. The lower official poverty headcount of 32 percent with a higher poverty line of Rs 748 per capita per month in 2001-02 was mainly due to the fact that some of the households with lower income were dropped from the sample before computing poverty headcount. Anwar, Qureshi, and Ali (2004) used this official poverty line of Rs 748 per capita and estimated a headcount of 38 percent in 2001-02 as opposed to 32 percent notified by the Planning Commission. Similarly, World Bank (2005) using official poverty line of Rs 748 per capita also reported 37 percent in 2001-02. The official poverty estimates were never corroborated from independent sources by any author or institution. Consequently, official poverty line and the headcount estimate were revised using CPI adjusted poverty line of Rs 723 in 2001-02 prices which gave 34.5 percent head count in 2001-02. The revised poverty estimates were in line and consistent with the findings of Anwar, Qureshi, and Ali (2004) and World Bank (2005). Table 1 reports the estimates of various studies.

The general consensus emerging from the review of the literature is that absolute poverty increased during the 1990s. However, the increase was more rapid in rural compared to the urban areas. In the subsequent period, rural poverty deteriorated further while urban poverty remained¹ constant. The rise in absolute poverty in the 1990s was attributed mainly to low economic growth of an average of 4 percent per annum in the 1990s declining from a growth trajectory of around 6 percent per annum in the 1980s.

Table 1

GDP Growth Rates and Headcount Measure for Pakistan—1990-91 to 2004-05

Poverty Lines	GDP Growth Rates %	FBS (2001)	World Bank	Planning	Anwar and	Planning
		Rs 682 in 1998-99 Prices	(2002) Urban Rs 767 Rural Rs 680 in 1998-99 Prices	Commission (2003) Rs 748 in 2001-02 Prices	Qureshi (2003) Rs 735 in 2001-02 Prices	Commission/CRPRID (2006) Rs 723 in 2001-02 Prices
Years		Headcount Measure (% below Poverty Line)				
		Overall				
1992-93	2.1	26.6	25.7	—	—	25.5
1993-94	4.4	29.3	28.6	—	—	28.2
1998-99	4.2	32.2	32.6	30.6	30.4	31.1
2001-02	3.1	—	—	32.1	35.6	34.5*
2004-05	8.6	—	—	—	—	23.9*
		Rural				
1992-93	—	29.9	27.7	—	—	27.6
1993-94	—	34.7	33.4	—	—	33.5
1998-99	—	36.3	35.4	34.6	32.1	35.1
2001-02	—	—	—	38.9	41.0	39.3*
2004-05	—	—	—	—	—	28.1*
		Urban				
1992-93	—	20.7	20.8	—	—	19.9
1993-94	—	16.3	17.2	—	—	15.4
1998-99	—	22.4	24.2	20.9	26.39	21.4
2001-02	—	—	—	22.6	26.47	22.7*
2004-05	—	—	—	—	—	14.9*

Source: Various studies cited above.

*Planning Commission /CRPRID (2006), based on inflation (CPI) adjusted official poverty line of Rs 723 in 2001-02 and Rs 878.64 in 2004-05.

¹Anwar and Qureshi (2002), Anwar, Qureshi, and Ali (2004) and Cheema (2005) have also arrived more or less at the same conclusion.

However, more recently absolute poverty, as measured by the official methodology, declined substantially by 10.6 percent from 34.5 percent to 23.9 percent between 2001-02 and 2004-05 (see Table 1). The decline was more pronounced in rural poverty, from 39.3 percent in 2001-02 to 28.1 percent in 2004-05. It is noteworthy that the economy witnessed an extraordinary growth rate of at 9.0 percent in 2004-05 which seems to have caused a decline in absolute poverty during this period. It appears that while low economic growth seems to have increased poverty in the 1990s, the high economic growth seems to have reduced absolute poverty in the recent period, 2001-02 and 2004-05.

2.2. Review of Inequality

The work on inequality indicates that a large number of attempts have been to estimate the extent of income inequality in Pakistan during the last four decades. Various studies on income distribution include Bergen (1967), Azfar (1973), Khundkar (1973), Naseem (1973), Alauddin (1975), Chaudhry (1982), Mahmood (1984), Kruik and Leeuwen (1985), Ahmad and Ludlow (1989), Malik (1992), Malik (1992), Anwar (1998) and Ahmad (2000). More recently, FBS (2001), World Bank (2002), Anwar (2003, 2005) and Planning Commission/CRPRID (2006) have estimated Gini coefficients for the 1990s. Table 2 reports the Gini coefficient estimated by recent studies during the 1990s. The Gini coefficients reported by FBS (2001), World Bank (2002) and Planning Commission (2006) are based on the consumption expenditure, while those reported by Anwar (2005) are based on household per capita income. According to both FBS (2001) and World Bank (2002), consumption inequality increased in Pakistan between 1992-93 to 1998-99. Urban inequality followed the same trend. On the contrary, rural inequality declined as measured by World Bank (2002) but increased according to FBS (2001) during this period.

Table 2

Gini Coefficient for Pakistan by Regions—1990-91 to 2004-05

Years	FBS (2001)	World Bank (2002)	Planning Commission/ CRPRID (2006)	Anwar (2005)*
Overall				
1992-93	0.2680	0.276		0.3937
1993-94	0.2709	0.276		0.3864
1998-99	0.3019	0.296		0.4187
2001-02	—	—	.2752	0.4129
2004-05	—	—	.2976	
Rural				
1992-93	0.2389	0.252		0.3668
1993-94	0.2345	0.246		0.3647
1998-99	0.2521	0.251		0.3796
2001-02			.2367	0.3762
2004-05			.2519	
Urban				
1992-93	0.3170	0.316		0.3970
1993-94	0.3070	0.302		0.3685
1998-99	0.3596	0.353		0.4510
2001-02			.3227	0.4615
2004-05			.3388	

Source: Various studies cited above.

*Based on household per capita income.

However, the above studies are based on consumption expenditure that has been used as the proxy for income. It is generally held that consumption expenditure is more equally distributed than income. In this context, it would be important to review inequality trends based on income. Anwar (2005) estimated inequality using the methodology that was consistent throughout the period of the 1990s. The Gini coefficients based on income were significantly higher than the one based on consumption implying that income is more unequally distributed than consumption expenditure among households (Table 2). The author found a rapid increase in income inequality during the 1990s. The rise was more rapid in urban compared to the rural areas. Consequently, income distribution of 1998-99 turned out to be the most unequal income distribution in the history of Pakistan. In the later period, income inequality declined in rural areas but continued to worsen in urban areas between 1998-99 and 2001-02. More recently, Planning Commission (2006) shows that consumption distribution has worsened between 2001-02 and 2004-05. To sum up, consumption inequality increased between 1992-93 and 1998-99, then declined between 1998-99 and 2001-02 and finally worsened in 2004-05. Income inequality more or less followed the same trend during the above mentioned period. It appears that while inequality increased during the period of slow growth in the 1990s, the inequality also worsened during the period of rapid growth in 2000s.

It is now clear that these studies examined the issue of poverty and inequality separately without linking changes in poverty to the changes in inequality. An increase or decrease in inequality will be all that we can conclude from it. We cannot deduce to what extent a change in inequality contributed² to a change in poverty over time. This is because conventional inequality measures including Gini coefficient are a poor guide to explain changes in mean income and changes in poverty. It is, therefore, important to find new tools to examine the contribution of growth in mean income and changes in inequality in order to quantify relative contribution of these components to poverty changes. In this perspective, the study is aimed at decomposing the poverty changes into growth and redistribution effects using the latest available tools.

3. DATA AND METHODOLOGY

The analysis of decomposition of poverty in this study is based on household unit record data of three household surveys conducted by Federal Bureau of Statistics (FBS), Government of Pakistan, Islamabad. Two household surveys—Pakistan Integrated Economic Survey (PIHS) were carried out in 1998-99 and 2001-02, while the third survey—Pakistan Social and Living Standard Measurement Survey (PSLM) was conducted in 2004-05. These surveys contain information and data on consumption expenditure on food and non-food items of each household. While income is generally under reported to the enumerator, the household consumption expenditure on non-durables is used as an alternative for ‘permanent income’ for the decomposition of poverty in this study.

²While Bhatti, *et al.* (1999) examined the relative contribution of various sectors to aggregate poverty, the author did not decompose poverty into inequality and growth components.

The universe of these surveys consists of all urban and rural areas of the four provinces of Pakistan defined as such by the 1998 Population Census. The primary data files contain population weights, which are designed to obtain the nationally representative estimates of population. The sample of PIHS, 1998-99 and 2001-02 respectively consists of 14,679 and 14,705 households whereas sample of PSLM, 2004-05 consists of 14,706 households both rural and urban in all the four provinces of Pakistan.

3.1. Measuring Poverty

For this study, the monetary value of household consumption expenditure in Pakistani rupee is chosen as a welfare measure. The methodology used by the Government of Pakistan in the derivation of the official poverty estimates has been used in this study. The official method prefers consumption expenditure on non-durables over income to estimate poverty. Inevitably, consumption is a preferred measure of well-being in developing countries for various reasons. First, consumption is a better indicator of the person's welfare because it is more closely related to the well-being than income. Second, consumption can be measured more precisely than income due to the widespread practice of tax evasion in developing countries. Finally, consumption is less volatile compared to income, and can be a better indicator of a household's actual standard of living.

Following the official method of measuring poverty, the measure of well-being used in this study is corrected for spatial and temporal prices. The study has adjusted household consumption expenditure for economies of scale by using 1 for adult and 0.8 for children 0-18 years. The regional price index has been used to take an account of regional differences between rural and urban areas. In general, the poverty line is a cutoff point and individuals with consumptions below this value are considered as poor. The official poverty line adjusted for inflation has been used to estimate the incidence of poverty in Pakistan over time. The official poverty line is defined by the government as the cost of buying a diet of 2350 calories per capita per day plus non-food expenditures to satisfy subsistence needs. The Planning Commission notified the estimated official poverty line at Rs 673 per capita per month in 1998-99 prices which has been adjusted for inflation by the consumer price index (CPI) for the survey period between 1998-99 and 2001-02 and between 2001-02 and 2004-05.

In poverty literature, a number of measures of poverty have been proposed. Among these scores of poverty measures the following three measures are commonly used and these measures belong to a class of poverty measures popularised by Foster, Greer, and Thorbecke (1984).

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q [(Z - y_i)/Z]^{\alpha} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

These measures have clear advantages for evaluating policies which aim at reaching the poorest. Note that if $\alpha = 0$, the FGT index, $P_{\alpha} =$ Headcount measure, if $\alpha = 1$, $P_{\alpha} =$ Poverty gap index or quotient and if $\alpha = 2$, P_{α} is the mean of squared proportionate poverty gaps and indicates greater severity of poverty among the poorest. The study uses

the three poverty measures—poverty headcount, poverty gap and poverty severity to decompose the changes in these measures into growth and distribution components.

3.2. Poverty Decomposition Methodology

To decompose the changes in poverty into growth effect and inequality effect, the Datt and Ravallion (1992) methodology has been used. For this purpose, the focus is on poverty measures which can be fully characterised in terms of the poverty line, the mean income of the distribution, and the Lorenz curve representing the structure of relative income inequalities. The poverty measure P_t at date t is written as

$$P_t = P(z/\mu_t, L_t) \quad \dots \quad (2)$$

Where P is a poverty measure written as a function of the ratio of the mean consumption μ_t to the poverty line z and the parameters of the Lorenz curve L_t at t date. Homogeneity in z and p is a common property of poverty measures. The level of poverty may change due to a change in the mean income μ_t relative to the poverty line, or due to a change in relative inequalities L_t . Lorenz curves may be presumed to follow a particular parametric form and fit to the data. The parametric specification of the Lorenz curve is given in Appendix.

For any two dates 0 and 1, the *growth component* of a change in the poverty measure is defined as the change in poverty due to a change in the mean from μ_0 to μ_1 while holding the Lorenz curve constant at reference level L_r . The *redistribution component* is defined as the change in poverty due to a change in the Lorenz curve, while holding the mean income constant at the reference level μ_r . Hence, a change in poverty over dates t and $t+n$ (say) can be decomposed as follows:

$$P_{t+n} - P_t = G(t,t+n;r) + D(t,t+n;r) + R(t,t+n;r) \quad \dots \quad \dots \quad \dots \quad (3)$$

Thus, total change in poverty

$$= \text{Growth effect} + \text{Redistribution effect} + \text{Residual}$$

In the above formulation the growth and redistribution components are given by

$$G(t,t+n;r) = P(z/\mu_{t+n}, L_r) - P(z/\mu_t, L_r)$$

$$D(t,t+n;r) = P(z/\mu_r, L_{t+n}) - P(z/\mu_r, L_t)$$

Where $R(t,t+n;r)$ in (3) stand for the residual. The residual in (3) exists whenever the poverty measure is not additively separable between P and L , specifically, whenever the marginal effects on the poverty index of changes in the mean (Lorenz curve) depend on the precise Lorenz curve (mean). In general, the residual does not vanish. Nor can it be apportioned between the growth and redistribution components, as some recent attempts at poverty decomposition have done. In general, the residual would not vanish. It can vanish only if the mean income or the Lorenz curve remains unchanged over the decomposition period. This is very unlikely for most of the empirical works.

The remainder of the study is divided into two interrelated sections. The first part investigates the changes in poverty and inequality, while the second section of the study decomposes changes in poverty into growth and distribution effects of poverty.

4. CHANGES IN POVERTY: 1998-99 TO 2004-05

To estimate the poverty in 1998-99, official poverty line in 1998-99 prices notified by the Planning Commission has been used. Poverty estimates for 2001-02 and 2004-05 have been computed by adjusting the official poverty for inflation using CPI during this period. The direction of change in poverty is then examined by looking at differences in poverty estimates during this period. Table 3 reports estimates of poverty in Pakistan for 1998-99 and 2001-02. The results show that poverty in Pakistan initially increased from 30.6 percent in 1998-99 to 34.4 percent in 2001-02 and then declined rapidly to 23.9 percent in 2004-05. The direction of change in poverty at the regional level shows that in absolute terms rural poverty fluctuated more than the urban poverty, but this partly reflects the higher base level of rural poverty. However, the relative decline was much larger in urban areas during the above period.

Table 3
*Trends in Poverty Incidence, Intensity, Severity and Gini Coefficient,
1998-99 to 2004-05 in Pakistan*

Regions	Headcount (P ₀)			FGT Poverty Gap Index (P ₁)			FGT Index (P ₂ □□)		
	1998-99	2001-02	2004-05	1998-99	2001-02	2004-05	1998-99	2001-02	2004-05
Pakistan									
Overall	30.6*	34.4	23.9	6.5*	6.9	4.8	2.0*	2.1	1.5
Rural	34.7*	39.2	28.1	7.4*	8.0	5.6	2.3*	2.4	1.8
Urban	20.9*	22.7	14.9	4.2*	4.5	2.9	1.3*	1.3	0.8
Pakistan	Gini Coefficient								
Overall	0.3019	0.2752	0.2976	–	–	–	–	–	–
Rural	0.2521	0.2367	0.2519	–	–	–	–	–	–
Urban	0.3596	0.3227	0.3388	–	–	–	–	–	–

Source: Calculations are based on primary data of PIHS 1998-99, 2001-02 and 2004-05, Federal Bureau of Statistics, Government of Pakistan, Islamabad.

Note: All poverty indices are expressed as percentages. *Based on poverty line of Rs 670 per capita month.

While rural poverty increased substantially from 34.7 percent³ in 1998-99 to 39.3 percent in 2001-02 and then declined to 28.1 in 2004-05, the urban poverty increased marginally in 2001-02 and then declined substantially from 22.7 percent to 14.9 percent during the above period. Both poverty gap, P₁ and poverty severity measures FGT P₂ indicate similar trends during this period. The results relating to inequality are quite contrary to those relating to poverty. In contrast to poverty, inequality in Pakistan initially declined between 1998-99 and 2001-02 and then increased between 2001-02 and 2004-05.

These results are quite consistent with the macroeconomic trends in the country during this period. While low economic growth due to drought seems to have increased rural poverty during the first period, the exceptional growth seems to have resulted in a rapid decline in poverty in the country during the second period. In contrast to this, low

³For 1998-99, poverty estimates are based on Rs 670 per capita month. However, if Rs 673 per capita per month is used as poverty line, it gives 31 percent below poverty line in 1998-99 as opposed to 30.6 percent in 1998-99 which was notified officially.

growth seems to have resulted in lower level of inequality during the first period, whereas high growth seems to have resulted in higher level of inequality during the second period.

5. DECOMPOSITION OF POVERTY, 1998-99 AND 2004-05

Table 4 presents the contributions of growth and redistribution to changes in poverty using the headcount, poverty gap and FGT P₂, poverty severity measures. The table shows that during the first period, 1998-99 to 2001-02, growth component is positive implying that growth component contributed to the rise in poverty over this period. On the other hand, negative redistribution suggests that had the inequality not declined, the increase in poverty would have been much higher. By components in terms of poverty headcount, growth accounted for 5.6 percentage points for the rise in poverty, while distributional shift accounted for 2.05 percentage points for lessening the negative effect of growth on poverty (see Figure 1). Consequently, the total rise in poverty was 3.83 percent in 2001-02. Notably, the adverse growth component significantly dominates the favourable redistribution component. This implies that a decline in per capita household consumption due to drought, particularly in rural areas, contributed to an increase in poverty during this period. This is also supported by the changes at regional levels as the adverse growth effect was higher in rural compared with urban areas. Similarly, a favourable redistribution effect was also higher in rural compared to urban areas, otherwise the rise in rural poverty would have been higher during the period.

In the second period, growth component is negative and redistribution component is positive in all regions implying that though growth contributed to a decline in poverty, the redistribution component dampened the effects of growth on poverty reduction over this period. While growth accounted for 12.48 percentage points in poverty reduction, the distributional shift adversely accounted for 1.42 percentage points and reduced the positive effects of growth on poverty. This implies that poverty would have been further reduced in 2004-05, had the government taken adequate measures to check deterioration of distribution. At regional level, growth and redistribution components were different in relative terms. The growth component was more dominant in rural compared to urban areas. Growth accounted for 14.29 percentage points reduction in poverty in rural areas, whereas it accounted for 8.06 percentage points reduction in urban poverty. On the other hand, distributional shift accounted for adversely 2.2 percentage points in rural areas compared to 1.18 percentage points in urban areas. Thus, poverty would have been further reduced in urban areas, had the distribution not worsened over the period.

The residual in the decomposition is relatively small for Pakistan compared with other countries particularly with India and Brazil computed by Datt and Ravallion (1992). The residual is the difference between the growth (redistribution) component measured at the terminal and initial Lorenz curve (mean consumption) respectively. If the mean consumption or the Lorenz curve remains unchanged over the decomposition period, then the residual disappears.

Table 4 also reports the decomposition components of growth and redistribution over the whole period, 1998-99 to 2004-05. The growth effects remained dominant over the period as a whole. Redistribution also contributed to decline in poverty but decline was pronounced in urban areas. The growth component accounted for 6.82 percentage

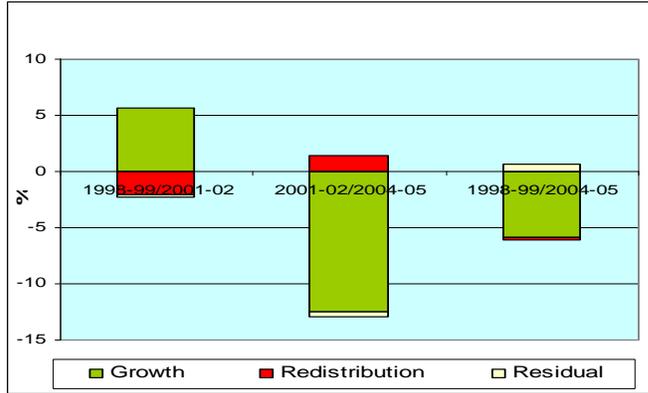
Table 4

*Decomposition of Poverty for Pakistan by Regions between 2001-02
to 2004-05 and 1998-99 to 2001-02*

	Growth	Redistribution	Residual	Total Change in Poverty Index
Headcount Index (H)				
1998-99 to 2001-02				
Pakistan	5.66	-2.05	0.22	3.83
Urban	4.58	-1.82	-0.99	1.77
Rural	6.12	-2.23	0.7	4.59
2001-02 to 2004-05				
Pakistan	-12.48	1.42	0.5	-10.56
Urban	-8.06	1.18	-0.91	-7.79
Rural	-14.29	2.2	0.93	-11.16
1998-99 to 2004-05				
Pakistan	-6.82	-0.63	-0.72	-6.73
Urban	-3.48	-0.64	1.9	-6.02
Rural	-8.17	-0.03	-1.63	-6.57
Poverty Gap index (PG)				
1998-99 to 2001-02				
Pakistan	1.59	-1.00	0.05	0.59
Urban	1.14	-0.73	0.12	0.41
Rural	1.79	-1.14	0.03	0.65
2001-02 to 2004-05				
Pakistan	-3.04	0.95	0.14	-2.09
Urban	-2.05	0.46	0.02	-1.58
Rural	-3.45	1.32	0.05	-2.13
1998-99 to 2004-05				
Pakistan	-1.45	-0.05	0.19	-1.50
Urban	-0.91	-0.26	0.14	-1.17
Rural	-1.67	0.19	0.08	-1.48
FGT Index (P₂)				
1998-99 to 2001-02				
Pakistan	0.60	-0.44	0.07	0.16
Urban	0.40	-0.30	0.05	0.10
Rural	0.68	-0.50	0.08	0.18
2001-02 to 2004-05				
Pakistan	-1.02	0.51	0.12	-0.51
Urban	-0.66	0.26	0.06	-0.40
Rural	-1.17	0.68	0.05	-0.49
1998-99 to 2004-05				
Pakistan	-0.42	0.07	0.19	-0.35
Urban	-0.26	-0.05	0.11	-0.30
Rural	-0.49	0.18	0.13	-0.31

Source: Author's computation from PIHS, 1998-99, 2001-04 and PSLM, 2004-05.

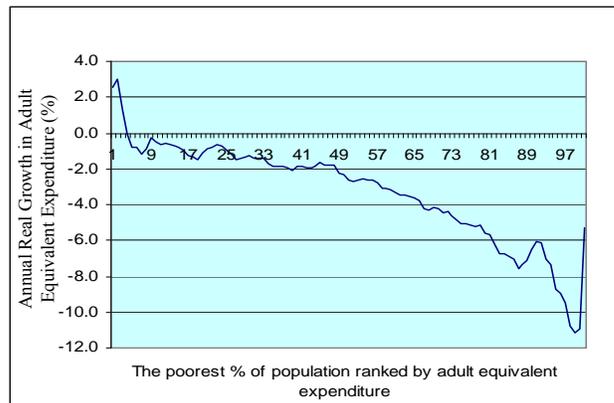
Fig. 1. Decomposition of Changes in Poverty Incidence in Pakistan, 1998-99 and 2004-05



points in poverty reduction, whereas the distributional shift accounted for 0.63 percentage points for the country as a whole. Consequently, total reduction in poverty was 6.73 percent between 1998-99 and 2004-05. One important thing also emerged from the results. The growth component remained dominant not only in two different periods but also over the period as a whole, though the shift in distribution in opposite direction was significant in the recent period with dominance of redistribution component in rural areas.

Decomposition results relating to poverty gap (P_1) and poverty severity measure FGT (P_2), follow the same pattern, if examined separately during the two periods. However, during the period as a whole, 1998-99 to 2004-05, these two measures show an adverse redistribution effect in rural areas which was not captured by conventional inequality measures such as Gini coefficient. For example, Gini coefficient shows a decline in rural inequality from 0.2521 in 1998-99 to 0.2519 in 2004-05 (see Table 3). In contrast, both poverty gap and FGT P_2 , poverty severity measures demonstrate an adverse effect of inequality on poverty in rural areas indicating that conventional inequality measures may be a poor guide to the way distribution shift can affect poverty measures (see Table 4).

