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CONTENTS

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ARTICLES

BOOK REVIEW

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Does Export Expansion Lead towards Economic Growth?

Bedi-uz-Zaman, Sami Ullah and Parvez Azim*

Abstract: Exports can help countries to integrate in the world economy and to reduce the impact of external shocks on domestic economy. Export promotion strategies generate many positive externalities like economies of scale, pecuniary and real economies, division and specialization of labour which ultimately enhance the economic growth. The objective of this study is to investigate the relationship between export expansion and economic growth in four SAARC countries that include Pakistan, India, Sri Lanka and Nepal by employing time series analysis. The ADF test is applied to check the stationarity and the result showed that all the variables for each country are non-stationary at levels but stationary at first differences. To check co-integration, Johansen co-integration technique is applied for the countries where it is applicable and multiple regression analysis for countries where Johansen co-integration test is not applicable. For Pakistan and Nepal, there was a significant positive correlation between export expansion and economic growth, while for India and Sri Lanka the relationship existed only for the short run.

Keywords: Economic Growth, Exports
JEL Classification: 014, F3

1. Introduction

Developing countries adopt two types of trade strategies to promote economic growth, that is, import substitution and export promotion. The relative effectiveness of the two strategies in promoting economic growth has been an issue of considerable interest. The neoclassical economic theory favors export-led growth (export promotion policy) as an effective development strategy to increase economic growth. It is argued that exports expand the economy through increased economies of scale, productivity, specialization, trade and technological advancement. Many East Asian countries have achieved high economic growth through the export promotion policy.

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Exports are the most important source of foreign exchange earnings, which can be used to ease pressure on the balance of payments and to generate much-needed job opportunities. According to Abou-Stait (2005), an export-led growth strategy aims to increase the capability of producing goods that can compete in the world market using advanced technology and makes provision for foreign exchange needed to import capital goods. Exports help a country to integrate in the world economy and also help to reduce the impact of external shocks on the domestic economy. When an economy adopts export promotion policy it will certainly generate many positive externalities like economies of scale (pecuniary and real economies), division and specialization of labour, which ultimately enhances economic growth. Tsen (2006) stated that experiences of East Asian economies provide good examples of the importance of this sector to economic growth and development; and this emphasizes the role of exports as an engine for economic growth. There is considerable literature that investigates the link and causation between exports and economic growth, but the conclusions still remain a subject of debate.

The main objective of this paper is to investigate the relationship between export expansion and economic growth in four SAARC countries that include Pakistan, India, Sri Lanka and Nepal. The study employs time series analysis. The structure of this paper consists of introduction in the first part; second part consists of literature review, third part explains methodology and data analysis and conclusion is given in the fourth part.

2. Literature Review

Erfani (1999) examined the relationship between economic growth and exports by analyzing several developing countries in Asia and Latin America for the period 1965- 1995. A time series analysis was undertaken to examine the relationship between export growth and output growth. The results showed the existence of a significant positive relationship between exports and output growth, which provided evidence in favor of export promotion.

Vohra (2001) examined the role of export-growth linkage in India, Pakistan, Philippines, Malaysia, and Thailand by analysing time series data from 1973 to 1993. The empirical results indicated that if a country has achieved some level of economic development, then exports have a

positive and significant impact on economic growth. It also signifies the importance of liberal market policies by pursuing export expansion strategies and foreign investments.

Mah (2005) found long run causality between exports and economic growth based on the significance of an error correction term, EC_{t-1}. This study also showed that export expansion is insufficient to explain the patterns of real economic growth.

Balaguer and Manuel (2002) examined the Spanish export-led growth hypothesis under trade liberalisation that was initiated four decades ago. For this purpose, both the export expansion and progression from traditional exports to manufactured and semi-manufactured exports is taken into consideration. A new evidence was reported for the above period. Besides, it was proved that the structural transformation in export composition has also become a key factor for Spain's economic development.

Pazim (2009) used panel data analysis to test the validity of the "export-led hypothesis" in three countries (i.e. Indonesia, Malaysia, and Philippines). One-way random effects model concluded that there was no significant relationship between the size of national income and exports. On the other hand, panel unit root tests implied that there was strong evidence of stationary process for both GDP and exports at the first differences. However, the panel co-integration test for these countries indicated that there was no co-integrating relationship between exports and economic growth.

Amavilah (2003) analyzed Namibia's data from 1968 to 1992 to determine the role of exports in economic growth. The results showed the general importance of exports, but found no visible sign of accelerated growth caused by it. There was some evidence supporting the political economist's hypothesis about declining terms of trade due to external demand-side factors. An important finding was that domestic export supply factors are more essential to economic growth than external demand factors.

Subasat (2002) explained empirical link between exports and economic growth. The empirical work presented some doubt on the overall validity

of the export-led development hypothesis. The analysis suggested that middle-income countries that are more export-oriented grow faster than relatively less export-oriented economies. For low and high income countries, however, export promotion does not have any significant impact on economic growth.

3. Methodology and Data Analysis

The variables used in this study of export-led growth are real gross domestic product (RGDP), real exports of goods and services (REXP) and labour force (LF). The sample period covers annual data from 1972 to 2007. The data sources include International Financial Statistics (IMF, 2008) and World Development Indicators (World Bank, 2008). The GDP deflator is used as a price deflator for all nominal series to deflate the inflationary effect. All the variables are given in log form.

To test stationarity, the Augmented Dickey-Fuller Test (Dickey and Fuller, 1979, 1981) is used. This test estimates the following equation:

$$\Delta y_t = c_1 + \omega y_{t-1} + c_2 t + \sum_{i=1}^{p} d_i \Delta y_{t-1} + v_t \qquad (1)$$

In equation (1), $\{y_t\}$ is the relevant time series, d_i is the first-difference lag operator, it is a linear trend and v_t is the error term. The above equation can also be estimated without including a trend term (by omitting the term $c_2 t$ in the above equation). The null hypothesis of the existence of a unit root is H_0: $\omega = 0$. The results of the ADF tests for India, Pakistan, Sri Lanka and Nepal are shown in Tables 1 to 4, respectively (Appendix). The results indicated that all the variables for India, Pakistan, Nepal and Sri Lanka are non-stationary at levels except for the Labour Force but stationary at first differences. This means that we can proceed with the Johansen co-integration test. For Pakistan, the first difference of LF is non-stationary. All other variables are non-stationary at their levels but stationary at their first differences. Thus, we can still perform the co-integration tests by excluding the Labour Force variable. For India, all the variables are non-stationary at their levels but stationary at the first

differences except Labour Force. So we perform the co-integration test by including Labour Force as an exogenous variable. In case of Sri Lanka all the variables are non-stationary at levels but stationary at first difference. So co-integration test can be applied. For Nepal all the variables are non-stationary at their levels but they are stationary at first differences except the Labour Force, which is stationary at second difference. So the co-integration tests can be performed by excluding Labour Force.

The generalized Johansen framework of co-integration test is used (see Pesaran and Smith, 1998). The general form of the vector error correction model is given by:

$$\Delta y_t = a_{oy} + a_{1y}t - \pi_y z_{t-1} + \sum_{t=1}^{p-1} \Gamma_{ty} \Delta z_{t-1} + \Psi_y w_t + e_t \qquad (2)$$

where $z_t = (y'_t, x_t')'$, y_t is an my x_1 vector of endogenous variables I (1), xt is an mx x 1 vector of exogenous variables I (1).

$$\Delta x_t = a_{ox} + \sum_{t=1}^{p-1} \Gamma_{1x} \Delta z_{t-1} + \Psi_x w_t + v_t \qquad (3)$$

where w_t is a q x 1 vector of exogenous/deterministic variables I(0). In this model, the disturbance vectors of e_t and w_t satisfy the assumptions (a) and (b) as given below:

$$(a) \qquad \mu_t = (e_t\ w_t)' \sim iid(o, \Sigma) \qquad (4)$$

$$(b) \qquad E(u_t | w_t) = 0 \qquad (5)$$

Equation (5) means that u_t (the disturbances in the combined model) is distributed independently of w_t.

a_{oy} and a_{1y} (the intercept and the trend coefficients, respectively) are my x_1 vectors; πy is the long run multiplier matrix of order my + m, where m = mx + my; $\Gamma_{1y}, \Gamma_{2y}, \ldots \ldots \Gamma_{p-1}$, y coefficient matrices capture the short run dynamic effects and are of order my x m; and Ψy is the my x m matrix of coefficients of the exogenous variables I(0).

The results of the trace tests for Pakistan and Nepal (we exclude LF in the tests) are given in Table 5 (Appendix). The Schwarz Bayesian Criterion (SBC) was used to determine the number of lags for the co-integration tests. In each case, the lag length turned out to be one. The trace tests indicated one cointegrating vector for Pakistan and Nepal, while no cointegrating vector is shown for India and Sri Lanka. The coefficients of these vectors are given in Table 6 (Appendix). For Pakistan and Nepal, the cointegrating vector shows that LRGDP is positively related with LRFC while negatively related with LREXP. For India and Sri Lanka, the regression results with LRGDP as the dependent variable and LREXP, LF and LRCF as independent variables are given in Table 7 (Appendix). To remove autocorrelation the AR (1) method is applied. The results showed that in India and Sri Lanka the growth rates of LRGDP, LREXP, LRCF and LF are positively related to each other as the coefficients were significant.

4. Conclusion

The study has empirically analyzed the short run and long run relationship between export promotion, capital formation, labor force, and economic growth of Pakistan, India, Sri Lanka and Nepal. Different time series techniques were used for the period 1972-2007. For Pakistan and Nepal, there is one cointegrating equation and showed a significant relationship between export expansion and economic growth. On the other hand, the results for India and Sri Lanka showed that there exist only short run relationship and no long run relationship. Almost in all cases, there is a positive relationship between economic growth, export expansion, labour force and capital formation.

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Appendix

Table 1: Unit Root Test for Pakistan

Variables	Level		First Difference	
	Test Statistic	Critical Value	Test Statistic	Critical Value
Log(RGDP)	-1.7760	-2.9511	-3.9876	-2.9540
Log(REXP)	-1.9503	-2.9511	-9.0684	-2.9540
Log(CF)	-1.4930	-2.9511	-4.0007	-2.9540
Log(LF)	1.8370	-3.7241	-5.9038*2	-3.7379

Note: All the variables for Pakistan are stationary at their first differences, except Log (LF), it is stationary in its second difference which is denoted by (*2).

Table 2: Unit Root Test for India

Variables	Level		First Difference	
	Test Statistic	Critical Value	Test Statistic	Critical Value
Log(RGDP)	2.4550	-2.9511	-5.7857	-2.9540
Log(REXP)	1.7041	-2.9511	-4.6920 t	-3.5529
Log(CF)	1.2463	-2.9511	-5.8051	-2.9540
Log(LF)	-6.8036	-3.7115	-1.2650	-3.005

Note: All the variables for India are stationary at their first differences, except Log (LF), it is stationary in its level, and "t" means the variable is stationary with trend.

Table 3: Unit Root Test for Sri Lanka

Variables	Level		First Difference	
	Test Statistic	Critical Value	Test Statistic	Critical Value
Log(RGDP)	0.1394	-2.9511	-5.8969	-2.9540
Log(REXP)	-1.5810	-2.9511	-5.2546	-2.9540
Log(CF)	-0.9936	-2.9511	-4.5815	-2.9540
Log(LF)	-1.0213	-2.9810	-4.7305	-2.9862

Note: All the variables for Sri Lanka are stationary at their first differences.

Table 4: Unit Root Test for Nepal

Variables	Level		First Difference	
	Test Statistic	Critical Value	Test Statistic	Critical Value
Log(RGDP)	0.3597	-2.9571	-6.0321	-2.9571
Log(REXP)	-1.0091	-2.9511	-5.1824	-2.9540
Log(CF)	-0.3338	-2.9540	-6.8008	-2.9540
Log(LF)	1.1624	-3.0123	-4.8824*2	-2.9981

Note: All the variables for Nepal are stationary at their first differences, except Log (LF), it is stationary in its second difference which is denoted by (*2).

Table 5: Cointegrating Trace Test

Null hypothesis Alternate hypothesis	r=0 r≥1	r≤1 r≥2	r≤2 r=3
Countries			
India	26.5056 (29.7971) [0.1143]	15.0685 (15.4947) [0.0579]	5.6225 (3.8415) [0.0177]
Pakistan	53.3425 (29.7971) [0.0000]	7.8193 (15.4947) [0.4849]	0.3141 (3.8415) [0.5752]
Sri Lanka	23.6178 (29.7971) [0.2171]	6.1457 (15.4947) [0.6783]	0.1563 (3.8415) [0.6926]
Nepal	34.6053 (29.7971) [0.0129]	12.5065 (15.4947) [0.1342]	2.1546 (3.8415) [0.1421]

Note: Critical values at 5 percent level of significance are given in parenthesis while the probability is given below the parenthesis. Cointegrating trace test indicates that there is only one cointegrating vector for Pakistan and Nepal while there is no cointegrating vector for India and Sri Lanka.

Table 6: Long Run Cointegrating Vectors

Countries	LRGDP	LRCF	LREXP
Pakistan	-1.0000	6.5717 (0.7144)	-4.3280 (0.5529)
Nepal	-1.0000	1.0735 (0.1141)	-0.1741 (0.0796)

Note: The vectors are normalized on LRGDP. For Pakistan and Nepal, LF is not included in the tests for co-integration because it is non-stationary in its first difference.

Table 7: Regression Results with LRGDP as the Dependent Variable

Variables	LREXP	LRCF	LF	R^2	Durban-Watson
Sri Lanka	0.3578 (0.1014)	0.2070 (0.0995)	1.0280 (0.3159)	0.98	1.7
India	0.0153 (0.0506)	0.2881 (0.0674)	2.1000 (0.7033)	0.99	1.8

Note: All values are significant at 95 percent confidence level and values of standard errors are given in parenthesis. Autoregressive Cochrane-Orcutt procedure of order 1 is used.

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Foreign Remittances, Income Inequality and Non-Linearity: Evidence from Pakistan

Muhammad Shahbaz*

Abstract: This paper explains large empirical literature and demonstrates evidence on the relationship between foreign remittances and distribution of income. The study has used time series data and Johansen Trace test, DOLS method and ARDL model has been applied. In the case of Pakistan, the relationship between foreign remittances and income inequality is U-shaped indicating that inequality initially decreases and then increases as emigration continues. The empirical findings support the evidence that foreign remittances have income distribution worsening impact in the long run while local migration (rural-urban) declines with income inequality. Increase in per capita income increases income inequality, which means, inequality is encouraged by an increase in per capita income. Improvements in human capital formation worsen the situation of income distribution. Inflation lowers the purchasing power of poor and raises inequality through its detrimental channels like unemployment. Increase in government consumption worsens the income inequality, which indicates that rich households use their political powers to exploit the poor, which raises the income inequality rapidly. This unique endeavor presents some policy implications for policy makers in a small developing country like Pakistan.

Keywords: Migration, Foreign Remittances, Income Inequality
JEL Classification: O11, O15, D31

1. Introduction

Remittances inflows are a key and stable source of foreign capital and revenue in developing economies as dependency on external factors like foreign loans and aids decreases.[1] In literature, the relationship between foreign migrants' remittances and income inequality is scarce and

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[1] Remittance income refers to regular cash payments received from household members working outside the community for periods of 6 months or more (Leones and Feldman, 1998).

incongruous. Some empirical evidences showed that remittances worsen the income distribution (Milanovic, 1987; Stark *et al.,* 1988; Adams, 1989; Taylor, 1992; Taylor and Wyatt, 1996; Rodriguez, 1998; Leones and Feldman, 1998; Adger, 1999; Gonzalez-Konig and Wodon, 2005). In contrast, others argued that foreign remittances decrease the income inequality (Barham and Stepehn, 1998; Ahlburg, 1996; Handa and King, 1997), but Adams (1992) found no significant impact of remittances on rural income distribution in case of Pakistan.

Remittances generate many negative externalities which are responsible for an increase in income inequality. It has been described that remittances do not have undesirable impact because the migrants' remittances are either very small or go disproportionately to those who are better off. In contrast, Stark (1978) and Stark *et al.* (1986) emphasized on enhancing equality associated with migration such as risk-diversification, mitigation of credit constraints and various sharing and filtering-down mechanisms pertaining to migrants' remittances.[2] It was also concluded that income inequality does not mean a social welfare loss, and may be consistent with situation that is preferred under both general social welfare and Pereto criteria. Stark *et al.* (1988) distinguished that the distributional impacts of migration are not the same for all types of migration and concluded that foreign remittances contribute in raising income inequality while internal remittances are having equalizing favorable impact on income distribution in villages.[3]

Stark *et al.* (1986) found the relationship between foreign remittances and income inequality is an inverse U-shaped (Kuznets Curve). It means that initially, effects of remittances on income inequality are positive while later on this effect on a village decreases at further stages of the migration. Jones (1998) distinguished three stages of migration: first is the "*innovative stage*" in which only the most adventurous and better off people migrate, in that case international remittances tend to increase income inequality; second is the "*early adopter stage*", when people from

[2] However, Stark and Levhari (1982) proposed a social welfare measure with desirable properties for assessing the effect of changes in income inequality and inequality upon social welfare.

[3] Remittances from internal migrants embody large returns to schooling component, and education is highly associated with household income in villages (Stark *et al.*, 1986).

lower segments of population also start to migrate and, comparatively, remittances equalize the income distribution; and the last one is, the "*later adopter stage*". Due to accumulation of remittances over time the migrant families move farther apart from the families without migrants and therefore remittances may worsen the income distribution. Stark *et al.* (1986) found that, in a Mexican village with little migration to United States, remittances are contributing in raising inequality while opposite is true for village where migration to United States has long history. But, Gonzalez- Konig and Wodon (2005) extended the methodology developed by Yitzhaki (1982) and Stark *et al.* (1986) and accomplished that impact of remittances on inequality depends where those who migrate are located in the distribution of income.

Carrington *et al.* (1996) found that the impact of international remittances on villages is likely to be different at different levels of migration history while net migration cost becomes endogenous to migration process. Similarly, Quibria (1997) argued that foreign remittances do not affect all the social classes symmetrically. The study utilized the two-factor, two-commodity, two-class general equilibrium model that makes a distinction between traded and non-traded goods. The division of losers and gainers depends on the volume of remittances, the distribution of factors of endowments and type of emigration.[4]

Taylor (1992) estimated direct, indirect and inter-temporal special effects of foreign remittances on income distribution and confirmed that remittances have indirect short run and long run impacts on the level and distribution of household-farm income through asset accumulation. In long run, remittances may finance the accumulation of income-producing assets. By influencing the distribution of these assets, remittances may help to reshape the distribution of total household-farm income overtime (Taylor, 1992; Rodriguez, 1998; Leones and Feldman, 1998). Lucas (1987) found a positive link between migrant remittances and agricultural productivity. Milanovic (1987) tested the possibility of trickle-down effect in Yugoslavia and found no support for the hypothesis that remittances increase income inequality throughout the period. Due to the existence of

[4] The model in this study is the static one that ignores number of dynamic economic considerations, especially those relating to saving and investment. It does consider the different uses of remittances.

imperfection of local credit or labor markets, remittances encourage the household to utilize inputs that are associated with higher crop incomes. Thus the marginal impact of remittances on household incomes may be greater than unitary (Oberai and Singh, 1980; Knowles and Anker, 1981; Stark and Levhari, 1982; Lucas, 1987; Taylor, 1992). On the basis of deprivation theory, Gonzalez-Konig and Wodon (2005) concluded that in poor and rural areas where level of social welfare tends to be lower, part of the expected positive impact of foreign remittances on family income might be offset by a higher level of income inequality at home. However, at the margin, remittances are less likely to improve the income distribution in poorer (rural) as compared to richer (urban) areas.[5]

Koechlin and Leon (2006) provided the evidence in support of existing theoretical literature that in the initial stages of migration remittances worsen the income distribution. Later, as opportunity cost of migration lowers, remittances sent to those households reduce income inequality: a clear indication of inverted U-shaped relationship between remittances and income inequality.[6] David and Rapoport (2004) investigated the overall impact of migration on distribution of income in Mexican rural communities. This impact is composed of direct and indirect effects of remittances, and other potential spillover and general equilibrium effects of migration. It was found that migration raises expected benefits and decreases the costs of migration, and generates a Kuznets-type relationship between remittances and income inequality.[7] All these studies, based on the Gini-Index decomposition with exogenous distribution of domestic incomes, may yield biased estimates of the inequality impact of international remittances, with the direction of bias being theoretically uncertain and depending on the initial distribution of

[5] Migrants from urban families are likely to occupy a lower position in income distribution compared to their rural counterparts, i.e. with similar level of income, migrants' families will tend to be comparatively richer in rural areas (when compared to other rural households) and poorer in urban areas (when compared to other urban households (Gonzalez-Konig and Wodon, 2005, p. 3).

[6] They used cross-country data of 78 economies utilizing ordinary least square, instrumental variables and panel data methods.

[7] Indeed, migration appears to increase inequality at low levels of society migration prevalence and reduces inequality at higher levels (David and Rapoport, 2004).

wealth. Gini-Index decomposition only provides information about point that decomposed.

