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The Dynamics of Rural Poverty in Pakistan: A Time Series Analysis

Abdul Saboor and Zakir Hussain*

Abstract

At the start of the 21st century, almost one-fifth of humanity-1.2 billion people-live on less than a dollar a day. Pakistan is confronted by a multifaceted dilemma. The major issues facing the country are poverty and income disparity, particularly among the rural segments of the society. And evidence indicates that both have worsened. The impact of poverty is particularly acute on the most vulnerable sections of the society. In the year 1990-91, 39.42 percent of the total 31.81 percent of the population below the poverty line were termed as absolute poor including 34 percent chronically and 61 percent extremely poor. During the last decade or so, nearly 2 million people are added to the clusters of extremely poor, 5 million to chronically poor, 7 million to transient poor. Thus bringing nearly 59.11 percent of the poor population out of poverty is to a certain extent easier than bringing the remaining 40.89 percent out of the poverty trap. Pakistan has witnessed a decline in the growth rate from 6.1 per cent during the 1980s to 4.2 percent during the 1990s. However, the Poverty Equivalent Growth Rate (PEGR) analysis reported in this paper indicates that the pro-poor growth scenario is improving in rural Pakistan. If growth remains pro-poor in the subsequent years as it was in the year 2000-01, there is a likelihood that the growth will trickle down to the poor more than the non-poor. Punjab province also showed an improving trend in terms of pro-poor growth in the analysis. In order to improve PEGR, the poverty alleviation policy must be accompanied by rational income distribution.

I. Introduction

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The existence of pervasive poverty in the midst of global opulence is a daunting challenge confronting the world today. At the start of the 21st century, almost one-fifth of humanity-1.2 billion people- live on less than a dollar a day. Rural poverty accounts for nearly 63 percent of poverty worldwide (World Bank, 2004). Out of total 1.2 billion poor more then 900 million live in rural areas around the globe and the count for Asia and the Pacific is 90 percent out of a total of 800 million poor (IFAD, 2002). It is due to this global threat of poverty that at the UN Millennium Summit in September 2000, the International Development Community of 149 countries, adopted the Millennium Development Goals (MDG), thereby agreeing to halve acute poverty from the 1990 level (less than $ 1 a day) by 2015 as the first and most important goal.

Pakistan is faced with a multifaceted dilemma. The major issues are poverty and income disparity particularly among the rural segments of the society. Pakistan has witnessed over the last three decades periods of high economic growth, as in the 1960s, accompanied with increasing poverty levels, periods of low economic growth, as in the 1970s accompanied by reduction in poverty levels, spells of high economic growth leading to decline in poverty as in the 1980s and periods of low economic growth as in the 1990s accompanied by increasing poverty levels. The growth rate declined from 6.1 per cent during the 1980s to 4.2 percent during the 1990s (Amjad, 2004). The impact of the crisis of poverty is particularly acute on the most vulnerable sections of the society: women and children (UNDP, 2003).

Thus the study in hand is undertaken to determine a threshold level of poverty using rigorous economic tools coupled with trend analysis of rural poverty in terms of chronic and transient poor in the country. It further aims at developing a poverty equivalent growth rate which reflects the pro-poor growth scenarios in the rural areas.

2. Review of Previous Studies

By the very standard of $ 1 a day, as reported in World Development Indicators for 2001, 31 percent of Pakistan's population fell under the poverty line in 1996. The extent of poverty in rural areas increased from 37.0 percent in 1998-99 to 44.6 percent in 2000-01 (Kemal, 2003). Anwar and Qureshi (2002) concluded that the use of consistent time series estimates of the poverty line shows that the head count measure of poverty has increased from 17.2 percent in 1990-91 to 30.4 percent in

1998-99 and 35.6 percent in 2001. World Bank (2002) estimated that there was a decline in the poverty rate by 2 percentage points during the 1990s while the Asian Development Bank (2002) claimed that poverty had increased over this period.

There is increasing evidence that the prevalence of transient poverty is significantly greater that that of chronic poverty in many parts of the developing world. Jalan and Ravallion (2000) found that 49.39 percent of the squared poverty gap in China is transient, while Gaiha and Deolalikar (1993) noted that over nine years, chronic poverty accounted for only one fifth of the total poverty in the ICRISAT VLS panel of rural south India. Baulch and McCulloch (1999) using a five round panel data set for Pakistan find that only 3 percent of the households were poor in all five years and half were poor in at least one period.

2.1. Dilemma of Economic Growth: Necessary Condition

The recent analyses of large international and interregional data sets show that the structure of growth is a major factor in explaining the bulk of poverty reduction. The structure of growth does indeed matter very much. The other factor of importance is the initial condition of income distribution. The skewed distribution of income and land not only slows down growth but does not help in reducing poverty. The substantial empirical evidence suggests that a high inequality in income is not conducive to either economic growth or poverty reduction.

Pakistan requires a high growth rate in agriculture, well above the population growth rate, in order to reduce poverty. In order to obtain two percent growth rate per capita, Pakistan requires a 4.6 percent rate of agricultural growth. India, with 1.3 percent rate of population growth in the same period, only requires a 3.3 percent rate of agricultural growth to get 2 percent per capita. In agriculture, the difference between 3.3 percent and 4.6 percent is significant. It is the rate of growth of agricultural output per capita that gives a boost to demand growth for the rural non-farm sector that subsequently checks the momentum of poverty (Mellor, 2001).

2.2. Distributive Pattern of Growth: Sufficient Condition

Ravallion and Chen (2002) defined growth as pro-poor if it reduces poverty. Dollar and Kraay (2001) opined that positive economic growth

benefits the poor to the same extent that it benefits the whole economy. Similarly Knowles (2001) finds a significant negative effect of inequality on growth. Foster and Szekely (2000) showed that growth elasticity of the general means can vary from 1.08 to extremely low. They concluded that the positive value of elasticity indicates that growth is good for the poor. The Foster-Szekely approach provides an important bridge to the design of welfare measures sensitive to and incorporating poverty and inequality- a high priority in the research agenda in development economics. It is, therefore, argued that to achieve rapid reduction in poverty, the Poverty Equivalent Growth Rate (PEGR) is to be maximized instead of normal growth rate alone (Kakwani and Son, 2004).

3. Materials and Methods

The study in hand is a secondary data based study. It covers the period from 1990-91 to 2000-2001 using time series data obtained from the various issues of *Household Income and Expenditure Survey*. The HIES is conducted in four rounds by the Federal Bureau of Statistics, Statistics Division, Government of Pakistan, on an irregular basis covering both rural and urban areas in the four provinces of Pakistan. Despite some limitations, HIES data sets are the best available source to analyze the gender and demographic dimensions of poverty in Pakistan. There are two major methodological considerations to achieve the objectives.

3.1. Pockets of Poor Population: Methods of Fixing Poverty Band

The condition called poverty is not confined to the population below the poverty line, but goes beyond and includes the people residing above the poverty line with high probability of falling below it. Following the classification of McCulloch and Baulch (1999), the population is distributed into six groups by income quartiles around the poverty line and analyzes the poverty dynamics by comparing salient characteristics of these quartile bands for the period under consideration.

3.2 The Absolute Poor Household Band

If the per capita per month income of the household is less than 75 percent of the poverty line, it is declared as an absolute poor household which is further subdivided into extremely and chronically poor bands:

i) Extremely Poor Band: $Y < 0.5\ Z$

ii) Chronically Poor Band: $Y > 0.5\ Z$ and $Y < 0.75Z$

Where:

Y = household per capita per month income.

Z = Poverty line.

3.3. The Transitorily Poor Household Band

If the per capita per month income of the household is less than 125 percent of the poverty line and more than or equal to 75 percent of the poverty line, it is termed as transitorily poor household which is further subdivided into Transitory Poor and Transitory Vulnerable Bands.

i) Transitory Poor Band: $Y > 0.75\ Z$ and $Y < Z$

ii) Vulnerable Poor Band: $Y > Z$ and $Y < 1.25Z$

3.4. The Non-Poor Household Band

If the per capita per month income of the household is more than or equal to 125 percent of the poverty line, it is categorized as a Non-poor Household which is further subdivided into Transitory Non-Poor and Non-Poor Bands.

i) Transitory Non-Poor Band: $Y > 1.25\ Z$ and $Y < 2Z$

ii) Non-Poor Band: $Y > 2Z$

3.5. Head-Count Index of Poverty

It is the proportion of population whose income(y) is less than the poverty line Z. It is obtained by counting the number of persons (and in some studies households) whose expenditures are below Z and denoting these as a proportion of the total population. Hence:

$H=q/n$

H = Head-count index

q= number of poor

n = size of the population

3.6. Poverty Equivalent Growth Rate (PEGR)

According to Ravallion and Chen (2004), growth is defined as pro-poor if it reduces poverty. This definition is similar to the trickle down theory. Trickle down development indeed reduces poverty but the rate of

poverty reduction may be much slower. Pro-poor growth calls for enhancing growth and goes beyond the idea of trickle down. On this account, pro-poor growth may be preferably classified as the growth that delivers proportionally (or absolutely) greater benefits to the poor than to the non-poor. Pro-poor growth can be defined in relative and/or absolute terms.

Suppose income X of an individual is a random variable with distribution function given by F(x). Let z denote the poverty line, which measures the society's minimum standard of living. A person suffers absolute deprivation if his income is less than z. If his income is greater than or equal to z, we say that he does not suffer any deprivation. H= F (z) is the proportion of individuals who suffer absolute deprivation because their income is below the society's minimum standard of living. HCR (Head Count Ratio) measures the incidence of poverty. Being a crude measure of poverty it assumes that every one whose income is below the poverty line suffers the same degree of deprivation. To take account of the intensity of deprivation, we define the degree of absolute deprivation suffered by an individual with income x as

$$\text{Dep}(x) = P(z,x) \quad \text{if } x < z$$

$$= 0 \quad \text{if } x \geq z$$

Where P(z, x) is a homogenous function of degree zero in z and x.

$$\frac{P(z,x)}{x} < 0$$

$$\frac{^2 P(z, x)}{x^2} > 0 \qquad (1)$$

which implies that deprivation decreases monotonically with income at an increasing rate. The degree of poverty in the society may be measured by the average deprivation suffered by the society, which is given by

$$\theta = 0^{z} P(z, x)\, f(x)\, dx \qquad (2)$$

where f (x) is the probability density function of x. This is a general class of additive poverty measures.

Poverty reduction largely depends on two factors. The first factor is the magnitude of economic growth rate: the greater the growth rate, the greater the reduction of poverty. Secondly, growth is generally accompanied by changes in inequality: an increase in inequality reduces the impact of growth on poverty reduction.

To measure these two impacts, we differentiate equation (2) to obtain

$$d\theta/\theta = l/\theta_0 \int^{z} P/x \, d(x) \, f(x) \, dx \qquad (3)$$

which follows from the assumption that P(z, x) = 0: if an individual's income is equal to the poverty line, then he or she does not suffer any deprivation. Suppose x(p) is the income level of population at the pth percentile. Eq (2) can be written as

$$d \, Ln \, \theta = l/\theta_0 \int^{h} P/x \, x(p) \, g(p) \, dp \qquad (4)$$

Where g(p) = dLn(x(p)) is the growth rate of income of people on pth percentile.

Suppose L(p) is the Lorenz function, which measures the share of total income enjoyed by the bottom p proportion of population when the individuals in the population are arranged in the ascending order of their income.