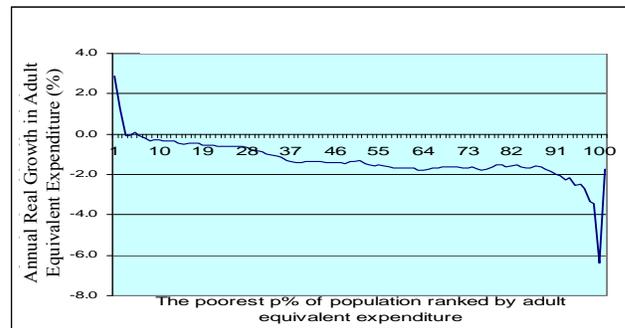
Fig. 2. Growth Incidence Curve for Urban Region, 1998-99 and 2001-02



5.1. Growth Incidence Curve

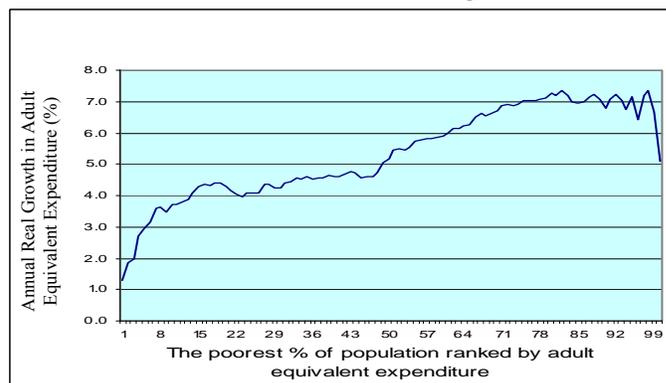
The growth incidence curve (GIC) is a useful tool to analyse the impact of economic growth over a wide range of distribution. The growth incidence curve shows the growth rate in income or consumption between two points in time at each distribution percentile. It would, therefore, be interesting to look at the growth incidence curve to evaluate the impact of economic growth over the two periods. The household consumption expenditure on non-durables has been used to examine the growth incidence curve, while CPI has been used to convert the nominal consumption expenditure into real values. Figures 2 and 3 show the growth incidence curve for both urban and rural regions for the first period, 1998-99 to 2001-02. The CICs, broadly, are downward sloping which shows a decreasing level of consumption expenditure over this period. However, consumption declined at faster rates in higher percentile groups compared to lower percentile groups resulting in lower inequality over this period.

Fig. 3. Growth Incidence Curve for Rural Areas, 1998-99 and 2001-02



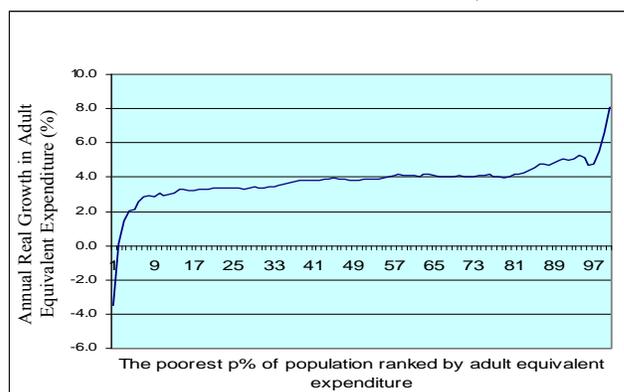
Further, GIC for both urban and rural areas lies mostly below zero implying that absolute poverty has increased over this period with reference to some conceivable poverty lines including the official. However, the growth rate was positive for the poorest about 5 percent of the population. But against a very low poverty line, the poorest 5 percent of population did not suffer any deterioration between 1998-99 and 2001-02.

Fig. 4. Growth Incidence Curve for Urban Region 2001-02 and 2004-05



In contrast to this growth incidence curve in the second period, the period between 2001-02 to 2004-05 shows entirely different trends in urban as well as rural areas. Growth in consumption of the richest quintile was the highest and the lowest for the poorest quintile, particularly in urban areas. This suggests an increased gap between the rich and the poor particularly in urban areas over the period (see Figures 4 and 5). Nevertheless, the growth in consumption of the lower deciles was sufficient to reduce absolute poverty. It appears that while growth seems to have contributed to a decline in absolute poverty in rural and urban regions, it seems to have increased the gap between the rich and the poor over the period. The GIC for rural areas needs particular attention as it lies below zero in the range of 1 percent of population implying that while absolute poverty has fallen over this period for some conceivable poverty lines, such as the official poverty line, the living standard of the poorest 1 percent had not improved. If one draws a very low poverty line in stringent terms, absolute poverty increased amongst the poorest 1.0 of population between 2001-02 and 2004-05 which the poverty headcount measures did not capture.

Fig. 5. Growth Incidence Curve for Rural Areas, 2001-02 and 2004-05



5.2. Comparison with Earlier Studies

The decomposition of changes of poverty into growth and redistribution components has not received adequate attention in Pakistan. The World Bank (2002) is the exception that made an attempt to decompose poverty using Datt and Ravallion's (1992) methodology for 1990-91 to 1998-99. According to World Bank (2002), decline in urban poverty was entirely due to the growth component and redistribution had had a negative effect. On the contrary, reduction in inequality in the absence of growth in consumption resulted in a small reduction in rural poverty during 1990-91 to 1998-99.

The finding of the World Bank study for the recent period is different from that for the earlier period of the 1990s (2002) in contrast to which growth contributed to a significant decline in poverty in both rural and urban areas over the whole period, 1998-99 to 2004-05. The growth components remained dominant both in urban and rural areas. The decline in poverty was mainly attributable to consumption while redistribution had adverse effect on poverty over the whole period. However, adverse distributional changes became more important in the recent period, 2001-02

to 2004-05 compared to the earlier era of low economic growth (1990-91 to 1998-99). This is in line with the view that rapid economic growth in recent time has benefited the middle and upper income classes more than the poorest segments of the population.

6. CONCLUSION

The study analysed the decomposition of changes in Pakistan's poverty profile covering rural and urban regions during 1999-98 to 2001-02 and 2001-02 to 2004-05. The first period, 1999-98 to 2001-02 relates to a low growth period mainly due to drought in the country. The second period, 2001-02 to 2004-05 relates to a period dominated by a growth-oriented poverty reduction strategy. The main conclusions that emerge from the analysis may be stated as follows.

During the first period, 1998-99 to 2001-02, the dominant growth component contributed adversely to the rise in poverty over this period. This is a low growth period characterised by drought that contributed to increase in poverty, particularly in rural areas. However, there are agriculture and industry linkages that seem to have affected the growth of consumption expenditure adversely leading to a rise in poverty in urban areas over this period. On the other hand, the redistribution component affected the poverty situation favourably otherwise the rise in poverty would have been much higher over the period. Thus, the role of inequality remained important in mitigating the adverse effects of growth on poverty between 1998-99 and 2001-02.

In contrast to this, the dominant growth component contributed significantly to decline in poverty, whereas the redistribution effects in the opposite direction depressed the effects of growth on poverty reduction during the second period. This suggests that poverty would have been further reduced in 2004-05, if the government had taken adequate measures to improve distribution. While the growth component remained dominant across rural and urban areas, the adverse redistribution component remained relatively large in rural areas. In sum, the role of growth has been more important in explaining changes in poverty in the recent period.

Over the period as a whole, from 1998-99 to 2004-05, while the effects of growth remained dominant, the redistribution component seems to have benefited only the urban areas. On the other hand, redistribution seems to have adversely affected the poor in rural areas. The policy implication of this empirical finding is that while the pursuit of growth as a strategy is important for poverty reduction in Pakistan, the contribution of redistribution in favour of the poor should not be ignored in order to enhance the effect of growth on poverty reduction. In this context, the major challenge is to pursue a poverty reduction strategy that is based on growth with redistribution. To meet this challenge, the government can enforce tax regimes and pursue expenditure policies that redistribute incomes from the rich to the poor while backward regions and provinces get preference in development programmes.

Analysis based on Growth Incidence Curve also supported the findings of the decomposition exercise performed in this study. The Growth Incidence Curve highlighted the role of inequality in the first period and that of growth in the second period in explaining the changes in absolute poverty. The use of GIC unveiled the rise in poverty amongst the poorest 1.0 of population in rural areas between 2001-02 and 2004-05 which

the conventional poverty measures failed to register. The rise in poverty amongst poorest 1.0 of population indicates their social exclusion from the process of growth. Targeted policy measures such as income or food support are required to protect this segment of population.

Appendix

A BRIEF NOTE ON PARAMETRIC SPECIFICATION OF THE LORENZ CURVE

The Lorenz curve is a method for representing the distribution of income. It is created by plotting cumulative income shares against cumulative population shares and forms the foundation of several inequality measures including the popular Gini coefficient. Lorenz curves may be constructed from grouped data using interpolation techniques or may be presumed to follow a particular parametric form and fit to tabulated data.

A Lorenz curve may be defined as

$$\eta = f(\pi)$$

Where

π is the cumulative population share of persons earning income equal to or below income level x .

η is the cumulative income share of population subgroup π .

A Lorenz curve must have the following properties:

$$\begin{aligned} D\eta/d\pi > 0, & \quad D^2\eta/d\pi^2 > 0, \\ \eta(0) = 0, & \quad \eta(1) = 1 \end{aligned}$$

and is defined on the domain $0 \leq \pi \leq 1$

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Exchange Rate Pass-through to Consumer Prices in Pakistan: Does Misalignment Matter?

ATIF ALI JAFFRI

This study investigates the impact of exchange rate changes on consumer prices (commonly known as exchange rate pass-through (ERPT)) in Pakistan for the period 1995M1 to 2009M3. The study estimates short-run and long-run ERPT in Pakistan while taking into account the existing real exchange rate misalignment (RERM). The results suggest that the ERPT to consumer price inflation in Pakistan is very low (close to zero). The impact of the previous periods' misalignment on inflation is found significant in managed exchange rate regime. However, the overall sample misalignment does not affect inflation. The impact of foreign inflation on domestic inflation is positive and statistically significant.

JEL classification: F31, F41, E31

Keywords: Pass-through, Misalignment, Inflation

1. INTRODUCTION

The hypothesis “exchange rate changes affect consumer prices” is important for both policy-makers and academia due to its relevance to effectiveness of monetary and exchange rate policies and adoption of a more flexible exchange rate regime. In the traditional literature, Exchange Rate Pass-through (ERPT) is defined in terms of import prices in local currency. According to Goldberg and Knetter (1997), “exchange rate pass-through is the percentage change in import prices in local currency resulting from a one percent change in the exchange rate between the exporting and importing countries”. The increase in import prices, however, also translates into increase in the producer and consumer prices in an economy if producers raise their prices in the wake of increase in import prices. Therefore, ERPT is broadly defined as the percentage change in domestic prices resulting from one percent change in exchange rate.

Specifically, changes in exchange rate can affect domestic prices through direct and indirect channels. Under the direct channel, a fall in exchange rate may trigger increase in the prices of imported finished goods and imported inputs in local currency. However, pass-through into local currency import prices is only complete if (a) mark-up of prices over costs is constant and (b) marginal cost of foreign exporter is constant [see Goldberg and Knetter (1997)].

Under the indirect channel, depreciation of the exchange rate makes domestic products relatively cheaper for foreign buyers, and as a consequence exports and

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aggregate demand rise and induce an increase in the domestic price level. Since nominal wage contracts are fixed in the short run, real wages decline. However, when real wages approach to their original level over time, the production cost increases and the overall price level moves up.

Recent literature tends to emphasise the importance of ERPT in conducting effective monetary and exchange rate policies. According to Choudhri and Khan (2002), “if the devaluation-inflation link exists, then devaluation comes with an important cost that necessarily must be factored into the exchange rate policy. Furthermore, it implies that the authorities can only affect the real exchange rate temporarily, because as domestic prices rise, the initial effects of a nominal depreciation on the real exchange rate would be reversed.” According to Choudhri and Hakura (2001), “a low exchange rate pass-through is thought to provide greater freedom for pursuing an independent monetary policy and to make it easier to implement inflation targeting”. Edwards (2006) argues that, “if the inflationary effects of exchange rate changes are large, the authorities will have to implement monetary and fiscal policies that offset the inflationary consequences of exchange rate changes.”

There are very few studies on ERPT for Pakistan (see Appendix Table 1). The existing studies provide mixed results regarding the relation between exchange rate and prices; however, the dominant view is that there is no evidence of any significant effect of devaluation on domestic price inflation [e.g., Siddiqui and Akhtar (1999) and Choudhri and Khan (2002)]. Recent literature on ERPT provides several explanations of low or decline in pass-through. By using a recursive VAR model, McCarthy (1999) examines the impact of exchange rates and import prices on domestic Producer Price Index (PPI) and Consumer Price Index (CPI) in nine selected industrialised economies for the period from 1976:1 to 1998:4.¹ The study concludes that pass-through is somewhat stronger in countries with a larger import share. Choudhri and Hakura (2001) test Taylor’s hypothesis that a low inflationary environment leads to low ERPT. They find strong evidence that the relation between pass-through and average inflation rate is positive and significant across regimes. Goldfajn and Werlang (2000) show that real exchange rate misalignment (RERM) is the most robust determinant of exchange rate pass-through for emerging markets.² They find that initial RER overvaluation negatively affects inflation and the ERPT coefficient. Goldfajn and Valdes (1999) illustrate that, “depreciations that are not based on required adjustments in relative prices would either induce inflation or reverse itself through a future nominal appreciation.”

The purpose of this study is to investigate whether misalignment is a significant determinant in pass-through relationship for Pakistan. The study contributes to the existing literature for Pakistan by, (a) developing a model to estimate ERPT while taking

¹Recently a number of studies used the McCarthy (1999) methodology for analysing ERPT in various countries. Among these are Bhundia (2002) for South Africa; Leigh and Rossi (2002) for Turkey; Rowland (2003) for Colombia; Gueorguiev (2003) for Romania; Belaisch (2003) for Brazil, and Hyder and Shah (2003) for Pakistan.

²RERM refers to a sustained departure of the real exchange rate (RER) from its long-run equilibrium real exchange rate (ERER). Empirically, an exchange rate is labeled overvalued (undervalued) when it is more appreciated (depreciated) than the equilibrium real exchange rate. ERER is defined as a rate consistent with macroeconomic fundamentals.

into account the existing level of RERM; (b) estimating the short-run and long-run ERPT for Pakistan; (c) providing implications for appropriate monetary and exchange rate policies. In the remaining part of this paper, Section 2 discusses the theoretical framework and the model estimated in this study, Section 3 elucidates empirical results; finally, conclusion and policy implications are discussed in Section 4.

2. THEORETICAL MODEL

In this study, the typical ERPT model specification approach is employed as a starting point. It is then extended to make it suitable to estimate ERPT at the aggregate level for CPI index and to incorporate the impact of RERM on inflation. The typical modeling approach in the pass-through literature is based on the pricing behaviour of a foreign exporting firm that exports its products to the domestic country [see, e.g., Dornbusch (1987); Knetter (1989); Marston(1990); Menon (1995); Goldberg and Knetter (1997) and Bailliu and Fujii (2004)]. The foreign firm solves the following profit-maximisation problem:

$$\text{Max } \pi = ER^{-1}pq - C(q) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

p

In Equation (1), π is profit in foreign currency, ER is the exchange rate defined in terms of the domestic currency per unit of the foreign currency, p is the price of the good in home currency, $C(.)$ is the cost function in foreign currency, and q is the quantity demand of good. Following Bailliu and Fujii (2004), Equation (2) represents the first-order condition (added by mark-up of price over marginal cost)³ drawn from Equation (1):

$$P = ER C_q \mu \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

Here, C_q is the marginal cost of the foreign firm, and μ is the mark-up. Equation (2) shows that it is essential to take into account variations in these control variables to properly isolate the effects of exchange rate changes on import prices. Previous studies on ERPT into import prices have employed import price equations derived within the mark-up framework [see, Menon (1995) and Goldberg and Knetter (1997)]. This framework allows for interaction between domestic and foreign firms by restricting the effect of changes in exchange rate on competitiveness by changing the mark-up. Menon (1996) has hypothesised mark-up to depend on competitive pressure in the domestic market and the exchange rate:

$$\mu = [P_D / (C_q ER)]^\alpha \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

Where, mark-up depends on exchange rate and the gap between the price of goods produced in importing country (P_D) and the exporter's production cost.

Substituting (3) into (2) and using lower-case letters to denote logarithms, a simple log-linear reduced-form equation is obtained as follows:⁴

³Mark-up may also be defined as $\mu = \lambda/1-\lambda$, where λ is price elasticity of demand for the good. In a perfectly competitive industry, λ is infinite so μ is always 1. However, in monopolistically competitive environment, the exporting firm may have some leverage to raise the price above marginal cost.

⁴In the empirical estimation, we do not impose the cross-coefficient restrictions implied by our theoretical model.

$$\begin{aligned}
 p_m &= \alpha p_d + (1-\alpha) c_q + (1-\alpha) er \\
 p_m &= \alpha p_d + \beta c_q + \gamma er \quad \dots \quad (4)
 \end{aligned}$$

The coefficient γ measures ERPT into import prices, and, α and β are measures of the importing country's demand conditions and exporter's marginal cost, respectively. Variants of Equation (4) are widely used in the literature of ERPT into import prices [see, Goldberg and Knetter (1997)].

A few changes are made in this specification for estimating ERPT to consumer prices.

First, let us define consumer prices in log form as

$$p = \theta p_m + (1-\theta)p_d \quad \dots \quad (5)$$

where θ represents weight of imported goods.

Second, substituting for p_m from (4) in (5), we get (6)

$$\begin{aligned}
 p &= \theta(\alpha p_d + \beta c_q + \gamma er) + (1-\theta)p_d \\
 p &= \theta\alpha p_d + \theta\beta c_q + \theta\gamma er + (1-\theta)p_d \\
 p &= (\theta\alpha + (1-\theta))p_d + \theta\beta c_q + \theta\gamma er \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (6)
 \end{aligned}$$

Third, the Equation (6) is transferred into difference form as CPI and exchange rate are generally observed to follow non-stationary paths.⁵

$$\Delta p_t = (\theta\alpha + (1-\theta))\Delta p_{dt} + \theta\beta \Delta c_{qt} + \theta\gamma \Delta er_t \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

Fourth, since ERPT model is estimated at high frequency data, and, for p_{dt} no appropriate price index (e.g., GDP deflator) at high frequency is available for Pakistan. Therefore, following Montiel (2002), and Kamin (1997), Δp_{dt} is related with real exchange rate misalignment.^{6,7}

$$\Delta p_{dt} = \lambda (rer - rer^*)_{t-1} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (8)$$

Where rer is log of real exchange rate and rer^* is the log of equilibrium real exchange rate. Substituting (8) into (7) we obtain Equation (9):

$$\begin{aligned}
 \Delta p_t &= (\theta\alpha + (1-\theta))\lambda (rer - rer^*)_{t-1} + \theta\beta \Delta c_{qt} + \theta\gamma \Delta er_t \\
 \Delta p_t &= \theta_0 (rer - rer^*)_{t-1} + \theta_1 \Delta c_{qt} + \theta_2 \Delta er_t \quad \dots \quad \dots \quad \dots \quad \dots \quad (9)
 \end{aligned}$$

Fifth, the literature on inflation dynamics has emphasised the need to account for the observed inertial behaviour of inflation. This is accomplished by including lags of inflation as explanatory variables in Equation (9).

$$\Delta p_t = \theta_0 RERM_{t-1} + \theta_1 \Delta c_{qt} + \theta_2 \Delta er_t + \theta_3 \Delta p_{t-i} + \varepsilon_t \quad \dots \quad \dots \quad \dots \quad (10)$$

In this equation, θ_2 measures the impact of exchange rate change on inflation. The magnitudes of the coefficient of the overvaluation are relevant. The exchange rate

⁵In case of Pakistan, monthly CPI index and exchange rate are nonstationary of order I(1).

⁶This kind of relation has been used in the literature in many studies, e.g., Adams and Gross (1986), Kamin (2001), and Klau (1998).

⁷The reason for substituting Δp_{dt} with misalignment (only) is to take into account domestic demand conditions. Pass-through models include the cost of foreign exporting firms and domestic demand conditions as control variables.

devaluation that does not overshoot its required adjustment would not have severe consequences in terms of inflation.

To estimate Equation (10), Foreign Consumer Price Index (FCPI) is used as a proxy for foreign exporter's cost and Nominal Effective Exchange Rate (NEER) as a proxy for exchange rate.⁸ The variable RERM is taken from Jaffri (2009). Jaffri (2009), estimates equilibrium real exchange rate through Behavioural Equilibrium Exchange Rate (BEER) approach. The BEER approach uses cointegration technique to establish a long run relationship between REER and its fundamental determinants.⁹

Rewriting Equation (10), by including lags of explanatory variables except RERM:

$$\Delta p_t = \theta_0 RERM_{t-1} + \theta_{1i} \Delta fcpi_{t-i} + \theta_{2i} \Delta neer_{t-i} + \theta_{3i} \Delta p_{t-1-i} + \varepsilon_t \quad \dots \quad (11)$$

Following Edwards (2006), Otani, *et al.* (2003), and Campa and Goldberg (2002) the short-run exchange rate pass-through (SRERPT) and long-run exchange rate pass-through (LRERPT) are calculated from the above mentioned model as follows:

$$\begin{aligned} \text{SRERPT} &= \theta_0 \\ \text{LRERPT} &= \sum \theta_{2i} / (1 - \sum \theta_{3i}) \end{aligned}$$

The SRERPT is a measure of contemporaneous impact of increase in NEER appreciation on consumer price inflation. The expected sign of this coefficient is negative. On the other hand, LRERPT takes into account the previous periods' exchange rate changes and inflation, thus, estimating aggregated pass-through. Let us suppose SRERPT = -0.05 and LRERPT = -0.40, then it means that 1 percent increase in the rate of appreciation of the trade weighted nominal exchange rate leads to 0.05 percent decline in CPI inflation in the same period, and 0.40 percent in the long-run.

The ERPT model (Equation 11) is estimated by Ordinary Least Square (OLS) method, as it provides an unbiased estimate of parameters in the presence of stationary variables in the model [see, Enders (2004)]. The OLS methodology could be inappropriate if causality runs both ways; however, using alternative methodologies, such as two-stage least squares, could also have problems like unavailability of sufficient data and proper instrument for Δ NEER. In recent literature, Edwards (2006), Campa and Goldberg (2002), and Gagnon and Ihring (2004) have used the OLS method to estimate models similar to this study. Edwards (2006) has discussed this issue in detail.

Data Description

The purpose of estimating model for two sub-samples was to check whether pass-through has declined after shifting toward a flexible exchange rate regime. For nearly thirty-five years, Pakistan maintained a fixed peg exchange rate regime. On January 8, 1982, the SBP adopted managed floating exchange rate regime, which continued until July 20, 1998 when the SBP decided to start the transition from managed floating to a free

⁸This study follows Choudhri and Hakura (2001) in extracting FCPI from REER and using NEER as proxy for exchange rate. Choudhri and Khan (2002) have also applied same definition of foreign prices and exchange rate.

⁹The variables used as proxies of fundamentals include: log of industrial production index (LPROD) as a proxy for productivity in tradable; log of exports (LOPEN) as a proxy of trade openness; log of foreign direct investment inflow (LFDI) as a proxy of capital inflows, and log of workers' remittances (LREMIT).

floating exchange rate regime. Pakistan experienced a dual exchange rate system between July 22, 1998 and May 18, 1999. From July 22, 1998 to July 20, 2000 the exchange rate regime was completely transformed from managed floating to free floating.