Despite the fact that a wide rage of strand of economic research has investigated the effects of remittances on variety of topics along with employing variety of techniques with different aspects, there is no formal study, in the case of Pakistan, to analyze whether remittances improve or worsen the income distribution or worsen. This study is advancement over previous literature in a number of important aspects. First, it uses the data set that is sufficiently large to enable robust conclusions to be drawn from econometric results using time series data from 1971 to 2006. Second, this paper includes other important determinants to investigate their impacts on income inequality like government spending, human capital formation, financial development, unemployment rate and local migration (urbanization) which were ignored in all previous literature.[8] Third, this paper employs three advanced techniques (Johansson Trace-Test, Dynamic Ordinary Least Squares and ARDL Bounds Testing) to test co-integration while Error Correction Method (ECM) is employed for short run dynamics. Section 2 explains the model, data collection procedure and methodological framework; Section 3 investigates and interprets empirical results. Lastly, Section 4 presents conclusions and policy implications.

2. Modeling, Data and Methodology

According to assumptions of Barro (1991) and Koechlin and Leon (2006), the most important econometric classification to investigate the significant relationship between income inequality and foreign remittances, the study has used log-linear modeling specification as given below. Bowers and Pierce (1975) suggested that Ehrlich's (1975) findings with a log linear specification are sensitive to functional form. However, Ehrlich (1977) and Layson (1983) argued that the log linear form is superior to the linear form. Both Cameron (1994) and Ehrlich (1996) suggest that a log-linear form is more likely to find evidence of a deterrent effect than a linear form, both on theoretical and empirical grounds. This makes our results

[8] In many developing economies migrants' who send remittances to their families have vey little access to financial intermediaries: a small percentage has bank accounts, saving accounts or access to credits.

more favorable to the deterrence hypothesis. Following the above discussion, empirical equation is being modeled as:

$$LGINI = \alpha_0 + \alpha_1 LREM - \alpha_2 CV + \eta_t \quad (1)$$

$$LGINI = \alpha_0 + \alpha_{11} LREM + \alpha_{12} LREM^2 + \beta_s CV + \eta_t \quad (2)$$

The inequality-narrowing hypothesis predicts $\alpha_1<0$, in contrast the inequality-widening hypothesis predicts $\alpha_1>0$, and inverted U-shaped hypothesis predicts if $\alpha_{11}>0$ and $\alpha_{12}<0$, if $\alpha_{11}<0$ and $\alpha_{12}>0$ U-shaped hypothesis predicts and CV are some control variables that effect income inequality.

Gini-Coefficient is a measure of income inequality while REM is a measure of international remittances, which is expected to have a declining impact on income inequality as described in literature but may be positive through its detrimental channels.[9] Real GDP per capita (GDPPC) is assuming inverse impact through its development process. HDI represents the human capital formation, which may be affecting income inequality either positively or negatively. CPI indicates the inflationary situation in the economy, assuming that monetary instability hurts poor and middle class relatively more than rich because latter class has better access to financial instruments that allow them to hedge their exposure to inflation and expecting positive effect of inflation on inequality[10]; while government expenditures conjecturing negative effect on inequality, but there can be opposite effect of government consumption on inequality if rich households use their political powers to exploit the poor.[11] Urbanization is represented by URB, which might decline the

[9] The estimates of Gini-Coefficient (proxy for Income Distribution) are available in the Economic Survey up to 1996-1997. After this, a simple interpolation technique is applied to take the decline or growth in trend between two points in time and fill the data gaps between successive observations.

[10] See, for example, Easterly and Fisher (2001).

[11] Government current consumption expenditure is for the purchase of goods and services including compensation of employees. It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation.

income inequality through the creation of employment opportunities.[12] Unemployment rate worsens income distribution through its direct and detrimental impacts, indicated by UMP. FD measures financial sector's development proxied by private credit. The share of GDP may equalize the income distribution directly and indirectly through growth effects.[13]

Descriptive statistics in Table 1 reveal that government spending, human capital formation, consumer prices and GDP per capita are highly but remittances are weakly correlated with income inequality. Human capital formation, consumer prices and economy size are associated positively with government spending but correlation of remittances is weak as mentioned in descriptive table. The data has been collected from IFS (International Monetary Fund, 2008), WDI (World Bank, 2008) and Economic Survey of Pakistan (various Issues) except income inequality.

[12] Migration of population to cities as share of total population.

[13] Private credit captures the amount of credit channeled from savers, through financial intermediaries, to private firms. Private credit is a comparatively comprehensive measure of credit issuing intermediaries since it also includes the credits of financial intermediaries that are not considered deposit money banks.

Table 1: Descriptive Statistics and Correlation Matrix

Variables	GINI	GS	HDI	REM	CPI	GDPPC
Observations	36	36	36	36	36	36
Mean	3.599	26.108	-0.825	1.223	3.961	9.484
Median	3.612	26.336	-0.804	1.565	3.950	9.496
Maximum	3.758	27.000	-0.616	2.360	5.101	10.200
Minimum	3.413	25.150	-1.108	-2.338	1.950	8.950
Std. Dev.	0.106	0.549	0.151	1.008	0.890	0.340
Skew-ness	-0.252	-0.308	-0.271	-1.546	-0.471	0.309
Kurtosis	1.843	1.753	1.790	5.639	2.418	2.372
Jarque-Bera	2.389	2.901	2.637	24.806	1.843	1.166
Probability	0.302	0.234	0.267	0.0000	0.397	0.558
Sum	129.59	939.91	29.732	44.035	142.62	341.42
Sum Sq.Dev.	0.394	10.571	0.806	35.580	27.732	4.059
GINI	1					
GS	0.9744	1				
HDI	0.997	0.973	1			
REM	0.348	0.340	0.328	1		
CPI	0.983	0.937	0.985	0.396	1	
GDPPC	0.925	0.912	0.912	0.163	0.854	1

Source: Author's own calculations.

2.1 KPSS Unit Root Test

Literature reveals that ADF and P-P tests are having low explaining power, especially in small data set. KPSS (1992)[14] test is used to investigate the order of integration for concerned variables in the model. KPSS (1992) test assumes null hypothesis is stationary. KPSS test states that any time series variable like X_t is the combination of three mechanisms i.e. deterministic trend, random walk plus error term as given below:

$$X_t = \gamma t - \chi_t - r_t + \mu_t \qquad (3)$$

[14] Theoretical form of KPSS test is based on Bahmani-Oskooee and Ng (2002).

In equation (4), random walk is specified as follows:

$$\eta_t = \eta_{t-1} - \nu_t \qquad (4)$$

To check out the stationarity of X_t, X_t is regressed on constant and trend terms and residuals (ε_t) from equation are used for KPSS test:

$$Z^{-2}\sum \frac{Y_t^2}{Y^2(l)} \qquad (5)$$

where

$$Y_t = \sum_{i=1}^{t} \varepsilon_t \text{ and } y^2(l) = Z^{-1}\sum_{t=1}^{Z} \varepsilon_t^2 + 2Z^{-1}\sum_{y=l}^{l} \varphi(y,l) \sum_{t=y+l}^{Z} \varepsilon_t \varepsilon_{t-z}. \qquad (6)$$

In KPSS test Bartlett wind is utilized which is assumed $\varphi(y,l) = 1 - \frac{1}{(1+l)}$, main reason is that KPSS test is highly sensitive with change of truncation lags.

2.2 Johansen Co-integration Technique

Engle and Granger (1987) discussed that, a set of economic series is not stationary, there may exist some linear combination of the variables that is stationary. All the variables are non-stationary at levels but stationary at first difference. This allows for the implementation of Johansen co-integration technique (1991, 1995). Two variables will be cointegrated if they have a long run relationship between them. Thus, co-integration of two series suggests that there is long run integration. The system approach developed by Johansen (1991, 1995) can be applied to a set of variables containing possibly a mixture of I(0) and I(1) (Pesaran and Pesaran, 1997; Pesaran *et al.,* 2001). The general form of the vector error correction model is as follows:

$$Z_t = \sum_{i=1}^{p-1} \psi Z_{t-1} + \alpha_\circ + \eta_t \qquad (7)$$

This can also be rewritten in the standard form as:

$$\Delta Z_t = \sum_{i=1}^{p-1} \Pi_i \Delta Z_{t-k} - \partial Z_{t-k} + \alpha_1 + \varepsilon_t \qquad (8)$$

where

$\Gamma_i = -I + \partial_1 - \partial_2 + \ldots\ldots - \partial_t \; i = 1,2,3,\ldots k-1$ and $\partial = I - \partial_1 - \partial_2 - \ldots \partial_k$

where p represents total number of variables considered in the model. The matrix Γ captures the long run relationship between the p variables. The Johansen Trace test is used, which is based on the evaluation of $H_\circ(r-1)$ against the null hypothesis of $H_\circ(r)$, where r indicates the number of cointegrating vectors. The co-integration test provides an analytical statistical framework for investigating the long run relationship among economic variables.

2.3 DOLS Procedure for Long Run Relationship

Stock and Watson (1993) developed a model for the investigation of long run relationships among dependent variable and explanatory variables. This procedure involves regressing the dependent variable on all explanatory variables in levels, leads and lags of the first difference of all I(1) explanatory variables (Masih and Masih, 1996). This method is superior to a number of other estimators as it can be applied to variables with different orders of integration (Stock and Watson, 1993). The inclusion of leads and lags of the differenced explanatory variables corrects for simultaneity bias and small sample bias among the regressors (Stock and Watson, 1993). The specification of DOLS model is given below:

$$X_t = \varphi_\circ + \varphi_1 Z_t + \sum_{j=-p}^{p} \phi_j \Delta Z_{t-1} + \eta_t \qquad (9)$$

where X_t is Gini-Coefficient, Z_t is a vector of explanatory variables and Δ is lag operator.

2.4 ARDL Approach for Co-integration

The structure of the study has suggested to employ autoregressive distributed lag (ARDL) bounds testing approach developed by Pesaran *et al.* (2001) to carry out co-integration analysis among income inequality, international remittances and a set of other explanatory variables. Statistical literature reveals that ARDL bounds approach has numerous advantages than other conventional cointegrating methods. In ARDL technique, there is no need of having same order of integration to find out co-integration among variables. It is concluded that ARDL can be applied irrespectively of whether the variable are integrated of order I(0) or integrated of order I(1) or having mixed order of integration. Fortunately, ARDL bounds testing overcomes all problems faced by traditional techniques for co-integration in literature. It has better explaining power and properties in small sample. Moreover, a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee and Newman, 1993). The dynamic ECM integrates the short run dynamics with the long run equilibrium without losing long run information.

Conditional error correction version of the ARDL model for co-integration is given below:

$$\Delta y=\{\lambda_1+\lambda_2 y_{t-1}+\lambda_3 z_{t-1}+\lambda_4 x_{t-1}\}+\left[\sum_{i=1}^{p}\gamma_i\Delta y_{t-1}+\sum_{j=0}^{p}\alpha_i\Delta x_{t-j}+\sum_{s=0}^{p}w_s\Delta z_{t-s}\right]+\mu_t \qquad (10)$$

where $\lambda_\circ$ is the drift component and μ is assumed to be white noise error process. The ARDL approach estimate $(p+1)^k$ number of regression in order to obtain optimal lag length for each variable, where 'p' is the maximum number of lag to be used and "k" is the number of variable in the equation (10). The optimal lag order of the first difference regression is based on minimum value of Schwarz-Bayesian criteria (SBC) to ensure that there is no serial correlation in the estimated residual[15] of equation. Following Pesaran *et al.* (2001), two different statistics are implemented

[15] SBC is known as selecting the smallest lag length to specify a parsimonious model. The mean prediction error of AIC based model is 0.0005 while that of SBC based model is 0.0063 (Shrestha, 2003).

to "bound test" for ensuring of long run relationship: an *F-test* for the joint significance of the coefficients of the lagged levels in equation (10) (with null hypothesis $[H_{\circ}: \lambda_2 = \lambda_3 = \lambda_4 = 0]$means no evidence of existence of long run relationship in concerned model and vice versa). Two asymptotic critical value bounds provide a test for co-integration when the independent variables are I(d) (where $0 \leq d \leq 1$), a lower value assuming the regressors are I(0), and an upper value assuming purely I(1) regressors. If the F-statistics exceeds the upper critical value, we can conclude that there prevails a long run relationship regardless of whether the underlying order of integration of the variables is I(0) or I(1). If the F-statistics falls below the lower critical values, one cannot reject the null hypothesis of no co-integration. If the F-statistics exceeds the upper bounds, one may reject the hypotheses of no long run relationship. However, if the F-statistics falls between these two bounds, inference would be inconclusive.[16] If any variable is having I(2) integrating order, then ARDL bounds testing will collapse.

The long run connection is investigated through the use of selected ARDL model. If variables are cointegrated, the conditional long run model can then be produced from the reduced form of equation (10), when the first differenced variables jointly equal to zero, i.e. $\{\Delta x = \Delta y = \Delta z = 0\}$. Thus,

$$y_t = (\partial_{\circ} + \partial_1 t - \partial_2 x_t + \partial_3 z_t) + \nu_t \qquad (11)$$

where $\partial_{\circ} = -\lambda_{\circ}/\lambda_2$; $\partial_1 = -\lambda_1/\lambda_2$; $\partial_2 = -\lambda_3/\lambda_2$; $\partial_2 = -\lambda_4/\lambda_2$, and ν_t are the random errors. These long run coefficients are empirically estimated by the ARDL model in equation (1) through OLS method. When there is long relationship between variables, there also exists error correction representation. Therefore, the error correction model is estimated as given in the reduced form below:

[16] Moreover, when the order of integration of the variable is known and if all the variables are I(1), the decision is made on the basis of upper bound. Similarly, if all the variables are I(0), then the decision is made on the basis of lower bound.

$$\Delta y_t = \sum_{i=1}^{p} \lambda_i \Delta y_{t-1} + \sum_{j=0}^{m} \beta_i \Delta x_{t-j} + \sum_{k=0}^{n} \beta_k \Delta z_{t-k} + \eta ECM_{t-1} + \omega_t \quad (12)$$

To ascertain the goodness of fit of the ECM model, the sensitivity analysis is conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroskedasticity associated with the model. The stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). Examining the prediction error of the model is another way of ascertaining the reliability of the ARDL model. If the error or the difference between the real observation and the forecast is infinitesimal, then the model can be regarded as best fit.

3. Interpretation Design

The ADF (Augmented Dickey-Fuller), Phillips-Perron and KPSS tests have been utilized in the present study. Results of both tests are reported in Table 2; all variables are stationary at first difference.[17]

[17] LCPI is also stationary at level with trend and constant term.

Table 2: Unit-Root Estimation

Variables	ADF Test at 1st Difference			Phillips-Perron at 1st Difference			KPSS at 1st Difference	
	Intercept and trend	Prob. Values	Lags	Intercept and trend	Prob. Values	Bandwidth	Intercept and trend	Bandwidth
LGINI	-3.945	0.021	2	-3.477	0.0580	10	0.1432**	9
LREM	-9.048	0.000	0	-7.765	0.0000	4	0.1087***	3
LGS	-3.564	0.048	1	-6.626	0.000	3	0.0996***	1
LGDPC	-5.420	0.000	0	-5.240	0.0009	3	0.1064***	4
LHDI	-3.244	0.094	3	-16.145	0.000	4	0.0852***	5
LCPI	-5.104	0.001	0	-5.281	0.0007	2	0.1236**	1

Lag Length Selection of VAR Model			
Lags	AIC	SBC	Maximum Likelihood
1	-22.95081	-21.08439	443.6392
2	-26.87495	-23.37330	534.8742

Note: ** and *** are MacKinnon (1996) one-sided p-values at 5 percent and 10 percent level of confidence, respectively.

This tends to support the use of most advanced techniques for the investigation of long run relationships among the macroeconomic variables. The lag length of VAR model is selected 2 on the basis of (AIC) and (SBC). The Johansen co-integration test is applied and the results are shown in Table 3. Starting with the null hypothesis of no co-integration ($r = 0$) among the variables, the Trace statistic is 236.1014, which is above 1 percent and 5 percent critical values as shown by the probability values. Hence it rejects null hypothesis of $r \leq 0$ in the favor of general alternative $r = 1$. Likewise, null hypothesis of no co-integration ($r = 1$) among the variables, the trace-test statistics is 142.0879, which is above 1 percent and 5 percent critical values as shown by the Prob-value. So, it also rejects null hypothesis $r \leq 1$ in the favor of general alternative $r = 2$. Consequently, one may conclude that there are six cointegrating relationships among income inequality, remittances as share of GDP, human capital formation, GDP per capita, government spending and consumer prices.

Table 3: Johansen's Multiple Co-integration Test Results

Hypotheses	Trace-Test	0.05 percent critical value	Prob.**
r = 0	236.1014	117.7082	0.000
r ≤ 1	142.0879	88.80380	0.000
r ≤ 2	91.02466	63.87610	0.000
r ≤ 3	46.72793	42.91525	0.019
r ≤ 4	27.35478	25.87211	0.033
r ≤ 5	12.66226	12.51798	0.047

Note: **MacKinnon (1996) p-values

Therefore, annual data from 1971 to 2006 supports the proposition that, in Pakistan, there exists a stable long run relationship among the above-mentioned variables in the model. The results of DOLS (Dynamic Ordinary Least Square) are reported in Appendix-A. Only significant regressors are shown in Table 7. The value of adjusted R^2 is 0.999692, which indicates a good-fit for the dataset. The F-statistics is -10714.32 (Probability value = 0.00) which is statistically significant at 1 percent level of significance, concluding that the explanatory variables are jointly

significant in influencing the income distribution for a small developing economy like Pakistan. The results of DOLS regression show that in long run international remittances, human capital formation and increase in per capita income, along with inflation and government spending, are having positive impact on income inequality. Finally, differenced terms of government spending, remittances and GDP per capita improve the income distribution (Appendix-A).

Finally, ARDL is applied to test the long run relationships and the results are shown in Table 4. The main assumption of ARDL is that the included variables in the model are having cointegrated order I(0) or I(1) or mutually. This tends to support for the implementation of bounds test, which is a three-step procedure. In the first step, lag order is selected on the basis of SBC because computation of F-statistics for co-integration is very much sensitive to lag length. The lag order selected is 2 based on the lowest SBC value. [18] The total number of regressions estimated following the ARDL method in equation (2) is $(2+1)^6 = 729$.

Table 4: F-statistic of Co-integration Relationship

Test-statistic	Calculated Value	Lag-order	Significance level	Bound Critical Values(restricted intercept and no trend)	
F-statistic	9.17	2		I(0)	I(1)
			1 percent	5.25	6.36
			5 percent	3.79	4.85
			10 percent	3.17	4.14
Short Run Diagnostic Tests Serial Correlation LM Test =0.195(0.824) ARCH Test = 0.196(0.664) White Heteroskedasticity Test = 1.721(0.138) Normality J-B Value = 1.998(0.368) Ramsey RESET Test = 10.255(0.0038)					

Source: Author's own calculations.

[18] At lower value of SBC, value of AIC is also low as shown in Table 2.

For the existence of a long run relationship, the ARDL co-integration method is used to estimate the parameters of log-linear equation (1) with a maximum lag order 2. The results of bounds test for long run relationship represent that the calculated F-statistic is 9.17, which is higher than the upper bound (6.36) and lower bound (5.25) at 1 percent level of significance; implying that the null hypothesis of no co-integration cannot be accepted. This indicates that there is indeed a co-integration relationship among the variables.

Long run coefficients of the variables are shown in Table 5. Model 1 reveals that increase in remittances worsen the income distribution significantly. The reason for this is that increase in cost of migration pushes the poor segments of population downward and rich people get the fruits of migration and become richer and richer, while rapid increase in per capita income also pushes the income inequality upward because growth effects did not trickle down to the lowest quintile of population (bottom 20 percent). Higher income inequality is coupled with low rate of human capital formation. Rise in consumer prices make income distribution more skewed through its detrimental direct and indirect channels.[19] Government spending affects the income inequality positively and significantly because rich households use their political powers to exploit the poor, which worsens the income distribution swiftly. There is also evidence of an increase in income inequality as international migration process continues. This means that the relationship between remittances and income inequality is Kuznets inverted U-shaped. This shows another proof of linear association between foreign remittances and income distribution, while internal migration (rural-urban) makes income distribution more equal through obtaining fruits from employment opportunities in urban areas.[20] Combined impact of remittances and human capital formation on income inequality is negative which indicates that an improvement in human capital formation through remittances reduces the income inequalities.