Following Kakwani (1980), we can write

$$X(p) = \mu \, L'(p) \qquad (5)$$

Where μ is the mean income of the society and L (p) is the first derivative of the Lorenz function. Taking logarithm of (5) and differentiating it, we obtain

$$dLn(x(p)) = dLn(\mu) + dLn(L'(p))$$

which immediately gives

$$g(p) = \gamma + dLn(L'(p)) \qquad (6)$$

where: $\gamma = dLn(\mu)$ is the growth rate of the mean income. Next, substituting (6) into (4) gives

$$d \, Ln \, \theta = \gamma\eta + I/\theta_0 \int^{h} P/x \, x(p) \, dLn(L'(p)) \, dp \qquad (7)$$

where:

$$\eta = I/\theta_0^h P/ \text{ x } x(p)\, dp \qquad (8)$$

is the growth elasticity of poverty derived by Kakwani (1993), which is the percentage change in poverty when there is a 1 percent growth in mean income of the society, provided the growth process does not change inequality (when every one in the society receives the same proportional benefits of growth). This elasticity is always negative. Dividing (9) by y gives

$$\delta = \eta + \zeta \qquad (9)$$

where $\delta = dLn(\theta)/ y$ is the total poverty elasticity and

$$\zeta = l/\theta\gamma_0^h P/x\, x(p)dLn(L'(p))\, dp \qquad (10)$$

measures the inequality effect of poverty reduction. It tells us how poverty changes due to changes in inequality during the growth process.

The growth is pro-poor (anti-poor) if the change in inequality that accompanies growth reduces (increases) the total poverty. Thus the growth is pro-poor (anti-poor) if the total elasticity of poverty is greater (less) than the growth elasticity of poverty.

The Poverty Equivalent Growth Rate (PEGR) is the growth rate γ^* that will result in the same level of poverty reduction as the present growth rate y if the growth process had not been accompanied by any change in inequality (when every one in the society had received the same proportional benefits of growth). The actual proportional rate of poverty reduction is given by δy, where δ is the total poverty elasticity. If growth were distribution neutral (when inequality had not changed), then the growth rate γ^* would achieve a proportional reduction in poverty equal to $\eta\ \gamma^*$, which should be equal to $\delta\gamma$. Thus, the PEGR denoted by γ^* will be given by

$$\gamma^* = (\delta / \eta)\ f\gamma = \varnothing\gamma \qquad (11)$$

where $\varnothing = \delta / \eta$ is the pro-poor index, which was developed by Kakwani and Pemia (2000). This equation implies that growth is pro-poor (anti-poor) if γ^* is greater (less) than y. If γ^* lies between o and γ, the growth is accompanied by an increasing inequality but poverty still reduces. This

situation may be characterized as a trickle down process when the poor receive proportionately less benefits of growth than the non-poor.

Thus, PEGR determines the equitable growth rate. Furthermore, the proportional reduction in poverty is an increasing function of γ^*: the larger is γ^*, the greater is the proportional reduction in poverty. Thus, maximizing γ^* is equivalent to maximizing the total proportional reduction in poverty. This suggests that the performance of a country should be judged on the basis of the poverty equivalent growth rate and not by the ordinary growth rate alone.

4. Empirical Estimates

4.1. Pockets of Poor Population: Poverty Bands

It is important to distinguish that even within "the poor" all poor are not the same: some are poor occasionally while others are often poor; and for each category of the poor, their distance from the poverty line is not similar. Some of them are only marginally poor while others are severely poor, and often the former outnumber the latter, in other words, it is imperative to distinguish which component of poverty is chronic and which is transitory.

Thus, the poverty lines alone are not adequately helpful in exploring the dynamics of poverty in the country. The "dynamics" mean the inter quartile based movement of the population over the time period from 1990-91 to 2000-01. The data in Table 1 illustrates that 39 percent of the total 32 percent of the population below the poverty line was found as absolute poor with chronically and extremely poor in the proportion of 34 percent and 61 percent respectively in the year 1990-91. The extremely poor, chronically poor and transient poor constitute 1.72 percent, 10.82 percent and 19.27 percent of the overall population below the poverty line in rural Pakistan.

The transitorily poor constitute 32 percent; a major proportion (25 million) of the overall population in the rural areas. There is almost continuous increase in the proportion of absolute poor and transitorily poor segments of the society from 1990-91 to 2000-01. During the entire time series, 2 million people added to the clusters of extremely poor, 5 million to chronically poor, 7 million to transient poor and 7 million to the vulnerable poor. On the other hand, there is a consistent decrease in the proportion of non-poor, both transient non-poor and non-poor. In 1990-91, there were 17 million rural segments considered as non-poor while the number for this class reduced to 13

million in 2000-01; thereby this reflects a 3.21 percent decrease in non-poor in the rural areas over the whole decade.

Bane and Ellwood (1986) found that the majority of poor persons at any time are in the midst of a rather long spell of poverty. It is interesting to note that clusters of population very close to the poverty lines have significantly increased from 31.53 percent to 40.88 percent-which reflects a proportionate increase of 29.65 percent. This high proportion of the population close to the poverty line calls for policy attention. There is very little effort on the part of the government institutions to check the vulnerability phenomenon on the one hand and pulling the transiently poor out of the poverty trap on the other. Thus taking 59.11 percent of the poor population out of poverty is rather easier than bringing the remaining 40.89 percent out of the poverty trap. Moreover, "halving poverty", as per one of the Millennium Goals (MDGs), seems an achievable target through target oriented economic policies.

There is a shift in population from the upper poverty bands into the lower ones; showing a decline in their welfare level and hence influx into poverty. The situation becomes alarming when the non-poor of one period have become poor in the next period. This makes poverty alleviation a two dimensional task; making sure that those under the poverty line are brought up and those above it maintain their status-quo. It is extremely important for any poverty reduction strategy.

Table-1: The Dynamics of Rural Poverty in Pakistan (Time Series Analysis)

Poverty Dynamics	**1990-91**	**1992-93**	**1993-94**	**1996-97**	**1998-99**	**2000-01**
Extremely Poor	1.72 (1.3)	1.95 (1.6)	2.01 (1.6)	2.14 (1.9)	2.55 (2.3)	2.70 (2.5)
Chronically Poor	10.82 (8.4)	11.25 (9.1)	11.54 (9.5)	12.48 (10.9)	12.76 (11.605)	13.25 (12.4)
Transient Poor	19.27 (15	19.98 (16.2)	20.65 (17.0)	21.98 (19.3)	22.59 (20.5)	23.06 (216.4)
Transient Vulnerable	12.26 (9.5)	13.72 (11.1)	14.08 (11.6	14.00 (12.3)	16.08 (14.6)	17.82 (16.7)
Transient Non-Poor	34.20 (26.6)	33.10 (26.8)	32.02 (26.5)	3 1.00 (27.1)	30.35 (27.5)	29.12 (27.3)

Non-Poor	21.73 (17)	20.00 (16)	19.70 (16)	18.40 (12)	15.67 (14)	14.05 (13.2)

Figures in parenthesis indicate rural population in "million"

4.2. Poverty Equivalent Growth Rate

This study further examines to what extent the rural poor benefit from agricultural economic growth. The index of pro-poor growth, known as Poverty Equivalent Growth Rate (PEGR), takes into account both the magnitude of agricultural growth and its benefits to the rural poor. The PEGR demonstrates that proportional reduction in rural poverty is a monotonically increasing function: the larger the PEGR, the greater the proportional reduction in rural poverty. The PEGR that satisfies the monotonic relation with poverty reduction, therefore, is not only a necessary but also a sufficient condition for poverty reduction in the rural areas of Pakistan.

In this study, PEGR scenarios are reported in Table-2. The short term PEGR revealed that agricultural growth is anti-poor in Pakistan and in all provinces from 1990-91 to 1992-93 and in the subsequent years (from 1992-93 to 1998-99), showed pro-poor growth in rural Pakistan. The Punjab province also follows the same pattern of pro-poor growth in the agricultural sector. In Sindh and NWFP, there is only one short term period (from 1996-97 to 1998-99) when the growth was pro-poor because the values of PEGR rates are greater than that of the agricultural growth rates.

However, the short run PEGR results are not sufficient to show unambiguous decision results whether growth has been pro-poor or anti-poor. Pro-poor growth is more a long term phenomenon rather than short run because of trickle down lag to the poor particularly in rural areas. Moreover, inconsistency in the HIES data creates empirical difficulties, thus short term PEGRs do not lead to conclusive policy initiatives. Among all provinces, Balochistan is the only province where agricultural growth showed a pro-poor scenario from 1990 to 2001 though anti- poor growth was observed in some short term periods. NWFP is the worst case in the series where policies remained anti-poor in most of the years.

In this way, the short run PEGR analysis revealed that the pro-poor growth scenario is improving in rural Pakistan. If the growth remains pro-poor in the subsequent years as reflected in the year 2000-01, there is a likelihood that growth trickles down to the poor more than the non-poor.

Punjab province also showed an improving trend in terms of pro-poor growth in the analysis. However, the situation is alarming in other provinces because of anti-poor growth.

Table-2: The Actual and Poverty Equivalent Growth Rates (Time Series Analysis)

Areas	1990-91 to 1992-93	1992-93 to 1993-94	1992-93 to 1996-97	1996-97 to 1998-99	1998-99 to 2000-01	1990-91 to 2000-01
Pakistan	1.48 (3.07)	16.13 (5.20)	89.60 (6.13)	-1.50 (3.20)	8.47 (3.40)	-86.03 (4.7)
Punjab	-5.19 (7.33)	0.79 (0.94)	9.66 (9.8)	-0.39 (-0.45)	6.45 (6.01)	-92.00 (7.8)
Sindh	-13.4 (8.99)	-20.54 (6.48)	-16.21 (6.10)	13.80 (8.47)	-16.45 (-2.51)	-26.18 (8.16)
NWFP	-8.14 (6.70)	-16.87 (18.36)	-48.9 (4.5)	11.44 (5.54)	-32.52 (1.92)	-107 (3.98)
Balochistan	17.09 (9.83)	-9.5 (5.62)	21.6 (5.11)	35.97 (11.17)	-13.52 (2.63)	63.36 (2.16)

Figures in parenthesis indicate the growth rates in mean incomes.

5. Conclusions and Recommendations

In conclusion, the short term PEGR revealed that agricultural growth is anti-poor in Pakistan (including Punjab Province) in the early 90s and in the subsequent years showed pro-poor growth. However, in Sindh and NWFP, growth was pro-poor in the mid 90s. In Pakistan, growth though positive for most of the periods, has been anti-poor and PEGR is negative. Bhagwati (1988) calls this "immiserizing" growth where more affluent farmers adopt new seeds and raise production that results in lower prices. The small farmers also benefit from economic growth but to a lesser extent than the large farmers.

The study further found that pro-poor growth is more a long term phenomenon rather than short run due to time lag in trickle down to the poor, particularly in rural areas. Among all provinces, Balochistan is the only province where, agricultural growth showed a pro-poor scenario from 1990 to 2001 though anti-poor growth was observed in some short term periods. NWFP is the worst case in the series where policies remained anti-poor in most of the years.

The poverty alleviation initiative should follow two dimensional approaches; making sure that those under the poverty line are brought up and those above it maintain their status-quo. The government should focus on poverty equivalent growth rate in agriculture rather than the actual growth rates. The trickle down philosophy is simply not working in highly populated pockets of the poor of Pakistan. In order to improve PEGR, the poverty alleviation policy must be in tandem with rational income distribution.

The dynamic analysis of rural poverty is an ignored area of research in Pakistan which, if thoroughly appraised, would certainly create comfortable room for the policy makers to frame different sets of target oriented policies for various segments of the society separately. One should be careful in setting the poverty threshold keeping in view poverty lines and poverty bands. Moreover, the same time series analysis needs to be undertaken at provincial and cropping zone levels. A comprehensive policy is extremely important for a sound poverty reduction strategy. Thus, checking vulnerability would offer a wide option for the policy makers to settle the issue of the severity of poverty in the future. Thus, the PEGR is more feasible than simple emphasis on a general growth rate in agriculture.

References

Amjad, R. 2004, Solving Pakistan's Poverty Puzzle: Who should we believe? What should we do?, PSDE, 19th Annual Conference, 13th -15th January, Islamabad.

Anwar, T. and S. K. Qureshi 2002, Trends in Absolute Poverty in Pakistan: 1990-91 and 2001, *Pakistan Development Review*, Winter 2002, Islamabad.

Asian Development Bank 2002, Poverty in Pakistan: Issues, Causes and Institutional Responses, Pakistan Resident Mission, Islamabad.

Bane, M. J. and D. Ellwood. 1986, 'Slipping in and out of Poverty: The Dynamics of Spells', *Journal of Human Resources*, Vol.21, Vol.1, 1-23.