In this study, the model is estimated for three specifications: (a) Regression 1: (for the overall sample period from 1995M1 to 2009M3); (b) Regression 2: (for the sub-sample from 1995M8-2000M7); and (c) Regression 3: (for the sub-sample 2000M8-2009-M3). The data sources are IFS CD-ROM and State Bank of Pakistan.¹⁰ All indices are adjusted for 2000 base year. The variables used in the model are described as follows:

Consumer Price Inflation (INF)

This study uses natural log differentials of overall CPI proxy for inflation. To examine the trends of CPI prices and inflation, the price index and its log differential are subsequently plotted in Figures 1a, 1b. From the figure 1a it is observed that LCPI is of increasing trend, which implies non-stationarity of CPI. However, the Figure 1b shows that the inflation series is converging on its mean, implying stationarity of the series.¹¹

Exchange Rate Appreciation (GNEER)

The proxy for nominal exchange rate used in this study is Nominal Effective Exchange Rate (NEER) index.¹² The NEER index represents the ratio (expressed on the base 2000=100) of an index of Rupee's period average exchange rate to US Dollar and a weighted geometric average of exchange rates for the currencies of selected countries.

The index is based on a methodology that takes account of each country's trade in both manufactured goods and primary products with its partner, or competitor, countries.¹³ An increase in NEER represents appreciation of Rupee against currencies of trading partners and vice versa.

The plots of log of NEER (LNEER) and its change (GNEER) are shown in Figures 1c and 1d. Figure 1c shows that NEER has a decreasing trend which means that NEER is depreciating throughout the sample period. Further, it reflects that the series is non-stationary. However, the difference of the series converges towards its mean implying stationarity of the series.

Foreign Inflation (FINF)

In this study, foreign weighted consumer price index (FCPI) is used as a proxy for foreign exporter's cost. Foreign inflation (FINF) is defined as difference of natural log of FCPI.¹⁴ The plots of natural log of FCPI (LFCPI) and foreign inflation (FINF) are shown in Figures 1e and 1f. The Figure 1e represents an increasing trend in foreign prices and

¹⁰Author has benefitted from E.Views programme for econometric estimation.

¹¹Formal tests of stationarity are presented in Table 1.

¹²This study uses IFS data on REER and NEER, however, SBP also publishes these indices based on 22 trading partner countries and 16 currencies but the data is available only for the period from January, 2001.

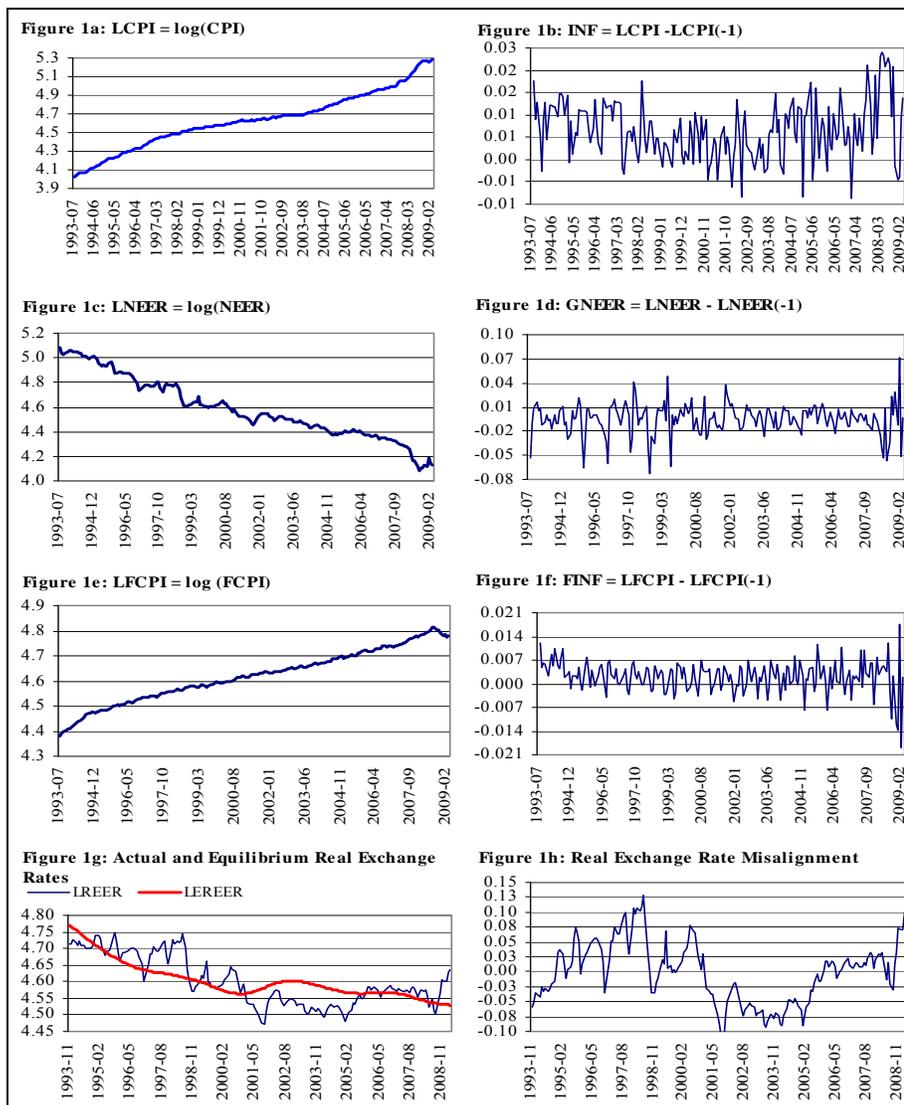
¹³An IMF's working paper entitled "A Primer on the IMF's Information Notice System" (WP/97/71), provides background on the concept and methodology underlying the effective exchange rates.

¹⁴Following Choudhri and Hakura (2001), FCPI is extracted from Real Effective Exchange Rate (REER). Choudhri and Khan (2002) have also followed this method of extracting FCPI from REER provided by INS.

shows the series is non-stationary. However, the difference of the series shows convergence toward means i.e., stationarity of the series.

Misalignment (MIS)

Misalignment (MIS) is the difference between the log of the actual and equilibrium real effective exchange rates. REER index represents a nominal effective exchange rate index adjusted for relative movements in home CPI index and of selected countries. An increase in REER represents appreciation of home currency and vice versa. In the Figure 1g, actual and equilibrium exchange rate (derived from BEER approach) in log form are shown. The RERM, which is the difference between actual and equilibrium REER is shown in Figure 1h.



3. ESTIMATION RESULTS

Before estimating the ERPT model (Equation 11), the stationarity property of variables has been checked by applying unit root test. Table 1 shows that all variables in ERPT model (Δ LCPI, Δ LNEER, Δ LFCPI, RERM) are stationary at level.

Table 1

Series in ERPT Model	<i>Unit Root Test</i>	
	With Intercept	With Intercept and Trend
Δ LCPI	-4.86(2)***	-4.89(2)***
Δ LNEER	-2.12(0)***	-12.08(0)***
Δ LFCPI	-4.1(14)***	-.33(14)**
RERM	-.97(1)**	-.99(1)*

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

The model has been estimated for two sub-samples along with the overall sample. Initially, the maximum number of lags permitted by data were considered for estimation of Regression 1. However, following the General to Specific method, most of the insignificant lags were dropped [for General to Specific Methodology, see, Hendry (2003); Nell (2003) and Pentecost and Moore (2006)].

The estimated model passes all the diagnostic tests such as normality, autocorrelation, heteroskedasticity, and RESET test for specification error. The adjusted R^2 of all regressions shows that they are reasonably good fits. All three specifications are stable as indicated by CUSUM and CUSUM Q stability tests (see Figure 2). The results of the estimation of ERPT model are reported in Tables 2 and 3. In the following, important outcomes of the estimation of these regressions are discussed.

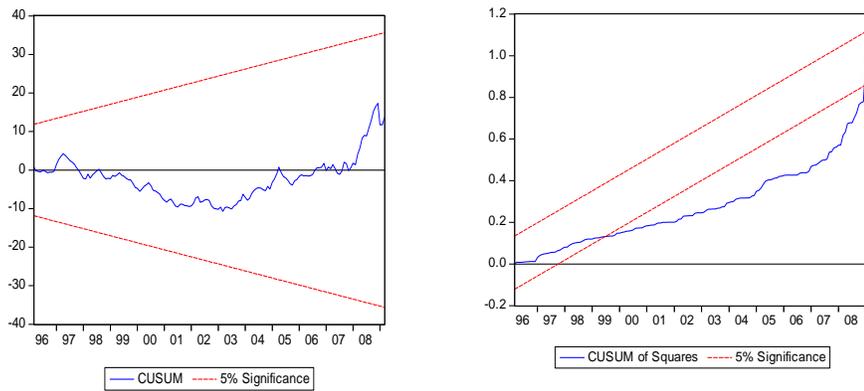
In the first regression, RERM (-1) variable is insignificant and has a weak magnitude. The SERPT is -0.05 percent whereas long-run ERPT is equal to -0.15. It shows that 1 percent increase in the rate of appreciation of the trade weighted nominal exchange rate leads to 0.05 percent decline in CPI inflation in the same period, and 0.15 percent in the long-run. The effect of foreign inflation on inflation with a positive sign is significant. The lagged domestic inflation exerted 0.20 percent increase in domestic inflation after 3 months.

In the second regression, the coefficient of RERM (-1) is negative and significant indicating that 1 percent overvaluation in the previous period exerted almost 0.03 percent reduction in domestic inflation. Moreover, the impact of foreign inflation is positive and significant.

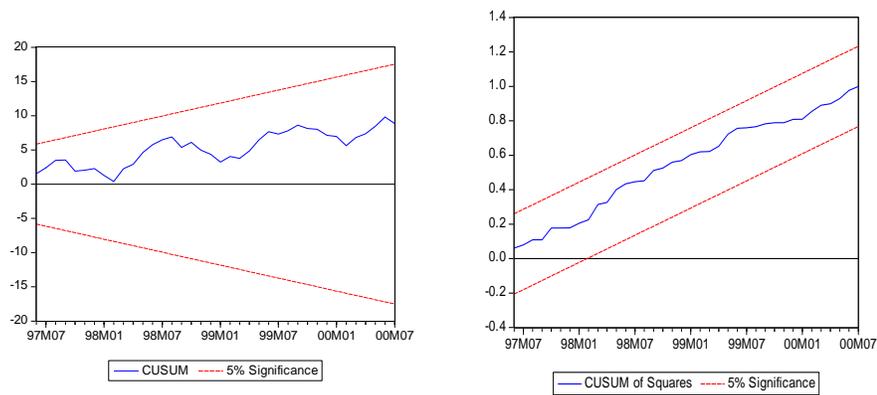
In the third regression, the pass-through coefficients are close to zero. Most of the coefficients of lagged foreign inflation affect inflation positively and significantly. The sign of the coefficient of lagged inflation is positive and maximum effect (0.17 percent) is realised after 3 months.

Fig. 2. Test for Stability of Parameters

Regression 1



Regression 2



Regression 3

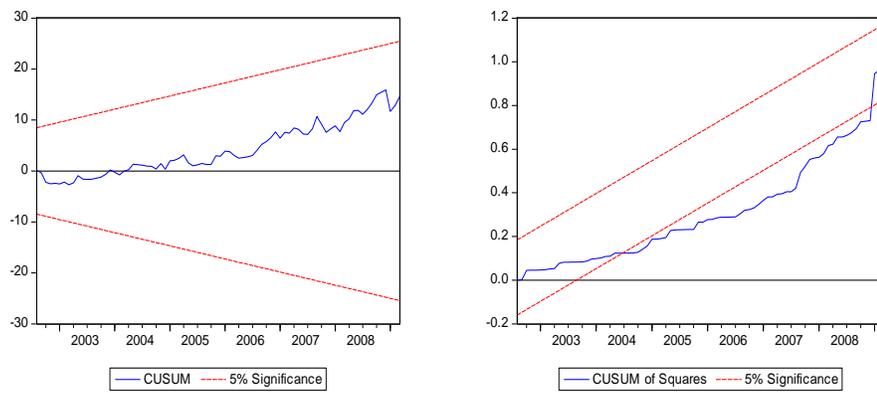
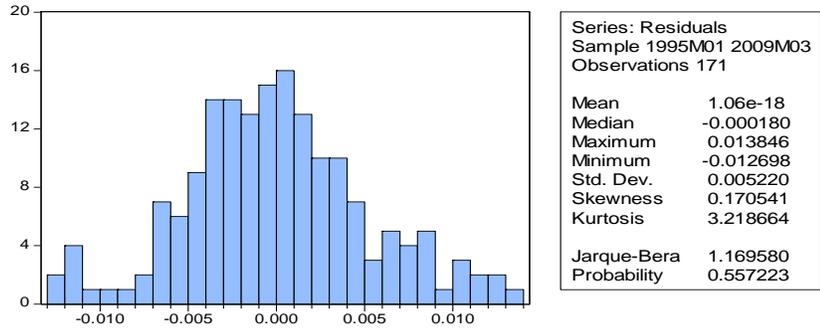
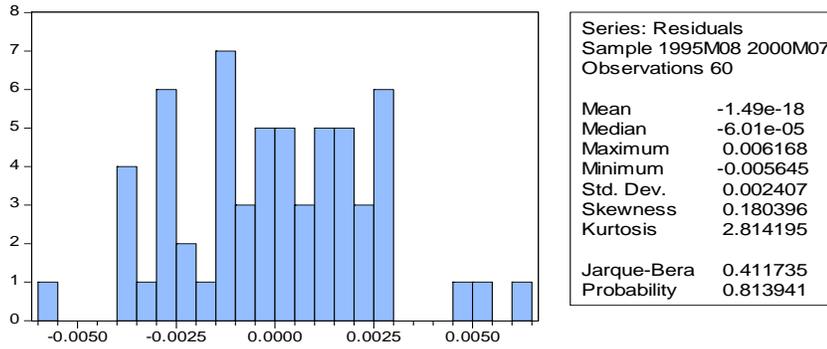


Fig. 3. Histogram-Normality Test
Regression 1



Regression 2



Regression 3

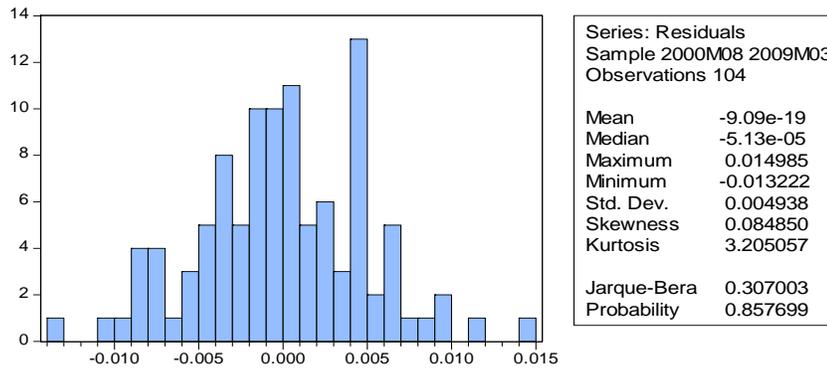


Table 2
Estimates of Pass-through Relation
Sample (Adjusted): 1995M01 2009M03

Variables	Coefficients	t-values
C	-0.000560	-0.60
MIS(-1)	-0.002634	-0.31
GNEER	-0.048745	-2.07**
GNEER(-7)	-0.021658	-0.85
GNEER(-10)	-0.027181	-1.07
GNEER(-17)	-0.067570	-2.78***
FINF	0.210417	2.79***
FINF(-1)	0.295562	3.53***
FINF(-2)	0.431233	4.24***
FINF(-3)	0.119985	0.87
FINF(-4)	0.326070	2.66***
FINF(-11)	0.322694	2.67***
FINF(-12)	0.572744	4.41***
INF(-3)	0.197551	2.44***
Adj. R ²	0.32	
SE of Regression	0.0054	

Diagnostic Tests

Jarque-Bera Normality Test	Chi ² (2) = 1.17 (0.56)
Breusch-Godfrey LM Test	Chi ² (1) = 4.20 (0.12)
Engle's ARCH LM Test	Chi ² (1) = 2.95 (0.11)
Ramsey's RESET Test	=Chi ² (1) = 1.67 (0.20)

Source: Estimation of this study.

***, **, * Reflect significance at 1 percent, 5 percent and 10 percent respectively. Figures in brackets are probabilities.

Table 3

Estimates of Pass-through Relation

Regression 2: (Adjusted Sample 1995M08 2000M07)			Regression: 3(Adjusted Sample: 2000M08 2009M03)		
Variables	Coefficients	t-values	Variables	Coefficients	t-values
C	-0.0018	-1.31	C	-0.007183	-2.97***
MIS(-1)	-0.025	-1.71*	MIS(-1)	-0.021878	-1.43
GNEER	0.0120	0.56	GNEER	-0.091164	-2.06**
GNEER(-2)	0.0681	2.89***	GNEER(-1)	0.097738	2.02**
GNEER(-3)	-0.0476	-2.02**	GNEER(-2)	-0.006367	-0.14
GNEER(-4)	-0.0417	-2.06**	GNEER(-6)	0.085589	1.83*
GNEER(-13)	0.0597	2.65**	GNEER(-7)	-0.166026	-3.30***
GNEER(-14)	-0.0015	-0.06	GNEER(-8)	0.151043	2.95***
GNEER(-15)	0.0743	2.61**	GNEER(-17)	-0.102580	-2.53**
GNEER(-16)	-0.0094	-0.35	FINF	0.371725	3.77***
GNEER(-17)	0.043	1.46	FINF(-1)	0.298793	2.43**
FINF	1.2880	4.02***	FINF(-2)	0.578176	3.34***
FINF(-1)	0.6234	2.70**	FINF(-3)	0.405591	1.80*
FINF(-2)	0.8414	2.99***	FINF(-4)	0.194521	0.91
FINF(-3)	0.6116	1.95*	FINF(-5)	0.538994	2.61**
FINF(-4)	0.4889	1.87*	FINF(-6)	0.043006	0.22
FINF(-5)	0.6130	2.46**	FINF(-7)	0.639146	3.07***
FINF(-6)	0.2751	1.29	FINF(-8)	0.333625	1.71*
FINF(-11)	0.4213	2.11**	FINF(-9)	0.263726	1.23
FINF(-12)	0.1619	0.52	FINF(-10)	0.580103	2.54**
INF(-3)	0.2083	1.78*	FINF(-11)	0.343753	1.65*
INF(-24)	-0.1597	-1.46	FINF(-12)	1.039366	4.85***
			INF(-1)	0.100420	1.03
			INF(-3)	0.166116	1.71*
Adj. R ²		0.632	Adj. R ²		0.44
SE of Regression		0.0030	SE of Regression		0.0056
Diagnostic Tests					
Jarque-Bera			Jarque-Bera		
Normality Test	Chi ² (2) = 0.41 (0.81)		Normality Test	Chi ² (2) = 0.31 (0.86)	
Breusch-Godfrey LM Test	Chi ² (1) = 3.16 (0.08)		Breusch-Godfrey LM Test	Chi ² (1) = 4.01 (0.13)	
Engle's ARCH LM Test	Chi ² (1) = 0.08 (0.78)		Engle's ARCH LM Test	Chi ² (1) = 5.88 (0.18)	
Ramsey's RESET Test	Chi ² (1) = 1.48 (0.22)		Ramsey's RESET Test	Chi ² (1) = 0.15 (0.70)	

Source: Estimation of this study.

***, **, *Reflect significance at 1 percent, 5 percent and 10 percent respectively. Figures in brackets are probabilities.

5. CONCLUSION AND POLICY IMPLICATIONS

This study investigates the impact of exchange rate changes on domestic consumer prices (ERPT) in Pakistan for the period 1995M1 to 2009M3. In case of Pakistan, the literature provides mixed results regarding the significance of pass-through relationship; however, the dominant view is that there is no evidence of any significant effect of devaluation on domestic inflation [e.g., Siddiqui and Akhtar (1999) and Choudhri and Khan (2002)]. The current literature on ERPT provides several explanations of low pass-through [e.g., Taylor (2000); Goldfajn and Werlang (2000) and Choudhri and Hakura (2001)]. According to Goldfajn and Werlang (2000) initial real exchange rate overvaluation and initial inflation are the most robust determinants of ERPT. In case of Pakistan, no previous study has incorporated misalignment in the pass-through model. This study develops an ERPT model which incorporates previous period's real exchange

rate misalignment as an independent variable. In the following, concluding remarks based on empirical findings of the study are presented.

First, short-run and long-run exchange rate pass-through, from NEER appreciation to consumer price inflation in Pakistan, is very low (close to zero).¹⁵ Second, overvaluation in the previous period significantly reduced inflation in managed exchange rate regime, although, coefficient of RERM (-1) is low. However, the coefficient of RERM(-1) is found insignificant in the overall sample (*Regression 1*) due to the dominance of second sub-sample which includes the transition period of the exchange rate regime. Third, the impact of foreign inflation on domestic inflation is positive. In all three regressions, foreign inflation significantly affects domestic inflation.

Policy Implications

- (1) Low pass-through into consumer prices has important policy implication for the adoption of inflation targeting by SBP.¹⁶ A floating exchange rate system is the requirement for a well functioning inflation targeting regime because in a world of capital mobility, independent monetary policy cannot coexist with a pegged exchange rate regime. The conjunction of inflation targeting and flexible exchange rates has raised question of exchange rate volatility and resulting fear of exchange rate pass-through into consumer price inflation. However, evidence of low pass-through supports the adoption of an inflation targeting regime in Pakistan.
- (2) To realign real exchange rate towards equilibrium, policy-makers must know both the level of existing RERM and pass-through relationship. For this purpose, misalignment may be estimated regularly like other macroeconomic variables.

¹⁵This finding is consistent with existing empirical evidence on ERPT for Pakistan [see, e.g., Choudhri and Khan (2002), and Choudhri and Hakura (2001)].

¹⁶According to Choudhri and Hakura (2001) “a low exchange rate pass-through is thought to provide greater freedom for pursuing an independent monetary policy and to make it easier to implement inflation targeting”.

APPENDIX

Appendix Table 1a

Recent Empirical Literature on ERPT in Pakistan

Authors	Hypothesis	Empirical Approach	Data	Findings Related to ERPT
1. Ahmad and Ram (1991)	Whether import prices affect inflation?	Monetarist model of price inflation by applying OLS	Annual data of Pakistan from 1960-61 to 1987-88	<ol style="list-style-type: none"> 1. The growth in import prices, monetary expansion and inflation in the past are the major causes of inflation. 2. The growth in output helps in controlling inflation but not very forcefully.
2. Khan and Qasim (1996)	Determinants of general food and non-food inflation in Pakistan	Single Equation Models/ OLS, Cointegration, Error Correction Model	Annual data of Pakistan from 1971-72 to 1994-95	<ol style="list-style-type: none"> 1. Borrowing from banks to finance budget deficit is main cause of inflation in Pakistan. 2. Frequent currency devaluation/depreciation has also caused inflation in Pakistan.
3. Ahmad and Ali (1999)	Relationship between ER and Prices	Simultaneous Equation Model/ Two Stage Least Square Method	Quarterly data from 1982:2 to 1996:4	Relationship between price level and exchange rate is not unidirectional, though the short run effect of devaluation on inflation is estimated to be smaller than the effect of inflation on devaluation.
4. Siddiqui and Akhtar (1999)	Impact of changes in foreign prices and changes in monetary and real variables on domestic prices	Monetarist type model, Cointegration, ECM, Granger Causality Test	Annual data of Pakistan from 1972 to 1998	<ol style="list-style-type: none"> 1. No significant uni-directional or bi-directional causal relationship between changes in exchange rate and domestic prices. 2. Money supply and level of domestic activity affect domestic prices.
5. Choudhri and Khan (2002)	Whether inflation systematically related to exchange rate changes?	Difference Model, VAR Model, Impulse Response Function, Variance Decomposition	Quarterly data of Pakistan from 1982:1 to 2001:2	<p>There is no evidence of a significant pass-through of Rupee depreciation to consumer prices in SR.</p> <p>Response of inflation to ER shocks is close to zero even after 2 years.</p>
6. Hyder and Shah (2002)	Effect of ER movements on domestic WPI and CPI inflation in Pakistan	Recursive VAR suggested by McCarthy (1999), Impulse Response Function, Variance Decomposition Method	Monthly Data from January 1988 to December 2002	<ol style="list-style-type: none"> 1. ER movement have moderate effect on domestic price inflation. 2. ER pass-through is stronger in WPI as compared to CPI. 3. The impact of pass-through on domestic prices spread over 18 months, however, the most effect is felt in first four months. 4. Response is weak in food group and strong in Fuel and Lightning.