[19] For details, see Easterly and Fisher (2001)
[20] See Stark, Taylor and Yitzhaki (1986)

Table 5: Long Run OLS (Ordinary Least Squares) Results

Dependent Variable: LGINI					
Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	2.741*** (7.77)	3.164*** (9.17)	2.729*** (6.90)	2.717*** (6.98)	2.698*** (6.81)
LREM	0.003** (2.41)	0.002** (2.34)	-0.0179* (-1.70)	-0.0157 (-1.47)	-0.0374 (-0.93)
$LREM^2$	.....	.....	0.0013* (1.90)	0.0008 (1.03)	0.0007 (1.01)
LGDPC	0.052** (6.87)	0.053*** (7.75)	0.059*** (6.93)	0.055*** (6.05)	0.055*** (6.00)
LHDI	0.325*** (3.71)	0.327*** (4.19)	0.275*** (3.52)	0.272*** (3.49)	0.274*** (3.47)
LCPI	0.033*** (3.41)	0.032*** (3.79)	0.038*** (4.38)	0.034*** (3.69)	0.033*** (3.49)
LGS	0.019** (2.104)	0.006 (0.62)	0.016* (1.65)	0.018* (1.81)	0.020* (1.87)
LURB	.....	-0.058*** (-2.96)	-0.047** (-2.42)	-0.046** (-2.45)	-0.044** (-2.20)
LEMP	.....	.....	.....	0.009* (1.71)	0.010* (1.76)
LFD	.....	.....	.....	0.003 (0.26)	-0.003 (-0.20)
LREM*LHDI	.....	.....	-0.019* (-1.82)	-0.017 (-1.57)	-0.021 (-1.58)
LREM*LFD	.....	.....	.....	.....	0.005 (0.56)
R^2 = 0.998294 Durban-Watson = 1.74 F-stat = 3510.42		R^2 = 0.998690 Durban-Watson = 1.71 F-stat = 3685.73	R^2 = 0.998889 Durban-Watson = 1.76 F-stat = 3034.93	R^2 = 0.999005 Durban-Watson = 1.97 F-stat = 2510.68	R^2 = 0.999018 Durban-Watson = 1.94 F-stat = 2220.263

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

Inequality is being positively affected by an increase in unemployment level, while access to credit (financial development) seems to worsen the income distribution insignificantly due to low quality and efficiency of financial institutions.[21] Combined impact of remittances and financial development is positive but insignificant describing that remittances are increasing inequality because these are not being properly channelized through banking sector due to low incentive to migrants. Net effect of financial sector's development improves distribution of income insignificantly.

Having found a long run relationship, the ARDL method was applied to investigate the long run relationship and the following equation was used for estimating the short run dynamic:

$$\Delta LGINI = \alpha_0 + \sum_{j=0}^{n} \beta_1 \Delta LREM + \sum_{j=0}^{n} \beta_2 \Delta LGDPc + \sum_{j=0}^{n} \beta_3 \Delta LCPI + \sum_{j=0}^{n} \beta_4 \Delta LHDI + \sum_{j=0}^{n} \beta_5 \Delta LGS + \eta CE_{t-1} + \varepsilon_t \quad (13)$$

[21] In financial development there is an interaction between remittances and financial institutions. First, providing financial intermediaries through remittances increase benefits to senders and recipients because it improves opportunities to save, borrow, buy other financial services like insurance, invest, and helps financial institutions to mobilize in local part of society where money is located. Due to international migration, increases in households' assets have national affects on growth and development in the economy. Thus national savings and investment ratio can improve growth rate when foreign savings are allocated to productive projects to strengthen the productive base of the local economy in the development process.

Table 6: Short-Run Dynamic Model (1, 1, 2, 2, 1, 1)

Dependent Variable: DLIGNI		
Variable	Coefficient	Prob-value
Constant	0.0041	0.1056
DLREM	-0.0008	0.6806
DLGDPC	0.0550	0.0030
DLGDPC(-1)	-0.0087	0.5851
DLCPI	0.0347	0.0458
DLCPI(-1)	-0.0023	0.8811
DLHDI	0.0602	0.4485
DLGS	0.0143	0.1040
CR(-1)	-0.6043	0.0218
$R^2 = 0.542$	R^2-Adjusted =0.395	
Durban-Watson = 1.74	F-stat = 3.69(0.005)	

Source: Author's own calculations.

The results of ECM are reported in Table 6. The results indicate that remittances improve the income distribution in short run insignificantly but increase in the volume of per capita income worsens the income distribution. The lag term of GDP per capita declines the income inequality but insignificantly, and this effect converges to its future affect. Consumer prices and government spending increase income inequality.

The error correction term CR_{t-1}, which measures the speed of adjustment to restore equilibrium in the dynamics model, appears with negative sign and is statistically significant at 5 percent level, ensuring that long run equilibrium can be attained. According to Banerjee and Newman (1993) a highly significant error correction term is a further proof of the existence of stable long run relationship.[22] The coefficient of CR (-1) is equal to -0.604, which implies that deviation from the long term income inequality is corrected by 0.604 percent over each year. The lag length of short run model is selected on the basis of AIC and SBC. The short run dynamics of the income inequality based on ARDL (1, 1, 2, 2, 1, 1) model for Pakistan

[22] Indeed, they have argued that testing the significance of CE_{t-1}, which is supposed to carry a negative coefficient, is relatively more efficient way of establishing co-integration.

is reported in Table 6. The diagnostic statistics indicate that the equation is misspecified. The model fulfills the conditions of non-serial correlation, no autoregressive conditional heteroskedasticity and normality of disturbance term. There is no heteroskedasticity in the short model.

Finally, the stability of the long run parameters together with the short run movements for the equation was examined. To this end, the study relied on cumulative sum (CUSUM) and cumulative sum squares (CUSUMSQ) tests proposed by Borensztein *et al.* (1998). Pesaran and Pesaran (1997) also tested the stability of the long run coefficients. The tests applied to the residuals of the ECM model along with the critical bounds are graphed in Figures 1 and 2 (Appendix-B). As can be seen in the Figures, the graph of CUSUM stay within the critical 5 percent bounds for all equations but CUSUMSQ statistics exceeds the critical boundaries due to misspecification of short run model.

4. Conclusions and Policy Implications

Present paper explains large empirical literature and explores empirical evidence on the relationship between international remittances and distribution of income. Robust evidence of long run relationship among the variables was established by using time series data covering period 1971-2006 and three advanced techniques: Johansen Trace-test, DOLS and ARDL model for co-integration. In the case of Pakistan, the relationship between international remittances and income inequality is U-shaped indicating that inequality initially decreases and then increases as migration history continues.

The empirical findings support the evidence that international remittances increase inequality in the long run while local migration improves income distribution. Increase in per capita income pushes the income inequality upwards which means inequality increases by an increase in per capita income. Improvements in human capital formation worsen the situation of income distribution. Inflation lowers the purchasing power of poor individuals in the economy and raises inequality through its detrimental channels like unemployment. Increase in government consumption worsens the income inequality, which indicates that rich households use their political powers to exploit the poor, which raises the income inequality swiftly.

The main policy implication of this study is that migration may lead to economic development in less developed areas of a country, which will improve the income distribution and alleviate poverty. A higher development in financial institutions and markets will allow an easier and cheaper transmission of migrants' remittances; lower transaction cost will also allow poorer households to receive remittances at earlier stages of migration, compared to how long they would have to wait if financial markets are less developed. Therefore, financial sector should regulate its institutions and markets to launch such policies to provide some particular incentives for remittance senders through proper formal banking system. The government should adopt such policies to enhance the volume of skilled labor through technical education in rural areas. More opportunities could be enhanced through regulation of recruitment process and safe transport facilities through supporting working rights for poor class. There will be a need to take initiatives to promote transport and safe mechanism for migrants to send small sums of money, and to create a more attractive investment climate in the country, particularly in rural areas, to alleviate poverty from its roots. More migrants' remittances from abroad mean more national saving, which is pre-requisite for development process and economic growth.

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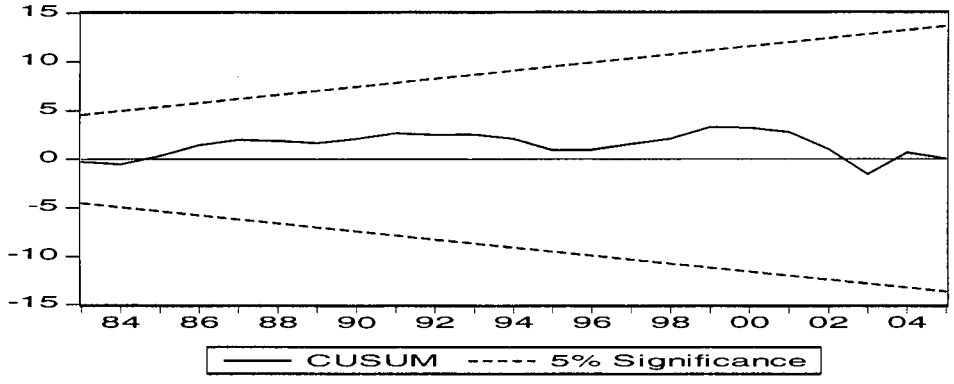
Appendix-A

Table 7: Estimated DOLS MODEL for Income Inequality

Dependent variable =LGINI			
Variables	Coefficient	T-Statistic	Prob-value
Constant	2.356451	11.97780	0.0000
LREM	0.004635	8.267295	0.0000
LHDI	0.192813	3.645794	0.0013
LCPI	0.052890	8.083849	0.0000
LGS	0.022064	4.766731	0.0001
LGDPC	0.064113	14.66855	0.0000
DLGDP	-0.014576	-2.221755	0.0364
DLCPI (+1)	0.023289	2.256998	0.0338
DLGS	-0.011272	-2.594354	0.0162
DLHDI (+1)	0.194594	5.252829	0.0000
DLREM	-0.005885	-5.898395	0.0000
R^2 = 0.999785		Adjusted R^2 = 0.999692	
S.E. of regression = 0.0018		AIC = -9.576276	
Durbin-Watson = 1.792835		F-statistic = -10714.32	

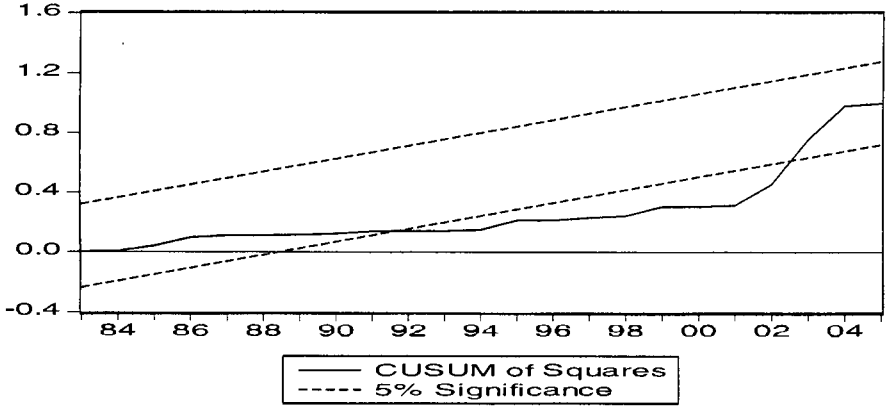
Appendix-B

Figure 1: Plot of Cumulative Sum of Recursive Residuals



The dotted straight lines represent critical bounds at 5 percent significance level.

Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals



The dotted straight lines represent critical bounds at 5 percent significance level.

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Effects of Pollution on Lahore Traffic Wardens' Productivity

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Abstract: The quantity and diversity of traffic in Lahore is not a new subject of study. However, since the introduction of traffic wardens in the Punjab to counter the growing effects of a mismanaged citywide road infrastructure, no study has attempted to analyze the efficiency of this new system of traffic policing. This paper looks at efficiency as both an economic and a social construct. It assesses the adverse impact of pollution on health, psychological and personal factors on the productivity of those guiding Lahore's relatively haphazard traffic. The study simultaneously uses traffic wardens themselves as the subject of the impact of pollutants from vehicular traffic. It then uses a Poisson Regression Analysis to study the count data obtained as a measure of productivity of the wardens and finds that motivation, lead concentration and smoking are the most influential factors on the efficiency of traffic wardens' performance. Although it does not assess the response of citizens to the performance of these public officers, it does make a strong case for better facilities and more flexible schedules for the traffic wardens of Lahore.

Keywords: Efficiency, Productivity
JEL Classification: G1, O4

1. Introduction

There has been an increasing trend in vehicular ownership today. In 1950, approximately 53 million cars were known to be on the streets of the world. By the year 2000, this figure had crossed 500 million with an average increase of 9 million cars a year. It is estimated that 12 years from today the number of cars worldwide will be double that of the 1990 level (Didyck and Moyano, 2003). Even more studies have been conducted to establish the link between rising pollutant concentration in urban air and vehicles, the ill effects these pollutants bear on health and the benefits of curtailing such emissions.

The city of Lahore is not immune to these international changes. Its sharp increase in car sales/leases, traffic jams and pollution levels are a few

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indicators of that. In the Punjab, the number of registered vehicles in 2006 was 4.5 million with a growth rate of more than 10 percent that year (Government of Punjab, 2007). 14 percent of the vehicles checked annually are non-compliant with vehicular emission standards (Pakistan Environmental Protection Agency, 2006). Furthermore, the Pakistan Environmental Protection Agency (EPA) in Lahore reported in 2006 that the greatest number of complaints registered with the Agency was related to air pollution.

Lead concentrations tested in the blood of the traffic police officers serving prior to the newly introduced wardens in Lahore were as high as 35 micrograms/dL (Aziz and Bajwa, 2004). This amount was well in excess of the international standards (10 micrograms/dL). While there are many types of individuals exposed to the negative externality that is pollution, traffic police are ideal subjects to study the effects of constant exposure to vehicular emissions. Currently, a new batch of traffic wardens has replaced the former ones. As such, there is no research on the health and related variables' impact on the productivity of traffic wardens of Lahore.

As public servants, wardens can be treated economically as social goods. The provision of public services like security, traffic control, education about traffic-related issues and assistance to citizens on the roads incur a social cost as their salaries are paid for through a public treasury. A negative impact on their health compels society to incur an additional social cost to compensate for the negative effects of pollution. This phenomenon and consequence merits investigation.

Although these men and women have only recently entered into the field, this study of their condition is an attempt to construct a data bank of relevant variables about the wardens that can be used as a benchmark in the future. It is inadequate to assess only the effects of health on their productivity. Hence, other variables are also considered in the model constructed here. More specifically, the study divides itself into pollution and non-pollution variables.

The use of such variables allows one final, but most fundamental, contribution of this study to come through. Measuring public service productivity is not only important, but also extremely difficult as output

cannot be measured in any one unit, such as kg/hr, or from any one perspective of 'production'. While this study uses a fairly simple definition of productivity, as a first attempt at original research by these researchers in the area of public servant productivity, it serves as a platform to builds further constructs of productivity upon.

The objectives of the paper are: a) to identify the multiple dimensions that affect productivity of public servants/officers such as the police (traffic wardens), b) to study the behavioral relationships among such dimensions, c) to test the implications of such dimensions on the productivity of traffic wardens, and d) to outline policy recommendations and areas for further research in the light of findings of this study.

Section 2 reviews significant contributions to the areas of health, productivity and psychological research and their interaction. Section 3 details the sampling method used. Section 4 tests the data using Integer Count Analysis and outlines the reasons why non-linear modeling was used. It is followed by Section 5, which examines the construction of variables, and Section 6 explains the significance of variables. Section 7 summarizes the recommendations the researchers arrived at in light of this study.

2. Literature Review

2.1 Labour Productivity

When considering productivity in its strictly economic sense, literature offers various methods of quantifying this variable in terms of output. Hirsch and Hausman (1983) used a logarithmic regression, while Weintraub (1938) advocated various technological measures, such as changes in plant size or percentage of plant capacity, be used to measure productivity. Kumbhakar and Hjalmarsson (1995) studied labour efficiency through the use of panel data in frontier functions and decomposition of technical inefficiencies faced by a firm. Valadkhani (2003) used time-series analysis to identify determinants and measure labour productivity as real output per hour worked.

On the other hand, when considering the efficiency of workers in public service, traditional methods of determining their output per time period

significantly excludes the social purpose behind public offices. Hence, the literature that caters more specifically to the nature of this research should look at the dimension of the 'public good'. Hatry (1978) highlighted the need for public service to be both (quantitatively) efficient and (qualitatively) effective. Guidelines he offered for measures of such productivity include output, employee attitude and consumer satisfaction. Stressing on the similar aspects, Shannon and Hanson (1979) outlined that operational and social demand factors need to be studied to help measure patrolling efficiency. Ostrom (1976) derived some productivity measures of police effectiveness from citizen surveys and police interviews. The study found multiple measures of police productivity like citizens' experiences and evaluations alongside officers' self-evaluations and proportions of crimes or warrants cleared, consistently indicate effectiveness of public performance. Likewise, Wadman and DeLadurantey (1984) argue for officers' self-evaluations and observation-based recordings of police performance rather than using traditional measures of productivity like crime rates, per capita costs of police and the like which host serious flaws.

2.2 Stress

Sager and Wilson (1995) reported 15 different definitions of stress. Proxies like somatization, depression or anxiety can be used (Derogatis and DellaPietra, 1994) or the level of the hormone cortisol (Kirschbaum and Hellhammer, 1999). Psychosocial instruments are being developed to define and measure stress more comprehensively like the abridged 9-item Psychological Stress Measure (Lemyre and Tessier, 2003) preferred to instruments such as the Brief Symptom Inventory, which entails a natural focus on dysfunctional clinical populations rather than treating stress as a socially acceptable phenomenon. Manning *et al,* (1996) provide a first-of-its-kind quantification of the health costs of work-related stress and strain.

2.3 Health Effects

Numerous studies establish a strong link between exposure to urban pollution and hypertension (Ibald-Mulli *et al.*, 2001; Urch *et al.*, 2005), increased lead concentrations (Romieu *et al.*, 1995; Heinze *et al.*, 1998; Essa, 1999; Vaglenov, 2001), mortality (Lave and Seskin, 1971; Venners *et al.*, 2003), decreased lung function (Pope III *et al.*, 1995; Tomei *et al.*,

2001; Friger *et al.,* 2004), and increased health costs (Lave and Seskin, 1971; Ostro, 1980; Pope III *et al.*, 1995).

The major part of this research has gone into developing a relation between pollution indicators and perceived health. Li and Fielding (1995) developed an instrument, the CPH-42, to measure current perceived health among Chinese people. It has been highlighted that current perceived health is a better indicator of health status than general perceived health. Tasiran and Coetzee (2004) used Cox Population Hazard and Accelerated Failure Time models to find that HIV-positive patients in South Africa, who experience an improvement in their perceived health, feel encouraged to re-enter the labour market. Arora (2001) also found that improvements in health patterns give rise to an increase in productivity patterns across 10 countries.

2.4 Motivation

Perry and Porter (1982) identified motivation as a hypothetical construct that exhibits the degree and effort in behaviour that energizes, directs and sustains one's behaviour. They elaborate upon 4 basic motivational methods: monetary incentives, goal setting, job design, and participation. Knoke and Wright-Isak (1982) identified three categories of public service motivation: individual utility maximization, conformance to social norms, and emotional responses to situations. Perry (1996) developed these in a Likert-scale set of 4 valid and reliable constructs of public service motivation: attraction to public policymaking, commitment to public interest, compassion, and self-sacrifice. Dunifon and Duncan (1998) studied a bi-dimensional concept of motivation – a sense of personal control and challenge versus affiliation – and found that both were strong predictors of change in earnings (an indicator of labour market performance).

2.5 Nutrition and Household Status

Strauss (1986) used a weight-for-height index to find a strong relation between calorific intake and labour productivity. A similar measure was used by Deolalikar (1988) in a panel-data study of a fixed-effects individual wage equation to demonstrate a long run positive relationship between nutrition levels and physical worker productivity.

3. Sampling Method

A multi-stage sampling technique was adopted in which the initial proportional sampling was of the sectors of Lahore that were to be sampled. On a second level, wardens were randomly sampled from within each sector selected using a table of random numbers. The total sample size was determined through the following formula (Casley and Kumar, 1988):

$$\frac{N.z^2.v^2}{N.d^2 + z^2.v^2}$$

where N = population size, z = normal variant, v = variability, and d = acceptable error

This study uses a 9% acceptable error and 50% variability (the worst-case scenario of variability in the sampling units). With 2690 elements in the population, the following computation gives us an approximate sample size of 96:

$$\frac{(2690).(1.8)^2.(50)^2}{(2690).(9)^2 + (1.8)^2.(50)^2} = 96.4$$

4. Poisson Regression Analysis

Also called Integer Count Analysis, the Poisson Regression is most commonly used for analyses of count data, which involves non-negative integer observations that have been counted, not ranked. Hence, this model does not look at the data as continuous. In using the Poisson regression, we fulfilled the assumption that each subject had been subjected to the same length of observation time. This was at two levels: an equal amount of time served in the field by each warden sampled, and observations counted as number of tickets issued per day. Furthermore, it was observed that the data did not consist of excessive zeros. Hence, the model was expected to produce sound, unbiased results.

Instead of using the null hypothesis approach, statistical measures of comparing models can be used. Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and the Hannan-Quinn (HQ)

measures of goodness-of-fit for model selection are compared; theory states that the lower the value of either of these criteria, the better the model is considered to be.

The equation thus developed is:

Productivity = f [(Mot), (St), (AvgEx), (PH), (DBP), (Edu), (S), (L)]

where Mot= Motivation, St= Stress, AvgEx= Average Expenditure per Member of Household, PH= Perceived Health Status, DBP= Diastolic Blood Pressure, Edu=Education, S= Smoking, L=Lead

$$E\,[\text{Tickets}_i \mid X_i] = \lambda_i = \exp^{(C_0 + C_1(\text{Mot}) + C_2(\text{St}) + C_3(\text{AvgEx}) + C_4(\text{PH}) + C_5(\text{DBP}) + C_6(\text{Edu}) + C_7(\text{S}) + C_8(\text{L})) + e}$$

where e is the error term.