Bhagwati, J. N. 1988, Poverty and Public Policy, World Development Report 16 (5), pp. 539-654.

Dollar, D. and Kraay, A. 2001, "Growth is Good for the Poor" Washington, D.C., World Bank, Policy Research Working Paper 2587:50.

Foster, J. and Szekely, M. 2000, "How good is growth?" *Asian Development Review*, 18, 2 pp. 59-73.

Gaiha R. and A. B. Deolalikar 1993, Persistent, expected and innate poverty: estimates for Rural South India, 1975-84, *Cambridge Journal of Economics*, 17(4): 409-421.

Government of Pakistan (Various Issues). *Household Integrated Economic Surveys*, Federal Bureau of Statistics, Statistics Division, Islamabad.

International Fund for Agricultural Development 2002, Enabling the Rural Poor to over come Poverty, Annual Report, IFAD, Rome, Italy.

Jalan, J. and M. Ravallion 2000, Is transient poverty different? Evidence for rural China, *Journal of Development Studies*, Vol.36, No.6, pp. 82-99.

Kakwani, N. 2003, Issues in Setting Absolute Poverty Lines, Poverty and Social Development, Paper No. 3, Regional and Sustainable Development Department, Asian Development Bank.

Kakwani, N. and H. H. Son 2004, Pro-Poor Growth: Concepts and Measurement, PSDE, 19th Annual Conference, 13th -15th January, Islamabad.

Kakwani, N. and Pemia, E. 2000, What is Pro-poor Growth, *Asian Development Review*, Vol. 16, No. l,pp. 1-22.

Kakwani, N. 1980, Income Inequality and Poverty Review: Methods of Estimation and Policy Applications, Oxford University Press, New York.

Kemal, A. R. 2003, Structural Adjustment And Poverty In Pakistan, Mimeo Technical Paper Series No. 14, Pakistan Institute of Development Economics, Islamabad.

Knowles, S. 2001, "Inequality and economic growth: the empirical relationship reconsidered in the light of comparable data". Paper prepared for WIDER conference on 'Growth and Poverty', WIDER, Helsinki.

McCulloch, N. and Baulch, B. 1999, "Distinguishing the chronically from the Transitory Poor: Evidence from Rural Pakistan", Paper presented at IDS-IFPRI Workshop on Economic Mobility and Poverty Dynamics, Institute of Development Studies, 7-8 April, 1999.

Mellor, John W. 2001, "Employment Multiplier from Agricultural Growth and Poverty Reduction", *The Pakistan Development Review*, 40: 4 Part I (Winter 2001) pp. 371-400.

Ravallion, M. and Chen, S. 2002, "Measuring Pro-poor Growth", World Bank, Working Paper no.2666.

United Nation Development Programme: UNDP, 2003, National Human Development Report, Poverty. Growth and Governance, Oxford University Press, Karachi.

World Bank, 2002, Poverty in Pakistan: Vulnerabilities, Social Gaps and Rural Dynamics Washington D.C.

World Bank, 2004. www.worldbank.org.

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Child Labor's Link with Literacy and Poverty in Pakistan

Imran Ashraf Toor*

Abstract

In developing countries, children have long been largely ignored in public policy-making and the development of program strategies for improving their welfare. The complex issue of child labor is a developmental issue worth investigating. The notion that children are being exploited and forced into labor, while not receiving education crucial to development, concerns many people. This study focuses on child labor in Pakistan with two main objectives. We first estimate the prevalence of child labor in the 100 districts of Pakistan and then examine the hypothesis that child labor is significantly higher in districts that have a higher incidence of poverty and lower level of educational attainment. The results show that child labor has a negative relationship with the literacy rate both 10-14 year age and 15 years and above. There is a negative but insignificant relationship with per capita income and Deprivation Index in the case of male child labor. The study proved that literacy rate and per capita income has influenced negatively on female child labor.

I. Introduction

In developing countries, children have long been largely ignored in public policy-making and the development of program strategies for improving their welfare. However, this situation is beginning to change; Governments as well as international development agencies have started increasingly to focus attention on the welfare of children. The World Summit for Children held in 1990 epitomized this realization and reaffirmed the collective commitment to changing the situation[1]. Presently, child labor is one of the chronic issues of children in the modern world.

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[1] The International Labor Organization brings together governments and workers' and

The complex issue of child labor is a developmental issue worth investigating. The notion that children are being exploited and forced into labor, while not receiving education crucial to development, concerns many people. Child labor is most prevalent in the developing regions. In absolute term, it is Asia, as the most densely populated region of the world, which has the most child workers (probably over half)[2]. Pakistan is also faced with the problem of child labor. According to the ILO, there are between 19 to 20 million working children in Pakistan. Many households depend on child labor for survival. While reliable statistics are not available, it is thought that about two thirds of the child population work in services, manufacturing, fishery, agriculture and forestry. Despite legal prohibitions, industrial child labor is widespread, especially in textile factories and home-based production. By conservative estimates, one million children work as carpet weavers alone.

To eliminate child labor, Kerala State in India is an excellent example for developing countries. The Kerala government is spending more on education than any other state government in India. The spending on education was 36 per cent of the GDP of the state revenues. Due to the high level of education, Kerala produces a high quality skilled labor force and the government has made no special effort to end child labor. It is the result of the school system rather than the enforcement of labor legislations

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employers' organizations to formulate international policies and programs that promote basic human rights at work, improve working and living conditions while enhancing employment opportunities and enterprise creation.

It establishes and supervises international labor standards, provides technical cooperation as well as training, education, research and publishing to support these efforts. It promotes decent and productive work for all. The ILO is 80 years old and pre-dates the founding of the United Nations.

The ILO decision-making bodies are made up of governments, employer and worker delegates from each member State. Its Governing Body is composed of 28 governments, 14 worker members and 14 employer members. It is the only tripartite institution in the multilateral system.

By ratifying an ILO Convention, a country becomes bound under international law to give effect to its provisions in national law and practice. The ILO has a procedure to supervise the application of ratified Conventions. It is based on regular reporting, independent input from the employers' and workers' organizations, on objective evaluation by independent experts and on examination of cases by the Organization's tripartite bodies.

[2] According to the definition of International Labor Organization (ILO) child labor is work done by children under fifteen. Exception is made of work done by children with their parents at home in so far as aid in the latter's work is concerned and the child is not deprived of the possibility of going to school.

that has reduced the amount of child labor.[3] The situation is different in Pakistan. The irrelevant and often inaccessible education system has led to an increase in child labor. In 1996, Carol Bellamy, Director of the United Nations Children's Fund, released the annual State of the World's Children report citing education as the single most important step in ending child labor. Bellamy's report went steadily further saying that with innovative programs which, for example, may pay families a small stipend to make up for the lost wages of children, developing nations can burnish their future prospects while rescuing today's children. That should be a focus of foreign aid as well. Provisions were made in the Pakistan Constitution to allow for the education of Pakistan's youth. Although these provisions were made, many children still find themselves illiterate, uneducated, and driven to work.

Mostly it is said that poverty and financial deprivation are reasons for sending small children to work under rigoros and hazardous conditions. But what forces the factory owners to employ child labor which is a clear violation of the national law and the constitution and the UN declaration of the rights of the child? It cannot only be because they are caring for poor and helpless families. It has to do with the availability of cheap and obedient labor who will not ask for raise in salaries or less working hours, not even protection of social security allowed by the law. The intention is quite clear. It is to make larger and larger profits but at the cost of the future generation of the nation.

A family's economic poverty may force the parents to engage their children in the labor market in lieu of schooling. Furthermore, sending children to school may be considered less critical, especially in settings where education appears to have no immediate benefits to parents and encouraging children to begin working could provide immediate economic relief to the family. In some situations, inconvenience or inaccessibility may also deter parents from sending their children to school, leading them to enter the labor force as a result.

An understanding of the key issues of child labor is necessary for the formation of effective policies in reducing and eventually eliminating child labor. This view underlines the many econometric analyses of child labor on micro data sets of developing countries. These studies had, earlier, mostly involved Latin American data on child labor, but recently they have

[3] Weiner M. 1991. The Child and the State in India.

extended to data sets of African and Asian countries. Examples include studies of Psacharopoulos (1997), Cartwright and Patrinos (1998) on Bolivian data, Grootaert (1998) on Cote d'Ivoire, Tienda (1979), Boyden (1988, 1991), Patrinos and Psacharopoulos (1997) on Peru, Psacharopoulos (1997) on Venezuela, Salazar (1988) on Colombia, Patrinos and Psacharopoulos (1995) on Paraguay, Jensen and Nielsen (1997) on Zambia, Addison *et al* (1997) on Pakistan and Ghana, Chaudhuri (1997) on India and Ray (1998) on Pakistani and Peruvian data. Child labor is still a cause for concern, for two reasons: first, because of the number of children affected, which is still very high; second, and most importantly, because of the negative repercussions that starting working life too young has on the personal development of children, as a result of the poor conditions in which it often takes place, and on the economic and social development of the country concerned.

In the last decade, the Pakistan National Assembly enacted two labor laws meant to curb such practices. The first, The Employment of Children Act of 1991, prohibited the use of child labor in hazardous occupations and environments. The second, The Bonded Labor Act of 1992, abolished indentured servitude and the *peshgi* system. As progressive as these laws were, the government failed to provide for their implementation and enforcement. It also neglected to inform the millions of working children and indentured servants that they were free and released from their debts. "We prefer to leave enforcement to the discretion of the police", says a Ministry of Labor official. "They understand best the needs of their community. Law is not an absolute. We must expect certain flexibility on the part of those who enforce it. Could this sometimes mean looking the other way? Absolutely."

A fundamental factor in the issue of Pakistan child labor rests in the inefficiency of protective legislation for working children. Although the government has made attempts to eradicate child labor, these provisions are greatly ignored and the industry continues. One problem with this legislation is that much of it fails to completely define the term child labor. Another complication lies within the country's vast population as their ignorance of the law and illiteracy prevent the enforcement of such proposals. This ignorance could be prevented through the establishment of a universal Pakistan dialect and a higher standard of education throughout the countryside.

This study focuses on child labor in Pakistan with two main objectives. We first estimate the prevalence of child labor in the 100 districts of Pakistan and then examine the hypothesis that child labor is significantly higher in districts that have a higher incidence of poverty and lower level of educational attainment.

The remainder of this paper is as follow: Section II describes the variables and data sources. The methodological issues are discussed in Section III. Section IV, gives the empirical results. The main conclusions are summarized in Section V.

II. Variable Description and Data Sources

Data from the 1998 census of Pakistan was used to estimate the prevalence of child labor in the country's 100 districts.[4] The census collected data on child labor among children 10-14 year old.

Child Labor Rate: Child labor refers to the percentage of children gainfully employed (for remuneration in cash or kind) among all children 10-14 years old at the time of the census. The child labor force consists mainly of unpaid family workers. Although it is a common practice everywhere, child labor in family enterprises is more prevalent in rural than in urban areas. Likewise, children employed as wage-earners usually account for a relatively small percentage of total child labor. Child wage-earners are to be found more often in urban than in rural areas; moreover, the older the children, the more likely they are to be in this category.

Per Capita Income: In the present analysis, we will use per capita agriculture and manufacturing production of each district as an income proxy. Household income and wealth is the most discussed welfare attribute in the literature. Direct income data at provincial or district levels are not available; therefore various proxies are used to estimate the income and wealth position of a district. For the rural economy, cash value of agricultural produce per rural person and livestock per rural capita (LIVESTOCK) are used. All major and minor crops are considered to estimate the district's cash value from agriculture. This indicator is based on aggregation by assigning weights as recommended by the FAO (Pasha and Hassan, 1982) to reflect the capital value of various animals and poultry.

[4] Actually, Karachi consists of five districts but in this analysis, it is used as one district. Umer Kot district is also merged in Tharparker district.

For the urban part of a district, per capita value added in large-scale manufacturing (MANUFACTURING) is used to proxy the level of urban income. Value added by the small-scale component could not be included due to lack of data.