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Taylor Rule and the Macroeconomic Performance in Pakistan

WASIM SHAHID MALIK and ATHER MAQSOOD AHMED

A near-consensus position in modern macroeconomics is that policy rules have greater advantage over discretion in improving economic performance. For developing countries in particular, simple instrument rules appear to be feasible options as pre-requisites since more sophisticated targeting rules are generally lacking. Using Pakistan's data, this study has attempted to estimate the Taylor rule and use it as monetary policy strategy to simulate the economy. Our results indicate that the State Bank of Pakistan (SBP) has not been following the Taylor rule. In fact, the actual policy has been an extreme deviation from it. On the other hand, counterfactual simulation confirms that macroeconomic performance could have been better in terms of stability of inflation and output, had the Taylor rule been adopted as monetary policy strategy. The study also establishes that further gains are possible if the parameter values of the rule are slightly modified.

JEL classification: E47, E31, E52

Keywords: Taylor Rule, Macroeconomic Performance, Counterfactual Simulation

1. INTRODUCTION

A near-consensus position in modern macroeconomics is that policy rules have greater advantage over discretion in improving economic performance [Taylor (1993)]. Through seminal papers, Kydland and Prescott (1977) and Barro and Gordon (1983) have convincingly shown that discretionary policies are time inconsistent. However, the adverse outcome can be avoided if private agents pursue a punishment policy of higher inflationary expectations that may cause loss of reputation of the monetary authority [Barro and Gordon (1983a)]. Alternatively, ensuring independence of the Central Bank may also reduce inflationary bias [Sargent and Wallace (1981), Rogoff (1985), Alesina and Summers (1993), and Walsh (1995) among others].

Interestingly, despite this overwhelming support initially for money growth targeting and later for inflation targeting, it was not clear how a rule could be used in practical policy formulation process until Taylor (1993) presented a state-contingent interest rate rule that is both, practicable and simple.¹ It calls for changes in the short-

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¹As instrument rules are simple, robust, easily verifiable and strict and there is fundamentally no role of policy-maker's judgment in time to time decisions, commitment to these rules is a good and feasible monetary policy strategy for developing countries. Compared to this, targeting rules (attributed to Svensson) are even though optimal and flexible, but not simple.

term interest rate (monetary policy instrument) in response to deviation of output from trend or potential level and that of inflation from the target with *equal weight* given to both these objectives in the policy reaction function. Taylor argues that adoption of the simple rule not only has the potential of improving macroeconomic performance, it also avoids the time inconsistency problem. He further maintains that the rule does not suffer from enforcement problem because of its easy verifiability by agents outside the central bank. In this context, commitment to this rule becomes technically feasible.

The purpose of the present study is to revalidate the Taylor rule by estimating it for Pakistan. It needs to be established whether or not the State Bank of Pakistan (SBP)—the Monetary Authority—has been following such a policy rule for the simple reason that historically Pakistan has experienced cycles in inflation and real economic activity. Inflation reached its peak of 23 percent in 1974, and touched the lowest level of 2.4 percent in 2002. Similarly, the real output growth varied between 8.7 percent in 1980 and -0.1 percent in 1997.² Besides this inconsistent macroeconomic performance, Pakistan's economy also suffered from weak institutional set-up. Not only that the independence of the central bank was continuously challenged, it also had to withstand regular fiscal pressures which largely weakened the monetary policy stance. Furthermore, there was a constant struggle for maintaining stability of the exchange rate.

Given these weaknesses, one would have argued that adoption of a simple instrument rule—like the Taylor rule—might have been a natural and feasible option. Given this perspective, the second objective of the study is to assess the macroeconomic performance on the basis of variability of inflation and output. For this purpose, the economy has been simulated, with and without Taylor rule, as monetary policy strategy. Finally, using counterfactual simulations, the study also investigates whether the parameter values of the Taylor rule (the weights on output and inflation stabilisation, and the inflation target) are optimal for Pakistan or some modification is needed to have better results.

The paper proceeds as follows. In Section 2, the two types of monetary policy rules, namely the instrument rules and the targeting rules, are defined and explained. The methodology for estimation, backcasting, and counterfactual simulation is presented in Section 3. An exhaustive discussion of empirical findings is the subject matter of Section 4. The final section summarises the main findings and offers insights for further research.

2. MONETARY POLICY RULES

A monetary policy rule can be defined as a description—expressed algebraically, numerically, and/or graphically—of how the instruments of policy, such as monetary base or the discount rate, change in response to economic variables [Taylor (1999b)]. Policy rules are similar to constant growth rate rules for money supply. However, in a broader sense, feedback rules such as money supply response to changes in unemployment and/or inflation etc. are preferred policy rules. As indicated, there is a near-consensus among macroeconomists that policy rules have greater advantage over discretion in improving economic performance. This, however, requires that the rule is

²It may be recalled that a country cannot graduate from low-income to middle-income status unless it registers a long period of high and sustained growth where the stability of prices is also ensured [Fischer (1993)].

adopted and followed for a reasonably long period of time to reap the benefits of stabilisation and the credibility associated with the rule. The literature related to rules versus discretion debate distinguishes between simple *instrument rules* [proposed by McCallum (1988); Taylor (1993) and others] and *targeting rules* due largely to Svensson (1997, 2002, 2003). The choice between the two reduces to such concerns as simplicity, robustness, reliability, practicability, technical feasibility, result-orientation and the role of policy-maker's judgment in decision-making. We begin with a brief review of the two rules.

Instrument Rules: Instrument rules are state-contingent reaction functions that link the policy tool with performance indicators of the economy [Meltzer (1987), McCallum (1988), Taylor (1993), and Henderson and McKibbin (1993)]. These rules are simple to follow and require little amount of information. These are robust and technically feasible in the sense that commitment to rule is easily verifiable. Of different variants, the one that has attracted most of the attention during 1990s has been the Taylor (1993) rule. Taylor offered an instrument rule to conduct monetary policy operations by setting the target for federal funds rate (operational target) equal to an 'equilibrium' real funds rate plus the current inflation and adding to it a weighted average of monetary authority's response to the deviation of current inflation from the target and percentage deviation of the real GDP from an estimate of its potential or full-employment level. He considered it to be an 'optimal' policy as it relates a plausible instrument to reasonable goal variables and performs reasonably well in a variety of macroeconomic models.³ The rule can be described by the following equation:

$$i_t = r^* + \pi_t + \alpha_1 y_t + \alpha_2 (\pi_t - \pi^*) \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

where r^* is the long-run equilibrium real interest rate, π_t is the current inflation rate (Taylor takes this as last four quarters average inflation including the current quarter), π^* is the target inflation rate, and y_t is the deviation of output in period t from its long-run trend. The restrictions on the coefficients to have macroeconomic stability are: $\alpha_1 \geq 0$ and $\alpha_2 \geq 0$. Supposing that the coefficient on inflation deviation is less than zero, then a rise in inflation would lead to an interest rate cut, which will induce increased spending. In turn, this would tend to increase aggregate demand, thereby increasing the inflation further (an unstable solution). On the other hand, if it is greater than zero then this instability does not arise, because then the rule ensures that inflation is equal to its targeted value π^* [Taylor (1999a)].

Targeting Rules: Some of the central banks adopted an elaborate framework to keep inflation on target and output on track during the 1990s. To start with, this framework was not 'tightly' supported by academic research. However, it recovered from this deficiency with the evolution of literature on 'inflation targeting' or 'inflation forecast targeting' [Svensson (1997)]. The revised framework starts with a rule that allows some discretion to the central bankers. Hence it was also regarded as 'constrained discretion' by Bernanke and Mishkin (1997) and targeting rule by Svensson (2002). It proceeds like this. The central bank announces a numerical inflation target (point target or target range) and monetary policy has a legislated mandate for achieving this target with clear instrumental independence. There is a high degree of monetary policy transparency and accountability of concerned authorities. The inflation forecast is taken as the intermediate target.

³This indicates the robustness of the rule.

Within targeting rules, a further distinction is made between ‘general targeting rule’ and ‘specific targeting rule’. While the former specifies an operational loss function, which the monetary policy is committed to minimise, in the case of the latter a condition for setting the instrument is specified, e.g., marginal rate of transformation and substitution between the target variables is equalised. It gives an implicit reaction function of the monetary authority that need not be announced. According to this framework, central banks collect large amount of data and use a complex policy formulation to set the path of instrument.⁴ The rule has a good theoretical base as there is no ad hoc representation of reaction function. Here the condition for instrument path is described by optimal first order Euler conditions and the central bank behaviour is not modeled in a mechanical way. There is also a clear role of judgment in the formulation and implementation of monetary policy [Svensson (2005)].

3. MODEL SPECIFICATION AND METHODOLOGY

Ever since the introduction of the Taylor rule, three issues that have occupied much space in research are positive analysis of central banks’ strategy to control inflation, robustness of rule to changes in transmission mechanism and ex-post macroeconomic performance once the rule is adopted. As indicated, the objective of the present study is not to identify the policy reaction function of SBP, instead our focus is on drawing a comparison of actual policy with the one suggested by the Taylor rule. We are also interested in knowing whether the economic performance would have improved had the Taylor rule been followed.

Starting with the first objective, the issue can be addressed either by invoking the standard regression techniques or through a simple comparison of the actual and the simulated data similar to one used by Taylor (1993). Regarding the first option, let us re-specify the Taylor rule as:

$$i_t = r^* + \pi_t + \alpha_1 y_t + \alpha_2^* (\pi_t - \pi^*) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

where

- r^* – Long run equilibrium real interest rate.
- i_t – Short interest rate taken as monetary policy instrument.
- π_t – Average inflation over previous four quarters including the current one.
- y_t – Output gap calculated as percentage deviation of actual output from the normal level.
- π^* – Long run inflation target of the central bank.

There are four parameters, r^* , π^* , α_1 and α_2^* in expression 2. The values of these parameters adopted by Taylor were: 2 percent, 2 percent, 0.5 and 0.5, respectively. Following in Taylor’s footsteps, we have also assumed that the central bank has information on current output and inflation.

The above rule (expression 2) can easily be converted into an estimable form as

$$i_t = \alpha_0 + \alpha_1 y_t + \alpha_2 \pi_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

⁴Examples of such policy formulation are the Reserve Bank of New Zealand and the Bank of England.

where $\alpha_0 = r^* + \alpha_2 \pi^*$ and $\alpha_2 = (1 + \alpha_2^*)$

It is contended that if the SBP strictly follows the rule then parameter values should be $\alpha_0 = 1$, $\alpha_1 = 0.5$ and $\alpha_2 = 1.5$, and if it is not then $\alpha_1 > 0$ and $\alpha_2 \geq 1$ must hold, otherwise the system would be unstable. It is relevant to point out that the second condition is referred to as ‘Taylor Principle’ in the literature [Taylor (1999) and Woodford (2001)].

Expression 3 can be estimated by OLS if time-series properties are satisfied. Otherwise the results are not consistent [Enders (2004)].⁵ For super consistency of the OLS estimates even in the case of non-stationary variables, the estimated residuals have to be stationary. To enforce these constraints, the model parameters in the present study are estimated after testing the presence or otherwise of unit root in the estimated residuals of the equation. In the second step, the short term interest rate is simulated with actual data on output and inflation assuming the Taylor rule as monetary policy strategy. The conjecture is that if the central bank has been following the Taylor rule, then both actual and simulated series should be close to each other showing similar behaviour and the same basic statistics like mean, range, standard deviation etc. It may, however, be added that even though Taylor (1993) has used this approach to evaluate the Fed’s policy, this method is somewhat less sophisticated. It can, nonetheless, perform well in identifying the behaviour of monetary policy instrument.

To accomplish the second objective of the study, the economy needs to be simulated with and without the Taylor rule as monetary policy strategy to assess the macroeconomic performance on the basis of variability in inflation and output and the loss to society. This analysis is undertaken for historical as well as stochastic simulation. In this regard, some issues need further elaboration. The first relates to macroeconomic model on the basis of which the economy is to be simulated. The literature highlights three types of transmission mechanisms emanating from the Lucas-type expectations-augmented Phillips curve model, Neo-Keynesian model, or the New-Keynesian model [Cukierman (2002)]. The estimation of the first and the third model not only requires the assumption of rational expectations, one also needs to have knowledge of prior values of some of the parameters for model calibration. Since the rational expectations hypothesis has not yet been tested in Pakistan, and also no earlier studies are available to provide prior values of the parameters, the obvious choice for the present study has been restricted to the use of the Neo-Keynesian type model suggested by Svensson (1997) and estimated by Rudebusch and Svensson (1999). According to Svensson (1997) the model although simple, has reasonably sound theoretical properties and captures the essential features of more elaborate models which some of the central banks use for policy analysis. The model is backward looking and assumes price rigidity in the economy.⁶ It can be described by the following two equations along with the central bank’s reaction function given as expression 3,

$$y_t = \beta_1 y_{t-1} + \beta_2 (i_{t-1} - \pi_{t-1}) + u_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

⁵Other techniques like Two Stage Least Squares (TSLS), Generalised Method of Moments (GMM), and Vector Autoregression (VAR) etc. may improve estimation efficiency, but it would be at the cost of loss of rule’s theory, as the rule specifies interest rate as a linear function of output gap and inflation.

⁶In the case of Pakistan, inertia in output and inflation is consistent with VAR study by Malik (2006).

$$\pi_t = \gamma_1 \pi_{t-1} + \gamma_2 y_{t-1} + \varepsilon_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (5)$$

The parameter restrictions are: $0 < \beta_1 < 1$, $\beta_2 < 0$, $0 < \gamma_1 > 1$, and $\gamma_2 > 0$. Since prices are assumed to be rigid, the central bank can affect aggregate demand through changes in the real interest rate. Output is affected by one period lagged real interest rate and its effect on inflation is indirect and takes effect after one period. This model can be estimated by OLS as long as the variables under consideration are stationary and there is no cross and contemporaneous correlation between the residuals of the equations in the model. If the variables are non-stationary, then this property can be imposed in the estimation and restricted OLS can be used to estimate the model [Rudebusch and Svensson (1999)]. Furthermore, if there is contemporaneous correlation across the equations, then the system needs to be estimated as a Seemingly Unrelated (SUR) model.

The final objective of the study concerns finding the optimal parameter values of the rule for Pakistan. This has been done by back-casting the economy with different combinations of the parameters in the rule and then comparing the results. The optimal set of parameters is the one that decreases output and inflation variability and hence minimises the loss to society. The expression 6 in the following describes the loss function which is defined over the variances of output gap and inflation respectively.

$$L = \frac{1}{2} [\text{var}(y_t) + \alpha \text{var}(\pi_t)] \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (6)$$

where α is the relative weight assigned by society to inflation. Finally, stochastic simulation establishes the statistical significance of the set of parameters.

4. ESTIMATION RESULTS AND DISCUSSION

Regression Approach

To see whether the SBP has been following the Taylor rule, the model has been estimated for the period 1991-2006 using quarterly data on call money rate (short interest rate taken as monetary policy instrument),⁷ consumer price index (CPI) as a measure of inflation, and real output gap. The results clearly indicate that the actual policy of the SBP does not correspond to the Taylor rule. The coefficient of output gap has opposite sign while the magnitude of inflation is different than the one prescribed by Taylor (1993).⁸ Since the residual series from this estimated equation is stationary as null of the unit root in Augmented Dickey Fuller (ADF) test, it is easily rejected at the conventional level of significance; therefore, we conclude that the results are super consistent.

$$i_t = 4.34 - 0.38 y_t + 0.51 \pi_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

(4.28) (-2.28) (4.17)

Adjusted $R^2 = 0.22$, DW = 0.89

ADF-stats for residuals = -4.11

There are several points related to these results that need further discussion. First, the outcome that the SBP has not been following the Taylor rule should not be

⁷This is the only interest rate data on which are available for the sample period. Call money rate indicates liquidity conditions in the money market and is not directly an indicator of monetary policy stance.

⁸t-statistics in parentheses.

taken as a surprise it has never claimed to be following such a rule. Not only that the policy was ineffective, it was not pursued independently since prior to the 1990s the SBP was mainly directed by the government. The monetary authority only got quasi-independence as a consequence of financial sector reforms initiated during early 1990s. Since then the job is entrusted to the SBP, but it is being conducted in a fairly discretionary manner.

The second point relates to the coefficient of output gap. According to the estimates, the SBP, over the years, has either raised interest rate or contracted money whenever the economy was in the recessionary phase; and this policy was relaxed whenever there was inflationary pressure or the output was above trend or the potential level. This outcome not only contradicts Taylor (1993), it is difficult to justify also. One possible explanation could be that, being the central bank of a developing country, SBP might have resisted leaning against the wind assuming that the economy is less elastic to domestic policy changes compared to external shocks. Therefore, whenever the economy started to blossom due to exogenous factors, the SBP allowed it to do so to keep the momentum going. While this justification makes sense only when there is an up-swing, it is less convincing in the opposite case scenario, especially raising interest rate during a recession. But to be fair with the monetary authority, one cannot rule out the possibility of getting such results in an economy where the central bank's loss function contains monetary policy objectives other than output and inflation, implying that the reaction function (expression 7) is mis-specified.

The third issue is concerned with the coefficient of inflation. According to Taylor Principle, the response of the central bank to inflation must be at least one-for-one otherwise the system would be divergent. This is so because the central bank's persistence with easy money approach when inflation is above target would mean that prices can potentially move without bounds. We have found the coefficient of inflation to be substantially less than one. This implies a pro-cyclical response of monetary policy to the business cycle.⁹ Once again this may have been due to the dominance of shocks to the economy that were outside the purview of the monetary sector.

Fourth, the R^2 is only 0.22 indicating that only about one-fifth of the variation in short interest rate is explained by output gap and inflation. If so, it is essential to identify factors, other than output gap and inflation, which play important role in monetary policy. It is well established that the monetary authority in Pakistan, like in other developing countries, is also worried about exchange rate stability, interest rate smoothing, financial sector stability etc. [Malik (2007)]. Thus an extended specification of the model remains an alternative option to be considered.

Finally, the value of Durbin-Watson (DW) statistics indicates a high degree of autocorrelation in the residuals of the estimated reaction function. One possible implication of this outcome is that the SBP, instead of pursuing a policy consistent with the Taylor type rule that might have increased the interest rate volatility, has preferred to smooth interest rate.¹⁰ Alternatively, it might also be a reflection of a mis-specified model where important variables have been omitted.

⁹SBP, being central bank of a developing country, does not always play a reactionary role. If the economy is in boom it may let it go. While in other times it is proactive in stimulating the economy.

¹⁰While alternative variants of the Taylor rule are proposed in the literature to deal with interest rate smoothing, the weight on this objective is not yet agreed upon.

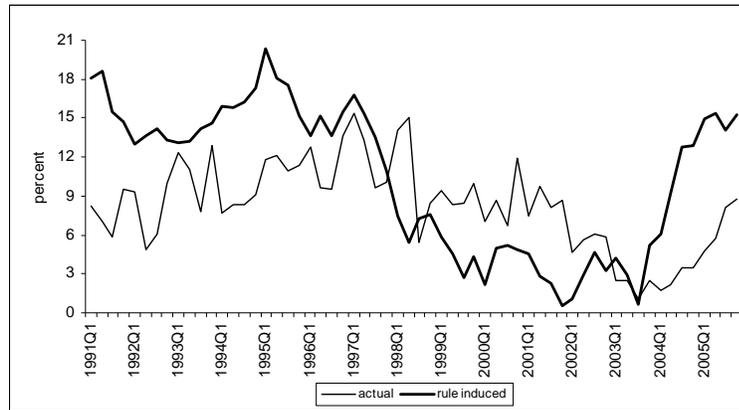
Simulation Approach

Using an alternative methodology, it has been shown that the rule-induced and the actual short-run interest rate have shown fairly different behaviour (Figure 1 and Table 1). With the exception of 1997-99 and 2002-04, the latter has lower average level and the fluctuations are also not as wild as has been the case with the former. It means that the rule would have favoured a more aggressive response to output and inflationary fluctuations than the one adopted by the SBP. This is why the level of variation in the actual interest rate has been quite low as compared to the rule-induced interest rate.

Table 1

<i>Actual and Taylor Rule-induced Short Interest Rate</i>		
	Actual	Rule-induced
Mean	8.24	10.42
Maximum	15.42	20.30
Minimum	1.05	0.51
Range	14.37	19.79
Variance	11.80	32.96
St. Deviation	3.44	5.74

Fig. 1. Actual and the Taylor Rule-induced Short Interest Rate



Next, following Judd and Rudebusch (1998), the time-series was divided into three sub-samples consistent with the era of three former heads of the SBP to see whether or not there was an inclination towards rule-based policy (expressions 8-10). It is quite revealing to find that none of the past three Governors of SBP had an appetite for rule-based policy during 1991-2006. While there was no consideration for output or inflation during 1991-93, the emphasis changed towards growth during 2000-06, probably due to the fact that inflation was already too low. The period in the middle had no clear-cut policy objective—in fact it could be placed somewhere in between the two policy regimes.

$$i_t = 17.04 - 0.60 y_t - 0.78 \pi_t \quad (1991-93 \text{ period}) \quad \dots \quad \dots \quad \dots \quad (8)$$

$$i_t = 8.68 - 0.08 y_t - 0.19 \pi_t \quad (1993-99 \text{ period}) \quad \dots \quad \dots \quad \dots \quad (9)$$

$$i_t = 5.77 - 0.18 y_t - 0.14 \pi_t \quad (2000-06 \text{ period}) \quad \dots \quad \dots \quad \dots \quad (10)$$

Macroeconomic Performance with Taylor Rule

One of the important considerations in managing the economy is that there should be consistency of policies irrespective of the nature of the rule. As indicated, the macroeconomic performance of the economy has been measured by estimating the society's loss function¹¹ where improved macroeconomic performance is defined in terms of less inflation and less output variability. It is argued that inflation variability is negatively correlated with growth because it generates uncertainty that distorts the agents' major economic decisions like saving and investment [Fischer (1993)].

Given this perspective and to accomplish the second objective of the paper, the economy has been back-casted for a period ranging between 1992 and 2006 and the results are compared with the original Taylor rule (using the original parameter values) while the search for the optimal parameter values in the rule is delayed till the next subsection.¹² Counter-factual simulations require estimation of the transmission mechanism (macroeconomic model) of the economy on the basis of which the previous data can be regenerated with alternative monetary policy setting. For this purpose, the Neo-Keynesian type model for Pakistan has been estimated by OLS. The results of estimation are reported as expressions 11 and 12 (with t-statistics in parenthesis).¹³

$$y_t = 0.53y_{t-1} - 0.27(\bar{i}_{t-1} - \bar{\pi}_{t-1}) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (11)$$

$$(4.68) \quad (-3.96)$$

$$S.E = 1.60, \quad DW = 2.08$$

$$\pi_t = 3.72 + 0.51\pi_{t-1} + 0.39y_{t-1} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (12)$$

$$(3.89) \quad (4.61) \quad (1.88)$$

$$S.E = 3.42, \quad DW = 2.04$$

It is evident that the signs of the estimated parameters are consistent with economic theory and the coefficient values are also in the acceptable range. Output is affected by its own lagged values and the average real interest rate over the previous four quarters. Inflation too has one-period inertia and it is also affected by the output gap of the previous quarter. These results confirm that, contrary to popular stance held by the central bank, only about one third of inflation in Pakistan is explained by monetary factors. Using these results and invoking the assumption that the Taylor rule has been the monetary policy strategy, the back-casting exercise of the economy was undertaken by incorporating in each period the estimated shocks (to output and inflation) from Equations 11 and 12. The striking outcome of this exercise has

¹¹It is assumed that the society puts equal weight to inflation and output stability.