Taking logarithm of the dependent variable to construct a log-linear model in the set of generalized linear models:

$$\ln E\,[\text{Tickets}_i \mid X_i] = \ln \lambda_I = C_0 + C_1(\text{Mot}) + C_2(\text{Str}) + C_3(\text{AvgEx}) + C_4(\text{PH}) + C_5(\text{DBP}) + C_6(\text{Edu}) + C_7(\text{S}) + C_8(\text{L}) + e$$

5. Variable Construction

5.1 Productivity

For the purpose of this study, we constructed the productivity variable as the average number of tickets issued by the respective warden per day. Since there is no quota as to the number of tickets that must be issued by wardens on a daily or monthly basis, it is assumed that the more alert a warden is the more observant and active he/she will be in detecting and fining traffic violators. Hence, the number of tickets issued indicates their productivity.

A key assumption is that the average is a more-or-less satisfactory indicator of the warden's performance on any randomly selected day in July or August (recent time period). It is also assumed that the marginal productivity of each warden equals to his/her wage rate (including perks/benefits/rewards) so that there remains an incentive to improve performance in an attempt to earn an increment or reward that translates into a higher wage rate. This assumption is validated by the fact that rewards and certificates of achievement or motorbikes are awarded as incentives to high performers by the CTPD.

5.2 Perceived Health

A combination of 3 questions was used to generate a composite value of perceived health. This was denoted as the number of times the respondent felt the need/desire to fulfill any of the indicators being used to represent a perceived decline in health. The numerical values of the three indicators were then summed up. The indicators were:

1. Number of times respondent desired visit(s) to a doctor due to perceived poor health per week
2. Number of times respondent desired taking medicine(s) in response to perceptions of weakness or poor health per week
3. Number of times respondent desired taking extra leaves from work due to perception of poor health.[1]

5.3 Lead Concentration

Blood samples of 5 ml were collected from each warden sampled using disposable, sterilized 10 ml Shifa Laboratories syringes by trained paramedics. The blood was then transferred into a lead-free Serum Clot Activator (with Gel) vacuette: a tube with a vacuum inside to draw in blood automatically. The purpose of the gel was to ensure that the blood remained relatively stable during its transportation to the laboratory so as not to hemolyze, which would have rendered the sample useless. The tubes were stored and transferred in a secure IKEA icebag, lined with reusable icepacks. The vacuettes were centrifuged to separate out the serum. Each serum sample was diluted in a 1:5 ratio (1 ml serum to 4 ml

[1] Under normal circumstances, one leave per week is granted to traffic wardens

deionized water) and stored in 10 ml glass test tubes with caps. These diluted samples were then transferred to the Punjab University's Institute of Chemistry for analysis through ICP method (Perkin-Elmer ICP-OES OPTIMA 2100).

5.4 Blood Pressure

Diastolic pressure is the lower reading of blood pressure, when the heart is in a state of relaxation. It was used in the analysis to determine the amount of stress of wardens' work on the heart, even in its relaxed mode.

5.5 Motivation

To draw up a motivational variable, literature was consulted. Out of the various questionnaires, philosophies and ideas proposed and a pre-test conducted by these researchers, 5 important questions were drawn up:

1. Why did you join this service?
2. Do you feel as though your presence has had a significantly positive impact on the pattern of traffic in your sector?
3. Do you perceive yourself as a figure of authority or is that a power granted on paper only?
4. Would you encourage young, educated boys/men to join this service or to look for better opportunities?
5. Would you encourage young, educated women to join this service?

Except for the first one, all the questions had pre-specified codes using a Likert scale from 1 to 5. The wardens' responses were entered into the appropriate category by the researchers. The scale was arranged in ascending order with 1 signaling the least motivated response and 5 indicating the most.

To construct the motivation variable, three main categories were identified as able to measure the dimensions of motivation as developed by previous research. The averages of the categories were then summed up (Perry, 1996). The categories are:

- Eagerness to Work: Reason for Joining and Social Value of Job
- Loyalty: Level of Encouragement to Boys and Girls for Joining Service
- Acceptance of Internal Job Limitations: Sense of Authority

Motivation=[(Reason for joining + Social Value of job)/2] + Authority + [(Encouragement for Boys + Encouragement for Girls)/2]

The higher the value, the higher the motivation level of an individual.

5.6 Stress

An abridged version of the Psychological Stress Questionnaire was used to target the following 4 important dimensions of stress:

1. Perception of fatigue (mental exhaustion or mental lethargy)
2. Physical pains
3. Feelings of being rushed, distracted or helpless
4. A rise in frustration and mood swing levels

Each of the questions was pre-coded and the respondents' answers were allocated to a concerned category.

6. Results

Table 1: Result for Poisson Regression

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.5226	0.2662	5.7209	0.0000
MOT	0.0661	0.0176	3.7428	0.0001
LEAD	-0.0524	0.0316	-1.6550	-0.0979
SMOK	0.2141	0.0852	2.5126	0.0119

Source: Authors' own computations

The first model constructed in the Integer Count Analysis included all the identified independent variables, but was subsequently altered by dropping both Stress and Perceived Health as they were found to be insignificant. In this case, Akaike Information Criterion (AIC) became 5.49 compared to 5.509 previously. While this may not have been a very big change, it still reflected improvement. Similarly, Schwarz Information

Criterion (SIC) improved from 5.749 to 5.68 as did Hannan Quinn Criterion (HQ) from 5.606 to 5.56. The Log-Likelihood Ratio test is used to indicate the probability of the occurrence of a particular phenomenon under consideration. The higher the value, the more likely this phenomenon is expected to occur and the greater the confidence with which inference can be made about a certain incident. In the original model, the Log Likelihood Ratio (LLR) was -255.45 with a statistical significance of 0.00077, which then increased to -256.70 with a statistical significance of 0.000466.

By removing the insignificant variables one by one, the final model was run with only Motivation, Lead and Smoking as significant variables. The final AIC was 5.44, SIC was 5.55 and HQ was 5.48, all significant reductions compared to the first values obtained previously. LLR also increased in absolute terms (-257.42) as did its statistical significance to 0.0000439. Hence, the best model selected from among the various models tested was the final one with only 3 significant variables.

7. Conclusions and Recommendations

To counter the potential harms of continuous exposure to this toxic metal (lead), policymakers are advised to undertake rigorous pollution control campaigns. This should involve identification of sources of lead, whether from gasoline or the old technology used in, for instance, 2-stroke auto rickshaws. Regular medical check-ups must be prescribed for wardens, a regulation that is currently not in place. Finally, the effort to reduce pollution levels on the roads of Lahore and in its air requires massive input across the board. Students, blue-collar and white-collar workers, the elderly, the policymakers and the government treasuries must all cooperate to devise a holistic agenda for change.

Many of the wardens interviewed for the purpose of this study were young, unmarried men, who had recently graduated from college. The asset that they collectively offer to the nation constitutes their youth, skill and commitment. These factors can become instrumental in enhancing the productivity of any segment of the economy. Currently, wardens are housed and/or hosted by the infrastructure of conventional police stations and jails. Their offices are located on the premises of these stations. While other policemen have recently been provided with updated facilities like

new and clean bedding and bathing units, the wardens and their superiors have been provided only 2-3 congested rooms, usually positioned at the back end of the station premises. Without a proper place to rest between 16-hour duties (in special cases) or even after an 8-hour duty before returning home, it can be expected that over the coming years, those in service will lose steam and passion for their jobs. Furthermore, without a proper mess/cafeteria/main dining centre for wardens, this new system of traffic police cannot feel fully institutionalized when compared to other forces.

It is crucial for policymakers to note that wardens as traffic police officers are in a job, the nature of which is quite different from other branches of the police. Firstly, the length of duty that currently stands at 8 hours could be reduced to 4 hours alternated with 4 hours of rest. In one day, a warden would still perform 8 hours of duty, but with a break adequate enough to recuperate to full strength for enhanced and, more importantly, continued productivity. Secondly, the climate of Lahore is ill suited to requiring wardens to direct traffic for such long hours in the heat, humidity and sun that is characteristic of this city. An initiative to address these issues is greatly needed.

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The Trade-Off between Inflation and Unemployment: An Empirical Evidence from Pakistan

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Abstract: The present study was aimed to analyze the trade-off between inflation and unemployment in Pakistan during 1973-2005. Chow test was applied, by using Ordinary Least Square method on the time series data, to examine the structural stability/instability of the parameters. The results showed that inflation rate was affected by three factors i.e. expected inflation rate, unemployment gap, and the speed by which unemployment changed. The study revealed the existence of trade-off between inflation and unemployment, a positive relationship between inflation and expected rate of inflation and a negative relationship between inflation and speed of unemployment. On the basis of this relationship, the 'expectations-augmented and change-in-unemployment extended Phillips Curve' was estimated for Pakistan during the study period (1973-2005).

Keywords: Inflation, Unemployment, Phillips Curve
JEL Classification: E3, J6, E3

1. Introduction

Since the start of mid-sixties, the Phillips Curve remained at the centre of macroeconomic debate. The empirical findings of the Phillips Curve relationship were considered contentious issues, particularly in the developed countries (Frisch, 1977; Johnston, 1980). Despite the fact that the original hypothesis of the Phillips Curve was questioned and challenged, nevertheless, the importance of this concept remained preserved by its continued relevance for macroeconomic policy. Friedman (1970; 1971) and Tobin (1980) pointed out that unemployment and inflation still occupy the minds of economists, statesmen, journalists, housewives, and everyone else.

For nearly a third of the last century, applied macroeconomics had, to a large extent, proceeded from the starting point of the interpretation of

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trade-off in the Phillips Curve. This relationship was one of the multiple discoveries in economics (Robert, 1997).

During the study period (1973-2005), rising inflation rate and higher unemployment level remained the most challenging problems for Pakistan's economy. Empirical evidences showed that inflation rate was bad if it crossed the threshold of 6 percent, and was extremely harmful if it crossed the double digit level. The data showed that annual inflation rate in Pakistan was above 11 percent for the past 32 years. Not surprisingly, average real per capita income growth was 2.8 percent in the years having less than 11 percent inflation as compared to the years of high inflation, which recorded an average real per capita income growth rate of 1.5 percent.

Unemployment also remained a problem of serious concern in Pakistan. Pakistan's population was estimated at 156.7 million during the financial year 2006-2007. Total labour force was 50.5 million of which 47.37 million were employed and the remaining 3.13 million were unemployed. Thus, unemployment rate was 6.2 percent. Beside this open unemployment, it was also estimated that 16 percent of the total labour force was underemployed and subjected to hard economic realities prevailing in the country. Pakistan was confronted with population pressure characterized by high growth rate of 1.8 percent per annum and high dependency with very low labour force participation rate which was 32.3 percent (Government of Pakistan, 2006).

There is limited empirical literature on the Phillips Curve in Pakistan (Hasan, 1987; 1988; Hasan *et al.,* 1995; Khan, 1988). Dua (2006) indicated some marvelous findings about the trade-off between inflation and unemployment in Asia but she ignored Pakistan in her analysis. In this scenario, the empirical study of the trade-off between inflation and unemployment in Pakistan was imperative to put the economy of Pakistan on proper track. The present study was aimed to provide a guideline to address the core issues of inflation and unemployment in Pakistan.

Generally, the Phillips Curve was examined by establishing a trade-off relationship between inflation and unemployment rates. The aim of the present study was not only to find relationship between inflation and

unemployment but also to estimate expectations-augmented the Phillips Curve coupled with determining the effect of a change in speed of unemployment on the inflation rate. Thus 'expectations-augmented and change-in-unemployment extended Phillips Curve' was estimated for Pakistan for the study period (1973-2005).

The Phillips Curve trade-off relationship between inflation and unemployment illustrated the Stigler's Law that no scientific discovery was named after its original discoverer. Phillips was far from the first to describe the relationship between inflation and unemployment. On the contrary, two hundred years before him, at least 10 economists, including such celebrated names as David Hume (1752) and Henry Thornton (1802) had done this. Fisher (1926) also presented various versions of the curve.

Phillips (1958) in his widely cited article, "The Relationship between Unemployment and the Rate of Change of Monetary Wage Rates in UK", made an empirical investigation to examine whether statistical evidence would support the existence of trade-off between money wages and unemployment in UK, during the time period 1861 to 1957. Post-Phillips economists such as Solow (1969), Samuelson and Solow (1960), Hansen (1970), and Friedman (1970, 1971) believed in adaptive expectations i.e. trade-off stability happens only in the short-run and in the long-run Phillips Curve remained vertical, which reflected ineffectiveness of the government policies. Among post-Phillips economists, some celebrated names in economics literature are Muth (1961), Okun (1962), Phelps (1968), Modigliani (1977), Taylor (1979) and Lucas (1980) who were in favour of rational expectations i.e. both actual and expected inflation adjusted identically and instantaneously to the anticipated policy changes.

2. Data and Methodology

The study has used annual time series data covering the time period from 1973 to 2005. The data sources include International Monetary Fund (2008), World Bank (2008), and the Government of Pakistan (2006).

Specification of the model starts with the general form of the original Phillips Curve as:

$$g_w = -\varepsilon(U_{nt} - U^n) \qquad (1)$$

where $g_w = (w_t - w_{t-1})/w_{t-1}$ = Wage inflation rate, U_{nt} = Actual unemployment rate prevailing in time t, U^n = Natural rate of unemployment at time t, ε = parameter that measured the responsiveness of wages to unemployment.

Equation (1) stated that wage inflation rate was falling when actual unemployment rate exceeded natural unemployment rate; it was rising when natural unemployment rate exceeded actual unemployment rate; and it was stable when actual unemployment rate was equal to natural unemployment rate. Hence, an economy was confronted with three possibilities; symbolically:

$$U_{nt} > U_n \Rightarrow g_w < 0 \qquad (2)$$

$$U_{nt} < U_n \Rightarrow g_w > 0 \qquad (3)$$

$$U_{nt} = U_n \Rightarrow g_w = 0 \qquad (4)$$

Although the original Phillips Curve related wage inflation to the unemployment rate, the term "Phillips Curve" gradually came to describe the relation between price inflation rate and unemployment rate. Thus, corresponding to equation (1), a new equation appeared:

$$\pi = -\varepsilon(U_{nt} - U^n) \qquad (5)$$

where π = Price inflation rate

Equation (5) stated that at the same previous pattern, an economy was confronted with following three possibilities:

$$U_{nt} > U_n \Rightarrow \pi < 0 \qquad (6)$$

$$U_{nt} < U_n \Rightarrow \pi > 0 \qquad (7)$$

$$U_{nt} = U_n \Rightarrow \pi = 0 \qquad (8)$$

Inflationary expectations were considered as the main shifting factor of the Phillips Curve and the so-called 'expectations-augmented Phillips Curve' was introduced (Friedman, 1970). Incorporating expected or trend inflation rate, the following equation was observed:

$$\pi = \pi^e - \varepsilon(U_{nt} - U^n) \qquad (9)$$

Equation (9) stated that price inflation, π, would decline relative to the previous trend or expected inflation rate (π^e) if the actual unemployment rate (U_{nt}) exceeded the natural rate (U^n) and vice versa (Dornbusch and Fisher, 1990). Thus equation (3) indicated the following three possibilities:

$$U_{nt} > U_n \Rightarrow \pi < \pi_e \qquad (10)$$

$$U_{nt} < U_n \Rightarrow \pi > \pi_e \qquad (11)$$

$$U_{nt} = U_n \Rightarrow \pi = \pi_e \qquad (12)$$

Equation (9) implied that:

$$\pi_t - \pi_t^e = -\varepsilon(U_{nt} - U^n)_t \qquad (13)$$

where π_t =Actual inflation rate at time t, π_t^e =Expected inflation rate at time t; the expectation being formed in year t-1 i.e. $\pi_t^e = \pi_{t-1}$

The econometric form of this expectations-augmented Phillips Curve was:

$$\pi_t - \pi_t^e = \varepsilon(U_{nt} - U^n) + U_t \qquad (14)$$

where U_t =N~ $(0, \sigma^2)$ i.e. the error term U_t was normally distributed with zero mean and constant variance

The Phillips Curve relationship given in equation (14) was known as the modified Phillips Curve, or the expectations-augmented Phillips Curve or the accelerations Phillips Curve. Since π_t^e was not directly observable, one could make a simplifying assumption that:

$$\pi_t^e = \pi_{t-1} \tag{15}$$

This expression indicated that expected inflation rate of current year was equal to the inflation rate of the previous year. Substituting this assumption into equation (5), the following regression model in standard form was obtained:

$$\pi_t - \pi_{t-1} = \beta_1 + \beta_2 U_{nt} + U_t \tag{16}$$

It was observed that the natural unemployment rate (U^n) appeared as a key-decision factor in the above discussion and played a pivotal role in the determination of wage inflation and price inflation in an economy. It was estimated as under (Gujarati, 2003):

$$\beta_1 = -\beta_2 U^n \qquad \Rightarrow U^n = -\beta_1 / \beta_2 \tag{17}$$

Equation (9) suggested that the expectations-augmented Phillips Curve was determined on the basis of expected inflation rate and unemployment gap. In other words, inflation rate was affected by expected inflation rate and unemployment gap under the concept of the expectations-augmented Phillips Curve. It was, however, observed that the speed, by which unemployment changed, was also one of the major determinants of inflation rate. This parameter was included in equation (9) by modifying it into the following equation (Pekos *et al.*, 2004).

$$\pi_t = \pi_t^e - \varepsilon(U_{nt} - U^n) - \lambda(U_{nt} - U_{nt-1}) \tag{18}$$

where λ measured the extent to which changing unemployment (U_{nt}- U_{nt-1}) affected inflation. Larger the λ, the more important was the effect of changing unemployment on the inflation rate. This equation was called the expectations-augmented and change-in-unemployment

extended Phillips Curve. This showed that inflation rate was affected by the following three factors: i) expected inflation rate; ii) unemployment gap; and iii) speed by which unemployment changed. This equation was very useful for policy decisions because it showed that there was a concrete trade-off between reduction in unemployment and disinflation. The more rapid the reduction in unemployment rate, the lesser the disinflation achieved at each level of the unemployment rate. Even in cases where unemployment rate was very high, the inflation rate falls little and the economy was moving too rapidly out of the recession. Conversely, a slow recovery reinforced the inflation rate, dampening the effects of high unemployment rate (Dornbusch and Fisher, 1990).

Equation (18) could also be written, using the original philosophy of the Phillips Curve as:

$$g_{w,t} = g^{e}_{w,t} - \varepsilon(U_{nt} - U^{n}) - \lambda(U_{nt} - U_{nt-1}) \qquad (19)$$

where $g_{w,t}$ = Wage inflation at time t, $g^{e}_{w,t}$ = Expected wage inflation, at time t

Equation (19) stated that wage inflation at time t was affected by expected wage inflation at time t, unemployment gap and the speed by which unemployment changed. It was termed as the expectations-augmented and change-in-unemployment extended Phillips Curve for wage inflation.

3. Results and Discussion

The regression between two non-stationary variables produces spurious results (Griffiths *et al.*, 2001). In order to check stationarity, Augmented Dickey-Fuller test (1979) was used which showed that that all series were stationary at level. Thus, OLS method was used to estimate the relationship. The results showed that unemployment rate was found significant at 0.01 probability level having the expected sign. It was imperative to check autocorrelation in order to obtain unbiased estimates. The Durbin-Watson statistics (1951) was applied to check autocorrelation. But one basic assumption of Durbin-Watson statistics was that the intercept term must be introduced for the specification of the model. The original specification of the Phillips Curve suggested that intercept term

should not be included in the analysis. Thus, Durbin-Watson statistics was not applied to check autocorrelation. In order to overcome the problem of autocorrelation, Breusch-Godfrey LM test (1978a) was applied. The results showed that the problem of autocorrelation existed as indicated by probability value 0.007 which was less than the critical value 0.05. In order to address this problem, the lag of inflation was introduced as an explanatory variable in the model. The results showed that there was a trade-off between inflation and unemployment gap. In order to check serial correlation, the Breusch-Godfrey Serial Correlation LM test (1978b) at lag (1) was applied. The results showed that at lag (1), there was still a problem of autocorrelation. Then lag (2) was introduced to remove autocorrelation. The results showed that the introduction of lag (2) removed the problem of autocorrelation because now the value of probability (0.103) was greater than critical value (0.05).

Chow test (1960) was used to investigate the structural stability/instability of the Phillips Curve. The test consisted of breaking the sample into two separate data sets (or more according to the case), estimating the equations for each of them and then comparing the residual sum of squares from these equations with that of the whole sample and applying F-test to accept or reject the null hypothesis.