Literacy Rate: Data on literacy come from the 1998 census. Child literacy refers to the percentage of those who can at least read, write and do simple counts among all children 5-14 years old at the time of the census. Adult literacy refers to the percentage of adults who can at least read, write and count among all adults, i.e. those 15 years old and older.

Educational level is an indicator not only of those economically active in agriculture but those knowledgeable about it. It is assumed that those with a longer period of education are more adjustable to new technologies and are able to experiment with new methods of farming compared to those with limited education or none at all. This is not to mention that higher educational standards could mean a good wage employment which can provide money for investment in the farm e.g. hire labor and buy inputs.

Deprivation Index: The Index of Multiple Deprivation (IMD) is based on the premise that deprivation is composed of multiple dimensions. These dimensions or sectors reflect different aspects of deprivations. Each sector is made up of a number of indicators. The selection of indicators is based entirely on the data available in the Population and Housing Census of 1998. The following indicators from four dimensions are used to compute district-wise indices of multiple deprivation: (a) Out of school male and female children aged 5-9: (b) Inadequate Housing structure and percentage of homeless population: (c) Residential housing services and (d) Unemployment rate.[5]

Household Size: We hypothetically assume that the larger the household, the more likely it is to be poor. One of the most important reasons put forward by especially the urban children for engaging in economic activity is to supplement household income. Rural children cited helping out in household economic enterprise as an equally important factor leading them to engage in market work.

[5] The detailed methodology of the Multiple Deprivation Index is available in the Appendix.

III. Methodology

The main techniques of data analysis used are simple correlation coefficients and linear multiple regression. The unit of analysis is the district, not individuals, in this sense, it is "ecological" research. The lack of reliable and comparable statistical series on child labor at the national level means that it is impossible to study the trend of child labor over time. The following models are used for male and female child labor force analysis at the national level.

Equation No. 1

$$ChildLB = \beta_o + \beta_1 Lit10 \beta_2 PCINM + \beta_3 Household + \varepsilon$$

Equation No. 2

$$ChildLB = \beta_o + \beta_1 Lit15 + \beta_2 PCINM + \beta_3 Household + \varepsilon$$

Equation No. 3

$$ChildLB = \beta_o + \beta_1 Lit10 + \beta_2 Dep\_Index + + \beta_3 Household + \varepsilon$$

Equation No. 4

$$ChildLB = \beta_o + \beta_1 Lit10 + \beta_2 Dep\_Index + + \beta_3 Household + \varepsilon$$

Where

ChildLB = Child Labor as percentage of total population aged 10-14 years.

Lit 10 = Literacy Rate population aged 10-14 years.

Litl5 = Literacy Rate population aged 15+ years.

PCINM = Per capita income of each district (Agricultural + Manufacturing).

Dep_index = Deprivation Index of each District.

Household = Household size of each district

IV. Empirical Analysis

Table-1 presents the descriptive statistics of all variables, which are used in this study. This table shows that 23.8 percent male children are involved in child labor. On the other hand, the share of the female labor force is only 1.4 percent. The results explain that child labor is purely a male child phenomena. The census data has not enough information about other aspects of child labor, and this makes it difficult to identify the children engaged in physically, intellectually or emotionally injurious work or conditions, and to target protection for them. Official statistics contain very limited data in these types of studies and reports of varying quality and objectivity.

Table-1: Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Maximum	Minimum
LFM1014	23.804	17.952	17.843	75.444	3.706
LITM1014	53.148	53.989	18.830	88.203	12.282
LITM15+	44.552	46.110	14.992	80.044	15.137
LFF1014	1.386	0.856	1.614	8.904	0.060
LITF1014	35.169	35.638	19.231	81.795	4.638
LITF15+	17.825	15.177	12.713	60.450	2.391
PCINM	4227.115	3958.425	2405.068	14965.00	229.990
Dep_Index	64.814	65.655	10.845	89.060	24.590
Household	6.840	6.780	1.061	9.840	4.970

Table-2 shows simple correlation among the variables which are used in this study. The correlation results clearly indicate that education has a negative relationship with child labor, both male and female. Per capita Income shows a non-relationship with male child labor, but it has a negative relationship with female child labor. On the other hand, district Deprivation Index has a strong positive relationship with male child labor.

Table-2: Correlation among variables

Variables	**(A)**	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**
LFM1014 (A)	1.000								
LITM1014(B)	-0.822	1.000							
LITM15+(C)	-0.787	0.959	1.000						
LFF1014 (D)	0.286	-0.382	-0.361	1.000					
LITF1014(E)	-0.629	0.880	0.912	0.278	1.000				
LITF15+(F)	-0.515	0.745	0.839	-0.240	0.944	1.000			
PCINM (G)	0.007	0.007	0.021	-0.115	0.048	0.022	1.000		
Dep_Index(H)	0.669	-0.806	-0.873	0.257	-0.881	-0.914	-0.050	1.000	
Household (I)	-0.214	0.150	0.091	-0.314	-0.101	-0.118	-0.259	-0.028	1.000

Table-3 shows the results of linear multiple regression analysis in which literacy rate aged 10-14 years, literacy rate aged 15+ years, per capita income, Deprivation Index and household size are used as independent variables. The signs of all the variables are according to the expectation in all equations. Equation-1 illustrates a negative relationship between child labor and literacy rate of children aged l0-14 years. Per capita income of the district has a negative relationship with child labor and is not significant. The other variable household size has a strong positive relationship with child labor. In equation-2, the literacy rate of age 15 and above has a strong negative relationship with child labor. It is confirmed that increasing education of adults has a negative impact on child labor. The other two variables have the same trend in this equation. In equations 3 and 4, we drop the per capita income and include 'Deprivation Index' of the district. The Deprivation Index is insignificant in these equations which shows that child labor is not only a deprived district phenomena but it also exists in the well developed districts. If one extends Basu and Van's (1998) prediction that a household will not send its children to school if it falls into poverty, then a negative and statistically significant sign of the poverty variable has provided confirmation of their result. As in the case of

child labor and, hence, consistent with the earlier results, the evidence on child labor confirms it. This provides confirmation of our earlier observation, also noted by Weiner (1996) that South Asian children, especially girls from poor districts, drop out of school to enter the labor market.

Table-3: Dependent Variable: Percentage of Male Child Labor Force 10-14 year aged

	Equation-1	**Equation-2**	**Equation-3**	**Equation-4**
Constant	32.897 (1.796)	45.245 (2.271)	12.127 (0.895)	31.266 (1.664)
Literate 10-14 years	-0.622 (10.688)		0.540 (6.611)	
Literate 15 + years		-0.756 (9.610)		-0.744 (5.257)
Log Per Capita Income	-0.583 (0.307)	-1.457 (0.711)		
Household Size	4.333 (3.618)	3.760 (2.940)	4.535 (3.861)	3.855 (2.983)
Depreciation Index			0.163 (1.400)	0.011 (0.070)
Adj-R^2	0.70	0.65	0.71	0.65
F-statistic	38.71	31.33	40.90	30.53
D-W Test	1.61	1.81	1.70	1.72
Mean Dependent Variable	18.75	18.75	18.75	18.75

The gender differential between sexes in Pakistan in respect of child labor is quite revealing with girls experiencing a much sharper reduction than boys in their schooling, when their households fall into poverty. Table-4 explains the linear multiple regression results of female child labor. Equation-1 shows a negative significant relationship between child labor and literacy rate of girls aged l0-14 years. This relationship shows the importance of female education. The price of investment on female education can be very high. Previously, most free public education is in fact very expensive for a poor family, which is expected to meet the cost of books and other school supplies, uniforms and clothes, transportation, and sometimes even provide unofficial payment to teachers. The close complementarity between girls' and female wages, have an impact on child schooling. In other words, when female wages rise, the working mother tends to pull the daughter out of school and takes the child to work with her. It is also interesting to observe that girls in Pakistan, though not boys, experience significantly more schooling in urban areas than in the rural countryside.

Per capita income of the district has a strong negative relationship with female child labor. Poverty is the greatest single force which creates the flow of children into the workplace. It forces many children to work full time for their own and their families' survival. Furthermore, because of poverty, the acute need of many households to keep many family members working to ensure income security makes it nearly impossible for them to invest in their children's education. Experts have always pointed at poverty as the main reason for the escalating rate of drop-outs. Many of the children are forced into child labor to help their poor families earn supplementary incomes for food. Orphans, children from women-headed homes and destitutes fall easy prey to child labor. In rural areas, child labor is rampant because most children drop out of school due to shortage of food, because they are assigned to draw water from distant sources or because of inadequate health facilities.

Household size has shown a strong negative relationship with female child labor in this study. A large family size may have more male earners, which has a negative impact on the female child labor force. In equation-2, the literacy rate of age 15 and above has a strong negative relationship with female child labor. The other two variables have the same trend in this equation. In equations 3 and 4, we drop the variable per capita income and include Deprivation Index of the district. In these equations,

the signs of all the variables are according to expectation. The Deprivation Index is insignificant in these equations which shows that female child labor is not only a deprived district phenomena but it also exists in the well developed districts. In order to overcome these obstacles, Pakistan must first recognize that a child labor crisis exists and then address each of its sources individually. Someone must be willing to accept responsibility for this injustice if it is to be eradicated.

Table-4: Dependent Variable: Percentage of Female Child Labor Force aged 10-14 year

	Equation-1	**Equation-2**	**Equation-3**	**Equation-4**
Constant	19.440	19.071	5.16	3.818
	(4.924)	(4.783)	(1.290)	(0.744)
Literate 10-14 year	-0.034		0.026	
	(3.153)		(1.010)	
Literate 15+year		-0.043		-0.021
		(2.930)		(0.405)
Log Per Capita Income	-1.573	-1.580		
	(3.816)	(3.780)		
Household Size	-0.530	-0.533	-0.457	-0.447
	(2.034)	(2.013)	(1.534)	(1.562)
Depreciation Index			0.070	0.021
			(0.160)	(0.324)
Adj-R^2	0.38	0.37	0.14	0.13
F-statistic	9.56	8.95	3.58	3.24
D-W Test	2.70	2.62	2.54	2.45
Mean Dependent Variable	1.46	1.46	1.46	18.75

The results of the equations suggest that a two-pronged policy intervention is needed: To raise their income which would make simultaneous efforts to increase literacy. Literacy will have an influence in reducing male and female child labor. Improvements in schooling would both discourage child labor and significantly improve the human development index. For example, poverty may be clustered in certain groups of people differentiated by ethnicity or other classifications. The results also suggest that there are different underlying socioeconomic conditions affecting the prevalence of male and female child labor.

The state of education in Pakistan also needs to be improved. High illiteracy and dropout rates are reflective of the inadequacy of the educational system. Poverty plays a role in the ineffectiveness of the educational system. Dropout rates are high because children are forced to work in order to support their families. The attitudes of the people also contribute to the lack of enrolment - parents usually feel that work develops skills that can be used to earn an income, while education does not help in this matter. Compulsory education may help in regard to these attitudes. The example of Sri Lanka shows that compulsory education has worked in those areas. There are many socioeconomic differences between Sri Lanka and Pakistan. What types of social welfare structure do these places have? What are the attitudes of the people? Is there some other reason why the labor market for child laborers is poor in these areas? These are some questions that need to be answered before applying the concept of compulsory education to Pakistan. Hopefully the future will show that this action has made progress towards universal education, and eradicating child labor.

Child labor cannot be eliminated by focusing on one determinant, for example education, or by brute enforcement of child labor laws. The government of Pakistan must ensure that the needs of the poor are fulfilled before attacking child labor. If poverty is addressed, the need for child labor will automatically diminish. No matter how hard Pakistan tries, child labor always will exist until the need for it is removed. The development of Pakistan as a nation is being hampered by child labor. Children are growing up illiterate because they have been working and not attending school. A cycle of poverty is formed and the need for child labor is reborn after every generation. Pakistan needs to address the situation by tackling the underlying causes of child labor through governmental policies and the enforcement of these policies. Only then will Pakistan succeed in the fight against child labor.