¹²The entire process has followed the following course of action. The three-equation model includes demand and supply equations and a money reaction function. Here the Taylor rule generates the value of real interest rate, which when used in the demand function allows us to determine the value of output y . When substituted in the supply function, it generates value of π . The rule based values of y and π are then compared with actual values. An outcome is preferred where variations in these variables are low.

¹³Results by SUR model and by FIML have been found almost the same as there is insignificant contemporaneous correlation between the residuals of the two equations in the model.

been that the economy would have performed better if the Taylor rule had been adopted rather than sticking with the discretionary policy stance (Table 2). Adoption of the Taylor rule would have decreased the variability in output gap and inflation.

To reconfirm these results further and to avoid over-reliance on historical simulation (one time estimates), stochastic simulation has also been carried out. This has been done by bootstrapping the standard deviation of output and inflation. The average results of 1000 trials along with the standard errors of estimates, presented in Table 2, reconfirm the earlier results (reduction in output and inflation variability) that continue to hold true even when the bootstrapped measure of variation is used. Similarly the probability (p-value) of standard deviation of rule based output gap and inflation, being greater than the one found in the actual data, is quite low. We have found that in only 20 out of 1000 simulations the standard deviation of simulated output gap has been greater than or equal to that of the actual data. For inflation series, it was true for 100 simulations. These results again prompt us to conclude that the Taylor rule would have performed significantly better than the actual policy that was pursued by SBP during 1991-2006.¹⁴

Table 2

		<i>Simulation with the Taylor Rule and the Estimated Model</i>			
		Actual	Rule Based		
			Historical	Stochastic*	p-value**
Interest Rate	Average	8.28	9.24		
	St Deviation	3.53	3.18		
Output Gap	Average	-0.24	-0.83		
	St Deviation	2.47	1.72	1.80 (0.21) (0.21)	0.002
Inflation	Average	7.36	7.00		
	St Deviation	4.31	3.50	4.04 (0.47) (0.47)	0.10

*Average of 1000 values of standard deviations in bootstrap simulation. Standard errors in parenthesis.

** Probability of standard deviation of a variable with rule being greater than that of actual data.

Finding the Optimal Parameter Values for Pakistan

In an effort to find optimal parameter values (in Taylor rule) for Pakistan, we start with the optimal inflation target. The anecdotal evidence suggests that the central banks that have adopted inflation-targeting as monetary policy strategy announce about 2 percent inflation target, though with some tolerance range.¹⁵ This is in line with Taylor (1993) who advocated an inflation target of 2 percent that was consistent with the 2 percent real economic growth of the USA. Compared to this, Pakistan being a developing country with a natural requirement for higher growth rate, cannot opt for a low real growth (and inflation) target of 2 percent. But to avoid ad hocism, we have used seven different inflation target options for simulation purpose. To start this process, the 2 percent target was adopted to simulate the economy.

¹⁴The comparison of actual and backcasted data on inflation, output-gap and interest rate using Taylor rule is given in Appendix A, Figure 2.

¹⁵None of the central banks, with any monetary policy strategy, target zero-inflation as central banks are not inflation nutters in King (1997a) terminology.

Since Pakistan experienced an average rate of about 5 percent real GDP growth over the period 1980-2006, this rate was selected as another option. Similarly, following the empirical evidence of Khan and Senhadji (2001) and Mubarak (2005) five values ranging between 7 percent and 11 percent have also been used.

The long-run equilibrium real interest rate has been calculated for Pakistan as the difference between the average nominal interest rate and inflation over the periods, 1973-2006, 1981-2006 and 1991-2006 as shown in Table 3.¹⁶ Even though the results do not portray a clear pattern, nevertheless in all the three periods the average real interest rate was found to be close to zero. As a result, the equilibrium value of zero real interest rate has been used as benchmark in the counterfactual simulation.

Finally, the optimal weights for output and inflation in the Taylor rule for Pakistan have been estimated. Even though Taylor (1993) used equal weight of 0.5 for both the objectives, i.e., output and inflation, we have used this scheme as a starting point only. In two subsequent scenarios, either the entire weight was assigned to output stabilisation with no regard for inflation deviation or according more importance to inflation than output deviation. While the former alternative could be more attractive for the developing countries (at least with asymmetric response) where output was the primary and inflation the secondary issue, the latter possibility is obviously more attractive for stable economies where more emphasis is on inflation control or price stability.¹⁷

Table 3

Estimation of Long-run Real Interest Rate

	1973-2006	1981-2006	1991-2006
Average Interest Rate	8.34	8.01	8.24
Average CPI Inflation	9.16	7.52	7.89
Average GDPD Inflation	8.92	8.02	8.92
Equilibrium Real Interest Rate*	-0.82	0.49	0.35
Equilibrium Real Interest Rate**	-0.58	0.00	-0.68

* When inflation is calculated as percentage growth in CPI.

** When inflation is calculated as percentage growth in GDP Deflator.

We have taken these three sets of weights and seven different targets of inflation (a total of 21 cases) and back-casted the output gap, inflation, and interest rate using estimated parameters and shocks in the macroeconomic model comprising equations 11 and 12. From the results of 21 cases, the best set of parameter values for Pakistan was selected on the basis of minimised variability in inflation and output and the minimum values of the loss to society. We have found that variability in inflation is a decreasing function of the level of inflation target but the variability of output started increasing above a certain level of inflation target.

The first best set of parameter values with which the rule has performed well in reducing the variability of inflation and output is the case when the central bank assigns

¹⁶Judd and Rudebusch (1998) used this methodology for the U.S. data.

¹⁷It should be noted however that none of the central banks, even the inflation targeting ones, practically do this, as inflation targeting is flexible in the sense that central banks put some weight on output stabilisation too, [Svensson (1997) and Ball (1999)].

equal weights to output and inflation stabilisation in the reaction function and targets inflation at 8 percent with zero real interest rate.¹⁸ The rule with this set of parameter values is given in Equation 13. This roughly indicates the optimal level of inflation for Pakistan and the results are consistent with earlier findings of Mubarik (2005) and Khan and Senhadji (2001).

$$i_t = 0 + \pi_t + 0.5y_t + 0.5(\pi_t - 8) \text{ or } i_t = -4 + 0.5y_t + 1.5\pi_t \quad \dots \quad \dots \quad (13)$$

The results for the measures of macroeconomic performance by the rule (both in case of historical as well as stochastic simulation) with the first best set of parameter values are given in Table 4. The procedure adopted here for comparison is the same as discussed above for the actual Taylor rule. It is clear that the variability in output gap and inflation decreases as we move from discretionary policy towards the Taylor rule when the first best set of parameter values for Pakistan are used. However the average values of the variables are somewhat greater. To confirm these results, and to find the probability of standard deviation of output and inflation in simulated series being greater than that in the actual series, we have used stochastic simulation by re-sampling the estimated shocks. The results indicate that the variability of both the variables has been lower, even in repeated simulation and the probability is also quite low.¹⁹

Table 4

		<i>Simulation with the First Best Set of Parameter Values</i>			
		Actual	First Best Set		p-value**
			Historical	Stochastic*	
Interest Rate	Average	8.28	8.08		
	St Deviation	3.53	3.11		
Output Gap	Average	-0.24	0.3		
	St Deviation	2.47	1.67	1.72 (0.24)	0.05
Inflation	Average	7.36	7.88		
	St Deviation	4.31	3.49	3.91 (0.47)	0.2

* Average of 1000 values of standard deviations in bootstrap simulation.

** Probability of standard deviation of a variable with rule being greater than that of actual data.

The second best set of parameter values was found when the central bank assigned one-hundred percent weight to output stabilisation with no response to inflation deviation from the target. The implication is that it does not matter what level of inflation is optimal to target. Regarding macroeconomic performance by the Taylor rule, the parameter values given below in Equation 14 were used.

$$i_t = 0 + \pi_t + y_t + 0(\pi_t - \pi^*) \text{ or } i_t = \pi_t + y_t \quad \dots \quad \dots \quad \dots \quad \dots \quad (14)$$

¹⁸The coefficient values are same as proposed by Taylor but inflation target is different.

¹⁹Comparison of actual and simulated data on inflation, output gap and interest rate using this proposed rule is given in Appendix A, Figure 3.

It can be seen from Table 5 that variability in interest rate, output gap and inflation decreased as one moved away from discretionary policy towards the proposed Taylor rule for Pakistan.^{20,21} The average values of all the three variables are found to be slightly greater when the rule is followed. To confirm these results further and to find out whether or not the probability of standard deviation of output and inflation in simulated series turns out to be greater than that in the actual series, stochastic simulation was used to resample the estimated shocks. The outcome confirmed that the variability remained lower even in the repeated simulations. It was also found that the probability of standard deviation of output and inflation being greater in simulated series than that in the actual data, with the rule as monetary policy strategy was quite low.²²

Table 5

		<i>Simulation with the Second Best Set of Parameter Values</i>			
		Actual	Second Best Set		p-value**
			Historical	Stochastic*	
Interest Rate	Average	8.28	8.17		
	St Deviation	3.53	2.58		
Output Gap	Average	-0.24	0.25		
	St Deviation	2.47	1.55	1.70 (0.20)	0.03
Inflation	Average	7.36	7.84		
	St Deviation	4.31	3.62	4.18 (0.48)	0.2

* Average of 1000 values of standard deviations in bootstrap simulation.

** Probability of standard deviation with rule being greater than that of actual data.

Loss Function and Comparison of Parameter Values

Besides minimising the variability in output and inflation, one can also calculate and compare loss to society associated with each set of parameter values as an attractive alternative. The loss function not only includes both the objectives, it also takes care of the trade off between them. In this respect it can do a better job of finding out the optimal parameter values.

For estimating the loss function, expression 6 has been used. In an effort to ensure comparability, the assumption that society assigns equal weight to inflation and output has been maintained. Using expressions 11 and 12, the economy has been back-casted for 21 sets of parameters discussed above, one at a time and the best set of parameters was chosen which minimised the loss function.

The results presented in Table 6 show that the loss is minimum when inflation target is set at 8 percent and equal coefficients of output and inflation in the reaction function are adopted. The second best set of parameter values has been found exactly the same as was proposed by Taylor. The third best option is found when the entire weight is given to real stabilisation in the reaction function. The results of stochastic simulation exercise given in Table 6 confirm these findings. It can be seen that the performance of

²⁰By the proposed Taylor rule we mean the rule with parameter values found optimal for Pakistan.

²¹Detailed comparison of actual and simulated data on inflation, output gap and interest rate with this proposed rule is given in Appendix A, Figure 4.

²²However this probability is higher in case of inflation.

the rule (with either set of parameters) is, on average, better than that in case of actual policy. The results show that there is very low probability (0.02 in all cases) of loss, associated with the rule, being greater than that with actual policy setting. Interestingly, Taylor's proposed parameter values give better results than the second best possibility when historical simulation is undertaken but the opposite is true in the case of stochastic simulation.

Table 6

Loss Associated with Different Parameter Values for the Rule

	Variance		Loss to Society		p-value**
	Output	Inflation	Historical	Stochastic*	
Actual Data	6.10	18.54	12.32		
First Best	2.80	12.15	7.48	7.82 (1.92)	0.02
Second Best	2.40	13.11	7.76	8.10 (1.78)	0.02
Taylor Rule	2.94	12.25	7.60	8.26 (1.72)	0.02

* Standard error in parenthesis.

** Probability of loss associated with rule being greater than that of actual data.

5. SUMMARY AND CONCLUDING REMARKS

In this study the Taylor rule for Pakistan has been estimated for the period 1991-2006 and for the sub-samples covering the period of three former Governors of SBP. One of the important findings of the study is that monetary policy has been generally conducted through discretionary measures rather than adopting a rule. This could have been due to the SBP's concentration on policy objectives other than inflation and output stabilisation. Through historical and stochastic simulation, the study has concluded that commitment to the Taylor-type rule would have significantly improved the macroeconomic performance, especially in terms of less variability of output and inflation. Regarding parameter values in the rule, it has been found that targeting inflation at 8 percent and treating output and inflation equally in the policy reaction function would have yielded an optimal scenario for the SBP.²³

The key messages that emerges from the study are as follows:

First, notwithstanding the fact that the pre-requisites for more elaborate policy rules are lacking and the institutional capacity is also quite weak in Pakistan, yet there is ample scope to reap benefits by committing to simple instrument rules with a clear understanding of the warning issued by McCallum (2000). It is proposed that adoption of simple instrument rules may be regarded as a first step for Pakistan and other developing countries to move from discretionary policy to a more elaborate inflation targeting framework. Second, although there is a need for having an elaborate range of targets in the monetary policy framework (including output and inflation), the study is not putting any restrictions on these possibilities, i.e., incorporating other objectives in the simple

²³These results are based on the assumption of zero real interest rate.

rules. However, we recommend a humble beginning as it allows better understanding of ground realities. Third, it is also advisable to adjust the parameters in the rule (especially the inflation target) according to the economic conditions prevalent in the economy.

Finally, it may be added that currently this is a passionately pursued area of research in macroeconomics. Thus, there is ample scope for further research. To start with, the inconclusiveness of literature on the Taylor rule, especially the coefficients of variables other than output and inflation in the policy reaction function, can provide further insights for developing countries, including Pakistan. There is also a possibility for exploring ways and means for adopting a more elaborate inflation targeting framework. In this regard the research can focus on the pre-requisites such as central bank independence, and transparency and accountability of its actions. These three notions might be the outcome of elaborate policy rules and not just the pre-requisites for it. Research in this area would be quite beneficial for developing countries where institutions are not yet strong and the focus on issues like monetary policy transparency and accountability is generally quite weak.

APPENDIX - A

Fig. 2. Actual and Taylor Rule-induced Short Interest Rate, Output Gap and Inflation

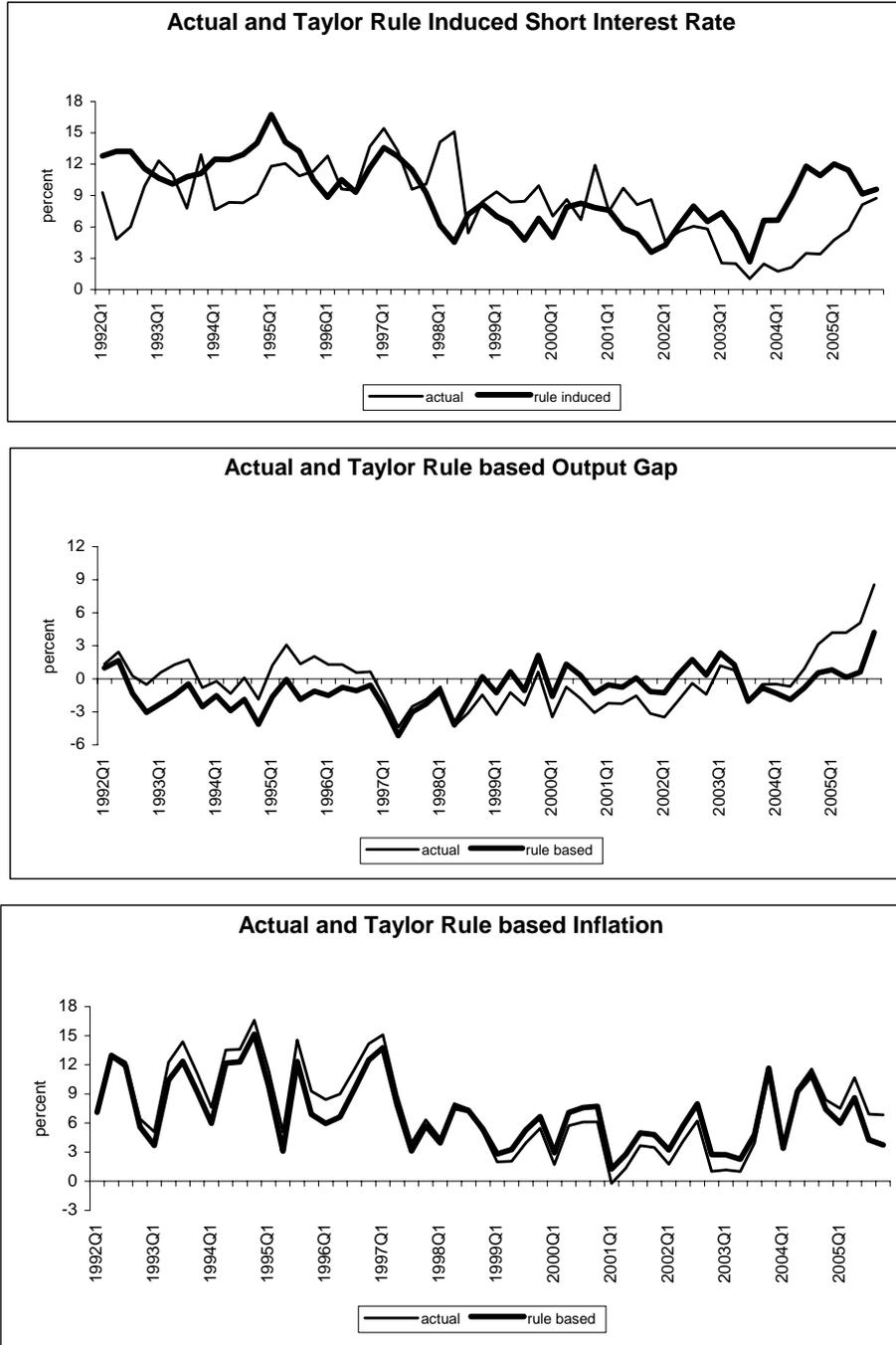


Fig. 3. Actual and First Best Rule-induced Short Interest Rate, Output Gap and Inflation

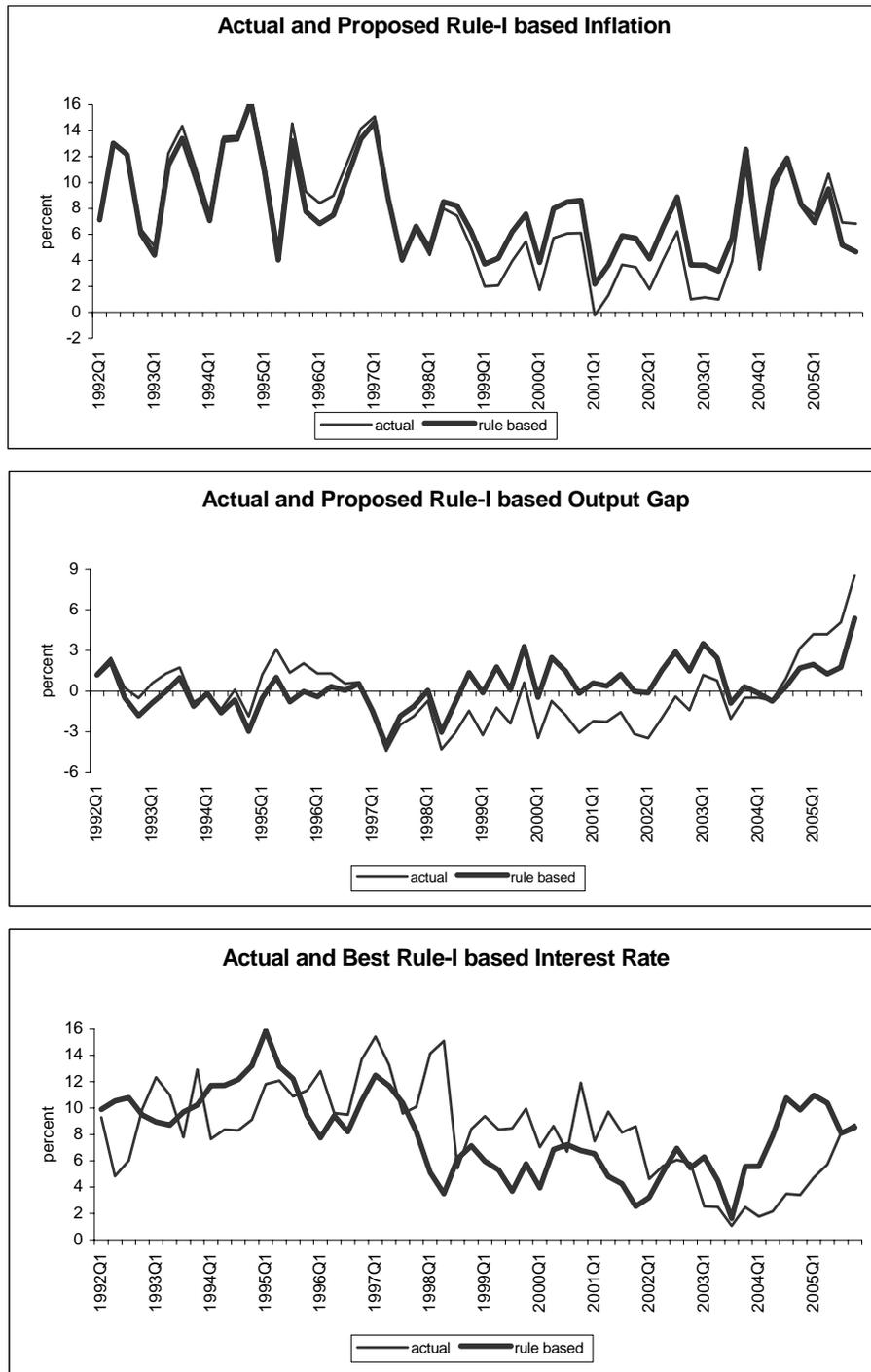
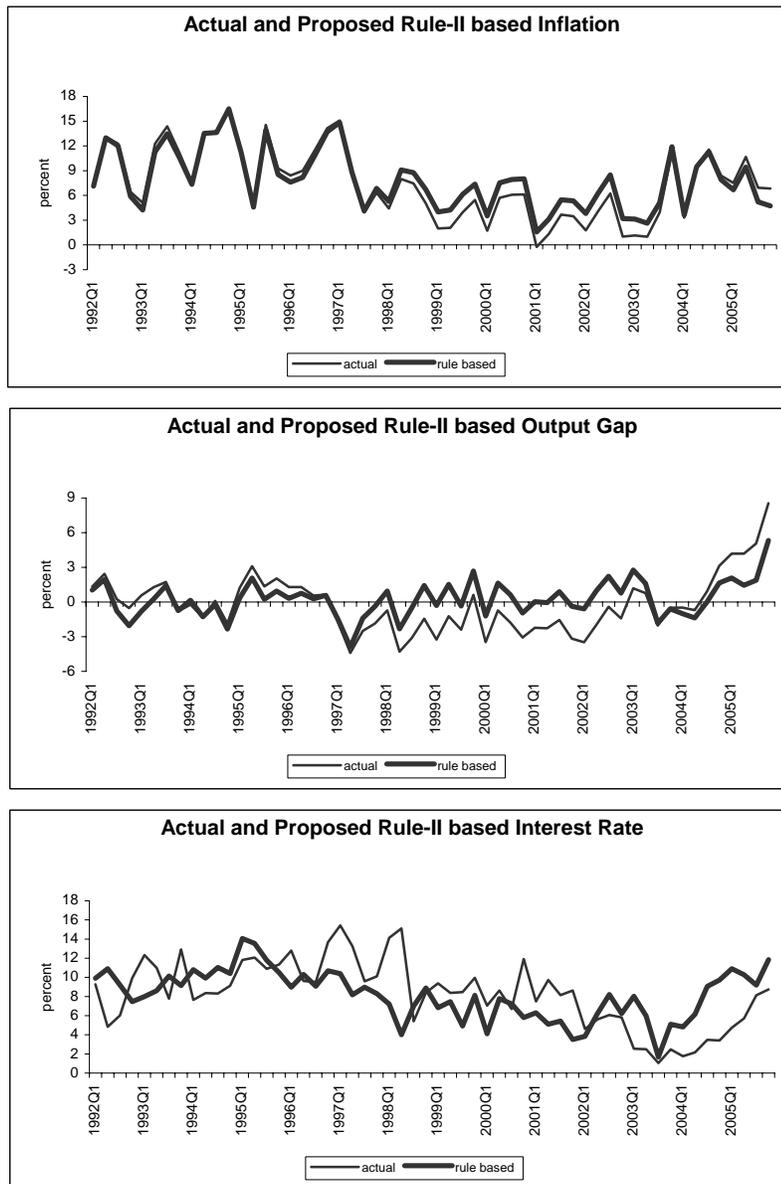


Fig. 4. Actual and Second Best Rule-induced Short Interest Rate, Output Gap and Inflation



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Environmental Efficiency Analysis of Basmati Rice Production in Punjab, Pakistan: Implications for Sustainable Agricultural Development

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The intensive use of chemicals worked as a catalyst to shift the production frontier but the most critical factor of maintaining a clean environment was totally ignored. The present study attempts to estimate the environmental efficiency of rice production by employing the translog stochastic production frontier approach. The data are collected from five major Basmati rice growing districts (Gujranwala, Sheikupura, Sialkot, Hafizabad, and Jhang) of Punjab in 2006. Chemical weedicides and nitrogen are treated as environmentally detrimental inputs. The mean technical efficiency index is sufficiently high (89 percent) but the environmental efficiency index of chemical weedicides alone is 14 percent while the joint environmental efficiency index of chemical weedicides and nitrogen is 24 percent implying that joint environmental efficiency is higher than chemical weedicide alone. It indicates that substantial reduction (86 percent) in chemical weedicide use is possible with higher level of productivity. Moreover, it is likely to contribute a considerable decrease in environmental pollution which is expected to enhance the performance of agriculture labour. The reduction in chemical weedicides will save Rs 297 per acre and Rs 1307.3 million over all from the rice crop in Punjab, improving the profitability of rice growing farmers by the same proportion. Empirical analysis indicates that reduction in environmental pollution together with higher level of profitability in rice production is achievable.