The regression equations were estimated on the basis of the following three different data sets:

a. For the whole sample (1973 – 2005) ---------- (n)
b. Transition Period (1973-82) ---------- (n_1)
c. Period of Structural Changes (1983-2005) ------ (n_2)

It was worth-mentioning here that the use of dummy variable was considered an appropriate technique for the analysis. In the present study, the sample observations were broken into two separate data sets and were regressed separately as per Chow test requirements. The whole sample was broken into the following two data sets:

(i) Transition Period (1973-82)
(ii) Period of Structural Changes (1983-2005)

In the present study, 1983 was selected as the year of structural break due to the following facts: i) A dramatic increase in remittances from the Middle East due to de-linking of Pak rupee with dollar in January 1982 i.e. Pakistan rupee declined by 52 percent within the period of 3 years which led to a substantial increase in the rupee value of remittances; ii) A marvelous performance by agriculture sector due to an excellent weather cycle; ensuring consistent and sufficient water supplies especially for the production of four main crops i.e. cotton, rice, wheat and sugarcane; it reached record levels during 1981 and 1982; iii) Low saving potential during early 1980s; iv) Energy crisis i.e. energy supply was rising at the rate of 11 percent while the demand was growing at the rate of 24 percent per annum; v) The reluctance of private sector to invest in large scale and manufacturing due to a variety of economic and non-economic factors like uncertainty, Soviet invasion in Afghanistan, fear of nationalization, discouraging taxation structure, lack of infrastructural facilities etc.; vi) Ignorance of social sectors like education, population welfare etc., for instance, the share of expenditure on education fell from 2.1 percent of GNP in 1976-1977 to 1.5 percent in 1983-1988; and viii) Higher defense allocations and debt-servicing payments. To apply Chow test, OLS method was used to estimate the relationship of the coefficients of the whole sample data (1973 – 2005). The results are shown in Table 1.

Table 1: Regression Results Relating Inflation with Independent Variables, Pakistan (1973-2005)

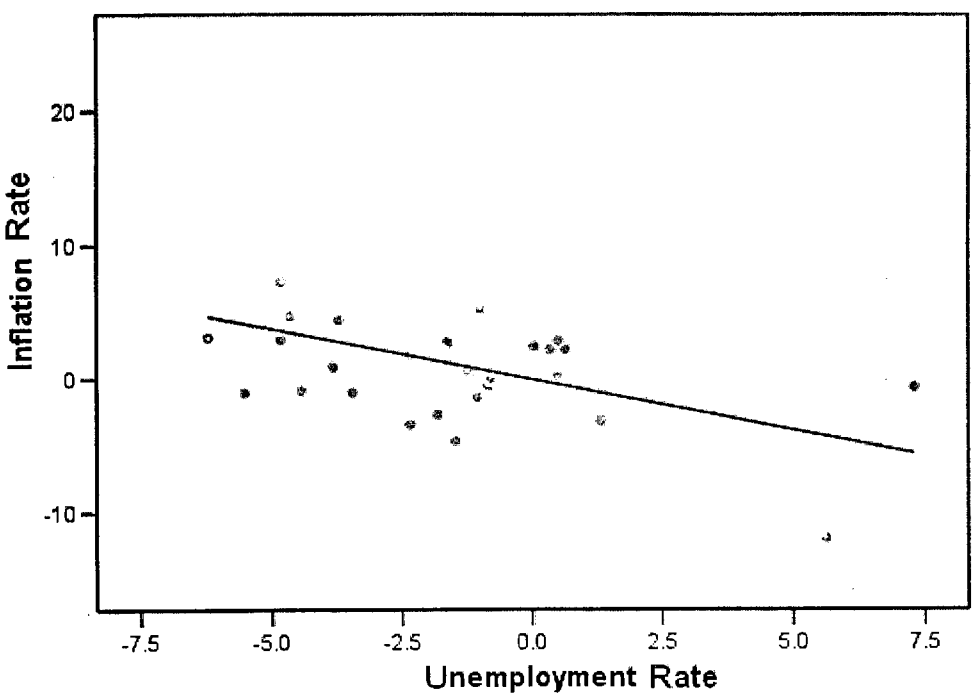
Variables	Coefficients	Std. Error	t-statistics
Unemployment gap	-0.756***	0.256	-2.952
Inflation (-1)	0.478***	0.164	2.907
Speed of Unemployment	-0.764	1.294	-0.59
R^2	0.84		

***show that coefficient is significantly different from zero at 0.01 probability level

The results showed that the estimated coefficients of unemployment rate and expected rate of inflation were significant (p=0.01) having expected negative and positive signs, respectively. The estimated coefficients of adjustment variable i.e. speed of unemployment also showed expected negative sign. Explanatory power (R^2) was fairly high.

Thus, the results reflected three main points that during the study period (1973-2005): i) there existed a trade-off between inflation and unemployment, ii) there was positive relationship between inflation and expected rate of inflation, and iii) there was negative relationship between inflation and speed of unemployment. The graphical interpretation of the results is shown below (Figure 1).

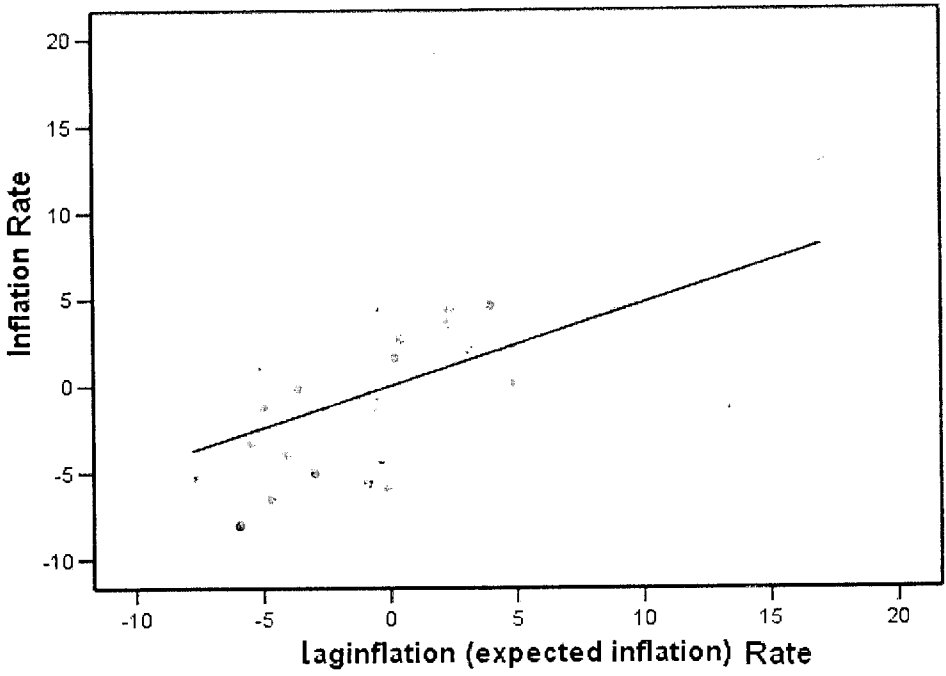
Figure 1: Trade-off between Inflation and Unemployment in Pakistan (1973-2005)



Source: Authors' own calculations

In Figure 1, a trade-off between inflation and unemployment in Pakistan (1973-2005) is shown by the negative slope of the curve. This shows that the parameters were not stable for the entire period and this evidence of structural instability of the parameters showed that government policies in Pakistan were effective to control at least one of the evils i.e. inflation or unemployment, during the study period (1973-2005).

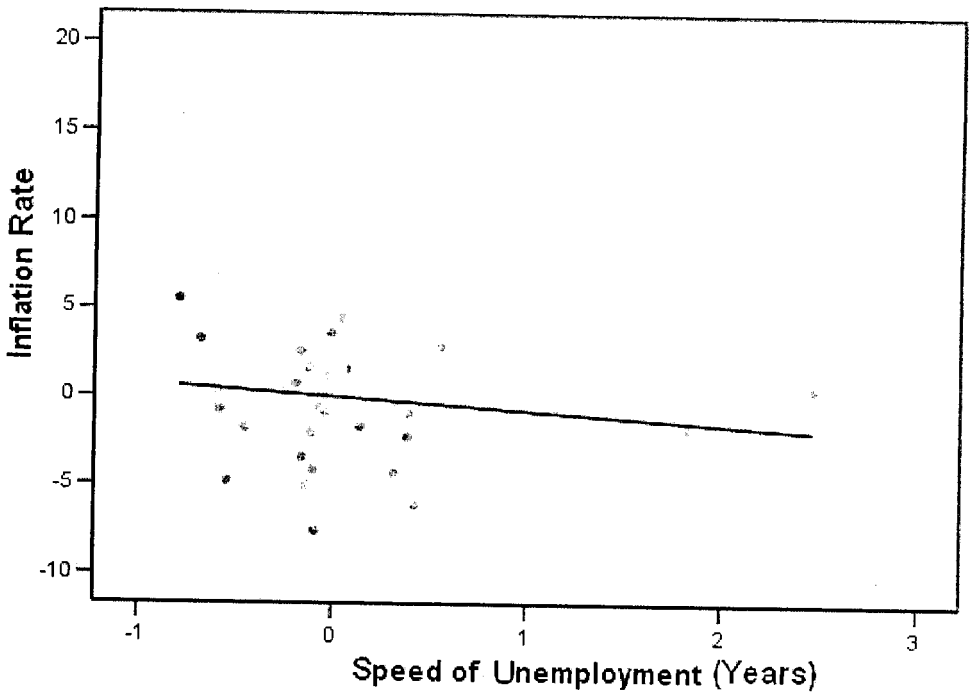
Figure 2: Relationship between Inflation and Expected Inflation Rate in Pakistan (1973-2005).



Source: Authors' own calculations

The slope of the curve in Figure 2 is positive, which showed that when expected inflation rate (based on the inflation rate of the previous year) increased, price inflation rate also increased and when expected inflation rate decreased, price inflation rate also decreased. This relationship was observed in Pakistan during 1973-2005. It provided future guidelines for all the stakeholders in Pakistan during the period under consideration.

Figure 3: Relationship between Inflation and Adjusted Variable in Pakistan (1973-2005).



Source: Authors' own calculations

The slope of the curve, as shown in Figure 3, is negative which showed that when speed of unemployment increased, rate of price inflation decreased and vice versa. It is very useful for policy decisions because it showed that there was a concrete trade-off between unemployment reduction and disinflation. The more rapid the reduction in unemployment rate, the lesser the disinflation achieved at each level of unemployment rate (Dornbusch and Fisher, 1990).

After the estimation and economic interpretation of the parameters for the whole data set (1973-2005), the results of transition period (1973-82) are shown in Table 2.

Table 2: Regression Results of Relating Inflation with Independent Variables in Pakistan (1973-1982)

Variables	Coefficients	Standard Error	t-statistics
Unemployment gap	-1.729***	0.601	-2.876
Inflation (-1)	0.143	0.306	0.467
Speed of Unemployment	-13.101**	6.8	-1.927
R^2	0.90		

***show that coefficient is significantly different from zero at 0.01 probability level
**show that coefficient is significantly different from zero at 0.05 probability level

The results showed that the estimated coefficients of unemployment rate and adjustment variable i.e. speed of unemployment were significant at 99 percent level of confidence and 95 percent level of confidence, respectively, having the expected negative signs. The estimated coefficient of lag inflation also showed expected positive sign. Explanatory power (R^2) was fairly high. The results reflected that, in Pakistan, during 1973-1982: i) there existed a trade-off between inflation and unemployment, ii) there was positive relationship between inflation and expected rate of inflation, and iii) there was negative relationship between inflation and speed of unemployment.

The regression results during the period of structural changes (1983-2005) are shown in Table 3.

Table 3: Regression Results Relating Inflation with Independent Variables in Pakistan (1983-2005)

Variables	Coefficients	Standard Error	t-statistics
Unemployment gap	-0.408**	0.227	-1.795
Inflation (-1)	0.653***	0.18	3.621
Speed of Unemployment	-0.272	0.882	-0.309
R^2	0.89		

***show that coefficient is significantly different from zero at 0.01 probability level
**show that coefficient is significantly different from zero at 0.05 probability level

The results showed that the estimated coefficient of unemployment rate was significant (p=0.05) having the expected negative sign. Expected rate of inflation was also significant (p=0.01) having the expected positive sign. The estimated coefficient of adjustment variable i.e. speed of unemployment also showed expected negative sign. Explanatory power (R^2) was fairly high. The results reflected that, in Pakistan, during 1983-2005: i) there existed a trade-off between inflation and unemployment; ii) there was positive relationship between inflation and expected rate of inflation during 1983-2005 and iii) there was negative relationship between inflation and speed of unemployment.

The residual sum of square of the above three subsets were obtained and it was labeled as SSRn, $SSRn_1$ and $SSRn_2$, respectively. The values of these residual sums of square were estimated as under:

$$SSRn = 633.467$$

$$SSRn_1 = 244.594$$

$$SSRn_2 = 164.837$$

F-statistics was calculated by using the following formula.

$$F = \frac{(SSRn - (SSRn_1 + SSRn_2))/k}{(SSRn_1 + SSRn_2)/(n_1 + n_2 - 2k)}$$

where k = the number of parameters.
It implied that:

$$F = \frac{(633.467 - (244.594 + 164.837))/3}{(244.594 + 164.837)/38}$$

$$F = 6.931$$

Thus, F-statistics was greater than the F-tabulated; therefore null hypotheses (H_0) were not accepted. This showed that the parameters were not stable for the entire period and thus concluded that there was an

evidence of structural instability. In other words, it was found that during the time period 1973-2005: i) there existed a trade-off between inflation and unemployment, ii) there was a positive relationship between inflation and expected rate of inflation, and iii) there was a negative relationship between inflation and speed of unemployment.

4. Conclusions

Since the mid-sixties, the Phillips Curve remained the centre of macroeconomic debate. Despite the fact that the original hypothesis of the Phillips Curve was questioned and challenged, nevertheless, the importance of this concept remained preserved by its continued relevance for macroeconomic policy (Friedman, 1970; 1971). Because of its central importance to macroeconomic policies, the relationship between inflation and unemployment was tested empirically for many developed countries. Thus, despite the pivotal role of trade-off between inflation and unemployment in macro policy decision making, very little attention was devoted to this issue in the developing countries in general, and Pakistan in particular (Khan, 1988). In the present study, a meaningful empirical relationship among basic ingredients of the Phillips Curve for Pakistan was estimated which, in turn, revealed the following conclusion:

The present study perceived that the Phillips Curve was generally examined by establishing a trade-off between inflation and unemployment rates. In the present study, it was suggested that inflation rate was affected by three factors i.e. expected inflation rate, unemployment gap and speed by which unemployment changed. On the basis of this relationship, the concept of "expectations-augmented and change-in-unemployment extended Phillips Curve" was estimated for Pakistan during the study period (1973-2005).

Keeping in view the empirical evidences in some countries, economists like Johnston (1980) claimed that trade-off between inflation and unemployment was dead. The present study refuted this claim, at least in the case of Pakistan. In the light of empirical evidence, the present study on Pakistan (1973-2005) revealed the existence of trade-off between inflation and unemployment. This showed that the parameters were not stable for the entire period and the evidence of structural instability of the parameters is the indication that government policies were effective to

control at least one of the evils i.e. inflation or unemployment in Pakistan, during the study period (1973-2005). It was witnessed that the estimated coefficients of unemployment rate and expected rate of inflation were significant ($p = 0.01$) having the expected negative and positive sign, respectively. The estimated coefficients of adjustment variable i.e. speed of unemployment also showed expected negative sign. Thus, the results indicated that during the study period (1973-2005), there existed a trade-off between inflation and unemployment, a positive relationship between inflation and expected rate of inflation and a negative relationship between inflation and speed of unemployment in Pakistan. The negative relationship between adjustment variable i.e. the speed of unemployment and the inflation rate showed that there was a concrete trade-off between reduction in unemployment and disinflation. The more rapid the reduction in unemployment rate, the lesser the disinflation achieved at each unemployment level (Dornbusch and Fisher, 1990).

Moreover, it was perceived that the concept of natural rate of unemployment played a crucial role in policy making. It was concluded that the policy which entailed unemployment rate below the estimated natural rate of unemployment, resulted in accelerated inflation. On the other hand, the policy that entailed unemployment rate above the estimated natural rate of unemployment, tended to lower inflation. Hence, the economy of Pakistan faced the dilemma of high-growth recovery that rapidly reduced unemployment and increased inflation, and a slow-growth recovery that reduced inflation, but at the cost of sustained unemployment. This study also suggested that inflation rate depended directly on expected rate of inflation. It provided a guideline for all the stakeholders in Pakistan, during the period under consideration.

5. Recommendations

The existence of trade-off reflected the structural instability of the parameters which was enough to declare the effectiveness of government polices to control inflation and unemployment in Pakistan. Effective measures for human capital formation and physical capital formation are strongly recommended to get rid of both the evils i.e. the inflation rate and unemployment in Pakistan.

It was imperative for the government to adopt stabilization policy, which was expected to be affective in exploiting the trade-off via channels of unemployment gap, speed of unemployment, exchange rate and imported inflation etc.

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Acreage Supply Response of Basmati Rice in the Punjab, Pakistan: A Time Series Analysis

Nisar Ahmad and Falak Sher*

Abstract: The paper estimates the acreage supply response of Basmati rice area in Punjab to the changes in the price of Basmati Rice, price of IRRI rice, yield of Basmati rice and yield of IRRI. The study covers the time period from 1973 to 2007. Rice is an important cash crop and staple food in Pakistan and plays an important role in the economic growth of our country. The rice industry is an important source of income and employment in the rural areas of Pakistan. The country, through the exports of superior qualities of rice, earns substantial foreign exchange every year. The variables included in the acreage supply response model have been found to be cointegrated. Therefore, the coefficients of the acreage supply response model were estimated through the Ordinary Least Squares method. The response of Basmati rice area was found to be dependent upon the yields and prices of Basmati rice and IRRI rice.

Keywords: Competition, Relative Price
JEL Classification: L1, D0

1. Introduction

Agriculture is an important sector of the Pakistani economy which comprises 20.9 percent of the country's GDP. Its sub-sectors include crops, livestock, forests and fisheries which contribute 10 percent, 10.4 percent, 0.2 percent and 0.3 percent, respectively. The major crops of Pakistan are wheat, Basmati rice, IRRI rice, maize, sugarcane, cotton, *mung*, millets, sorghum, onion, potato, barley, chickpea and rapeseed (Government of Pakistan, 2007a, 2007b). Out of these, rice is one of the most important cash crops and staple food in Pakistan which has played an important role in the country's economy. The rice industry has always been an important source of income and employment in the rural areas of Pakistan and is flourishing rapidly due to vast production of rice in the country. The rice crop accounts for 5.5 percent of the value addition in agriculture and its contribution to GDP is 1.4 percent. Basmati rice area

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comprises 63 percent of the total cultivated rice area in Pakistan (Government of Pakistan, 2005, 2006, 2007a and 2007b). The production of rice not only meets the domestic needs of the country but the surplus is exported to other countries. Pakistan is exporting superior quality rice every year and earning huge foreign exchange from its export. Pakistan, in 2007, was included in the list of 10 largest rice exporting countries of the world. Pakistan exported 2900 thousand metric ton of rice to in the aforementioned year and had a share of 10.5 percent in the global market (USDA, 2007).

Mahmood *et al.* (2007) determined the factors affecting the cultivation of Basmati rice in Punjab using Ordinary Least Square Method covering the time period from 1982 to 2002. The lagged Basmati Acreage, lagged Basmati price, lagged Basmati yield and lagged IRRI price were found to be the important determinants of acreage supply of Basmati rice in Punjab.

Acreage supply response has been an important issue in agricultural economics as the responsiveness of farmers to economic incentives determines agriculture's contribution to the economy. It also suggests that agricultural policy plays a significant role in raising farm production. Acreage supply response, therefore, has been used as an effective tool in determining the price mechanism of farm production (Nerlov, 1958). Krishna (1963) estimated the acreage response of wheat, cotton, rice and sugarcane in the Punjab region using time series data for the time period from 1914 to 1945. The Ordinary Least Square Method was employed to estimate the single equation model for each crop. In case of rice, the estimated long run and short run price elasticities were 0.59 and 0.31, respectively. In addition to the relative prices of the crops for the response model, relative yield was also found to be an important explanatory variable.

The production and supply of rice mainly depends upon socio-economic factors, technology, risk, irrigation system and climatic conditions of the region. The cropping areas, yields, price of the crop as well as the competing crops were the main determinants of the rice supply. The present study has been undertaken to determine the factors of acreage supply response of Basmati rice in the province of Punjab, Pakistan.

2. Data and Methodology

To determine the acreage supply response, the Basmati and IRRI rice cropping system of Punjab was selected because Punjab is the leading province in rice production. The secondary data of Basmati rice area (AB), IRRI rice area (AI), Basmati rice yield (YB), IRRI rice yield (YI), price of Basmati rice (PB) and price of IRRI rice (PI) was collected from Government of Pakistan (2005, 2006, 2007a, 2007b). The variables are:

AB = Basmati Rice area (000 hectares);
AI = IRRI Rice area (000 hectares);
YB = Basmati Rice yield (kgs per hectares);
YI = IRRI Rice yield (kgs per hectare);
PB = price of Basmati Rice (Rs. per 40 kgs); and
PI = price of IRRI Rice (Rs. per 40 kgs).