Appendix

Definition and Methodology of Index of Multiple Deprivation (IMD)

The Index of Multiple Deprivation (IMD) is based on the premise that deprivation is composed of multiple dimensions. These dimensions or sectors reflect different aspects of deprivations. Each sector is made up of a number of indicators. The selection of indicators is based entirely on the data available in the Population and Housing Census of 1998. The following indicators from four dimensions arc used to compute district-wise indices of multiple deprivation.

Education

Out of School Children - Male [Male children aged 5 to 9 years, not attending school]
Out of School Children - Female [Female children aged 5 to 9 years, not attending school]
Illiteracy Rate - Male [Percentage of illiterate males among the male population aged 10 years and above]
Illiteracy Rate — Female [Percentage of illiterate females among the male population aged 10 years and above]

Housing Quality and Congestion

Inadequate Wall Structure [Housing with walls of un-baked bricks, earth bound, wood or bamboo material]
Inadequate Roofing [Houses with un-baked bricks, earth bound, wood or bamboo used in roofing]
Index of Overcrowded Housing [Person per rooms standardized with (Actual- 1.5)/(Maximum- l.5*l00]
Housing Units with One Room [Percentage of houses reporting only one room in the house]
Percentage of Homeless Population [Population with no shelter]
Percentage of Non-Owners' Households [Rented or rent free houses]
Percentage of Households with No Facility of

- Separate Kitchen
- Bathroom
- Latrine

Residential Housing Services

Un-electrified Households [Percentage of Households having no electricity connection]
Households not using Cooking Gas [Households using wood or kerosene oil as cooking fuel]

Housing with no Inside Piped Water Connection

Employment

Unemployment Index [Unemployment rate is referred to as a percentage of the population aged a 15 to 65, not working and looking for work] standardized with (unemployment rate/maximum unemployment* 100)
Index of Non-Manufacturing Employment [Share of non-manufacturing employment in total employed labor force] standardized with (share /maximum share* 100).

The methodology used for constructing the Deprivation Indices is as follow. Given that all the above indicators are used in terms of 'percentages of the population affected by the type of deprivation', they can be easily combined. Therefore, deprivation indicators in each sector are first combined to create the four Sectoral Indices.

The indicators can be combined by assigning them equal weight. This would, however, not take account of the relative importance of the different indicators in sectoral deprivation. As such, the Principal Component Technique of Factor Analysis is used to generate weights. This statistical procedure assigns the highest weight to those variables that have the greatest variance (or dispersion); indicators with the lowest level of inequality are assigned the lowest weight. After assigning these weights, sectoral indices are computed and then ranked in order to compare deprivation levels across districts and provinces.

Once sectoral indices have been calculated, an overall index of multiple deprivations is derived. Having considered various options for computing the overall index, it has been decided to employ the criteria used by the UNDP for deriving their Human Poverty Index (HPI). The following formula is used to derive the Index of Multiple Deprivation.

$$IMD = [1/4^{a}\{(E)\}^{a\circ} + \{HQ)^{a} + (HS)^{a} + (L)^{a}\}]^{1/a}$$

Where

IMD = Index of Multiple Deprivation
E = Index of Education Deprivation
HQ = Index of Deprivation in Housing Quality
HS = Index of Deprivation in Housing Services
L = Index of Deprivation in Employment
$\forall$ = 3

The value of $\forall$ has an important impact on the value of the Index. If $\forall$=l, the IMD is the average of its four sectors. As $\forall$ rises, greater weight is assigned to the sector in which there is the most deprivation. Following UNDP, the value of $\forall$ is set at 3 to give additional but not overwhelming weight to the area of greater deprivation.

References

Addison, T., Bhalotra, S., F. Coulter and C. Heady 1997, *Child Labor in Pakistan and Ghana: A Comparative Study*, mimeo. Centre for Development Studies, University of Bath, UK.

Alderman, Harold, Peter F. Orazem and Elizabeth M. Patemo 1996, "School Qaulity, School Cost and the Public/Private School Choices of Low-Income Households in Pakistan", The World Bank: Impact Evaluation of Education Working Paper Series No. 2.

Basu, K. and P.H. Van 1998, "The Economics of Child Labor", *American Economic Review*, 88(3), pp412-427.

Blackwood, D.L. and R.G. Lynch 1994, "The Measurement of Inequality and Poverty: a Policymaker's guide to the literature", *World Development* 22 (4) pp567-578.

Borooah, Vani K 2000, "The Welfare of Children in Central India: Econometric Analysis and Policy Simulation", *Oxford-Development-Studies* 28(3), October 2000.

Cartwright, K and H.A. Patrinos 1998, "Child Labor in Urban Bolivia" in C. Grootaert and H. Patrinos (eds), *The Policy Analysis of Child Labor: A Comparative Study'* Mimeo: World Bank, Washington.

Chaudhuri, D.P. 1997, "A Policy perspective on Child Labor in India with Pervasive Gender and Urban Bias in School Education", *Indian Journal of Labor Economics*, 40(4), pp789-808.

Ghayur Sabur 1996, "Labor Market Issues in Pakistan: Unemployment, Working Conditions,a nd Child Labor", *Pakistan Development Review* 35(4) pp 789-803

Glewwe, Paul and Jacques Van der Gaag 1990, "Identifying the poor in developing countries: do definitions matter?". *World Development* 18(6) pp803-814.

Grootaert, C. 1998, "Child Labor in Cote d'lvoire: Incidence and Determinants" in C. Grootaert and H. Patrinos (eds), *The Policy*

Analysis of Child Labor: A Comparative Study' Mimeo: World Bank, Washington.

Hyder S. Nazre 1998, "Child Labor in Pakistan: Problems, Policies and Programmes", *Asia-Pacific Development Journal* 5(1), pp 121-32.

ILO 1996, Economically Active Populations: Estimates and Projections, 1950-2010, International Labor Organization, Geneva.

Jacob, Hanan G. and Emmanuel Skouflas 1997, "Risk, Financial Markets, and Human Capital in a Developing Country", *Review of Economic Studies* 64 (July): pp 311-335.

Jari S.M. Younus and Raishad 1997, "Sonic Dimensions of Child Labor in Pakistan", *Pakistan Development Review* 36(1) pp69-86.

Jensen, P. and H.S. Nielsen 1997, "Child labor or School Attendance? Evidence form Zambia", *Journal of Population Economics,* 10(4) pp 407-424.

Mehra-Kerpelman, K. 1996, "Children at Work: How Many and Where?" *World of Work* 15:pp8-9

Patrinos, H.A. and Psacharopoulos,G. 1995, "Educational Performance and Child Labor in Paraguay", *International Journal of Educational Development,* 15(1) pp 47-60.

Patrinos, H.A. and Psacharopoulos, G. 1997, "Family Size, Schooling and Child Labor in Peru: An Empirical Analysis", *Journal of Population Economics,* 10(4), pp 377-386.

Psacharopoulos, G. 1997, "Child Labor Versus Education Attainment: Some Evidence for Latin America", *Journal of Population Economics,* 10(4), pp 377-386.

Ravallion, Martin and Quentin Wodon 2000, "Does Child Labor Displace Schooling? Evidence on Behavioral Responses to an Enrollment Subsidy", *Economic Journal,* Vol. 110, March 2000, pp 158-176.

Ray, R. 1998, "Analysis of Child Labor in Peru and Pakistan: A Comparative Study", mimeographed. School of Economics, University of Tasmania.

Ray Ranjan 2000, "Analysis of Child Labor in Peru and Pakistan: A Comparative Study", *Journal of Population Economics* 13(1) pp 3-19.

Salazar M.C. 1988, "Child Labor in Colombia: Bogota's Quarries and Brickyards", in A. Bequele and J. Boyden (eds), *Combating Child Labor,* ILO, Geneva.

Thapa Shyam, Chhetry Devendra and Aryal Ram H. 1996, "Poverty, Literacy and Child Labor in Nepal: A District-level Analysis", *Asia-Pacific Population Journal* 11(3), pp3-14

Tienda, M. 1979, "Economic Activity of Children in Peru: Labor Force Behaviour in Rural and Urban Contexts", *Rural Sociology,* 44(2), pp 370-391.

Weiner, M. 1991, The Child and the State in India. Princeton: Princeton University Press.

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Explaining Financial Crises in Emerging Markets: A logit model on the Turkish data (1984-2001)

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Abstract

This article aims at explaining the financial crises Turkey experienced in the last decade through a random effects logit model which incorporates 26 macroeconomic, political, and financial sector variables. Evidence emerges that the only significant variables are current account/GDP, fiscal balance/GDP, GDP per capita, national savings growth, foreign exchange reserves, terms of trade, stock prices, and import growth. Results indicate that all variables have expected signs with the exception of import growth.

Keywords: Logit models, financial crises, currency crises, emerging markets

I. Introduction

The Turkish economy was shaken by two devastating financial crises in the last decade. The first one coincides with a managed floating exchange rate regime whereas the latter, which had more severe effects than that of the first one, occurred in the midst of a stabilization program, which involved a crawling peg exchange rate regime.

Following the liberalization of the finance sector in the late 1980s, Turkey had attracted capital inflows due to high real interest rates. This led to an overvaluation of the Turkish lira. The appreciation of the currency and also the tariff reductions in 1989 caused current account deficits. The pressures on the exchange rate and the interest rates, and the open position of the banking system, which was around 5 billion dollars, increased the

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demand for dollars. At the end of 1993, public sector debt stock and deficits as a percentage of GDP reached record high levels and the burden of interest payments increased. The government attempted not to impede growth prior to the local election of the governments in March 1994 and it made an attempt to control the interest rates. So, there was a policy shift from bond-finance to money-finance starting from the last months of 1993. Several Treasury bill auctions were cancelled and the Treasury started to rely on short-term advances from the Central Bank. Therefore, there was a substantial real increase in the Central Bank's domestic credits starting from the beginning of September 1993 (Akyuz and Boratav, 2002). The real return on Treasury bills turned to negative at the end of 1993. The cancellation of auctions increased the uncertainty in the financial markets and shook the confidence of investors. Finally the Treasury lost its ability to borrow.

Turkey followed a managed floating exchange rate regime until the end of 1999. In January 2000, Turkey signed a stand-by agreement with the IMF and began following a stabilization program, which involved implementing a crawling peg against a dollar-German mark basket, which allowed the exchange rate to fluctuate within a band. The uniqueness of this crawling peg exchange rate regime was that both the exit strategy and the date of exit were publicly known at the beginning of the program: the exchange rate would be allowed to fluctuate in a continuously widening band after eighteen months. Due to the fixed exchange rate policy, when the US dollar became overvalued, the Turkish Lira became overvalued as well, making exports expensive and imports cheap. This in turn, increased Turkey's trade deficit, interest rates, level of unemployment, and diminished its national production. Consequently, the country experienced a financial crisis on February 23, 2001, just four months before the exit day, triggered by an argument between Prime Minister Bulent Ecevit and President Ahmet Necdet Sezer over how to fight public-sector corruption, and had to give up its anchored exchange rate policy with an immense devaluation of 50% of the Turkish Lira, a huge decline in foreign exchange reserves of the Central Bank.

This article aims at explaining the financial crises Turkey experienced in the last decade through a random effects logit model which incorporates 26 macroeconomic, political, and financial sector variables. The paper is structured as follows. The next section provides an overview of the literature. Section III

introduces the data and the methodology. Section IV presents the findings, and Section V points out the conclusions that emerge from the study.

II. Literature Review

Literature on financial crises is categorized into three mainstream models, namely first-generation models, second-generation models, and third-generation models. In the "first-generation" models (Krugman 1979; Flood and Garber 1984), a government with persistent money-financed budget deficits is assumed to use a limited stock of reserves to peg its exchange rate and the attempts of investors to anticipate the inevitable collapse generates a speculative attack on the currency when reserves fall to some critical level.

In 'second-generation' models (Obstfeld 1994, 1996, Ozkan and Sutherland 1995, Radelet and Sachs 1998) policy is less mechanical: a government chooses whether or not to defend a pegged exchange rate by making a tradeoff between short-run macroeconomic flexibility and longer-term credibility. The crisis then arises from the fact that defending parity is more expensive as it requires higher interest rates. Should the market believe that defense will ultimately fail, a speculative attack on a currency develops either as a result of a predicted future deterioration in macro fundamentals, or purely through self-fulfilling prediction.