JEL classification: N5, O13

Keywords: Rice Production, Environmental Efficiency, Weedicide, Fertiliser (NPK), Stochastic Translog Frontier

1. INTRODUCTION

Rice is one of the most important food crops that augment and earn foreign exchange for the national economy.. It contributes more than two million tonnes to our food requirements and is a major source of employment and income generation in the rice growing areas of the farm land. Rice is the third largest crop in terms of area sown, after wheat and cotton. It was cultivated on over 2.9 million hectares in 2008. Accounting for 5.9 percent of the total value added in agriculture and about 1.3 percent to GDP [Pakistan (2009a)] its importance in the national economy is obvious. Pakistan has two major rice-

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producing provinces, Punjab and Sindh. Both provinces account for more than 88 percent of total rice production. Punjab, due to its agro-climatic and soil conditions has assumed the position of a major centre of Basmati rice production, accounting for nearly all the Basmati rice the country produces.

It is well documented that the use of fertiliser and pesticides (insecticides, weedicides and herbicides) in agriculture has increased manifolds since the introduction of the so-called green revolution. The intensive use of inputs has worked as a catalyst to shift the production frontier of almost all grain crops to feed the growing population but the most critical factor of maintaining a clean environment has been totally ignored. Pesticides play an important role in raising agricultural yields in developing countries. They offer the most attractive low cost method of increasing output per hectare of land and give the farmer a high economic return for his labour and investment. The use of pesticides has considerably increased in developing countries however its advantages seem to have not been fully exploited [Nguyen, *et al.* (2003)]. It is observed that the quantity of agrochemicals used in the agricultural system of Pakistan has increased more than four times just in seventeen years i.e., from 1990 to 2007. The total quantity of agrochemicals consumed increased from 20213 tonnes in 1990 to 94265 tonnes in 2007 and in value terms, the consumption increased from 5536 million Rupees to 10534 million Rupees for the same period [Pakistan (2009b)]. The negative impact of these agrochemicals on human productivity, environment and ground water quality has been neglected in the past, posing a grave threat to the sustainability of agriculture production system.

The increasing awareness about the role clean environment plays in human productivity has intensified the demand to eliminate or minimise the negative externalities of different production systems. Like any other production system, agriculture also generates positive and negative externalities. The challenge for scientists is to minimise or eliminate the negative externalities to sustain the clean environment for future generations while increasing the productivity level through modern technologies or reducing environmental pollution by sustaining productivity levels with the given set of technologies. Fertiliser, pesticides, weedicides and herbicides are the major inputs that cause environmental and ground water pollution in agriculture sector. These inputs could be re-allocated in a way that environmental pollution was significantly reduced by keeping output levels within a given framework of production technologies and available resources.

A significant body of literature exists dealing with the technical and allocative efficiency in different crops and in different regions [Good, *et al.* (1993); Ahmed and Bravo-Ureta (1996); Wilson, *et al.* (1998); Wadud (1999); Wang and Schmidt (2002); Larson and Plessman (2002); Villano (2005); Abedullah, *et al.* (2007)] but little work has been done to estimate the environmental efficiency of agro-chemicals (weedicide, pesticide, herbicide and fertiliser) in agricultural production system [Reinhard, *et al.* (1999); Zhang and Di-Xue (2005) and Wu (2007)] which is expected to play an important role in the reduction of environmental pollution. According to our knowledge there is no study in respect of Pakistan that deals with environmental efficiency. The present study hopefully would fill this gap. The objective of the present study is to estimate the environmental efficiency of chemical weedicides and fertiliser in rice production by employing a stochastic production frontier approach.

The scheme of the paper is as follows. The next section presents the conceptual framework and delineates the empirical model with variable specification to explain the estimation procedure of technical and environmental efficiency. This section also explains the selection of sample and the data collection procedure. Empirical results are presented and implications are derived in the subsequent section. Section 4 discusses the limitation of data. The summary and conclusion is presented in the last section.

2. METHODOLOGY AND DATA COLLECTION PROCEDURE

The methodology is defined in two steps: conceptual framework and empirical model. The conceptual framework discusses general procedure adopted to estimate the technical and environmental efficiency while the empirical model explains the details of production function specification and mathematical manipulation employed to estimate environmental efficiency. The last part of this section explains the data collection procedure used for empirical analysis.

2.1. Conceptual Framework

There are two main approaches (with a number of sub-options under each) to measure technical efficiency (TE). These include, stochastic frontier (parametric approach) and data envelop analysis (DEA), also named as non-parametric approach. These two methods have a range of strengths and weaknesses which may influence the choice of methods, in particular with regard to application and constraints. The advantages and disadvantages of each approach have been discussed by Coelli (1996), Coelli and Perelman (1999). The present study is employing a stochastic frontier production approach introduced by Aigner, *et al.* (1977); and Meeusen and van den Broeck (1977), later on followed by a number of studies. Following their specification, the stochastic production frontier can be written as,

$$y_i = F(x_i, \beta)e^{\varepsilon_i} \quad i = 1, 2, \dots, N \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

where, y_i is output for the i -th farm, x_i is a vector of k inputs, β is a vector of k unknown parameters, ε_i is an error term. The stochastic frontier is also called “composed error” model, because it postulates that the error term ε_i is decomposed into two components: a stochastic random error component and a technical inefficiency component as follow,

$$\varepsilon_i = v_i - u_i \quad \dots \quad (2)$$

where, v_i is a symmetrical two sided normally distributed random error that captures the stochastic effects beyond the farmer’s control (e.g., adverse weather, natural disasters and what the farmer might call ‘his luck’), measurement errors, and other statistical noise. It is assumed to be independently and identically distributed $N(0, \sigma_v^2)$. Thus, v_i allows the frontier to vary across farms, or over time for the same farm, and therefore the frontier is stochastic. The term u_i is one sided ($u_i \geq 0$) efficiency component that captures the technical efficiency of the i -th farmer. The variance parameters of the model are parameterised as:

$$\sigma_s^2 = \sigma_v^2 + \sigma_u^2, \gamma = \frac{\sigma_u^2}{\sigma_s^2} \text{ and } 0 \leq \gamma \leq 1 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

The parameter γ must lie between 0 and 1. The maximum likelihood estimation of Equation (1) provides consistent estimators for β , γ , and σ_s^2 parameters. Hence, Equation (1) and (2) provide estimates for v_i and u_i after replacing ε_i , σ_s^2 and γ by their estimates. Multiplying by e^{-v_i} both sides of Equation (1) and replacing β 's with maximum likelihood estimates, yields stochastic production frontier as:

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

where, y_i^\bullet is the observed output of the i -th farm adjusted for the statistical random noise captured by v_i [Bravo-Ureta and Rieger (1991)]. All other variables are as explained earlier and β^\otimes is the vector of parameters estimated by the maximum likelihood estimation technique. The technical efficiency (TE) relative to the stochastic production frontier is captured by the one-sided error components $u_i \geq 0$, i.e.

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

The technical efficiency index in Equation (5) can be defined as the ratio of the observed to maximum feasible output which is estimated by employing the traditional stochastic production frontier approach while according to Reinhard, *et al.* (2000, 2002) the environmental efficiency index can be defined as the ratio of minimum feasible to the observed use of an environmentally detrimental input, given technology and the observed levels of output and conventional inputs.

Pittman (1983) was the first to consider environmental effects as undesirable outputs while estimating the Törnqvist index of productivity change. However, undesirable outputs cannot be priced in the markets because markets do not exist for such products; hence the modeling of undesirable products is feasible only if the undesirable outputs can be valued by their shadow prices. The author used econometric techniques to estimate shadow prices of demand for biochemical oxygen generated in the process of converting wood pulp to paper for thirty Michigan and Wisconsin mills, but it is observed that shadow prices are constant across all the observation. Following Pittman (1983), Fare, *et al.* (1989) and Fare, *et al.* (1993) also modeled environmental effects as undesirable outputs. All these studies include environmental effects in the output vector, and then to obtain inclusive measures of technical efficiency, and occasionally, productivity change, incorporate the generation of one or more environmental effects as by-products of production process [Reinhard, *et al.* (1999)]. However, Pittman (1981) is the first who modeled pollution as an input in the production function and later his approach is refined and modified by Haynes, *et al.* (1993), Haynes, *et al.* (1994), Hetemäki (1996), Boggs (1997) and Reinhard, *et al.* (1999). These seminal works have considered environmental effects as a conventional input rather than as an undesirable output which distinguished their study from the earlier literature. Recently this approach has been adopted by Reinhard, *et al.* (2002), Zhang and Xue (2005) and Wu (2007). Following the later group of studies we also incorporated environmental effects (weedicide and fertiliser) as a conventional input in the production process. Different

studies have used different variables as environmental determinant according to their objectives and availability of data. We consider weedicides and fertiliser as environmentally detrimental in rice production however since pesticides are being used only by a small number of farmers (less than 15 percent) and on an average its impact on the production process is not expected to be significant. Following Reinhard, *et al.* (1999) we estimated technical and environmental efficiency separately.

The mathematical representation of environmental efficiency can be written as:

$$EE = \min \{ \Phi : F(X, \Phi Z) \geq Y \} \leq 1 \quad \dots \quad \dots \quad \dots \quad \dots \quad (6)$$

where, $F(X, \Phi Z)$ is the new production frontier and $(X, Z) \in R_+$ (a set of positive real numbers) while X and Z are, respectively a vector of conventional and environmentally detrimental input and $Y \in R_+$ is yield estimated by employing maximum likelihood estimation technique as defined earlier in Equation 1. To obtain the environmental efficiency index, a new frontier production function as defined in Equation 6 could be developed by replacing the observed environmentally detrimental input vector Z with ΦZ and setting $u_i = 0$, representing a function at full technical efficiency. The environmental efficiency is explained by employing the definition of Reinhard, *et al.* (2000); Reinhard *et al.* (2002) as $EE = \Phi Z/Z$ and then by taking natural logarithm on both sides of the equation, it can be written with more detail as below:¹

$$\text{Ln } EE = \text{Ln } \Phi Z - \text{Ln } Z = \text{Ln}(\Phi Z/Z) = \text{Ln } \Phi \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

Where, “LnEE” is the logarithm of environmental efficiency and it is equal to the logarithm of new frontier function with $u_i = 0$ minus the original frontier function when $u_i \neq 0$.

2.2. Empirical Model

There is only one output in our case and therefore, as discussed by Wu (2007) we estimate a stochastic production frontier rather than a stochastic distance function to relate the environmental performance of individual farms to the best of environment-friendly farming. To minimise the misspecification of model we have used a stochastic translog production frontier and under the assumption of one environmentally detrimental variable X_7 (which is represented by Z due to environmentally detrimental variable), the translog production frontier is defined as below:

$$\begin{aligned} \text{Ln } Y = & \beta_0 + \beta_1 \text{Ln } X_1 + \beta_2 \text{Ln } X_2 + \beta_3 \text{Ln } X_3 + \beta_4 \text{Ln } X_4 + \beta_5 \text{Ln } X_5 + \beta_6 \text{Ln } X_6 + \\ & \beta_7 \text{Ln } Z + 0.5\beta_{11} \text{Ln}^2 X_1 + 0.5\beta_{22} \text{Ln}^2 X_2 + 0.5\beta_{33} \text{Ln}^2 X_3 + 0.5\beta_{44} \text{Ln}^2 X_4 + \\ & 0.5\beta_{55} \text{Ln}^2 X_5 + 0.5\beta_{66} \text{Ln}^2 X_6 + 0.5\beta_{77} \text{Ln}^2 Z + \beta_{12} \text{Ln } X_1 \text{Ln } X_2 + \\ & \beta_{13} \text{Ln } X_1 \text{Ln } X_3 + \beta_{14} \text{Ln } X_1 \text{Ln } X_4 + \beta_{15} \text{Ln } X_1 \text{Ln } X_5 + \beta_{16} \text{Ln } X_1 \text{Ln } X_6 + \\ & \beta_{17} \text{Ln } X_1 \text{Ln } Z + \beta_{23} \text{Ln } X_2 \text{Ln } X_3 + \beta_{24} \text{Ln } X_2 \text{Ln } X_4 + \beta_{25} \text{Ln } X_2 \text{Ln } X_5 + \\ & \beta_{26} \text{Ln } X_2 \text{Ln } X_6 + \beta_{27} \text{Ln } X_2 \text{Ln } Z + \beta_{34} \text{Ln } X_3 \text{Ln } X_4 + \beta_{35} \text{Ln } X_3 \text{Ln } X_5 + \\ & \beta_{36} \text{Ln } X_3 \text{Ln } X_6 + \beta_{37} \text{Ln } X_3 \text{Ln } Z + \beta_{45} \text{Ln } X_4 \text{Ln } X_5 + \beta_{46} \text{Ln } X_4 \text{Ln } X_6 + \\ & \beta_{47} \text{Ln } X_4 \text{Ln } Z + \beta_{56} \text{Ln } X_5 \text{Ln } X_6 + \beta_{57} \text{Ln } X_5 \text{Ln } Z + \beta_{67} \text{Ln } X_6 \text{Ln } Z + (v - u) \quad \dots \quad (8) \end{aligned}$$

¹According to Reinhard, *et al.* (2002) and Reinhard, *et al.* (2000) the environmental efficiency is the ratio of minimum feasibility to an observed input which is environmentally detrimental.

Where Ln represents the natural logarithm, Y is the yield in maunds per acre, X_1 is tractor hours used for land preparation, X_2 is amount of seed in kg, X_3 is the number of irrigations, X_4 is the amount of labour in hours per acre, X_5 is per acre active nutrient of Phosphorus and Potash (PK) in kg, X_6 is per acre active nutrients of nitrogen (N) in kg, and Z is the cost of chemical weedicide in Rupees per acre and it is also considered as the environmentally detrimental variable. The Equation (8) can be estimated by employing Frontier Version 4.1 developed by Coelli (1994). The new stochastic frontier function as discussed above in empirical framework can be obtained by replacing Z with ΦZ in Equation (8) in such a way that technical inefficiency of each farmer approaches to zero (i.e., $u_i = 0$) that exists in the original frontier function (Equation 8). It should be noted that Φ is environmental efficiency index. Hence, the new translog function can be written as,

$$\begin{aligned}
 LnY = & \beta_0 + \beta_1 Ln X_1 + \beta_2 Ln X_2 + \beta_3 Ln X_3 + \beta_4 Ln X_4 + \beta_5 Ln X_5 + \beta_6 Ln X_6 + \\
 & \beta_7 Ln \Phi Z + 0.5 \beta_{11} Ln^2 X_1 + 0.5 \beta_{22} Ln^2 X_2 + 0.5 \beta_{33} Ln^2 X_3 + 0.5 \beta_{44} Ln^2 X_4 + \\
 & 0.5 \beta_{55} Ln^2 X_5 + 0.5 \beta_{66} Ln^2 X_6 + 0.5 \beta_{77} Ln^2 \Phi Z + \beta_{12} Ln X_1 Ln X_2 + \\
 & \beta_{13} Ln X_1 Ln X_3 + \beta_{14} Ln X_1 Ln X_4 + \beta_{15} Ln X_1 Ln X_5 + \beta_{16} Ln X_1 Ln X_6 + \\
 & \beta_{17} Ln X_1 Ln \Phi Z + \beta_{23} Ln X_2 Ln X_3 + \beta_{24} Ln X_2 Ln X_4 + \beta_{25} Ln X_2 Ln X_5 + \\
 & \beta_{26} Ln X_2 Ln X_6 + \beta_{27} Ln X_2 Ln \Phi Z + \beta_{34} Ln X_3 Ln X_4 + \beta_{35} Ln X_3 Ln X_5 + \\
 & \beta_{36} Ln X_3 Ln X_6 + \beta_{37} Ln X_3 Ln \Phi Z + \beta_{45} Ln X_4 Ln X_5 + \beta_{46} Ln X_4 Ln X_6 + \\
 & \beta_{47} Ln X_4 Ln \Phi Z + \beta_{56} Ln X_5 Ln X_6 + \beta_{57} Ln X_5 Ln \Phi Z + \beta_{67} Ln X_6 Ln \Phi Z + v \quad \dots \quad \dots \quad (9)
 \end{aligned}$$

By subtracting Equation (8) from Equation (9) and with little mathematical manipulation the result can be written as:

$$\begin{aligned}
 0.5 \beta_{77} [Ln \Phi Z - Ln Z]^2 + [\beta_7 + \beta_{17} Ln X_1 + \beta_{27} Ln X_2 + \beta_{37} Ln X_3 + \beta_{47} Ln X_4 \\
 + \beta_{57} Ln X_5 + \beta_{67} Ln X_6 + \beta_{77} Ln Z] [Ln \Phi Z - Ln Z] + u = 0 \quad \dots \quad \dots \quad \dots \quad (10)
 \end{aligned}$$

By employing the result of Equation (7) in Equation (10) it can be modified as follow:

$$0.5 \beta_{55} [Ln EE]^2 + [\beta_7 + \beta_{17} Ln X_1 + \beta_{27} Ln X_2 + \beta_{37} Ln X_3 + \beta_{47} Ln X_4 + \beta_{57} Ln X_5 + \beta_{67} Ln X_6 + \beta_{77} Ln Z] [Ln EE] + u \quad \dots \quad (11)$$

Now Equation (11) can be solved for LnEE by using the quadratic equation formula as below:²

$$\begin{aligned}
 Ln EE = & \left[-(\beta_7 + \beta_{17} Ln X_1 + \beta_{27} Ln X_2 + \beta_{37} Ln X_3 + \beta_{47} Ln X_4 + \beta_{57} Ln X_5 + \right. \\
 & \left. \beta_{67} Ln X_6 + \beta_{77} Ln Z) + \left\{ (\beta_7 + \beta_{17} Ln X_1 + \beta_{27} Ln X_2 + \beta_{37} Ln X_3 + \beta_{47} Ln X_4 + \right. \right. \\
 & \left. \left. \beta_{57} Ln X_5 + \beta_{67} Ln X_6 + \beta_{77} Ln Z)^2 - 2 \beta_{77} u \right\}^{0.5} \right] / \beta_{77} \quad \dots \quad \dots \quad \dots \quad \dots \quad (12)
 \end{aligned}$$

The environmental efficiency “EE” from Equation (12) can be estimated just by taking the exponent of this equation i.e.

²In the quadratic formula there are both positive and negative (\pm) outside the under- root term but we took only positive because $u_i = 0$ only if we will consider the positive sign outside the under-root term.

$$EE = \exp(Ln EE) = \Phi = \left(\frac{\Phi Z}{Z} \right) \dots \dots \dots \dots \dots \dots (13)$$

It should be noted that Φ is the environmental efficiency index as discussed earlier. In case of two environmentally detrimental variables (active nutrients of nitrogen and cost of chemical weedicide) the description for “LnEE” as described in Equation (12) is changed as follow:

$$LnEE = \left[- \left(\beta_6 + \beta_7 + \beta_{16} Ln X_1 + \beta_{26} Ln X_2 + \beta_{36} Ln X_3 + \beta_{46} Ln X_4 + \beta_{56} Ln X_5 + \beta_{66} Ln X_6 + \beta_{17} Ln X_1 + \beta_{27} Ln X_2 + \beta_{37} Ln X_3 + \beta_{47} Ln X_4 + \beta_{57} Ln X_5 + \beta_{67} Ln X_6 + \beta_{77} Ln X_7 \right) + \left(\beta_6 + \beta_7 + \beta_{16} Ln X_1 + \beta_{26} Ln X_2 + \beta_{36} Ln X_3 + \beta_{46} Ln X_4 + \beta_{56} Ln X_5 + \beta_{66} Ln X_6 + \beta_{17} Ln X_1 + \beta_{27} Ln X_2 + \beta_{37} Ln X_3 + \beta_{47} Ln X_4 + \beta_{57} Ln X_5 + \beta_{67} Ln X_6 + \beta_{77} Ln X_7 \right)^2 - 4 \left(0.5 \beta_{66} + 0.5 \beta_{77} + \beta_{67} \right) u_i \right]^{0.5} \dots \dots \dots \dots \dots \dots (14)$$

$$\left(\beta_{66} + \beta_{77} + 2\beta_{67} \right)$$

In case of translog production function the elasticities are not the coefficient of production function as in case of Cobb-Douglas. However, the elasticity of output with respect to different inputs in case of translog production function can be estimated by taking derivative of Equation (8) with respect to logarithm of any specific input as shown below:

$$\frac{\partial Ln Y}{\partial Ln X_1} = \frac{\partial Y}{\partial X_1} * \frac{X_1}{Y} = \beta_1 + \beta_{11} Ln X_1 + \beta_{12} Ln X_2 + \beta_{13} Ln X_3 + \beta_{14} Ln X_4 + \beta_{15} Ln X_5 + \beta_{16} Ln X_6 + \beta_{17} Ln X_7$$

It should be noted that X_7 has been represented by Z in Equation 8 and the above equation can be written in more general form as follow:

$$\frac{\partial Ln Y}{\partial Ln X_j} = \frac{\partial Y}{\partial X_j} * \frac{X_j}{Y} = S_j = \beta_j + \sum_{i=1}^7 \beta_{ji} Ln X_i \dots \dots \dots \dots \dots (15)$$

where, “i” stands for the number of explanatory variables. The cross elasticity of substitution for input factor “j” and “k” can be written by following the formula developed by Ferguson (1969) as follow:

$$H_{jk} = \left[\frac{\beta_{jk}}{(S_j + S_k)} \right] + 1 \dots \dots \dots \dots \dots \dots (16)$$

A positive elasticity of substitution implies that two input factors “j” and “k” are complementary while a negative elasticity of substitution indicates a competitive relationship between two inputs.