The Augmented Dickey Fuller (ADF) (Dickey and Fuller, 1981) unit root test was applied to find the order of integration of the time series variables included in the study. The following equations were estimated to determine the order of integration of the variables under consideration:

With constant:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \varepsilon_t \qquad (1)$$

With constant and trend:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \beta T + \varepsilon_t \qquad (2)$$

where Y_t is the series for which the order of integration was found, T is the time trend, $\Delta Y_t = Y_t - Y_{t-1}$ and $\delta = \rho - 1$. The null and alternative hypotheses formulated in the light of regression equations were H_0: $\delta = 0$ (unit root) and H_1: $\delta \neq 0$ (no unit root). The results of ADF at level are reported in Table 1 and Table 2.

Table 1: Unit Root Tests using Augmented Dickey-Fuller Method

Variables	Without trend	With trend
AB	-1.07	-3.25
AI	-3.55	-3.50
YB	1.08	-0.64
YI	-0.31	-0.39
PB	5.17	2.48
PI	4.61	3.11

Source: Authors' own calculations.

Table 2: Unit Root Tests using Augmented Dickey-Fuller Method

Variables	Without trend	With trend
DAB	-4.07	-3.99
DAI	-4.31	-4.38
DYB	-4.68	-6.39
DYI	-3.04	-4.03
DPB	-2.01	-4.52
DPI	0.41	-4.04

Note: D denotes the first difference of the series.

These series were found to be non-stationary, with and without trend, as shown by the results given in Table 2. However, the series were stationary at first difference as shown in Table 3. Therefore, all the variables used in the study were found to be integrated of order one i.e. I (1). Under these conditions, Johansen (1988) and Johansen and Juselius (1990) Maximum Likelihood Estimation (ML) approach was used to test the co-integration among the variables that include AB, AI, YB, YI, PB and PI. The unrestricted intercept and no trend model was used to find the cointegrating vectors among the variables. The results showed that all variables were found to be cointegrated. The order of the VAR model was also determined before finding the co-integration among the variables. The selected order of the VAR model was equal to four (see Appendix A, Table 1). The results of co-integration with unrestricted intercepts and no trends in the VAR model, based on maximum Eigen value, are provided in Table 4. Five cointegrating vectors were determined on the basis of these results.

Table 3: Johansen Co-integration Results for Acreage Supply Response Model

Hypothesis		Eigen Values	Critical Values
H_o	H_a		
$r = 0$	$r = 1$	144.1822	39.8300
$r \leq 1$	$r = 2$	83.3138	33.6400
$r \leq 2$	$r = 3$	53.3887	27.4200
$r \leq 3$	$r = 4$	33.1682	21.1200
$r \leq 4$	$r = 5$	14.8869	14.8800
$r \leq 5$	$r = 6$	2.0069	8.0700

Source: Authors' own calculations.

The co-integration results with unrestricted intercepts and no trends in the VAR, based on maximum Trace value of the stochastic matrix, are given in Table 5. Four cointegrating vectors were selected on the basis of Trace Value Test and it was concluded that all the variables were cointegrated.

Table 4: Johansen Co-integration Results for Acreage Supply Response Model

Hypothesis		Trace Value	Critical Value
H_o	H_a		
$r = 0$	$r \geq 1$	330.9467	95.8700
$r \leq 1$	$r \geq 2$	186.7645	70.4900
$r \leq 2$	$r \geq 3$	103.4507	48.8800
$r \leq 3$	$r \geq 4$	50.0620	31.5400
$r \leq 4$	$r \geq 5$	16.8938	17.8600
$r \leq 5$	$r \geq 6$	2.0069	8.0700

Source: Authors' own calculations.

Thus, it was concluded, in the light of results stated in Table 4, that all the variables in the acreage supply response model were cointegrated.

Therefore, Ordinary Least Square (OLS) method was applied, to estimate the parameters. The model for acreage supply response is specified as:

$$AB = \beta_0 + \beta_1 AB(-1) + \beta_2 AI(-1) + \beta_3 YB(-1) + \beta_4 YI(-1) + \beta_5 PB(-1) + \beta_6 PI(-1) + \mu \quad (3)$$

where AB = current year's Basmati rice area (000 hectares), AB (-1) = lagged Basmati area (000 hectares), AI (-1) = lagged IRRI area (000 hectares), YB (-1) = last year's Basmati yield (kg/ha), YI (-1) = last year's IRRI yield (kg/ha), PB (-1) = lagged Basmati price (Rs.40/kg), PI = lagged IRRI price (Rs.40/ kg) and μ = error term.

3. Results

The relationship of Basmati rice area (AB) in Punjab with other explanatory variables was determined through Ordinary Least Square (OLS) method. The results of the OLS estimates are given in Table 6. The first column in Table 6 presents the explanatory variables where AB (-1) is lagged Basmati rice area, AI (-1) is lagged IRRI area, YB (-1) is lagged Basmati rice yield, YI (-1) is lagged IRRI yield, PB (-1) is lagged Basmati rice price and PI (-1) is lagged IRRI price and C is the intercept term. The estimated coefficients are reported in the second column of Table 6.

The results of the study indicate that the current cultivated area of the Basmati rice is mainly dependent on last year's prices and yields of Basmati rice and IRRI rice. However, the results of the study do not explain the role of lagged area of Basmati rice and IRRI rice in the acreage supply response of Basmati rice in the Punjab.

Table 6: Regression Results for Basmati Rice area

Regressors	Coefficient	Std. Error	t-Ratio	Prob.
C	1148.4	285.785	4.018	0.000**
AB(-1)	0.196	0.143	1.368	0.180[b]
AI(-1)	0.358	0.129	2.770	0.010*
YB(-1)	0.262	0.146	1.791	0.0850[a]
YI(-1)	-0.589	0.134	-4.400	0.000**
PB(-1)	0.986	0.330	2.985	0.006**
PI(-1)	-0.179	0.641	-0.280	0.782[b]
R-Square	0.97	R-Bar-Square	0.97	
DW-statistic	1.90	Durbin's h-statistic	0.51	

Note: * and ** indicates significance level at 5 percent and 1 percent, respectively.
a= Significant at 10 percent level.
b= Insignificant at 10 percent level.

The estimated coefficient of lagged Basmati rice yield was 0.262 and was significant indicating that a 0.262 times increase in the current area of Basmati rice was due to a unit increase in the lagged yield of the Basmati rice. Therefore, last year's yield of Basmati rice was found to be an important indicator of the acreage supply response of the Basmati rice. The negative sign of the lagged IRRI yield is also in accordance with the theory. The improved lagged yields of IRRI rice influenced the acreage supply response of Basmati rice negatively as Basmati rice and IRRI rice are competitive food crops.

The estimated coefficient of the lagged price of Basmati rice was 0.986 and was highly significant. It showed that 0.986 times increase in the acreage supply of Basmati rice was due to the unit increase in the last year's price of the Basmati rice. Similarly, the negative sign of the lagged IRRI price is also in accordance with the theory. It explains that an increase in the lagged price of IRRI rice negatively influences the acreage supply of Basmati rice. Therefore, the cropping decisions of the farmers are dependent upon not only the price of the same crop but also upon the competing crop. Regarding the cross price effects, the results of the study were comparable with other studies. Mahmood *et al.* (2007) also estimated the coefficient of lagged IRRI price with a negative sign,

significant at 10 percent level suggesting that the price of IRRI rice had an inverse relationship with Basmati acreage.

4. Conclusions and Policy Recommendations

The study estimated the responses of Basmati rice area in Punjab to the changes in the price of Basmati rice, price of IRRI rice, yield of Basmati rice and yield of IRRI rice. It covered the time period from 1973 to 2007. The time series properties of the data were analyzed and it was concluded that the variables included in the supply response model were cointegrated. Therefore, the coefficients of the area response model were estimated through the Ordinary Least Squares method. The response of Basmati Rice area was found to be dependent upon yields and the prices of Basmati rice and IRRI rice.

It is deduced that the supply and production of Basmati Rice mainly depend upon its yield and the prices. Therefore, government should take measures to improve the productivity of Basmati rice; these may include adoption of new technologies and provision of cheaper inputs to the farmers. It is also concluded that prices are one of the main determinants of acreage supply response. The model suggests that higher price of a crop is an incentive for the farmers to cultivate more of that crop. Therefore, rice support price should be encouraged and new markets for rice export must be explored to increase its production. Such measures will not only reduce the cost of production of rice but it will also enhance the profitability of rice cultivation in our country.

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Appendix-A

Table 1: Order of VAR for the Acreage Supply Model

List of variables included in the unrestricted VAR:			
AB AI YB YI PB PI			
List of deterministic and/or exogenous variables			
CONSTANT			
Order	AIC	SBC	
10	-137.20	-146.95	----------
9	-141.097	-150.239	3.5239[.060]
8	-141.594	-150.126	4.6016[.100]
7	-142.630	-150.552	6.0673[.108]
6	-142.445	-149.758	6.6543[.155]
5	-142.207	-148.910	7.2028[.206]
4	-143.072	-149.167	8.5462[.201]
3	-142.079	-147.564	8.5509[.287]
2	-141.091	-145.967	8.5597[.381]
1	-140.092	-144.358	8.5600[.479]
0	-142.219	-145.876	10.8118[.372]

Note: p - values in the parentheses, AIC=Akaike Information Criterion, SBC=Schwarz Bayesian Criterion.

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Purchasing Power Parity: The Linkages between Goods and Assets Markets in the West African Countries

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Abstract: The study examines the linkages between goods and assets markets in establishing purchasing power parity (PPP) in the West African countries. Johansen co-integration technique was applied to examine long run relationship between bilateral exchange rates, prices and the interest ratios for each country. The study shows that few countries support purchasing power parity (PPP) with both bivariate and multivariate approach.

Keywords: Purchasing Power Parity, Exchange Rate, Whole Sale Price Index
JEL Classification: F3, F3, E3

1. Introduction

One of the basic issues of international monetary economics, that has received a growing interest, is the validity of parity condition (Berilacqua, 2006). Liew *et al.* (2005) have highlighted some of the reasons behind this enthusiasm in revealing long run purchasing power parity (PPP); it has major implications for Economics in general and policy decisions in particular. Among others, PPP estimates are often used for practical purposes such as determination of the extent of misalignment of the nominal exchange rates and the appropriate policy response, the setting of exchange rate parities and the international comparison of national income levels. In essence, it serves as a basis to determine the international competitiveness of a country's goods and services. Thus, if PPP is found not to be valid, all the models built on it simply collapse. Consequently, the policy suggestions become inapplicable.

A number of studies have tried to establish the validity of both the absolute and relative forms of PPP (Halid *et al.*, 2007). However, the

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empirical inconclusiveness of the PPP has motivated the researchers to look back on the assumptions underlying the theory. The inconclusiveness of previous studies is due to the methodology employed. The traditional unit root tests are not reliable in detecting PPP whenever there is structural break, cross sectional effect and non-linearity (Liew *et al.,* 2005).

Many studies have examined the validity of both relative and absolute measures of PPP. While the consensus in literature is always the rejection of absolute PPP, there is mixed evidence for the relative PPP. Halid *et al.* (2007) gave two general conclusions derived from the previous works. First, PPP holds over a long run but is weak in the short run period. Second, it holds in countries with underdeveloped capital markets and high rates of inflation. Nevertheless, PPP holding in the long run has always been a subject of debate in the literature (Cheng, 1999; Halid *et al.*, 2007). Some other studies on developed countries, with relatively low rates of inflation, have been found to support PPP (Sarno and Taylor, 2002; Alba and Papell, 2007; Halid *et al.,* 2007).

The validity of the PPP relationship has been observed on temporal horizon of more than 50 years (Berilacqua, 2006), while shorter horizon shows persistent deviation from PPP (Rogoff, 1996). Juselius and MacDonald (2000) suggested a number of possibilities for this deviation in the short and medium term. Most of the previous studies tested the validity of PPP by examining the relationship between prices and exchange rates (Halid *et al.,* 2007). However, this bivariate analysis overlooks the connection between the markets for goods and assets in determining exchange rate and could be a possible explanation of why the evidence does not support PPP (Johansen and Juselius, 1992).

In principle, the Standard International Economics maintains that in a small open economy with floating exchange rate and perfect capital mobility, the domestic and international interest rates are supposed to be equal. Therefore, if the domestic interest rate is higher than the foreign interest rate, foreign demand for domestic securities tends to increase, thereby increasing the value of domestic currency. An increase in domestic interest rate may cause the domestic currency to appreciate. Dornbusch (1976) sticky price model can be used to explain the link

between prices, exchange rates and interest rates. The model assumes that the long run relationship holds between the Uncovered Interest Parity (UIP) and PPP. The model states that nominal exchange rate is a function of both the price level differential and also the Interest Rate differential (Halid *et al.,* 2007).

Monetary Union in West Africa dates back to the colonial era. Former British colonies, which include Nigeria, Ghana, and Sierra Leone, had a West Africa Currency Board, whose sole responsibility was issuing currency in these countries. This Currency Board, established in 1912, was abolished in 1960s. The establishment of Central Banks led to the demise of the Currency Board of West African Anglophone countries. However, the Currency Board in the Francophone countries of West Africa survived independence. This zone, comprising Benin, Burkina Faso, Cote d'Ivoire, Mali, Senegal and Togo, use "France de la Communaute Financiere de I Afrique" (CFA franc) which is issued by the "Banque des Etats de I'Afrique d Ouest" as their currency. Only Liberia retained its independence, at the price of major territorial concessions. Following Bretton Woods Agreement in 1971 and the pursuit of market reforms, inter-bank markets for foreign exchange are now in operation in West African countries with floating exchange rates (Alagidede *et al.,* 2008).

The recent growth in the PPP in Africa stems from the fact that the continent is becoming more integrated, with the countries adopting more flexible exchange rate regimes associated with their economic reform programs. The last 35 years have witnessed tremendous policy initiatives to promote integration as a means of stimulating economic development in Sub-Saharan Africa.

This paper has examined the validity of PPP in major West African economies, taking into consideration the relationship between prices, exchange rates and interest rates. Study on the West African economies is important since they are open economies which may influence and be influenced by the behavior of exchange rates. Most of the previous studies have focused on developed economies, with few studies on Africa. Out of these few, only Alagidede *et al.* (2008) has focused solely on West Africa, though there are few others that have included one or two countries from this region (Cuestas and Mourelle, 2008). However, all of these works

have used bivariate approach of nominal rates and prices to examine PPP in their studies. The present study examines the validity of PPP in West African economies by taking into consideration the linkages between prices, exchange rates and interest rates.

The rest of this paper is organized as follows: Section 2 reviews the literature on PPP followed by methodology and data analysis, which is given in Section 3. Section 4 analyses the results and Section 5 concludes the paper.

2. Literature Review

Purchasing Power Parity (PPP) estimates are often used for practical purposes to determine the level of misalignment of the normal exchange rate, to know the appropriate policy response, setting of exchange rate parities and international comparison of national income level. For these reasons, if PPP does not hold, then its practical application will be limited (Halid *et al.,* 2007). Recent empirical works on PPP test for its validity in the post Bretton-Woods period (Brissimis *et al.,* 2005). Generally, empirical studies in the 1980s rejected PPP hypothesis and the real exchange rate was assumed to exhibit random walk (Brissimis *et al.,* 2005). This failure to establish 'means reversion' was interpreted to indicate the governing of real exchange rate by permanent shock. But analysis of the long historical data suggests that shocks to real exchange rate have long life span (Lothian and Taylor, 1996).

The empirical studies supporting this view followed one of the four main approaches: (i) the use of long time series; (ii) the use of panel data and methods; (iii) the use of tests with improved power and (iv) the use of advanced co-integration techniques (Brissmis *et al.*, 2005). Abauf and Jorion (1990) and Lothian and Taylor (1996) used univariate method to analyze samples of more than one century and found support for PPP.

Using panel data for large countries, most of the studies have provided evidence in support of PPP, though the extent varied for different countries (Abauf and Jorion, 1990; Sarno and Taylor, 1998; Brissims *et al.,* 2005)

Engle and Granger (1987) noted that combining regimes of fixed and floating exchange rates could have subjected the data to a large sample size bias. Also, it does not always provide supporting evidence (Brissmis *et al.,* 2005). Panel unit root approach has been criticized for not producing strong evidence in some cases (Abauf and Jorion, 1990) and the real exchange rate can be cross-sectionally dependent (O'Connell, 1998). Tests for PPP, using sequential root test, conclude that permanent shocks are not relevant in PPP analysis over current float. It is also argued that the puzzling behavior of real exchange rate is a result of long–memory dynamics.

On the methodological ground, many studies on PPP have examined its validity in a bivariate framework, testing the relationship between prices and exchange rates by using unit root methodology and co-integration techniques. These studies include Christev and Noorbakhsh (2000) and Sarno and Taylor (2002) for developed countries and Baharumshah and Arif (1997), Liew *et al.* (2005), Cuestas and Mourelle (2008), and Alagidede *et al.* (2008) for developing economies. Most of the work on data from developed economies using bivariate framework provides evidence in support of PPP. However, such a framework, using either unit root methodology or co-integration technique, has not provided much support for PPP in developing countries (Halid *et al.*, 2007).

According to Dropsy (1996), any inferences made on the interaction of variables by omission of a relevant variable may be biased. Using theoretical framework of Dornbusch (1976) on the exchange rate determination, Johansen and Juselius (1992), Juselius (1995), Cheng (1999), Caporale *et al.* (2001), Halid *et al.* (2007) and several others have augmented past studies on prices and exchange rates by including interest rate variables. Despite the differences in the techniques employed, ample support was found in favor of PPP.

3. Theoretical Background

The absolute PPP states that once converted to a common currency, the price levels in two countries should be equal (Rogoff, 1996). The log of the absolute PPP is defined as:

$$s_t = \alpha + \beta p_t + u_t \qquad (1)$$

where s_t is the exchange rate (either nominal exchange rate measured in local currency per US dollar, or real effective exchange rate) and p_t is the ratio of price indices [consumer price index (CPI) divided by CPI of US] respectively, while u_t is the error term. Tests of PPP often take the form of testing the null hypothesis of $\beta = 1$. If the PPP holds empirically, the above expression is expected to be of zero order integration.

To link goods and asset markets together, interest rate variable is included into equation (1):

$$S_t = \alpha + \beta_1 p_t + \beta_2 z_t + u_t \qquad (2)$$

where S_t denotes the initial exchange rate (bilateral exchange rate of each of the country's currency per US dollar), p_t is the ratio of CPI of each country to United States' CPI, and z_t represents the percentage rate of interest rates between each country against U.S.A. Following Cheng (1999) and Halid *et al.* (2007), this study has used interest rate ratio of $z_t = (1+i)/(1+i^*)$, which reflects better approximation of the actual nominal interest rate differential.

4. Data and Methodology

This study has used quarterly observations of exchange rates, price indices and interest rates for the 30-year period from 1980Q1 to 2009Q1. The data has been obtained from the online data resource of International Financial Statistics (International Monetary Fund, 2008). Quarterly data of bilateral exchange rates, price indices ratio and interest rates for eight countries in West Africa: Burkina Faso, Cote d' Ivorie, Gambia, Ghana, Nigeria, Senegal, Sierra Leone and Togo against USD were used for the study. These countries were chosen to reflect their line of colonization and also to reflect the diversity in their monetary systems. Based on this, the eight selected countries can be divided into two groups: Burkina Faso, Cote d' Ivorie, Togo and Senegal are Francophone countries while Gambia, Ghana, Sierra Leone and Nigeria are Anglophone countries that were formally under the British rule.

The choice of USD was due to its importance in the world currency in post Bretton-Woods agreement. The ratios of price indices were computed using Consumer Price Index (CPI). In testing for PPP, CPI, wholesale price index (WPI), gross domestic product (GDP) deflator and wage rate indices (WRI) can be used as proxies for price indices. This study has used CPI since it is the most commonly used among the researchers (Sosvilla-Rivero and Garcia, 2003) and also due to limited availability of the data. As for the interest rates, various measures of interest rate have been used in the past (Berilacqua, 2006). This study has used quarterly discount rate as it applies to each of the countries studied.

The study starts with the visual inspection of the data. The time series graphs of all the relevant variables in this study were obtained at level and first difference (Appendix-A). These variables were then tested for stationarity using Augmented Dickey Fuller (ADF) procedure. This was to confirm that the variables are non-stationary at level and have the same order of integration. Once the hypothesis of same order of integration was accepted for each of the variables, this study then tested the variables for co-integration using Johansen's Likelihood test.

As demonstrated by Johansen and Juselius (1990), the procedure involves the identification of rank of $(n*n)$ matrix Γ in the specification given by:

$$\Delta X_t = \pi + \sum_{i=1}^{k-1} \Pi_i \Delta X_{t-1} + \Gamma X_{t-k} + e_t \qquad (3)$$

where X_t is a column vector of n variables, Π and Γ represent the OLS coefficient matrices, Δ is a difference operator, k denotes the lag length, and π is a vector of constant terms. The likelihood ratio test of the null hypothesis of zero cointegrating relations for Γ has zero rank. On the other hand, the alternative hypothesis depends on the rank r of Γ. If the rank r is greater than zero, however, there will exist in it r possible stationary linear combinations.