The need for third generation models became apparent in the 1990s with the Mexican Tequila crisis of 1994 and the East Asian crisis of 1997. A number of new approaches have emerged to explain how these crises evolved and how they spread from country to country. Third-generation models (Dooley 1997, Krugman 1998, Radelet and Sachs 1998) are categorized into three different groups such as herd-behavior, contagion, and moral hazard.

There have been numerous studies in the literature on early warning systems (EWS) of financial crises**.** Although studies differ in terms of the econometric method followed, variables employed, definition of financial crisis, and the time span on which the EWS is built, the literature can conveniently be categorized into two main groups. The first group consists of studies based on a model known as Signals Approach, which involves observing the behavior of a number of indicators as they issue signals when they exceed certain threshold values. The second approach is based on a

logit or probit model and uses lagged values of early warning indicators and a crisis dummy variable designed to predict crises.

Signals approach was developed by Kaminsky *et al.* (1998) and consists of a bilateral model where a set of high frequency economic variables during a specified period is compared, one at a time, with a crisis index so that when one of these variables deviates from its normal level beyond a specific threshold value prior to a crisis, it issues binary signals for a possible currency crisis. The model devised by Kaminsky *et al.* (1998) consists of 15 variables with optimal thresholds estimated for each country in relation to percentiles of the distribution of observations of the indicator maximizing the correct signals and minimizing the false ones. They set their signal horizon at 24 months and defined a currency crisis as a sharp depreciation of the currency or a large decline in international reserves that exceeds the mean by more than three standard deviations. The percentage of correct signals to the percentage of false signals, on the other hand, gives an indication of the accuracy of each indicator. They used monthly data of 15 developing and 5 industrial countries from 1970 to 1995 and detected an average of 61 crises during this period. Their best indicators, based on noise-to-signal ratio, are real exchange rate, banking crises dummy, exports, stock prices, and M2/international reserves. This model was later improved by Kaminsky and Reinhart (1999), who used the same sample as in Kaminsky *et al.* (1998). Their model identified a total of 26 banking and 76 currency crises, 18 of which were twin crises. They found that the occurrence of both types of crises has increased sharply since the early 1980s with only one twin crisis taking place before 1980. In their study Kaminsky and Reinhart (1999) also found out that banking and currency crises had common causes with the former usually preceding the latter and following a particular pattern where the peaks of banking crises follows the currency crises.

Probit and logit models, pioneered by Frankel and Rose (1996), use limited dependent variable models known as probit or logit regressions to identify the causes of crises and to predict future crises. This approach defines a crisis indicator equal to one or zero depending on whether a currency crisis does or does not occur within the specified time period. Frankel and Rose (1996) attempted to find out how international debt structure and external factors affected the probability of currency crises. They used a number of external, internal and foreign macroeconomic variables in a multivariate probit model specified for 105 developing

countries, covering annual data from 1971 to 1992. They defined a crisis as at least 25% depreciation of the nominal exchange rate that also exceeds the previous year's depreciation level by at least 10% and constructed a dummy crisis variable according to that rule. Results of their model indicate that the significant variables are output growth, foreign direct investment/total debt, reserves, domestic credit growth, external debt and foreign interest rates.

Sachs, Tornell and Velasco (1996) also used a probit model to analyze currency crises, particularly the Mexican Tequila Crisis of 1995, using a sample of 20 emerging countries that were vulnerable to the contagion effect. They used the weighted sum of the percent decrease in reserves and the percent depreciation of the exchange rate as their crisis index. They found that crises happened only in the countries with weak fundamentals such as low reserves**,** fragile banking systems and overvalued exchange rate. They also found evidence showing that short-term capital inflows do not matter when reserves and fundamentals are strong whilst government consumption and current account deficits matter only in the countries with weak fundamentals and weak reserves.

Berg and Pattillo (1999) tested models offered by Kaminsky, Lizondo and Reinhart (1998), Frankel and Rose (1996) and Sachs, Tornell, Velasco (1996) to see if these models could predict the Asian Crisis using information available at the end of 1996. They found that the models offered by Sachs, Tornell, Velasco (1996) and Frankel and Rose (1996) were ineffective in forecasting the Asian Crisis. The Kaminsky, Lizondo and Reinhart (1998) model, on the other hand, proved to be successful. Crisis probabilities generated by this model for the period between May 1995 and December 1996 were statistically significant predictors of actual crisis occurrence over the following 24 months. Berg and Pattillo (1999) also found that in all three approaches, the probability of a currency crisis increases when domestic credit growth is high, the real exchange rate is overvalued relative to trend, and the ratio of M2 to reserves is high.

In a recent study, Komulainen and Lukkarila (2003) examined the causes of financial crises in 31 emerging market countries during 1980-2001 using a probit model based on 23 variables. Their findings show that financial crises occur together with banking crises and an increase in private sector liabilities, public debt, foreign liabilities of banks, unemployment, inflation, and US interest rates raises the probability of a crisis. Table 1 summarizes the empirical literature on financial crises.

III. Data and Methodology

The logit model is estimated for a set of 26 macroeconomic, political, and financial sector variables spanning the period 1984:1 – 2001:2. Most data are gathered from DataStream, International Financial Statistics (IFS), and Turkish State Planning Organization database. The data for government debt figures come from several sources, including DataStream, IFS, the World Bank's WDI and IMF country reports. All data are transformed into natural logarithms in order to achieve mean reverting properties and to make statistical testing procedures valid. Indicators are selected on the basis of currency crisis theories and previous empirical literature. In addition to the traditional macroeconomic variables, we include several indicators describing the vulnerability of domestic banks. These indicators include the growth of bank deposits, the ratio of the lending rate to the deposit rate, and the ratio of bank reserves to assets. We also employ variables that indicate vulnerability to a sudden stop of capital inflows. These variables are public debt, broad money to reserves, and private sector liabilities. To study foreign influences on crises, we include the US interest rate. Besides, several political factors, namely the number of political parties in the government, left-wing dummy, central bank governor turnover, and a dummy variable for the timing of elections, are used. Since we study all these variables simultaneously, we hope to distinguish those indicators that reflect actual causes of the recent crises in Turkey. Table 2 shows the explanatory variables.

Table-1: Literature Review on Financial Crises

Study	Kaminsky, Lizondo, Reinhart (1998)	Sachs. Tornell, Velasco (1996)	Kaminsky, Reinhart (1999)	Berg, Patillo (1999)	Frankel, Rose (1996)	Komulainen and Lukkarila (2003)
Approach	Signals approach	Probit model	Signals approach	Both approaches	Probit Model	Probit Model
Data	1970-1975 monthly data from 15 developing and 5 industrial countries	Monthly data from 20 emerging markets.	Same sample as Kaminsky, Lizondo, Reinhart (1998)	Same variables as Kaminsky, Lizondo, Reinhart (1998) plus	1971-1992 annual data from 105 developing countries	1980-2001 monthly data from 31 emerging and developing countries

				M2/reserves and CA/ GDP		
Crisis Index	Weighted average of exchange rate and reserve changes with a threshold of mean +3 standard deviation.	Weighted sum of percent decrease in reserves and the percent depreciation of the exchange rates	Weighted average of exchange rate changes and reserves	Same as Kaminsky, Lizondo, Reinhart (1998)	Exchange rate change over 25%, at least 10% higher than previous year	Equally weighted exchange rate depreciation and loss of reserves with a threshold of +2 standard deviations
Significant Variables	Real exchange rate, exports, banking crises dummy, stock prices, M2/international reserves	Low reserves, fragile banking systems, overvalued exchange rate	Banking and currency crises have common causes	Real exchange rate, current account, reserve, export, and M2/ reserves	Output growth, foreign direct investment/ total debt, reserves, domestic credit growth, external debt and foreign interest rates	Private sector liabilities, public debt, foreign liabilities of banks, unemployment, inflation, and US interest rates

Table-2: Explanatory Variables

Indicator & Expected Sign		Explanation
Inflation	+	Inflation is associated with high nominal interest rates and may proxy macroeconomic mismanagement that adversely affects the economy and the banking system (Demirguc-Kunt and Detragiache 1997). Countries whose inflation rates diverge from those of the anchor countries will find it difficult to maintain currency stability over extended periods of time. One-month

		lagged inflation is used, as current inflation will be affected by devaluations through rising import prices.
Real Exchange Rate	-	Currency overvaluation may lead to deteriorations in the current account and have historically been associated with currency crises (Berg *and Patillo,*. 1999).
Export Growth	-	Weak exports may lead to deteriorations in the current account and have often been associated with currency crises (Dowling and Zhuang, 2000).
Import Growth	+	Excessive import growth could lead to worsening in the current account and have been related with currency crises (Berg and Patillo 1999)
M1	+	Growth of M1 indicates excess liquidity, which may invoke speculative attacks on the currency thus leading to a currency crisis (Eichengreen *et al*. 1995).
Domestic Credit/GDP	+	High levels of domestic credit indicate the fragility of a banking system (Kaminsky and Reinhart, 1998).
Stock Prices	-	Recessions and a burst in asset price bubbles often precede currency crises (Kaminsky and Reinhart, 1999).
Terms of Trade	-	Increases in terms of trade strengthen a country's balance of payments position and lower the probability of a crisis (Kaminsky *et al*. 1998).
Public Debt/GDP	+	Higher indebtedness is expected to raise vulnerability to a reversal in capital inflows, and hence to raise the probability of a crisis (Lanoie and Lemarbre, 1996).
Foreign direct investment/ GDP	+	Shows net inflows in the reporting economy. East Asian countries had been dependent on net capital inflows over the decade preceding the crisis
US Interest rates	+	International interest rate increases are often associated with capital outflows (Edison, 2003)

Bank Reserves/ Bank Assets	-	Shows the liquidity of the banking system. Adverse macroeconomic shocks are less likely to lead to crises in countries where the banking system is liquid (Demirguc-Kunt and Detragiache, 1997).
Financial development	-	Broad money as a ratio of GDP is commonly used to measure the level of a country's financial development. In financially underdeveloped countries a large component of broad money is currency held outside the banking system. We use (M3–M1)/GDP to exclude currency in circulation from the broad money stock (Demetriades and Hussain, 1996).
Real interest rate	+	Used as a proxy of financial liberalization. Liberalization process itself tends to lead to high real rates. High real interest rates have been increased to repel a speculative attack (Kaminsky *et al*. 1998).
Foreign exchange reserves	-	Most currency collapses are preceded by a period of increased efforts to defend the exchange rate, which are marked by declining foreign exchange reserves (Kaminsky *et al*. 1998).
Banking crisis dummy	+	Banking and currency crises tend to occur simultaneously (Kaminsky and Reinhart, 1998) A dummy variable was used taking the value 1 if there was a banking crisis starting or ongoing within the previous six months.
Lending Rate-Deposit Rate	+	An increase of this indicator reflects a deterioration in credit risk as banks are unwilling to lend or decline in loan equity (Kaminsky *et al*. 1998)
Current Account/GDP	-	An increase in the current account is associated with large capital inflows which indicate a diminished probability to devalue and thus to lower the probability of a crisis (Berg and Patillo 1999). Large current account deficit (lagged) may indicate a need to devalue to achieve external balance. One-month lagged variable is used, as the cost of imports increases and export revenues decrease immediately after the

		devaluation event, as part of the J-curve effect.
M2/Foreign Exchange reserves	+	Indicates to what extent the liabilities of the banking system are backed by foreign reserves. It also captures the ability of the central bank to meet sudden domestic foreign exchange demands (Berg and Patillo 1999).
Fiscal Balance/GDP	+	Higher fiscal deficits are expected to raise the probability of crisis since they increase the vulnerability to shocks and investor's confidence. Besides, large deficits may indicate a need for seigniorage finance, which endangers the peg. (Demirguc-Kunt and Detragiache, 1997).
Number of Political Parties	+	Represents the number of political parties forming a government. The least stable form of government under deteriorating economic conditions is a multi-party coalition, as under economic pressure individual parties tend to withdraw from the coalition agreement for fear of being associated with economic mismanagement. It takes the value of zero for dictatorial systems, one for single-party government, two for two-party coalition government, three for three-party coalition government, and so on.
Elections	+	A government is less likely to undertake politically costly defense of the exchange rate and is more likely to use monetary and exchange rate policy to boost employment when they face an election. Besides, frequent elections restrain the governments from fiscal austerity, and correcting external misalignments. The dummy consists of a dummy variable used to capture the effects of elections on the likelihood of a crisis. It assumes the value of one in the six months preceding the elections, including the election month.
Central bank governor turnover	+	Used as a proxy for the independence of the central bank. If governors are easily replaced then they are less likely to pursue policies that are disadvantageous to the government. This is the average turnover rate of

		central bank governors in a two-year period. A high turnover indicates a low degree of central bank independence.
Left-wing dummy	+	Left wing governments are seen as more focused on internal objectives such as employment and growth, rather than external objectives (Simmons, 1994). The proxy takes the value 1 in each year a leftist party is in power, or in the coalition.
GDP per capita	-	Deterioration of domestic economic activity is expected to increase the likelihood of crises (Lanoie and Lemarbre 1996).
National Saving Growth	-	High national savings may be expected to lower the probability of debt rescheduling (Lanoie and Lemarbre 1996).