2.3. Data Collection Procedure

Analysis is carried out by using primary data on input-output quantities and prices from 500 farm households’ belongings to five major basmati rice growing districts in terms of production—“Gujranwala, Sheikupura, Sialkot, Hafizabad, and Jhang” of

Punjab Province [Pakistan (2005)]. From each of these districts 100 farmers are selected by choosing 25 from each tehsil. Four teshils from each district (because most of the districts in our sample have four or less than four teshils) and 2 villages from each tehsil are randomly selected. From the first village in each tehsil 12 farmers and from the second village 13 farmers are randomly selected, in order to make 25 from each tehsil. The number of villages in each tehsil increased accordingly where districts have less than four teshils in order to maintain the sample of 100 farmers from each district. A well structured and field pre-tested comprehensive interviewing schedule is used for the collection of detailed information on various aspects of rice farmers in 2006. The mean value of inputs and output are reported in Table 1. Only fifteen percent farmers in our sample are using pesticides and that is why it is not reported in the table and neither it is considered as an environmentally detrimental variable.

Table 1

<i>Summary Statistics of the Sample</i>					
Variables	Mean	Median	Maximum	Minimum	Std. Dev
Yield (Mounds/Acre)	35.0	35	55.0	18.0	5.7
Tractor (Hours)	3.8	3.5	12.3	0.5	1.7
Seed (Kg)	5.0	4.0	6.0	2.5	0.8
No. of Irrigations	8.0	10.0	16.0	5.0	3.2
Labour (Hours)	180.0	175.0	220.0	142.0	36.3
Nutrients of PK (Kg)	22.5	23.0	57.5	0.0	9.4
Nutrients of N (Kg)	34.5	32.0	70.5	0.0	9.8
Weedicide Cost (Rs)	345.1	275.0	400.0	40.0	33.7

3. RESULTS AND DISCUSSIONS

The results of Maximum Likelihood Estimates (MLE) for translog production function are reported in Table 2 which can be used to test the null hypothesis that no technical inefficiency exists in rice production. It should be noted that the values of log-likelihood function for the stochastic frontier model and the OLS fit are calculated to be 237.40 and 229.22, respectively and reported in Table 2. This implies that the generalised likelihood-ratio statistic for testing the absence of technical inefficiency effect from the frontier is calculated to be $LR = -2*(229.22-237.40) = 16.36$ which is estimated by the Frontier 4.1 and reported as the "LR" test of the one sided error. The value of likelihood-ratio "16.36" exceeds the critical value of "10.371" obtained from Table 1 of Kodde and Palm (1986) for the degree of freedom equal to 5 at five percent level of significance. It should be noted that degree of freedom is equal to the number of restriction in null hypothesis. The log likelihood ratio test indicates that technical inefficiency exists in the data set and therefore, null hypothesis of no technical inefficiency in rice production is rejected.

Table 2

Coefficients of Translog Production Function with Maximum Likelihood Estimation (MLE) Technique

Parameters	Coefficients	t-ratio	Parameters	Coefficients	t-ratio
B ₀	-0.63	-0.39	B ₁₇	0.01	0.39
B ₁	-0.35	-1.24	B ₂₃	0.41	2.43
B ₂	-1.49	-1.40	B ₂₄	-0.05	-0.37
B ₃	0.85	1.64	B ₂₅	-0.01	-0.43
B ₄	1.03	3.18	B ₂₆	-0.06	-0.90
B ₅	0.18	1.08	B ₂₇	0.04	0.43
B ₆	0.09	0.65	B ₃₄	0.04	0.29
B ₇	0.32	1.14	B ₃₅	0.00	-0.06
B ₁₁	-0.12	-2.42	B ₃₆	-0.03	-0.55
B ₂₂	0.37	0.53	B ₃₇	-0.08	-0.80
B ₃₃	-0.42	-1.69	B ₄₅	-0.02	-0.75
B ₄₄	-0.10	-0.76	B ₄₆	-0.05	-1.04
B ₅₅	0.02	2.29	B ₄₇	-0.04	-0.54
B ₆₆	0.00	-0.34	B ₅₆	0.00	0.82
B ₇₇	-0.01	-0.42	B ₅₇	-0.01	-0.97
B ₁₂	-0.03	-0.42	B ₆₇	0.05	1.16
B ₁₃	0.08	1.05	sigma-squared	0.07	1.72
B ₁₄	0.02	0.37	gamma	0.81	7.41
B ₁₅	-0.01	-0.63	Log Likelihood	237.4	
B ₁₆	0.01	0.48			

The parameters of translog stochastic frontier production are reported in Table 2. These results of production function are employed to estimate the elasticities of output with respect to different inputs as explained in Equation 14 and summary statistic of these output elasticities are reported in Table 3. The output elasticities of tractor hours (used in land preparation) and irrigation are negative, while that of seed, labour, PK (active nutrients of phosphorus and potash), N (active nutrients of nitrogen) and cost of

Table 3

Output Elasticity of Translog Function

Variables	Mean	Median	Maximum	Minimum	Std. Dev
Tractor (Hours)=X ₁	-0.09	-0.10	0.13	-0.25	0.06
Seed (Kg)=X ₂	0.07	0.06	0.72	-0.37	0.13
No. of Irrigations= X ₃	-0.11	-0.12	0.57	-0.44	0.13
Labor (Hours)=X ₄	0.28	0.26	0.83	0.12	0.08
Nutrients of PK (Kg)=X ₅	0.09	0.10	0.17	-0.08	0.04
Nutrients of N (Kg)=X ₆	0.03	0.04	0.09	-0.30	0.03
Weedicide Cost=X ₇	0.07	0.07	0.23	-0.39	0.07

weedicide are positive. The elasticity of tractor hour is negative but it is not clear why it is so. The coefficient of tractor hour is 0.09 with negative sign and it implies that by increasing one percent of tractor hours, the yield declines by 9 percent. In order to explain its negative sign, more specific soil related information is required which is missing in our data set. The elasticity of seed is positive in rice production. Rice is a water intensive crop and it requires high quantities of water compared to other crops. Such a large quantity of water is not available from irrigated sources and therefore, farmers depend more on ground water in rice production areas. The quality of ground water is poor in the rice zone areas and the negative elasticity of number of irrigations is due to poor ground water quality. But if we had information on the distribution of number of irrigations from canal water and ground water, it would have made our statement more reliable. However, the negative elasticity coefficient for irrigation reflects wasteful irrigation practices and expenditures as well as posing environmental problems. It also emphasises the need for farmers' education in crop irrigation, need for testing the quality of tubewell water and its suitability for irrigation. The use of unfit tubewell water may be posing an environmental problem as well. The elasticity of labour and active nutrients of PK and active nutrients of N are positive which are 28, 9 and 3 percent respectively and these results are according to prior expectations. It implies that if labour, active nutrients of PK, and active nutrients of N are increased by 100 percent then output will increase by 28, 9 and 3 percent, respectively, implying that the contribution of labour is higher than the joint contribution of fertiliser PK and N nutrients. Rice is a labour intensive crop and that is why elasticity of labour is highest and positive followed by active nutrients of nitrogen. The elasticity of weedicide is also positive implying that if the cost of weedicide increases by 100 percent then it contributes to increase in yield by 7 percent.

The cross elasticities of substitution are estimated by employing Equation 15 and results are reported in Table 4. The negative value of cross elasticities of substitution indicates a competitive relationship while the positive value reflects the complementary relationship between the two inputs. It is observed that tractor hours and seed, tractor hours and labour, seed and labour, seed and active nutrient of PK, number of irrigations and active nutrients of N, and active nutrients of phosphorus and potash "PK" and active nutrients of nitrogen "N" all have competitive relationship, while all others have complementary relationship. Competitive relationship between two inputs indicates that decline in one input can be compensated with the other, implying that inputs are substitutable in the production process. Complementary relationship implies that output can be raised by increasing both the inputs simultaneously.

The technical efficiency of rice production in Pakistani Punjab is estimated by employing Equation 8 and results are summarised in Table 5. The results indicate that technical efficiency of rice production is reasonably high ranging from 0.59 to 0.97 with an average value of 0.89. This implies that rice production could be increased up to 11 percent from the given set of resources, just by using the available resources more efficiently. It is observed that 62 percent farmers are technically more than 90 percent efficient and only 12 percent farmers are technically less than 80 percent efficient, implying that distribution of farmers is skewed towards high technical efficiency, and that is why average technical efficiency is reasonably high.

Table 4

Cross Elasticities of Substitution

	Mean	Median	Maximum	Minimum	Std. Dev.
X ₁₂	-0.09	-0.10	0.13	-0.25	0.06
X ₁₃	0.07	0.06	0.72	-0.37	0.13
X ₁₄	-0.11	-0.12	0.57	-0.44	0.13
X ₁₅	0.28	0.26	0.83	0.12	0.08
X ₁₆	0.09	0.10	0.17	-0.08	0.04
X ₁₇	0.03	0.04	0.09	-0.30	0.03
X ₂₃	0.07	0.07	0.23	-0.39	0.07
X ₂₄	-2.70	3.29	1845.27	-2702.15	185.83
X ₂₅	-10.53	7.47	855.04	-7736.51	364.13
X ₂₆	3.98	0.14	1152.59	-21.05	56.08
X ₂₇	4.79	1.53	2168.90	-237.88	97.89
X ₃₄	52.13	-2.70	25342.45	-731.92	1137.34
X ₃₅	6.69	-1.05	1622.54	-118.89	99.61
X ₃₆	-6.34	-19.34	60618.75	-24943.67	3403.14
X ₃₇	1.52	-0.15	822.60	-152.75	47.67
X ₄₅	1.12	0.59	240.20	-54.80	14.70
X ₄₆	5.26	-12.80	9777.10	-1452.65	509.44
X ₄₇	2.00	5.13	1277.58	-2738.88	151.12
X ₅₆	-0.63	0.10	107.96	-149.27	15.12
X ₅₇	1.11	1.07	11.87	-8.40	1.28
X ₆₇	12.40	5.93	1206.11	-656.76	112.03

Table 5

Technical Efficiency Estimates

Value	Count	Percent	Cumulative Count	Cumulative Percent
[0.6, 0.69]	6	1.2	6	1.2
[0.7, 0.79]	56	11.2	62	12.4
[0.8, 0.89]	126	25.2	188	37.6
[0.9, 1]	312	62.4	500	100
Total	500	100.0	500	100.0

As discussed earlier we have assumed the cost of chemical weedicide and active nutrients of nitrogen (N) as environmentally detrimental variables. The environmental efficiency of chemical weedicide is estimated by employing Equation 12 and 13 and results are reported in Table 6. The mean environmental efficiency of chemical weedicide in our sample group is only 0.14, ranging from 0.00 to 0.73, implying that environmental efficiency is considerably less than technical efficiency. Our finding reveals that the average level of rice output can be sustained or even increased by reducing 86 percent of chemical weedicide use. Such substantial reductions in chemical weedicide use will not only increase profitability of rice production by decreasing cost of Rs 296.7 per acre but it is also expected to significantly contribute in the improvement of

Table 6

Environmental Efficiency Estimates for Weedicide Only

Value	Count	Percent	Cumulative Count	Cumulative Percent
[0.0, 0.09]	266	53.2	266	53.2
[0.1, 0.19]	103	20.6	369	73.8
[0.2, 0.29]	56	11.2	425	85
[0.3, 0.39]	24	4.8	449	89.8
[0.4, 0.49]	15	3	464	92.8
[0.5, 0.59]	24	4.8	488	97.6
[0.6, 0.69]	9	1.8	497	99.4
[0.7, 0.79]	3	0.6	500	100
Total	500	100.00	500	100.00

environmental quality.³ The significant reduction in environmental pollution is expected to increase the productivity of other resources such as land and labour. Rice was grown on 4.4 million acres of land in Punjab in 2006 [Pakistan (2006)]. Hence, Rs 1307.3 million can be saved each year from the reduction in use of chemical weedicide in Punjab with higher level of output. From the frequency distribution of environmental efficiency, it is observed that 93 percent farmers have less than 50 percent environmental efficiency and remaining 7 percent farmers fall in the range of 50 to 80 percent category of environmental efficiency. There is no farmer in our sample who has more than 80 percent environmental efficiency of chemical weedicide use. The distribution of joint environmental efficiency of chemical weedicide and active nutrients of nitrogen “N” is depicted in Table 7. It is observed that average joint environmental efficiency is almost double (0.24) the average environmental efficiency of weedicide alone (0.14). The higher environmental efficiency score of two detrimental variables might be due to more efficient and judicious use of nitrogen in rice production. The higher environmental efficiency of nitrogen use leads to improvement in the joint effect of two detrimental variables but still substantial scope exists to improve environmental efficiency that can be explored. It appears there is a lot of wasteful expenditure in the use of these chemicals which needs to be economised. It is obvious that the use of fertilisers has assumed great importance in farm production and perhaps is the principal component of the out of pocket expenditures in the production of rice. Our results revealed that a large amount of nitrogen could also be saved with improvement in environmental conditions and higher level of output.

³Rs 60 = \$1.

Table 7

Environmental Efficiency Estimates for Weedicide and Fertiliser

Value	Count	Percent	Cumulative Count	Cumulative Percent
[0.0-0.09]	37	7.4	37	7.4
[0.1-0.19]	105	21	142	28.4
[0.2-0.29]	230	46	372	74.4
[0.3-0.39]	106	21.2	478	95.6
[0.4, 0.49]	20	4	498	99.6
[0.5, 0.59]	2	0.4	500	100
Total	500	100.00	500	100.00

4. LIMITATION OF DATA

It should be noted that primarily this data was collected for another study and at the time of data collection the focus was not on environmental efficiency. This would mean that important information that a study on environmental efficiency would require was not obtained. Especially, in order to justify the negative sign of the elasticity of irrigation we should have had more detailed information on sources of irrigation which is missing in our case. Similarly, we do not have detailed information on soil characteristics of the farms which is again required to justify the negative sign of the elasticity of tractor hours used for land preparation. Hence, future researchers should be mindful of these weaknesses while organising their study.

5. SUMMARY AND CONCLUSION

The present empirical study is based on a sample data of 500 rice farmers collected from five major rice growing districts in Punjab. First of all, we tested the presence of technical inefficiency in our data set and we rejected the null hypothesis of no technical inefficiency in our sample data. The output elasticity of tractor hours and irrigation is negative, while the output elasticity of seed, labour and active nutrients of PK and active nutrients of N, and weedicide cost is found to be positive. The cross elasticities of substitution for different inputs are also estimated in order to observe the nature of relationship between different inputs in the production process. On an average technical efficiency is found to be 89 percent in our sample farmers.

Environmental efficiency is estimated by assuming a single (chemical weedicide) and two environmentally detrimental variables (chemical weedicide and active nutrients of nitrogen) in major rice production districts of Punjab. The environmental efficiency of chemical weedicide is found to be 14 percent only. It suggests that a substantial improvement in resource allocation can be made by reducing 86 percent of chemical weedicide in rice production with higher level of output. It could help to improve the profitability of Rs 296.8 per acre in rice production that totals to an expected saving of Rs 1307.3 from the reduction in the use of chemical weedicides. Moreover, it is likely to alleviate the problem of environmental pollution by sustaining the productivity of the agriculture system. Moreover, it is expected to increase the productivity of agricultural labour. The joint environmental efficiency of two detrimental variables (chemical weedicide and active nutrient of nitrogen) is 24 percent which is almost 71 percent higher

than the single detrimental variable (chemical weedicide). This might be due to the reason that though fertiliser is being used more efficiently in rice production but still substantial scope exists that can be explored. Nitrogen which is a major source of cash input can be substantially saved without affecting the level of output, and with higher level of environmental quality.

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Book Reviews

Sartaj Aziz. *Between Dreams and Realities: Some Milestones in Pakistan's History.* Karachi: Oxford University Press. 2009. Pak. Rs 595.00.

The geo-strategic location of a country gives it advantage or disadvantage in its relation with the comity of nations and addressing its domestic challenges. The vision, acumen and capacity of political leadership, however, determine the maximisation of advantages from geo-strategic location in attaining the national interests. Interplay of domestic political power, geo-strategic location and global power dynamics are aptly reflected in the political history of Pakistan as narrated in "Between Dreams and Realities".

"Between Dreams and Realities" is both an autobiography and dispassionate account of Pakistan's chequered history as the author puts it "watched the political drama as ring side observer." The author was actively engaged in roles, confronting formidable challenges to improve policy coordination and implementation. A sequenced political, economic, and foreign relations history of Pakistan is described illustrating turning points, milestones, and debacles in her existence as a country. The political scenario of Pakistan, marred by intermittent military takeovers, with disregard, and mutilation of the constitution, mainly served personal interests. The rulers, irrespective of whether elected or otherwise, conjoined survival of their rule with that of the country. Thereupon, usurpation of power is legitimised by engineered elections or putting in place pliable judiciary. The indiscipline in political parties, absence of vision, political inexperience, self-centered, and headlong political leaders, increased the vulnerability of parliament to complete its tenure. Weak organisation of political parties is, thus easily maneuverable to the wheeling, dealings, and gaming of 'establishment'. This is amply visible in all military takeovers of elected governments, right from throwing of Zulfiqar Ali Bhutto's government to dissolution of Nawaz Sharif's government in 1999.

As a by-stander, the author dispassionately analysed various events and milestones in the history of the country, which changed the shape of domestic politics, economy, and regional and diplomatic dynamics. Various accounts of Kargil debacle are available, but the version of the crisis as seen by the then foreign minister takes the maximum space (38 pages), followed by the longest chapter on "Military Take Over October, 1999" (59 pages). According to the author, there exists no institutional framework to coordinate effectively the work of foreign office and military inputs to arrive at concerted foreign policy formulation and implementation for improved regional and global relations, especially with super powers. The foreign office does not know the military planning, while military is engaged in actions without consulting the relevant institutions. One reason for Kargil crisis was the absence of this institutional coordinating framework. The efforts to maintain regional peace and to demonstrate responsible behaviour by a Muslim nuclear power were derailed by Kargil operation. Megalomaniac military adventurism assumed adversary as weak. Non-involvement and absence of consultation with political

leadership proved disastrous. Conversation between General Musharraf and General Aziz on 26 and 29 February 1999 intercepted by RAW, does not suggest sagacious and prudent act. It speaks volumes of how the military has not learnt from its past blunders, and in this particular situation caused derailing of peace process and embarrassment to the whole nation. Statements and counter statements whether General Musharraf mentioned Kargil sector in the briefing on 5th February, 1999, where he claims in his book 'In the Line of Fire' that he informed the Prime Minister; is challenged by the author as he himself was present in the meeting. Knowing the author's excellent memory and integrity both intellectual and professional, the veracity remains unchallenged. Like many other disasters, this debacle is termed as a 'black spot' in the history of Pakistan, which caused immense set back to diplomacy, regional and international relation, and infamy to the country. Moreover, it weakened the Kashmir cause.

Interestingly, there were many plans, which were originally envisaged during the second Nawaz Sharif Government and for which General Musharraf took credit. One such act was restarting the peace process which was stopped due to Kargil adventurism. During the Agra Summit, he imaged himself as friendly, diplomatic General. Did he want the laurels of the peace with India placed on his head?

A strange phenomenon observed in the sixty-three years history of Pakistan is the intermittent military takeovers, which has left both the institutions and political parties dwarfed and incapacitated to respond to the challenges, both domestic and international. The proposition stated in the book, that boggles the mind of thinking persons in Pakistan is that "each time Pakistan is required to participate in a great global game, there is military rule in Pakistan; whether this coincidence is really accidental", requires further research. The geo-strategic location of the area comprising Pakistan, even before independence, was important for the global powers. Each super power wanted this area under its sphere of influence for its own reasons. For example, Russian interest was access to warm waters; and US to counter Russian influence and control over energy resources. After independence, the tug of war intensified and China joined the fray and its interest in the region was to look for shortest route through Pakistan to Middle East and Europe but in low note approach. Military rule in Pakistan is amenable to U.S. interests. The military rulers sought legitimacy to their rule. They mainly have two ways to legitimise their rule. They look for support from super power and in *quid pro quo* allow super power to work for its national interest in the area. The second is to arm twist judiciary to make it pliant and thus legitimise all military actions. In the process, military rule weakens the institutions by setting example of usurping power through unconstitutional means. Thus, weaker the institutions easier it is for external power to penetrate and take benefit from the situation. U.S. interests in Pakistan's domestic issues have been omnipresent, covertly and overtly until today. USA could not digest defiance of Nawaz Sharif of carrying out nuclear test in May 1998. Its concern over impending passage of Shariat Bill and micro management of domestic issues was not coincidental; rather it is designed to protect its global interest.

The mishandling of institutions (judiciary and executive) by the politician and military rulers alike, and above all the tussle between the institutions of the President and Prime Ministers, has been the constant battle fronts adding to the miseries of the people of Pakistan; eroding credibility, predictability, and trust in the institutions.

The book has many policy lessons for politicians and military rulers, provided it is read dispassionately and the mistakes are thought through to rectify and avoid future blunders. The book is written with a purpose to “convey to the coming generations” that Pakistan, despite its many failings, “can survive only through a genuine democratic framework” fulfilling the aspiration of people through participation of federating units and adopting fair and justice practices in distribution of resources and dialogue with stakeholders. The self-sustaining democratic institutions, based on the parameters of separation of powers of the three pillars of state, without meddling into each other’s domain and allowing it to function in unison, rather cross cutting, can take the nation forward. Finally, there is no disagreement, the cultural and ethnic diversity is an asset of the Pakistani nation and through participating, democratic framework; this diversity can bring vitality to economic progress and military strength.

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Syed Nawab Haider Naqvi. *The Evolution of Development Policy: A Reinterpretation.* Oxford University Press, 2010. 442 pages. Hardbound. Pak. Rs 995.00.

‘The Evolution of Development Policy: A Reinterpretation’ by S. N. Haider Naqvi is an excellent and timely discourse on development paradigms. The author lucidly traces evolution of different development paradigms and in the process not only thoroughly explains, what each paradigm stands but also critically evaluates each paradigm.

The book is organised into seven parts. Part I, comprising ‘preliminaries’ gives an overview of the evolution of thinking on development policy. The analytical framework highlights the faults in the structure of development policy. To set the framework for analysing development policy, the book argues that an evolutionary perspective on development policy should be examined under three paradigms: traditional development paradigm; the liberalist paradigm and the human development paradigm. The author takes pains to describe various important aspects of this framework. The author also argues that some aspects of the traditional development paradigm have been misunderstood and in the process elucidate the subject.

The second part of the book is devoted to a discourse traditional development paradigm which views increase in per capita income as the success of development policy. The planning models adopted by number of countries have more often been based on this paradigm. The reader is told that developing countries have managed the development related affairs with varying degree of success. It is argued that though the pursuit of the traditional development paradigm did yield a reasonable increase in per capita income, generated employment and also, to an extent, alleviated poverty but the paradigm failed to support the agenda of ‘systematic change’.

Part three of the book explains what the liberalist paradigm stands for and how the paradigm has evolved overtime. The liberalist paradigm is based on the premise that the folly lay in distortion of the price structure by the traditional interventionist policies. The liberalist paradigm advised the developing world to undertake major reforms in the trade and public sectors. The liberalist, argues the book, assumed that anything good for the developed world is also good for the developing countries and therefore set about to minimise the government size and abolish restrictions on flow of goods and services in the developing world.

Part four of the book is about anti liberalist consensus which signifies the criticism of the liberalist paradigm. The anti liberalist consensus forcefully challenged the liberalist claims about universal market success, minimal government and laissez-faire. The author states that “the anti-Liberalist consensus has pushed the liberalist paradigm into an irretrievable hibernation by showing frangibility of its theoretical foundations and inapplicability of policy prescriptions”. The author acknowledges that though the anti liberalist consensus has brought to fore the weaknesses of liberalist paradigm but the contribution of the anti-liberalist consensus to understanding development processes is minimal.