This study has used the Johansen procedure under both the bivariate and multivariate approaches. It tests the order of integration for exchange rates and price ratio for each of the countries under study (bilateral exchange rate).

Later, relative interest rate was included to test multivariate co-integration in order to account for the linkages between goods and assets markets.

5. Results

5.1 Unit root test

Table 1 shows the results for unit root test (number of selected lags through (AIC) is shown in the bracket). The results show that the exchange rate series, prices and interest ratios of all the countries (except for price and interest ratio of Sierra Leone) are not stationary at level. On the other hand, the data was stationary at first difference. Thus, the null hypothesis of non-stationarity to find support for the PPP may be rejected.

5.2 Johansen Co-integration test

After confirming that all the data series are non-stationary and integrated at same level *I* (1), this study proceeded with the co-integration test. The test was applied for bivariate relationship using local currency exchange for US dollars in each of the countries to US dollar and their respective price ratios to that of US. The Johansen Likelihood test for co-integration (maximal Eigen value and Trace tests) is applied to the vector X_t consisting of s_t and p_t with a lag length chosen by AIC. Table 2 shows the output of bilateral exchange rate (s_t) of US dollar for Burkina Faso, Cote d' Ivorie, Ghana, Nigeria, Senegal, Sierra Leone, The Gambia and Togo. Results show no support for PPP in Burkina Faso, Cote d' Ivorie, Ghana, Nigeria, The Gambia and Togo, while co-integration between bilateral exchange rate and price ratios is found in Senegal and Sierra Leone. The Trace statistics show that there are two significant relationships between bilateral exchange rate and price ratio in Sierra Leone and Senegal (See Table 2).

In addressing the linkages between goods and asset market as suggested by Dornsbuch (1976), Baxter (1994) and used by Halid *et al.* (2007), this study has included interest rate ratios in the vector X_t of Johansen co-integration test. The results for multivariate co-integration test are presented in Table 3. Table 3 shows that with the inclusion of interest rate ratio, only Sierra Leone showed a significant co-integration. This indicates that there is no long run relationship among these three variables in all $\mathbf{H_0}$ countries except Sierra Leone.

Table 1: Unit Root Test Statistics

Variables	Augmented Dickey Fuller Test	
	At Level	First Difference
Burkina Faso CFA per USD (EB) Burkina Faso interest rate (IB) Burk. Faso price level (PB) Burk. Faso relative price level (RPB)	-1.957785* (AIC 2) -1.017866* (AIC 2) -1.052626* (AIC 4) -1.864873* (AIC 4)	-10.08524** (AIC 2) -10.43274** (AIC 2) -9.065743** (AIC 4) -9.148142** (AIC 4)
Cote d' Ivorie CFA per USD (EC) Cote d' Ivorie interest rate (IC) Cote d' Ivorie price level(PC) Cote d' Ivorie relative price level(RPC)	-1.957785* (AIC 2) -1.017866* (AIC 2) -1.144268* (AIC 5) -0.754408* (AIC 5)	-10.08524** (AIC 2) -10.43274** (AIC 2) -4.146864** (AIC 5) -8.031455** (AIC 5)
Senegal CFA per USD (ES) Senegal interest rate (IS) Senegal price level(PS) Senegal relative price level(RPS)	-1.957785* (AIC 2) -1.017866* (AIC 2) -2.418100* (AIC 4) -1.931524* (AIC 4)	-10.08524** (AIC 2) -10.43274** (AIC 2) -8.769048** (AIC 4) -8.934525** (AIC 4)
Togo CFA per USD (ET) Togo interest rate (IT) Togo price level(PT) Togo relative price level(RPT)	-1.957785* (AIC 2) -1.017866* (AIC 2) -0.868756* (AIC 4) -1.444418* (AIC 4)	-10.08524** (AIC 2) -10.43274** (AIC 2) -4.080193** (AIC 4) -4.058804** (AIC 4)
Ghana cedi per USD (EG) Ghana interest rate (IG) Ghana price level(PG) Ghana relative price level(RPG)	-1.817660* (AIC 0) -1.975835* (AIC 1) -2.401831* (AIC 3) -2.425230* (AIC 3)	-10.32961** (AIC 0) -8.841332** (AIC 1) -5.069107** (AIC 3) -5.071191** (AIC 3)
Nigeria naira per USD (EN) Nigeria interest rate (IN) Nigeria price level(RPN) Nigeria relative price level(RPN)	-1.198958* (AIC 0) -2.396611* (AIC 1) -1.170984* (AIC 3) -1.084429* (AIC 3)	-9.935983** (AIC 0) -10.37694** (AIC 1) -3.433139** (AIC 3) -3.576027** (AIC 3)
Gambia dalasis per USD (EM) Gambia interest rate (IM) Gambia price level(PM) Gambia relative price level(RPM)	-1.604664* (AIC 2) -3.273664** (AIC 2) -2.491643* (AIC 4)	-10.33988** (AIC 2) -9.233906** (AIC 2) -5.689616** (AIC 4)
Sierra Leone leone per USD (EL) Sierra Leone interest rate (IL) Sierra Leone price level (PL) Sierra Leone relative price level(RPL)	-2.042610* (AIC 0) -3.555400** (AIC 0) -3.880162** (AIC 2) -3.533416** (AIC 2)	-8.018267** (AIC 0) -7.975774** (AIC 0) -5.205760** (AIC 2) -5.239602** (AIC 2)

Note:*Since t stat value > ADF test stat value, accept null-unit root or non-stationary at 5
** Since t stat value < ADF test stat value, reject null hypothesis of no unit root at 5 percent ADF critical value of -2.78.

Table 2: Unrestricted Co-integration Rank Test (Maximal Eigen value and Trace) of Exchange Rate (local currencies per USD) and Relative Prices in West African countries with Linear Deterministic Trend

	Maximal Eigen value test					Trace test			
				Critical value				Critical value	
	H_o	H_1	Eigen value	95%	99%	H_1	LR ratio	95%	99%
EB & RPB (AIC 7)	r=0	r = 1	8.05	14.26	37.36	$r \geq 1$	12.38	15.49	13.95
	r≤1	r = 2	4.33	3.84	3.74	$r \geq 1$	4.33	3.84	3.74
EC & RPC (AIC 7)	r=0	r = 1	7.78	14.26	40.08	$r \geq 1$	9.33	15.49	33.52
	r≤1	r = 2	1.54	3.84	21.33	$r \geq 1$	1.55	3.84	21.33
ES & RPS (AIC 7)	r=0	r = 1	12.76	14.26	8.51	$r \geq 1$	16.65*	15.49	3.34
	r≤1	r = 2	3.88	3.84	4.88	$r \geq 1$	3.88	3.84	4.88
ET & RPT (AIC 6)	r = 0	r = 1	9.30	14.26	26.17	$r \geq 1$	10.99	15.49	21.19
	r ≤ 1	r = 2	1.68	3.84	19.38	$r \geq 1$	1.688	3.84	19.38
EG & RPG (AIC 3)	r = 0	r = 1	10.65	14.26	17.25	$r \geq 1$	14.58	15.49	6.82
	r ≤ 1	r = 2	3.93	3.84	4.74	$r \geq 1$	3.93	3.84	4.74
EN & RPN (AIC 4)	r = 0	r = 1	8.86	14.26	29.74	$r \geq 1$	10.70	15.49	23.02
	r ≤ 1	r = 2	1.83	3.84	1750	$r \geq 1$	1.83	3.84	17.50
EM & RPM (AIC 7)	r = 0	r = 1	4.11	14.26	84.66	$r \geq 1$	7.03	15.49	57.43
	r ≤ 1	r = 2	2.91	3.84	8.80	$r \geq 1$	2.91	3.84	8.80
EL & RPL (AIC 6)	r = 0	r = 1	22.22	14.26	0.23	$r \geq 1$	32.94**	15.49471	0.01
	r ≤ 1	r = 2	10.73	3.84	0.11	$r \geq 1$	10.72	3.841466	0.11

Note:* (**) denotes rejection of the hypothesis at the 5 percent (1percent) level.
B (Burkina Faso), C (Cote d' Ivorie), S (Senegal), T (Togo), G (Ghana), N (Nigeria), M (Gambia) and L (Sierra Leone leone).

Table 3: Unrestricted Co-integration Rank Test (Maximal Eigen value and Trace) of Exchange Rate (local currencies per USD), Interest Rate and Relative Prices in West African countries with Linear Deterministic Trend

	Maximal Eigen value test					Trace test			
				Critical value				Critical value	
	Ho	H_1	Eigen value	95%	99%	H_1	LR ratio	95%	99%
EB, IB & RPB (AIC 7)	r =0	r = 1	10.16	21.13	72.88	r ≥ 1	19.96	29.79	42.52
	r ≤1	r = 2	6.14	14.26	59.44	r ≥ 2	9.79	15.49	29.66
	r ≤ 2	r = 3	3.65	3.84	5.60	r ≥ 3	3.65	3.84	5.60
EC, IC & RPC (AIC 7)	r =0	r = 1	9.64	21.13	77.69	r ≥ 1	14.86	29.79	78.88
	r ≤1	r = 2	4.41	14.26	81.30	r ≥ 2	5.21	15.49	78.55
	r ≤ 2	r = 3	0.80	3.84	37.10	r ≥ 3	0.80	3.84	37.10
ES, IS & RPS (AIC 7)	r =0	r = 1	13.65	21.13	0.39	r ≥ 1	21.82	29.79	30.83
	r ≤1	r = 2	5.21	14.26	0.71	r ≥ 2	8.17	15.49	44.72
	r ≤ 2	r = 3	2.96	3.84	0.08	r ≥ 3	2.96	3.84	8.53
ET, IT & RPT (AIC 6)	r =0	r = 1	17.26	29.79	62.01	r ≥ 1	10.74	21.13	67.25
	r ≤1	r = 2	6.52	15.49	63.38	r ≥ 2	4.20	14.26	83.66
	r ≤ 2	r = 3	2.31	3.84	12.84	r ≥ 3	2.31	3.84	12.84
EG, IG & RPG (AIC 3)	r =0	r = 1	12.95	21.13	45.59	r ≥ 1	23.75	29.79	21.12
	r ≤1	r = 2	6.79	14.26	51.40	r ≥ 2	10.79	15.49	22.47
	r ≤ 2	r = 3	3.99	3.84	4.55	r ≥ 3	3.99	3.84	4.55
EN, IN & RPN (AIC 4)	r =0	r = 1	19.48	21.13	8.35	r ≥ 1	27.04	29.79	10.06
	r ≤1	r = 2	6.63	14.26	53.32	r ≥ 2	7.55	15.49	51.45
	r ≤ 2	r = 3	0.91	3.84	33.83	r ≥ 3	0.91	3.84	33.83
EM, IM & RPM (AIC 7)	r =0	r = 1	11.55	21.13	59.15	r ≥ 1	17.23	29.79	62.26
	r ≤1	r = 2	3.38	14.26	91.81	r ≥ 2	5.67	15.49	73.34
	r ≤ 2	r = 3	2.29	3.84	12.99	r ≥ 3	2.29	3.84	12.99
EL, IL & RPL (AIC 2)	r =0	r = 1	22.56*	21.13	3.12	r ≥ 1	52.82*	29.79	0.00
	r ≤1	r = 2	20.19	14.26	0.51	r ≥ 2	30.25	15.49	0.02
	r ≤ 2	r = 3	10.05	3.84	0.15	r ≥ 3	10.05	3.84	0.15

Note: H_o=null hypothesis; H_1 =alternative hypothesis and (*) denotes rejection of the hypothesis at the 5 percent (1percent) level.

6. Conclusions

The paper explored the validity of purchasing power parity in West African countries. In achieving this, we exploit the linkages between goods and capital as suggested by Dornsbusch (1976) and Baxter (1994), and empirically proven for developed economies. The study used Johansen co-integration technique to test the relationship between prices, exchange rates and interest rates for West African economies. Visual inspection of the data was done using graphical method while unit root test was performed to confirm the graphical observation of non-stationarity of the data. Having confirmed that the data is integrated of the same order, Johansen approach was employed to find bivariate and multivariate co-integration among the variables. The findings suggest that, when bivariate approach was used, Senegal and Sierra Leone showed long run relationship between the variables. When multivariate approach was employed, only Sierra Leone showed the co-integration relationship. Whereas, Burkina Faso, Cote d' Ivorie, Ghana, Nigeria, Gambia and Togo, have no co-integration either under bivariate or multivariate co-integration test. This means that PPP does not hold in most of these West African countries.

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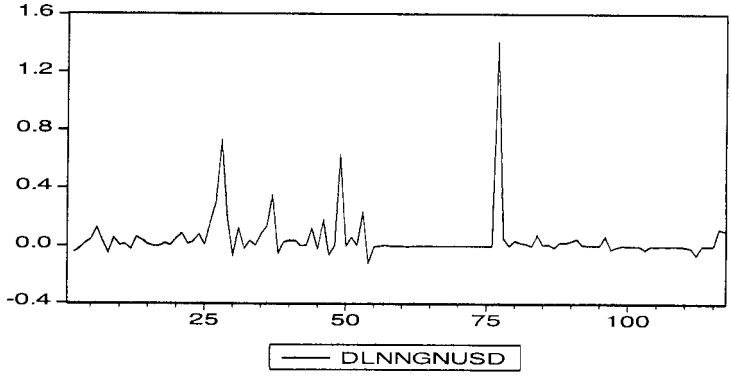
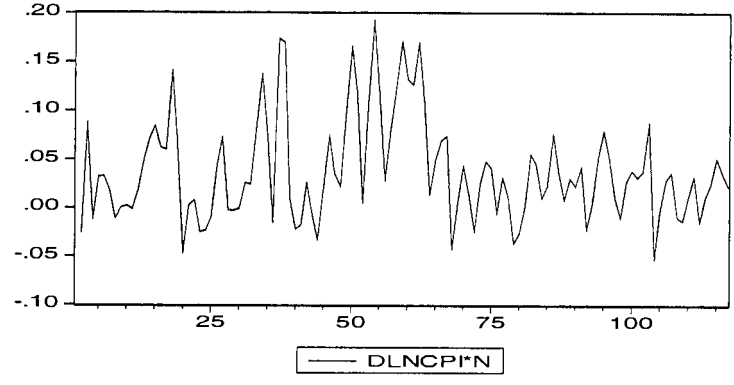
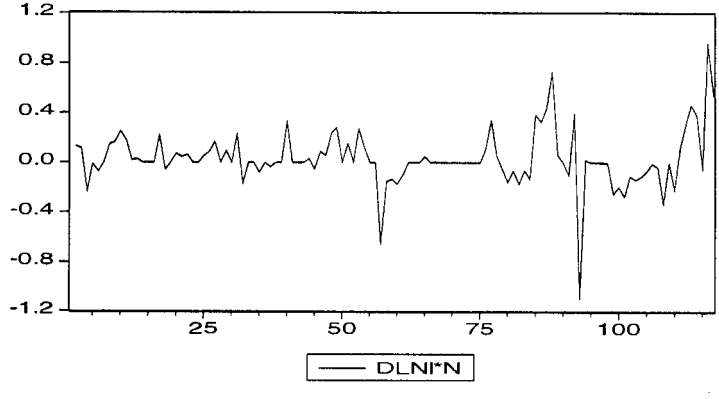
Appendix-A