The dependent variable is determined based on the change in the log of the annual average Turkish lira – US dollar exchange rate. Since the Turkish lira devalued every year during the last two decades, a random effects logit is estimated in this study. For each month, we observe the binary dependent variable Y:

$$Y = \begin{cases} 1 \textit{ with probability } \Pr(Y = 1) = P \\ 0 \textit{ with probability } \Pr(Y = 0) = 1 - P \end{cases} \quad (1)$$

We explain the crisis index Y by a set of K independent variables X. Hence X is a KN x T matrix of observations. The aim of the model is to estimate the effect of the indicators X on the probability P of experiencing a crisis Y. We denote γ as the vector of K marginal effects:

$$\gamma = \frac{dP}{dX} \quad \textbf{(2)}$$

In probit and logit models the probability of a crisis is a non-linear function of the indicators:

$$\Pr(Y = 1) = F(X\beta) \quad (3)$$

Using a logistic distribution defines the logit model:

$$\Pr(Y = 1) = F(X\beta) = \frac{e^{X\beta}}{1 + e^{X\beta}} \quad (4)$$

In the logit model the effect of the indicators on the odds is then defined as:

$$\Omega(Y = 1 \mid X) = \frac{P}{1 - P} = e^{X\beta} \quad (5)$$

The effect of the indicators on the odds ratio, given two realizations of X, e.g. X_1 and X_0, is:

$$\frac{\Omega(Y = 1 \mid X_i)}{\Omega(Y = 1 \mid X_o)} = e^{(X_1-} \quad (6)$$

The odds ratio shows how the odds of observing Y=1 change when X moves from X_1 to X_0. The observed variable receives a value of 0 or 1 depending on whether a crisis has occurred or not. Since in currency crisis situations a successful attack leads to sharp currency depreciation and substantial reserve losses, both the signal approach and limited dependent models traditionally define a currency crisis as a discrete event. One common technique is to construct an index of exchange market pressure as a weighted average of exchange rate changes and reserves changes (as well as interest rates in some cases). The crisis is said to occur when the index exceeds a particular threshold level. At this point, we calculate an exchange market pressure index (EMP) for each country. The index includes exchange rate depreciation and loss of reserves, which are weighted to influence equally. The exchange market pressure index takes the form:

$$EMP = \Delta e - (\sigma_e/\sigma_r)^* \Delta r \quad (7)$$

where Δe denotes the change in exchange rate and Δr in international reserves, σ_e and σ_r denote the standard deviation of exchange rate alteration and reserves, respectively. We determine the values of the EMP index more than two standard deviations above the mean as a crisis. Since macroeconomic variables often worsen prior to the actual crisis, we define as a crisis not only the crisis month but also the eleven months before. In other words, we use a one-year window for our variables.

Table-3 presents the results of the regression. Strong evidence emerges that eight variables are significant in explaining the financial crises in Turkey in the last two decades. These variables are current

account/GDP, fiscal balance/GDP, GDP per capita, national savings growth, foreign exchange reserves, terms of trade, stock prices and import growth, all with signs that are in line with our expectations except import growth which has a negative sign.

Table-3: Logit Regression Results

Variable	Coefficient	Z-statistic	Variable	Coefficient	Z-statistic
Current Account/GDP	-11.928427	2.49673**	Inflation	12.72111	0.56732
M2/Foreign Exchange reserves	0.013242	0.05508	Real Exchange Rate	-13.23113	0.46155
Fiscal Balance/GDP	3.87829	1.75243*	Export Growth	-0.01231	0.75202
Number of Political Parties	0.04201	1.05024	Import Growth	-0.04914	1.68047*
Elections	12.021114	1.12038	M1	12.04421	0.12033
Central bank governor turnover	22.89281	1.34422	Domestic Credit/ GDP	0.05142	0.03374
Left-wing dummy	0.00121	1.01363	Stock Prices	-23.14223	1.69363*
GDP per capita	-11.23222	-1.79552*	Terms of Trade	-2.19395	-3.29552***
National Saving Growth	-22.32211	1.71380*	Public Debt/ GDP	0.09722	1.01330
Real interest rate	12.62211	1.12038	Foreign direct investment/ GDP	0.06051	0.00991
Foreign exchange reserves	-36.46514	2.53574**	US Interest rates	0.05047	-0.03234
Banking	22.34222	1.01353	Bank	-0.02095	-0.06231

crisis dummy			Reserves/ Bank Assets		
Lending Rate-Deposit Rate	0.01953	-0.25582	Financial development	-7.10251	2.56732
C	21.72221	1.713380			

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.
C is the intercept term

IV. Conclusions

In this study a random-effects logit model is built for Turkey using 26 macroeconomic, political, and financial sector variables. The logit model built in this study employs not only macroeconomic indicators but also qualitative variables such as banking crises, political variables, and central bank government turnover rate. Evidence emerges that the only significant variables are current account/GDP, fiscal balance/GDP, GDP per capita, national savings growth, foreign exchange reserves, terms of trade, stock prices, and import growth. Results indicate that all variables have expected signs with the exception of import growth.

References

Akyuz, Yilmaz and Korkut Boratav 2002, "The Making of the Turkish Financial Crisis", *UNCTAD Discussion Paper* Number 158.

Berg, Andrew and Catherine Pattillo 1999, "Predicting Currency Crises: The Indicators Approach and an Alternative", *Journal of International Money and Finance,* Vol. 18, No. 4, (August) pp. 561- 586.

Demetriades, P. O. and Hussein, K. A. 1996, "Does financial development cause economic growth? Time-series evidence from 16 countries." *Journal of Development Economics,* 51, 387-411.

Demirguc-Kunt, A. and E. Detragiachhe 1997, "The Determinants of Banking Crises in Developing and Developed Countries", *IMF Working Paper* 106, IMF, Washington, D.C.

Dooley, M 1997, "A Model of Crisis in Emerging Markets". NBER Working Paper Number 6300, Cambridge, MA.

Dowling, Malcolm and Juzhong Zhuang 2000, "Causes of the 1997 Asian Financial Crisis: What More Can We Learn from an Early Warning System Model?" Department of Economics, *Melbourne University, Australia Working Paper.* Number 123.

Edison, H. J. 2003, "Do indicators of financial crises work? An evaluation of an early warning system", *International Journal of Finance and Economics,* 8(1), 11–53.

Eichengreen, B., A.K. Rose, and C. Wyplosz. 1995, "Exchange Rate Mayhem: The Antecedents and Aftermath of Speculative Attacks", *Economic Policy,* Number 21.

Flood, R., and P. Garber 1984, "Collapsing Exchange Rate Regimes: Another Linear Examples." *Journal of International Economics,* 41: 223-234.

Frankel, Jeffrey and Andrew Rose 1996, "Currency Crashes in Emerging Markets. An Empirical Treatment," *Journal of International Economics,* 41, November, 351-366.

Kaminsky, G., Lizondo, S., Reinhart, C. 1998, "Leading Indicators of Currency Crises", *IMF staff papers*, Vol. 45, No 1.

Kaminsky, G. L., and C.M. Reinhart 1998, "The Twin Crises: The Causes of Banking and Balance of Payments Problems", *American Economic Review*, Vol. 89 (June) pp. 473-500

Komulainen, T. and J. Lukkarila 2003, "What Drives Financial Crises in Emerging Markets?, *Emerging Markets Review,* Vol. 4: 248-272

Krugman, P. 1979, "A Model of Balance of Payments Crises", *Journal of Money, Credit, and Banking* 11: 311-325.

Krugman, Paul, 1998, Bubble. Boom, Crash: Theoretical Notes on Asia's Crises (unpublished) Cambridge MA: MIT

Lanoie, P. and S. Lemarbre 1996, "Three approaches to predict the timing and quantity of LDC debt rescheduling", *Applied Economics*, 28(2), 241– 246.

Obstfeld, Maurice 1994, "The Logic of Currency Crises" Cahiers Economiques et Monetaires (43): 189-213

_____ 1996, "Rational and Self-Fulfilling Balance of Payments Crises", *American Economic Review,* Vol. 76 (March), pp. 72-81.

Ozkan, G. and A. Sutherland 1995, "Policy Measures to Avoid Currency Crisis." *Economic Journal*, 105: 510-519.

Radelet, S. and J. Sachs 1998, "The East Asian Financial Crisis: Diagnosis, Remedies, Prospects". Brookings Papers on Economic Activity, 1: 1-90.

Sachs, J., A.Tornell, and A.Velasco 1996, "Financial Crises in Emerging Markets: The Lessons from 1995," Brookings Papers on Economic Activity pp. 147-218.

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Demand and Supply of Exports in Pakistan – A Disequilibrium Model

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Introduction

Both single-equation models [Houthakar and Magee (1969), Naqvi *et al* (1983), Bahmani-Oskooee (1986)] and simultaneous equation models [Khan (1974), Goldstein and Khan (1978), Arize (1986), Balassa *et al* (1989), Anwar (1985) Khan and Saqib (1993) and Afzal (2001)] have been used to study export behavior in developed and underdeveloped countries. Goldstein and Khan [(1978)] have investigated the price responsiveness of export demand and export supply of eight industrial countries for the period 1955-70 using both equilibrium and disequilibrium models. The studies on the behavior of Pakistan's exports [Naqvi *et al* (1983), Anwar (1985), Khan and Saqib (1993) and Afzal (2001)] have not investigated the disequilibrium aspect of exports' response.

Pakistan embarked on vigorous trade liberalization and export promotion policies in the early 1990s following the example of the Asian Tigers and other developing countries to make the economy more efficient and competitive. Before this import substitution remained a dominant development strategy during the past decades. The purpose is to see how exports respond to the dynamics of demand and supply of exports. It may help to examine the behavior and performance of exports to get an insight for policy making.

This study is important and desirable in order to view the adjustment of not only aggregate exports but also of other categories of exports [Primary, Manufactured and Semi-Manufactured] because the importance of the composition of exports for economic growth has been emphasized in the literature [Kavoussi (1984), Dollar (1992), Khan and Saqib (1993), Afzal (2001)]. Kavoussi [(1984)] investigated how

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commodity composition of exports affects the relationship between exports and economic growth for a sample of 73 low and middle-income countries for the period 1960-78. He concluded that the level of development already achieved and the composition of exports significantly affects the relationship between exports and GDP. Afzal [(2001)] has concluded that since primary exports have negative world income elasticity vis-à-vis manufactured and semi- manufactured exports, a desirable strategy would be to promote manufactured and semi- manufactured exports.

The significance of the Disequilibrium model lies in the fact that it throws light on how the lagged year exports influence the current year exports because past behavior of exports may serve as a guide as well as incentive for the current period.

Therefore, following Goldstein and Khan [(1978)] the objective of this paper is to investigate the responsiveness of both export demand and export supply for aggregate exports, as well as Primary, Manufactured and Semi-manufactured exports of Pakistan for the period 1972 -2003. The rest of the paper is structured as follows. Section II describes the model and data sources. Section III briefly describes the economic classification of Primary, Semi-manufactured and Manufactured exports. Estimation results and discussion are given in Section IV and Section V is devoted to conclusions.