Part five of the book is devoted to the discourse on human development paradigm. The basic elements, different strategies, the key growth-related issues, and the moral motivation behind human development paradigm have been discussed. The discussion highlights the contribution of human development paradigm to knowledge and

understanding of the development process. The author explains that human development paradigm has established an identity of its own. The paradigm has distinguished itself with the traditional development paradigm. Two main features of the new paradigm are worth mentioning; Firstly, it assures us that caring for the least privileged in the society and an uncompromising insistence on social justice has a scientific rationale. Second, the paradigm rejects the liberalist 'self help' principle. The human development paradigm has brought to fore the shortcomings of development theory conceptualized in the traditional sense. The paradigm elucidates a moral theory successfully but what the paradigm lacks is an 'adequate development theory' argues the author.

The sixth part "towards a new development paradigm", as the name suggests, ignite new hopes. The author advocates that a successful development policy is one that understands the complexity and multi-dimensionality of the process of economic and human development. The author suggests that the new development paradigm should account for the moral values while establishing development principles. The new development paradigm, the author hopes, would recognize the role of the State in economic development will not look at import substitution with disgust and would also favor globalization as well as export expansion.

Part seven 'A Recapitulation' sums up the book. The author concludes that the new development paradigm should change the focus of development policy. The author believes that the development policy in vogue needs a reorientation. He also believes that only a creative synthesis of the traditional development paradigm and human development paradigm can provide the needed reorientation. The author sums it all with the statement "Development theory must reflect an uncanny understanding of reality".

The book is an excellent discourse on different development paradigms practiced overtime. It is extremely useful for students, researchers and development practitioners. It's a book not to be missed.

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Guillermo E. Perry, Luis Servén, and Rodrigo Suescún (eds.). *Fiscal Policy, Stabilisation, and Growth: Prudence or Abstinence?* Washington, D.C: The World Bank. 2008. Paperback. 329 Pages. Price not Given.

'Fiscal Policy, Stabilisation, and Growth' edited by Guillermo Perry, is an excellent volume covering the typical but current debate on "Does Fiscal Policy Matters". The book highlights the procyclical and anti-investment biases embedded in fiscal policies, explores their causes and macroeconomic consequences. The text provides empirical substance to the theoretical models and offers policy and recommendations, to help overcome the procyclicality and anti-investment biases of fiscal policies adopted thereof. With wide range of technical and empirical discussions, political economy aspects of the budgets have also been examined. Though the focus of the book is Latin American and the Caribbean countries, the debate is so holistic that it can be used for policy recommendations else where as well.

The book is organised in two parts; the first part, spread over four chapters, covers the procyclicality of Fiscal policy while the Part II, comprised of five chapters, elucidates the impact of fiscal policy on economic growth. The discourse takes into account the fiscal policy solvency condition and its imbedded biases towards certain policy options.

Chapter 1 provides an excellent overview of what is discussed in the volume. The book argues that excessive focus of fiscal agents on short term indicators of fiscal health, namely the government debt or cash flows, may detract attention from tracking the inter-temporal solvency. Such detraction will affect the macroeconomic stability and long-term growth, argues the book. Perverse incentives, that have political economy context, are at the root of flawed policies such as procyclical policies, contends the book.

Chapter 2 explains the nexus of Fiscal discipline, volatility and economic growth. Specifically, the role of fiscal instruments such as automatic stabilisers is the focus of debates. The authors have empirically examined the impact of institutions versus restrictions on fiscal policy. They validate the popular belief that fiscal policies contain discretionary components which cause business cycle volatility and hamper long-term economic growth. Finally they conclude that developing fiscal institutions and ensuring enforcement of fiscal discipline are feasible and politically viable. This would not only furnish the restrictions required but also provide enough flexibility to reduce the cost of restrictions.

Chapter 3 is about the size and effectiveness of automatic stabilisers, in the Latin American and the Caribbean (LAC) region. Competing theories of 'let the automatic fiscal stabilisers work' and 'discretionary fiscal management' have been empirically examined. The author develops a theoretical steady state model of a small open economy with households, firms and government. The setting is dynamic and stochastic with possibility of multiple shocks. The automatic fiscal stabilisers for LAC region are found to be small as compared to the industrial economies. These stabilisers are also found to be non-responsive to economic cycles in the LAC region. This shows that adoption of fiscal rules such as Maastricht Treaty and Stability and Growth Pact is not a viable policy option for LAC economies.

Chapter 4 of this edited volume critically examines the role of procyclical fiscal policies and fiscal federalism as a case study for Argentina and Brazil. To begin with cross country data is examined in the context of procyclicality of fiscal balances (e.g.

budget surplus). Preliminary examination shows that the developed economies tend to behave in a typical procyclical manner as predicted by Keynesian-New Growth model however, the data suggests that, developing and emerging economies do not behave in this fashion. The author develops a model of fiscal federalism and tests the same for Argentina and Brazil. The interesting portion of his analysis is where the authors try to capture the issue of procyclical government spending across sub-national governments in these two Latin American countries and found that these sub-national governments follow the footsteps of the central governments. Although they found that it is not attributable to federal transfers only. Finally the authors recommend that fiscal institutions should be promoted to reduce the degree to which the procyclical tax base becomes the part of government expenditures.

Chapter 5 evaluates the performance of fiscal rules and also examines the improvement in the issue of fiscal balance being procyclical. The author argues that there is a trade-off between letting the automatic stabilisers work on the one hand and the fiscal consolidation on the other hand. He develops the argument by emphasising the need for procyclical fiscal policy to achieve welfare objectives, but at the same time stresses the creation of an environment for well-designed fiscal rules. A procyclical fiscal policy may exacerbate volatility and cause huge deficits as well. This in turn calls for fiscal adjustments, which if practiced has a negative impact on investment and hence growth. He traces the procyclicality of fiscal balances to faulty policies, weak budgetary institutions, asymmetric information and problems with international financial markets. The author argues that adopting automatic rules may allow fiscal stabilisers to work over the business cycles and pave the way for rules-based countercyclical policies. He cautions, however, that adopting a rule may lead to the dilemma of choosing between flexibility and credibility. With rigid rules the fiscal stance may be over-tight and in certain circumstances may continue to be procyclical. On the other hand allowing for flexibility may impinge upon the credibility of authorities. Finally while reviewing the performance of fiscal rules in Latin America, the author concludes that setting a rule, based on the goal of structural balance may help in letting the automatic stabilisers do their job, and still avoid sharp changes in public expenditures, that are associated with changes in revenue receipts.

Part II (chapters six to ten) of the book covers the core issue of fiscal policy and economic growth. Chapter six revolves around the nexus of fiscal discipline, public investment and growth. The author argues that solvency of the government is typically gauged against cash deficit while public assets and or future income stream of public sector are ignored altogether in this regard. He points out that fiscal adjustment programs adopted on the basis of such flawed indicators had led to excessive cuts in public investments. The author favours the determination of fiscal solvency on the basis of budgetary components rather than consolidated budget. The rationale is that productive expenditure generate returns in future as well while non-productive expenditures do not. Therefore, the author argues, the two types of expenditures should not be treated at par while designing fiscal rules to protect solvency. The author also recommends that the government should not involve itself in sectors where the private sector has a comparative advantage. The implication is that retracting from such sectors would provide fiscal space to the government and will minimise the need for fiscal adjustment.

Chapter 7 informs the reader as to how only a change in accounting method of recognising expenditures may allow an increase in public investment while remaining within the limits specified by fiscal rules? The authors argue for accrual accounting rather than cash accounting to determine budget deficits. As the accrual accounting spreads the capital expenditure over the useful life of the assets therefore the budget deficits, determined under accrual accounting, would not only be lesser but realistic as well. The principles of tax smoothing and intergenerational equity have also been discussed with reference to capital budgeting and debt. After discussing the pros and cons of debt finance capacity of the government, the authors recommend that commercially viable (self liquidating) capital expenditures be partially funded through debt and the rest be financed from operational budgets.

Chapter 8 is about the possibility of improvement in Stability and Growth Pact (SCP) through the use of better accounting methods for Public Investment. Given the failure of the pact in restricting demand as reflected by high deficits across some member countries, the authors suggest some improvements in the Pact. The authors recommend that the pact should treat the debt financing of projects with high social return differently and intergenerational transfers should be taken into account. The possibility of what type of investment to include in the balance budget rule and what to ignore is discussed rigorously. The authors also recommend the setting up of public investment agencies under the principles of good governance.

Chapter 9 critically evaluates the accrual accounting method and its impact on long term fiscal projections. The author stresses upon the need for having a long-term view of government expenditures as opposed to the mere focus on the traditional fiscal indicators. In this regard the merits and demerits of accrual accounting are discussed at length. He also argues that cash based accounting compels the analyst to focus on short term benefits and thus long term benefits of self liquidating projects are overshadowed. He recommends that for determining the solvency of a government, the use of fiscal indicators should be supplemented by information on the value of government's physical assets, net worth and the change in net worth year on year basis. In this regard the use of Government Finance Statistics Manual 2001 prepared by IMF is recommended. Moreover preparation of financial reports according to the standards of International Public Sector Accounting Standards Board is also recommended.

The tenth and final chapter of the book examines the impact of infrastructure on growth in Brazil. Capital formation in public sector has been declining over the last 25 years and this had adverse repercussions for all of the sectors of the economy. After presenting some stylised facts about the issue, the authors develop an argument in favour of increased investment on infrastructure by the public sector through debt financing. Based on their simulation results, the authors recommend that public investment in infrastructure should be increased for revenue generating projects and for such projects that contribute to increase the productivity in the private sector.

To sum up this is an excellent book for all those interested in fiscal management. I strongly recommend the book to fiscal managers and researchers in particular and students of fiscal policy in general.

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Shorter Notices

Asian Development Bank and Asian Development Bank Institute.
Infrastructure for Seamless Asia. Tokyo: Asian Development Bank Institute, 2009.

'*Infrastructure for Seamless Asia*' published by Asian Development Bank Institute, addresses major challenges in developing regional infrastructure, particularly exploring the costs and benefits, financing requirements, and infrastructure priorities in the region. The key message of the book is that now is the time to go ahead with the goal of integrating this vast and diverse Asian region by developing the Pan-Asian infrastructure connectivity. The book addresses questions like: What are the costs and benefits of regional infrastructure in Asia? What are the major challenges confronting the seamless connectivity in Asia? What are the regional priorities in terms of different infrastructure projects for Asia? What are the financing requirements for developing Asian infrastructure? The book also explores what kind of institutions, policies and frameworks are needed to foster regional cooperation for creating a seamless Asia? Thus the book is a sort of feasibility study on seamless connectivity in Asia. Energy and transport sectors receive special attention in the book.

The book evaluates existing regional infrastructure programmes, policies, and institutions. Empirical case studies have been used to focus on issues common to Asian countries. Examples of best practices have been drawn from key sectors and sub sectors, such as, roads, railways, airways, and ports (transport) and electricity and gas (energy). The literature recognises that soft structure like regulatory requirements human and institutional capacities are as much important as the physical structure is for the smooth flow of goods and services as well as people across national boundaries. Given this, the book examines both soft and hard aspects affecting infrastructure and regional cooperation.

The book recognises that infrastructure development in Asia lags behind its economic growth both in terms of quantity and quality. Rapid growth in several developing countries has put enormous pressure on the infrastructure. It is acknowledged that the lack of adequate infrastructure can hinder growth, weaken competitiveness of a country, and negatively affect poverty reduction programs. The book informs that within Asia, countries that can boast of better infrastructure have been able to expand their trade while the countries, with poor infrastructure have poorer trade volumes. The South Asian countries fall in this latter category.

Asia is home to almost two-thirds of the world's poor population. Working collectively, the Asian countries can tap their huge economic potential and attain reasonable growth, thereby alleviating poverty. Physical connectivity, can provide a boost to trade and investment, improve environmental health as well as social conditions. While acknowledging that sub-regional programs, within Asia, have contributed to increased connectivity through land, sea, and air transport networks, but a lot need to be done as yet, argues the book. The book notices that energy (such as electricity) and transport (such as roads) are the two most important elements of infrastructure that have not been fully provided so far.

The book estimates that at least \$750 million will be required annually during 2010-2020 to fulfill requirement of infrastructure investment in Asia. It is argued in the book that intergovernmental coordination and regional cooperation is needed to achieve the goals set by individual countries as well as by subregional programs, like Greater Mekong Subregion, (GMS), Association of Southeast Asian Nations (ASEAN), South Asia Subregional Economic Cooperation (SASEC), and Central Asia Regional Economic Cooperation CAREC. Without a serious commitment and efforts on the part of the governments of the region, these regional infrastructure projects are unlikely to be implemented.

Dilating upon financing of infrastructure projects, the book stresses that the idea of a seamless Asia cannot be put to practice without the availability of sufficient funds. Financing infrastructure projects, especially the ones that cross national boundaries, is challenging task. Given the risk and uncertainties involved, the private sector is shy of investing in such projects. Most regional infrastructure projects are therefore developed and financed by governments. Even the ones that involve public-private partnerships also require some form of government guarantee. Lessons drawn from the experience of European Union show that developing and financing regional projects is a slow and a complicated process. Regional projects often receive relatively low priority for domestic policymakers. Therefore such projects usually require assistance from multilateral institutions. Concessionary financing from external sources may be necessary to make such projects more attractive to investors.

The book notices that till now the approach of the Asia to infrastructure development has largely been bottom-up and market-driven. The book argues that now it is necessary to complement this approach with a more top-down, market-expanding, and demand-inducing approach geared toward creating a seamless Asia. Moreover, the possibility of a prolonged downturn in Asia's major export markets underscores the need for a long-term rebalancing of its economy toward meeting local needs. This will call for many policy changes, particularly putting Pan-Asian connectivity, on the priority list.

To make a case for regional connectivity, the book provides facts on Asia's energy resources (Asia has substantial energy resources—7 percent of the world's oil reserves, 12 percent of its natural gas, and 32 percent of its coal in 2006), the book informs the readers that these resources are unevenly distributed across the region, and are often untapped. The book very convincingly argues that the full benefits of Asia's size and diversity can be realised only by creating a single market where goods, services, capital, information and people move freely. All this obviously call for moving toward that long-term vision of a seamless Asia.

The book will serve as a knowledge product primarily for policymakers in the region. (*Muhammad Ramzan*)

Partha Chatterjee. *Empire and Nation, Essential Writings 1985-2005.* New Delhi, India: Permanent Black Himalayana Mall Road Ranikhet Cantt, 2010. 368 pages. Hardback. Indian Rs 695.

'Empire and Nation' is a collection of writings of Partha Chatterjee, a professor of Political Science and Anthropology. In his essays, he explores India from political, cultural and historical perspectives. Indian nationalism and identity is one of the main ideas of the book. The superiority of Indian culture and thoughts is put forth and western philosophies and thoughts are downplayed with reason.

The book sets the stage for examining the evolution of Indian culture with a discourse on Indian Mythologies and then moves on to the many aliens, especially the Muslims and the East India Company, who ruled India at different times in history. The influence of Muslims on Indian culture is discussed at length, right from the times of Muhammad-Bin-Qasim to Mughal emperors. Different omens prevalent in ancient India have been discussed with examples like Mahabharata and the wars of Indian gods. The book then describes how the alien traditions, and religions foreign to India, mingled with the Indian culture and religions to influence the Indian culture.

Besides the introduction written by Nivedita Menon, the book is organised into three parts. The Part I; 'Empire and Nation' provides an interesting history of Indian nationalism going back to Indian mythologies, gods and goddesses. The Part II: 'Democracy', explores the democratic movements in India and talks of all major players in the Indian democracy. In 'Capital and Community', the final part of the book, diverse issues like civil society, Capital and the Problems of Bengal have been discussed in this part of the book.

Chatterjee, has tackled controversial issues like modernity, nationalism, democracy, the role of women and minorities with sagacity and the writings have been enriched with lively criticism of the western thought on the subjects. Most of his arguments are grounded in history. Different political thoughts and philosophies have also been discussed, with their pros and cons to the Indian context. To conclude the book discusses various theories of society and culture and examines how these theories fit in the Indian context.

The book is useful for those who want to study infant democracies, especially democracies that have to cope with ethnic, religious and cultural diversity. (Kashif Munir)

Tim Harford. *The Logic of Life: Uncovering the new Economics of Everything.* London: Little, Brown, 2008. 272 pages, Price 12.99 UK.P

The Logic of Life, Tim Harford looks at everyday experiences of people from economic perspective. The book talks about the rational foundations of human behaviour. The central theme of the book is that human behaviour is based on rational concepts and that rational behaviour is much wider than one can expect. However, a rational choice does not always mean a feasible outcome rather the outcome may be random. The author argues that if one cannot understand the rational behaviour, s/he cannot understand the world. To explain the logic behind human behaviour, the book covers a wide range of situations such as the causes of the higher divorce rates, marriages, smoking, drug-dealing, high pays to corporate officers, industrial revolution, role and importance of cities, sugar subsidies, sex, splitting the bill at meal, institutional racism, to explain the theory of rational behaviour. The author convincingly argues, without employing the rigour of mathematics and statistics, that human behaviour in aforementioned situation is almost always rational.

For instance, the author explains how racism can become a vicious circle for the society. If a Black person, with sound education, fails to find decent jobs he is not likely to pay enough attention towards education of his children. This in turn, will strengthen employer discrimination towards blacks. Similarly, while explaining why corporate

officers are overpaid and many talented employees are underpaid, the author describes that this problem occurs due to the lack of information about talent, honesty, hard work, and difficulty in measuring the contribution of the employees accurately, particularly when there is subjective performance evaluation system in the company. The book shows that making rational decisions in our routine life causes economic growth.

The book is an outstanding summary of the latest research in the, as yet, developing field of behavioural economics. It highlights that despite making irrational decisions in laboratory experiments, in real world we are more likely to act rationally. The author argues that we may act irrationally when confronted with a new or abnormal situation but then the experience crafts us into making rational decisions. The book shows that standard economics explains the novelties of life. It is recommended to all those with an interest in understanding the economic rationale of human behaviour. (Muhammad Zakaria)

Joseph Stiglitz and Linda Bilmes. *The Three Trillion Dollar War.* Penguin Group. 2008. 311 pages. Hardbound. UK Pound £20.00.

The quick and costless conflict in Iraq, predicted by the Bush administration, is nowhere to be seen and the actual costs of the war in Iraq far exceeds the estimates developed by the then administration before going to war. This is the central message of *The Trillion Dollar War* by Joseph Stiglitz and Linda Blimes.

The authors argue that the cost of the military operation in Iraq has exceeded the cost incurred on the 12-year war in Vietnam and is more than two times the cost incurred on Korean War. They show that the per troop cost of the Second World War was less than \$100,000, in real terms, while the cost of war in Iraq is around \$ 400,000 (in 2007 dollars). The authors lament that the war in Iraq has been financed from borrowings rather than taxes. They argue that recognition of the cost of war cannot be put off for long and cannot be transferred to the coming generations without risking adverse consequences for the economy.

The authors argue that the estimates of war expenditure were nothing but fallacious. Larry Lindsey (Bush's economic advisor) had put the estimate of the total expenditure on war at \$200 billion as the war began. This figure was cut down to an unbelievable \$60 billion by Mitch Daniels, secretary to Donald Rumsfeld, the then Defense Secretary. The fallacy of these estimates was exposed when the U.S. Congress approved \$845 billion for 2008 alone, for military actions and war supplemental requisites, in Iraq and Afghanistan. Only the running expenditure on military operations cost the U.S. exchequer \$12.5 billion per month in 2008. This does not cover the \$500 billion per year expenditures of the U.S. Defense Department and other hidden costs.

Human life, though priceless, must be priced to arrive at some reasonable estimate of the expenditures on wars, and this is what the book does to account for the U.S. casualties in the war. Putting the price tag of \$7 million on human life — the monetary value typically assigned by the U.S. government to a young man killed in a car accident, the authors put the cost of 4000 casualties of American soldiers at \$28 billion. If the casualties like, 'killed in night-time vehicle accident', which the government terms as non-combat incidents, are also accounted for, then the cost of human tragedies shores up significantly. Arguing in this manner the authors arrive at an estimate of \$3 trillion as the

cost of Iraq War, to the United States alone, add to it the explicit and implicit, expenditures incurred by rest of the world and the estimates balloon.

United Kingdom—The second major player in the Iraq War has also paid heavily for the war. The book establishes an estimate of the cost of the war for United Kingdom as well. The estimates show that by the end of 2007 the estimated direct monetary cost to UK had reached to £7 billion. With thousands of soldiers becoming disable and many family members sacrificing jobs to care for their wounded relatives, the social costs to UK was no different than that incurred by the U.S. The authors expect that the long term macroeconomic costs for UK might be lesser than what the U.S. would have to assume. The reason, the book argues, lies in the tight fiscal policy maintained by the UK. However despite the reduction in troops and the corresponding cut in personnel cost, the aggregate cost of war in Iraq will increase by 2 percent for the United Kingdom. Based on these assumptions the total cost to UK of the wars in Iraq and Afghanistan exceed £20 billion in 2010, if the social cost is included.

To conclude, the book induces the reader to ponder, whether the war planners themselves believed in the estimates and what benefits they had in mind to justify the costs and whether the benefits will outweigh the costs. The book is highly recommended for those with interest in political economy. (*Abdul Qayyum Khan*)

Alan B. Krueger: *What Makes a Terrorist: Economics and the Root of Terrorism?* Princeton University Press. 2007. 192 pages. Hardcover. US\$ 24.95.

Terrorism has captured greater attention of the world since 9/11. Numerous studies have been conducted by social scientists in general and economists in particular on the determinants and consequences of terrorism. Conflicting conclusions of such studies makes it difficult to form appropriate anti terrorism policies. Moreover the intensive use of statistical analysis often makes it difficult for those unacquainted with sophisticated statistical techniques, to understand the message of these studies. This called for a volume which would convey the message of studies written in technical jargon to an ordinary reader. I believe the book "What Makes a Terrorist: Economics and the Root of Terrorism" has served the purpose in an embracing manner.

This book is based on the lectures delivered by Krueger at the London School of Economics and Political Science, in 2006. The book is organised into three sections. The first section deals with the characteristics of a terrorist as an individual; the second with socioeconomic and political conditions of the country to which the terrorist originally belongs, and the third is devoted to the consequence of terrorism. Krueger argues in the first section that, contrary to the common belief, the lack of education and economic deprivation in the form of poverty and low income are not the drivers of terrorism. Referring to many studies, including the one he did for Philistine, he rejects the hypothesis that illiteracy and economic deprivation of an individual induces him to be involved in terrorist activities. This perception is based more on faith than empirics, asserts Krueger. He substantiates the assertion with the fact that almost all of the terrorists involved in major attacks come from moderate-income countries rather than the poor ones. Nevertheless, he accepts that worse economic condition may force individuals to commit hate crimes; a theoretical justification of economic causes of terrorism on which the economists rely heavily.

In the second section of the book, Krueger examines the overall socioeconomic and political conditions of the country to which the terrorist traces his origin. He establishes that, even at the national level, the economic factors are not the reason for terrorism. Rather, it is the absence of political rights and civil liberties that could lead to terrorism—with freedom of speech curbed, opinions may find vent in violence. Krueger also considers religion as a factor explaining terrorism in Iraq.

Turning to the consequences of terrorism in the third section, Krueger highlights the fact that the consequences of terrorism are economic, social and physiological. His discussion of the economic consequences brings to fore the debate between Milton Friedman and Robert Barro on the bad and good consequences for an economy. Krueger, very truly, also points finger on the role of media in the enhancing the impact of terrorism. He suggests that the media sometimes serves the purpose of the terrorists by highlighting their objectives and throwing them into limelight.

The book is a thought provoking gift for those interested in the subject of 'Conflict', especially it enables researchers to start with a sound grasp of the issues in terrorism and political violence. (*Muhammad Nasir*)