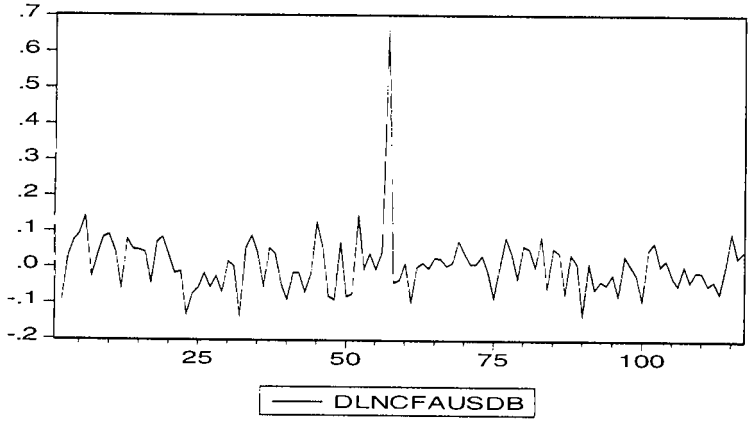
Nigeria: First difference

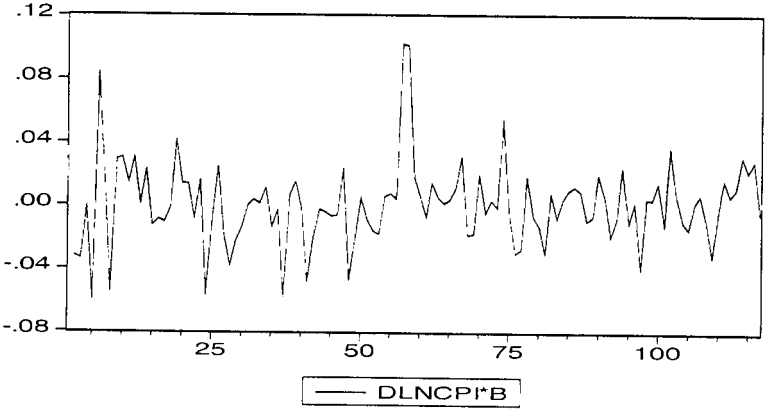


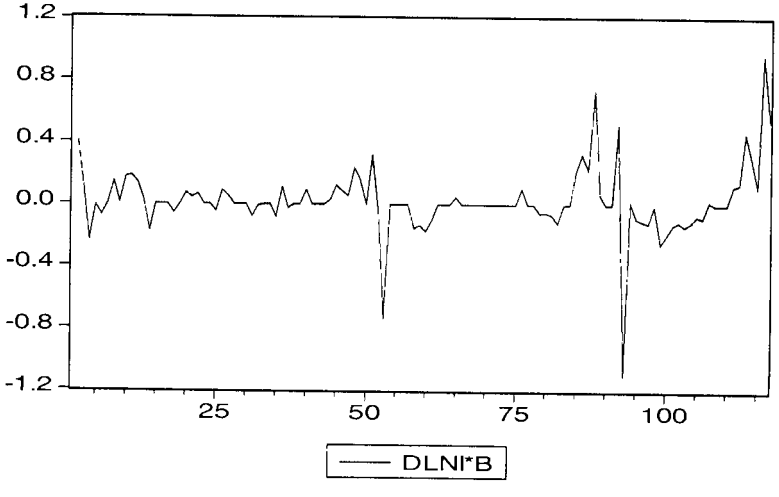




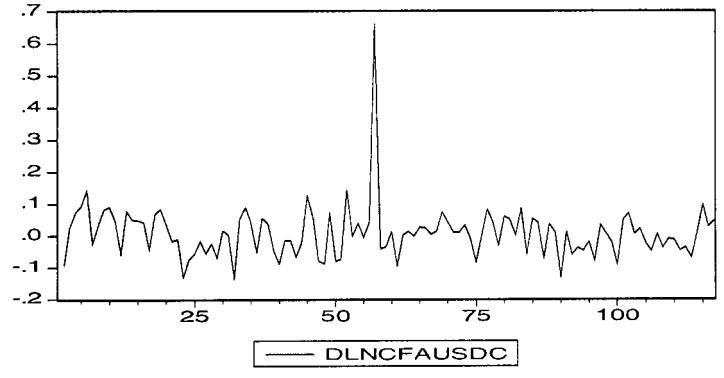
Burkina Faso: First difference

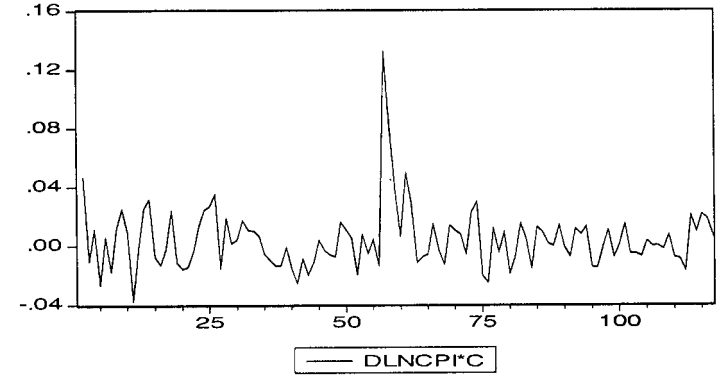


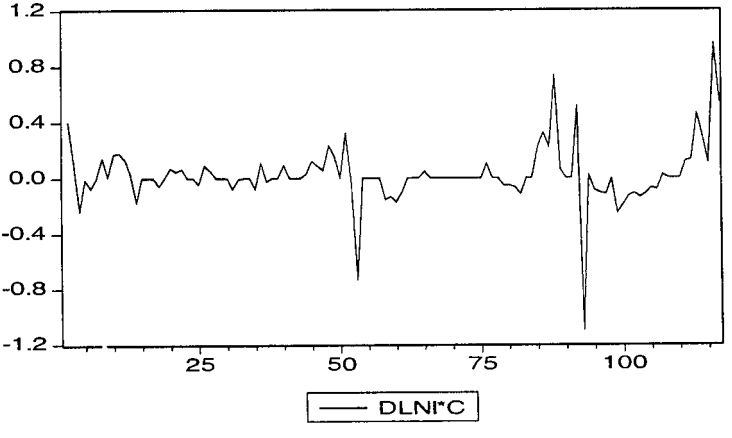




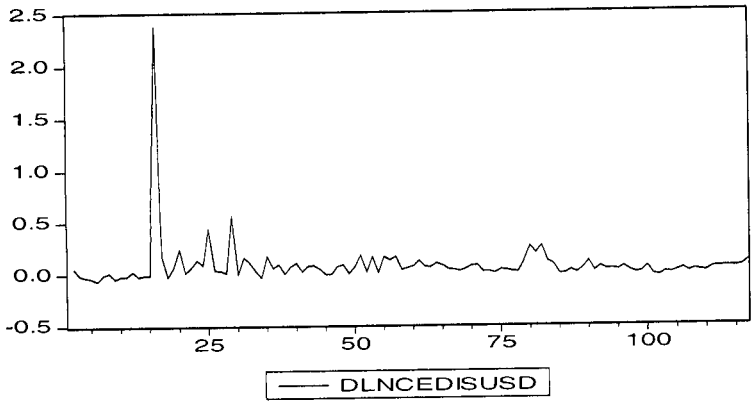
Cote d' Ivorie: First difference

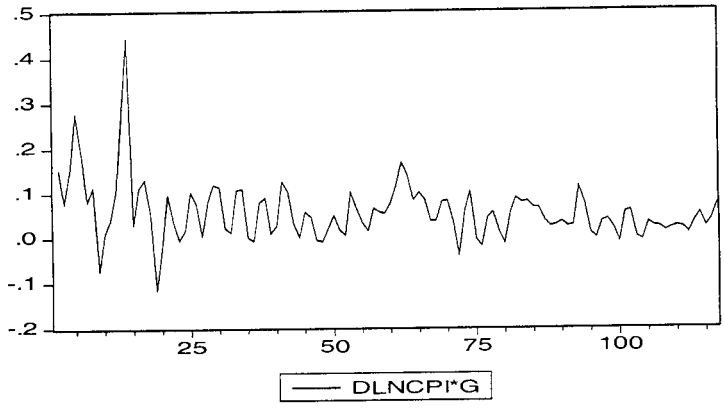


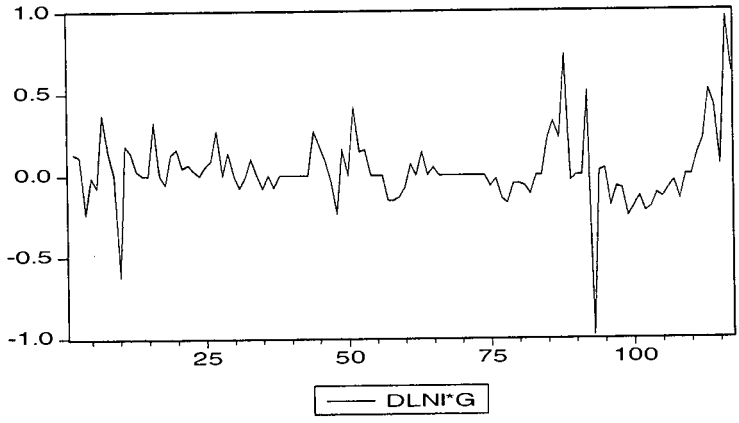




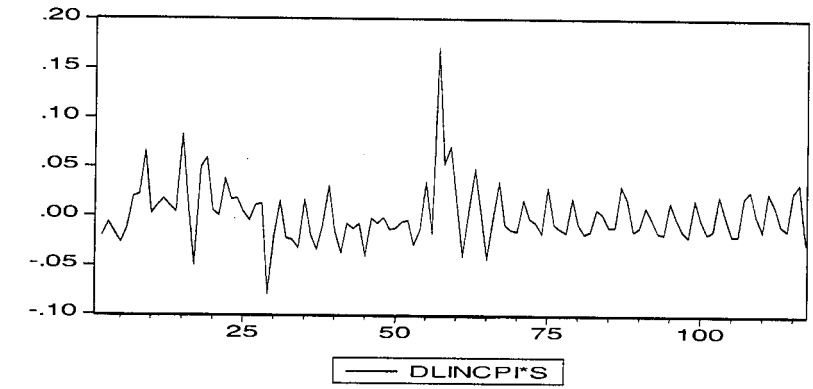
Ghana: First difference

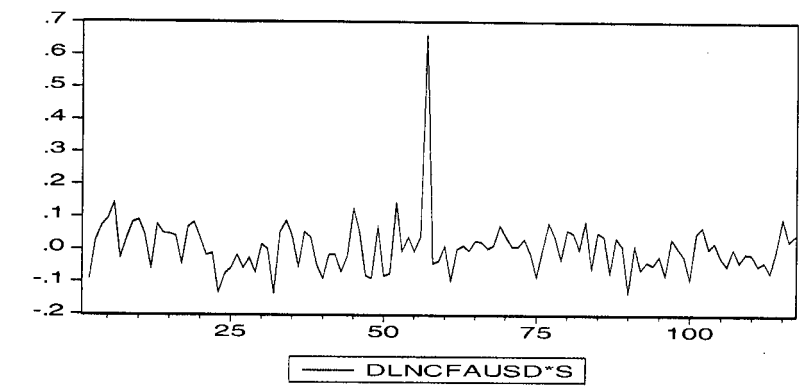


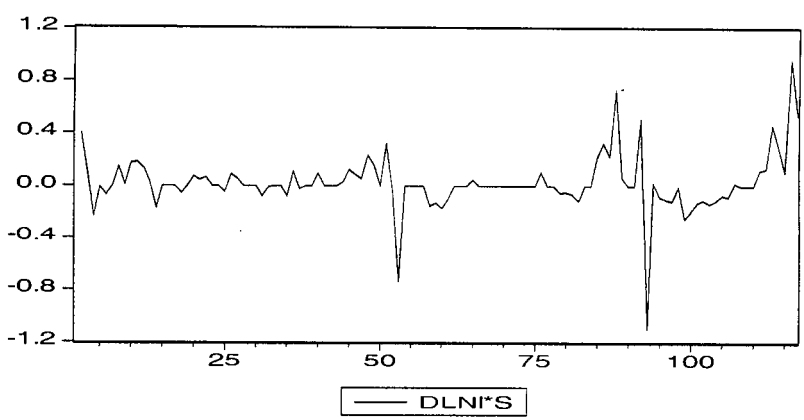




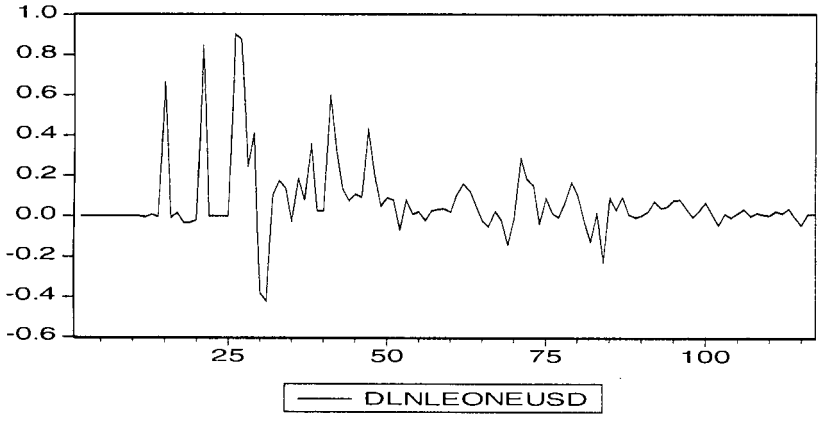
Senegal: First difference

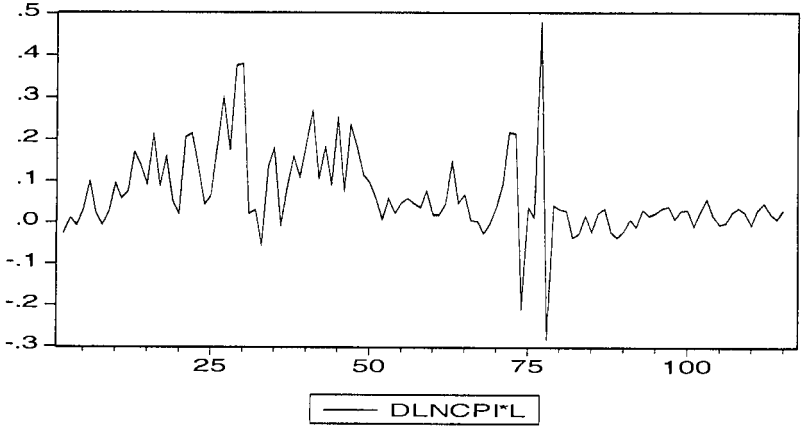


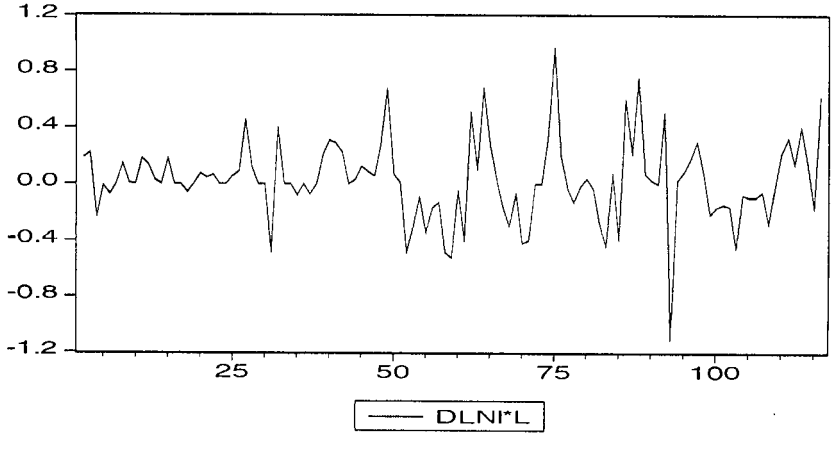




Sierra Leone: First difference







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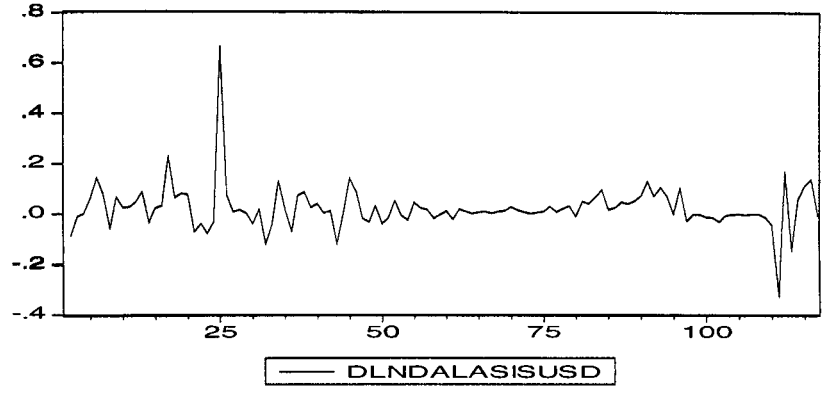

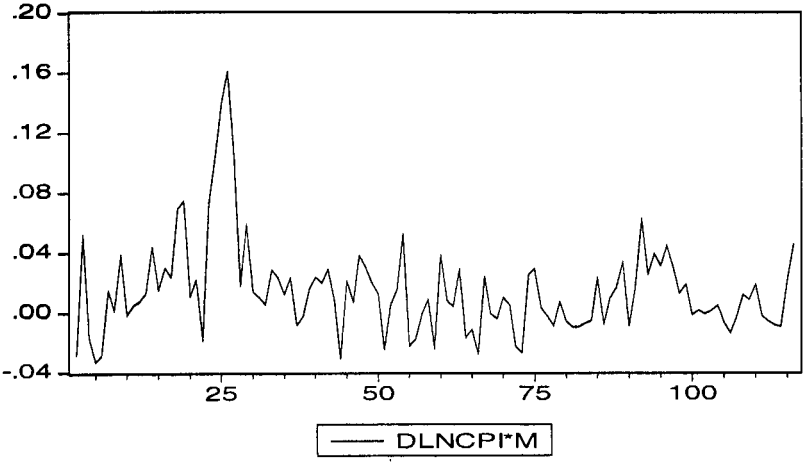

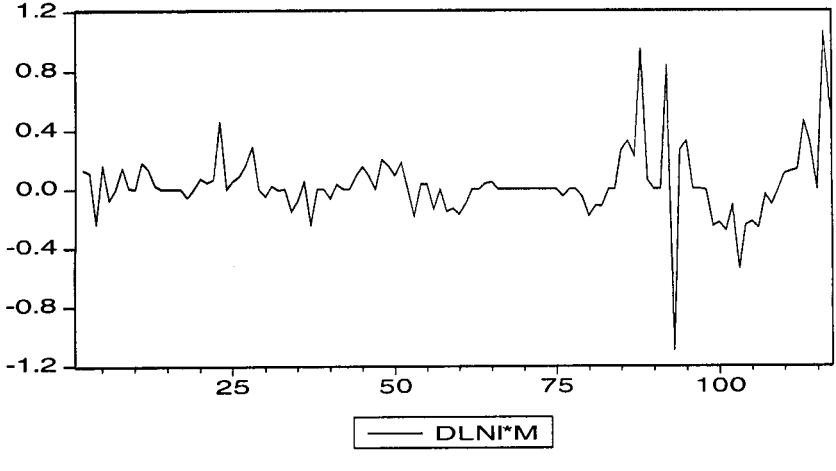

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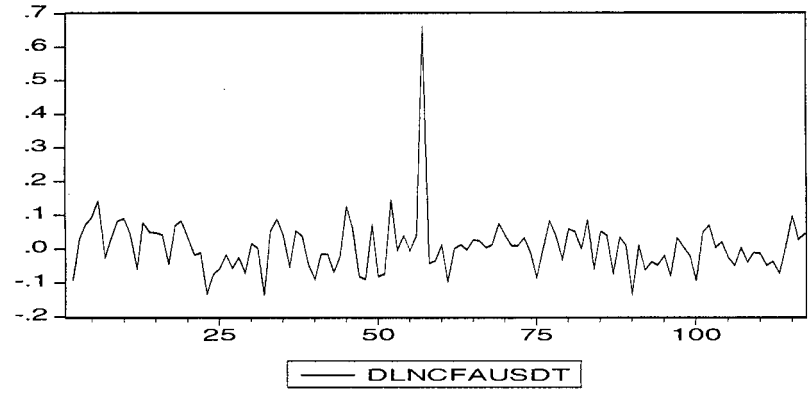

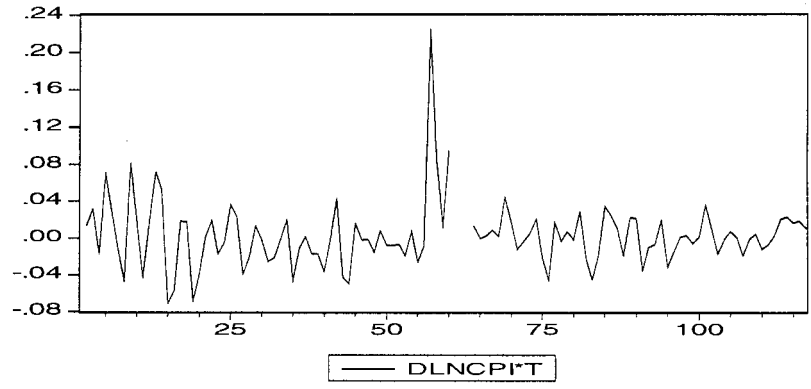

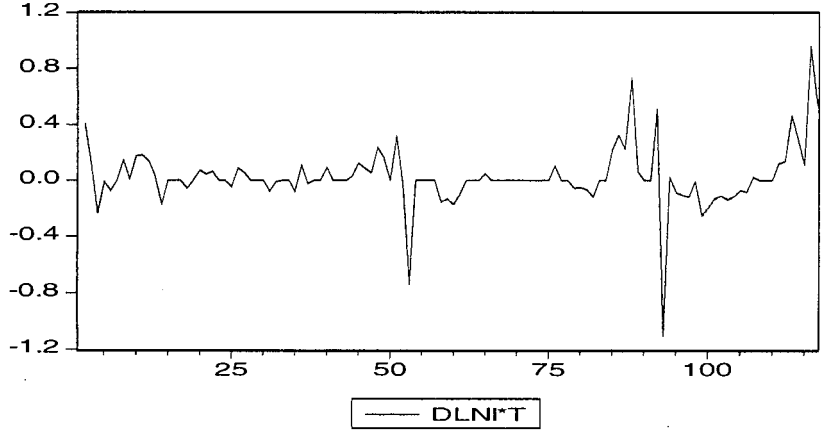

GCU Economic Journal, Volume XLII (1 & 2), 2009, pp. 113-115

Book Review

Fan Industry of Pakistan, Growth Dynamics of Small, Medium and Large Enterprises. By Khalid Aftab, Eric Rahim, Aqueel Imtiaz, Uzair Ahson and Raees Aslam. Publication of the Economics Department, GCU, Lahore in collaboration with Strathclyde University, UK. 2010. pp1-137.*

Small and Medium Enterprises have gained significance in the recent years due to their contribution in economic growth, social cohesion, employment generation and local development. They are considered to be labour absorbing in nature, leading to reduction in poverty through increased employability. Despite the multi-dimensional nature of these enterprises, unfortunately they are not listed among the priority sectors of the Pakistani economy. Due to lack of interest in this sector, it has been unable to contribute constructively in the achievement of economic goals and targets.

The research report, "Fan industry of Pakistan: Growth Dynamics of Small, Medium and Large Enterprises" is a publication of the Department of Economics, G.C. University, Lahore (Pakistan) in collaboration with the University of Strathclyde, Glasgow (UK). This report has analyzed the dynamics and various aspects of growth among small, medium and large firms belonging to one product group, in this case, the fan industry. It provides an insight to the operational process and mechanics alongwith the details of entrepreneurial profile of the fan manufacturing industry.

The research report starts with a brief introduction of the historical evolution of the fan industry. It traces its origins back to the settlement of Mughals, who were engaged in metal works in the surroundings of Gujrat and Gujranwala districts. These crude skills set the stage for the establishment of the National Metal Works as the oldest fan manufacturing firm in the country. With the passage of time, there has been a surge in the number of firms due to an increase in domestic and foreign demand for fans, leading to cluster formation in these areas.

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* The research report is available at the Department of Economics, GC University, Lahore.

The study has developed a definition of small, medium and large enterprises based on the industry specific attributes alongwith the details regarding their characteristics such as the number of employees, market size, branding of the product, power consumption, equipment used for production process and information of a similar nature.

A comprehensive analysis of industrial, entrepreneurial and firms' profile based on aggregated and disaggregated data is presented in the report. The data incorporates both the qualitative and quantitative aspects of the firms working in the fan industry. Techniques of Chi-Square and likelihood ratios have been used for developing statistical association between different characteristics of these firms. These calculations, however, could have been converted into illustrations such as pie charts, bar charts or other forms of graphs which would have made the data easily comprehensible.

The analysis highlights that there is a lack of formal training received by the entrepreneurs as well as the laborers involved in fan manufacturing. The government did set up a Fan Development Institute in mid-1990s but majority of the firms did not have any awareness about this institute. Training of labourers is mainly through the conventional and informal method of training widely present in Pakistan termed as *ustad-shagird* system of learning.

One of the most important elements, in terms of the exploring and capturing international markets, is the presence of international certifications for production processes and the product itself. The report highlights that three types of quality certificates are available internationally. However, 55 percent of firms continue production without any of the certifications. The government needs to incentivize firms to acquire these certifications so that they can compete in the global arena and capture a larger share of the international market.

Growth figures of any sector, industry or firm remain important variables in assessing its performance levels. The report generates a comprehensive explanation regarding the factors that indicate association with the growth orientation. Quantitative variables such as firm size, type of ownership, competence of entrepreneurs, financial resources, quality of product, market type, nature of technology and machines, research and

development, diversification of product, number of workers and future demand forecast have shown significant association with the growth orientation of a firm.

Lack of financial resources, especially in case of small and medium sized firms, remains one of the major impediments to the process of growth. Financial institutions have been reluctant in lending to these entrepreneurs. Therefore, the financial requirements are met through personal loans from family and friends. In this regard, firm owners have mentioned that government and other supporting institutions are yet to lend consistent and proper support with respect to the problems faced by this industry.

This research has contributed to literature in terms of its industry specific findings, and also by developing an estimate of 'growth orientation' of different sized firms and their determinants. One important general finding is that the firms with higher growth orientation are more active in terms of investment, technological up-gradation, certification, and product diversification. They formally analyze key factors shaping the demand and production process, though with less sophisticated methods and techniques. On the other hand, low growth oriented firms lack the relevant resources and hence are unable to overcome the barriers to growth. The resource heterogeneity hints towards what is often referred to as 'technological dualism' within the industry. The real challenge for any policy for the technological up-gradation and also for skill development, at firm and industry level, is to address this issue effectively. It is expected that further research would build on this analysis and would discover new horizons in our understanding of the SMEs in Pakistani context.

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