II. Model and Data Sources

The demand for exports depends on the world or important trade partners' income and also on the competition of domestic export prices with the world or important trade partners' export prices. Similarly, supply of exports is determined by the domestic price of exports, domestic price level and domestic income. Therefore, in log – linear form equations 1 and 2 are the demand (X_d) and supply (X_s) equations for exports. It is assumed that $X_d = X_s$. This is the Equilibrium model. The same equations also apply to the decomposition of exports into Primary [X_p], Manufactured [$X_{m]}$, and Semi- manufactured [X_{sm}] exports.

$$LnX_d = \alpha_0 + \alpha_1 LnPU + \alpha_2 LnZW \quad [1]$$

$$LnX_s = \beta_0 + \beta_1 LnZZ + \beta_2 LnY \quad [2]$$

Since the equations are specified in logarithm, the coefficients are elasticities. The expected signs of the coefficients in the export demand

equation are $\alpha_1<0$, and $\alpha_2>0$ and the expected signs of the coefficients in supply equation are: $\beta_1>0$, and $\beta_2>o$.

Where

X_d = real value of exports demanded

X_s = real value of export supply

X = total exports

X_p = real value of Primary exports

X_m = real value of Manufactured exports

X_{sm} = real value of Semi-manufactured exports

UVX_P = Unit value of exports of Pakistan in US dollars

UVX_w = Unit value of exports of world in US dollars

PU = $UVX_{P/}$ UVX_w

ZW = world real income

PX = Unit value of exports of Pakistan in domestic currency rupees [Rs]

WPI = Wholesale Price Index [WPI] of Pakistan

ZZ = PX / WPI

Y = real GDP of Pakistan

In the Disequilibrium model the exports demand and supply equations are as under:

Export Demand Equations

$$LnX_d = \gamma_0 + \gamma_1 LnPU + \gamma_2 LnZW + \gamma_3 LnX_{t-1} \quad [1\text{-A}]$$

γ_1, γ_2 and γ_3 are respectively relative price, real world income, and lagged exports [X_{t-1}] elasticities. The expected signs of the coefficients are: $\gamma_2>0$, $\gamma_3 > 0$, and $\gamma_1< 0$. The inclusion of lagged dependent variables in the equation 1-A implies a partial adjustment process. That is the change in

exports is related to the difference between the demand for exports in period t and actual exports in period t-1.

Therefore,

$$\Delta LnX_t = \lambda [LnX_t - LnX_{t-1}] \qquad [1\text{-}B]$$

Where λ is the coefficient of adjustment [assumed positive] and Δ is the first difference operator, and $\Delta LnX_t = [LnX_t - LnX_{t-1}]$. This applies to both demand and supply equations for exports in order to avoid repetition. The adjustment function [1-B] assumes that the quantity of exports adjusts to conditions of excess demand in the rest of the world and therefore, the price of exports is determined in the exporting country [Goldstein and Khan (1978), p.277].

Substitute 1-A in equation 1-B, we get

$$LnX_t = C_1 + C_2 LnPU + C_3 Ln ZW + C_4 LnX_{t-1} \qquad [3]$$

Where

$$C_1 = \lambda \gamma_0; \quad C_2 = \lambda \gamma_1; \quad C_3 = \lambda \gamma_3; \quad \text{and} \quad C_4 = 1-\lambda$$

Based on the expected signs of the parameters in equation 1-A, we would expect that $C_2 < 0$, $C_3 > 0$, and $C_4 > 0$. The average time lag in the adjustment of exports can be calculated from the parameters of the equation 3 as $(1- C_4)^{-1}$ or $1/(1-\lambda)$ and this applies to all equations that follow below.

Export Supply Equations

In the Disequilibrium model the following is the export supply function for Pakistan in terms of the traditional format:

$$LnXs = \Psi_0 + \Psi_1 LnZZ + \Psi_2 LnY + \Psi_3 lnXs_{t-1} \qquad [2\text{-}A]$$

Ψ_1, Ψ_2 and Ψ_3 are respectively relative price for export supply, real GDP, and lagged export supply elasticities. The expected signs of the coefficients are: $\Psi_1 > 0$; $\Psi_2 > 0$, and $\Psi_3 > 0$. Like the export demand equation, we substitute equations 2-A in equation 1-B and get the following equation:

$$LnXs = d_0 + d_1 LnZZ + d_2 LnY + d_3 lnXs_{t-1} \qquad [4]$$

Where

Do $= \lambda\Psi_0$ $d_1 = \lambda\Psi_1$, $d_2 = \lambda\Psi_2$, and $d_3 = 1-\lambda$

Based on the signs in equation 2-A the expected signs are:

$d_1 > 0$, $d_2 > 0$, and $d_3 > 0$,

Problems in Time Series Data

Autocorrelation and Spurious Regression are the major problems in time series data. Granger and New Bold [(1974)] have suggested that *an $R^2 > d$ is a good rule of thumb to suspect that the estimated regression suffers from spurious regression*. Since autocorrelation is generally found in time series data, where necessary autocorrelation has been corrected. Therefore, it is assumed that disturbances follow first order autoregressive [AR (1)] scheme. Autocorrelation has no universal cure. Different methods suggested in Econometrics literature have their own limitations [Gujarati (1995)]. The first order autoregressive process for the error terms in the modes is as follows:

$$\mu_t = \rho\mu_{t-1} + \varepsilon_t \qquad [3\text{-A}]$$

The parameter ρ is the first order serial correlation coefficient and $-1<\rho<1$. The AR (1) model incorporates the residual from the past observation into the regression model for the current observation. The ε_t is distributed as N $(0, \sigma^2_\varepsilon)$ and is independent of other errors over time as well as being independent of μ; and μ_t is distributed as N $(0, \sigma^2_\mu)$ but is not independent of other errors overtime. Several considerations in obtaining consistent estimates in the case of autocorrelation in TSLS are discussed in Fair [(1970)].

The Durbin-Watson d-statistic may not be used to detect first order serial correlation in autoregressive models because if we routinely compute the d-statistic for such models, there is a built-in bias against discovering the first order serial correlation. Despite this many researchers compute the d-value for want of anything better [Gujarati (1995), p. 605]. Therefore, we have used the d-statistic where lagged values have been used. Except equations 6 and 7 for semi-manufactured exports, other d-statistic is reasonably acceptable. Moreover in the Simultaneous equation model both R^2 and DW are less clear.

Cochrane-Orcutt iterative technique has been used to take care of the autocorrelation problem that is often used in practice [see Gujarati (1995), p.436]. DW suffers from some limitations. Therefore, the Q-

statistic and the Breusch-Godfrey LM test are preferred in most applications. But these are applicable in large sample cases [50 or 60 observations at least]. But this is not the case in finite or small samples. Moreover, there are problems in selecting the appropriate lag length. Therefore, both statistics reported in this study are comfortable. More recent Cointegration and Error Correction techniques of time series econometrics have not been used as we are dealing with a Simultaneous equation model and these techniques have not been developed for this model.

The data on GDP, aggregate, Primary, Semi-manufactured and Manufactured exports have been taken from the *Pakistan Economic Survey* [various issues]. Real world Income data were obtained from World Tables [various issues]. The data regarding export unit value index for both Pakistan and the world in US$, world Wholesale Price Index [WPI], unit value of exports in domestic currency have been collected from *International Financial Statistics* yearbooks [various years]. The aggregate as well as the aforementioned categories of exports were deflated by unit value indices of exports [1990=100]. The period of the study is from 1972-2003.

III. Economic Classification of Exports

The changing composition of foreign trade of an economy reflects the structural changes that have taken place over the years. The share of primary commodity exports was 48% in 1974-75. After this year the declining trend of primary commodities exports is visible. It was as low as 20% in 1989-90,and 11% in 1996-97, 2001-02 and 2002-03 [Table1]. The share of semi-manufacture shows a mixed trend during the period under review. Its share was 27% in 1971-72 but fell to 11% in 1980-81 because some of the semi-manufactured goods were processed to higher stages of production and were exported as finished products and increased to 24% in 1989-90. During 1990s its share increased to 25% in 1994-95 but fell to 17% in 1997-98 and 11% in 2002-03. The manufacturing goods exports have exhibited an increasing trend. Its share increased from 29% in 1971-72 to 78% in 2002-03. This indicates a healthy trend in the composition of Pakistan's exports over the years. Growing importance of manufactured exports has been stressed in the literature as mentioned above.

Table-1: Economic Classification of Exports (%)
[1972 - 2003]

Year	Exports		
	Primary commodity	**Semi-manufacture**	**Manufacture**
1971-72	45	27	29
1974-75	48	13	39
1978-79	32	21	50
1980-81	44	11	45
1983-84	30	14	57
1985-86	35	16	49
1989-90	20	24	56
1992-93	15	21	64
1996-97	11	21	68
1997-98	13	17	69
1998-99	12	18	70
2000-01	13	15	72
2001-02	11	14	75
2002-03	11	11	78

Source: *Pakistan Economic Survey* [1997-98 and 2002-04 (Statistical appendix)]

IV. Results and Discussion

TSLS [Two Stage Least Square] estimated all the said equations on aggregate as well other categories of exports. The estimation results for aggregate exports demand for *Equilibrium* and *Disequilibrium* models are as under:

Equilibrium Model

$$LnX_d = \underset{(-1.80)^{**}}{-18.21} \; \underset{(-1.78)^{**}}{-1.14\ LnPU} \; + \underset{(2.69)^{*}}{1.63\ LnZW} \qquad [1]$$

$R^2 = 0.96$ D.W. = 1.55

Disequilibrium Model

$$LnX_d = \underset{(-0.33)}{-2.89} \; \underset{(-0.62)}{-0.25\ LnPU} \; + \underset{(0.49)}{0.28\ LnZW} \; + \underset{(5.58)^{*}}{0.80\ LnX_{t-1}} \qquad [3]$$

$R^2 = 0.95$ D.W = 1.67

Note: The number in parentheses in all the equations are t-statistics where * stands for 5 % and ** for 10% levels of significance respectively.

The signs of the relative price variable and the world income are correct and significant [Equation 1] for the aggregate exports demand. This is in agreement with Khan's [(1974)] results that also obtained significant price (-1.84) and world income (0.92) coefficients. Since the estimated price elasticity is greater than unity, this implies a fairly large response of exports to changes in relative prices. In six of the eight industrial countries, Goldstein and Khan [(1978)] obtained price elasticity greater than unity in the equilibrium model. The estimated short run demand function [equation 3] shows that the short run price and world income elasticities are not significant. The mean time lag is slightly greater than one year.

The short run price elasticity is smaller in absolute terms than the equilibrium model elasticity. Goldstein and Khan [(1978)] had similar results for eight industrial countries. But unlike them, short run world income elasticity [0.28] is smaller than the Equilibrium model income elasticity [1.63]. This result is according to expectations and the real world experience because LDCs face low-income elasticity for their exports as they generally export primary products, while the demand for the industrial countries does not suffer form this problem. This confirms the fact that the world demand conditions play a pivotal role in contributing to the promotion of exports. Trade optimists tend to ignore this fact.

For aggregate export demand the coefficient of adjustment λ is 0.20 implying that 20% of the discrepancy between the desired and actual demand for exports is eliminated in a year. The mean time lag in the adjustment of total exports is equal to λ^{-1} that can be calculated from the parameters of the equation. Since $C_3 = 1-\lambda$ and therefore, $\lambda^{-1} = (1-C_3)^{-1} = (1-0.80)^{-1} = 0.20$. Moreover, the mean time lag in the adjustment of exports to changes in independent variables is five years. This is rather a longer and unrealistic lag and shows the limitations of the partial adjustment model. Goldstein and Khan [(1978)] reported mean time lag that ranges from one quarter for USA and over five quarters for Germany as they used quarterly data. Lagged year exports [equation 3] have significant influence on the demand for current exports. Khan [(1974)] also got significant lagged year exports and not significant world income**.**

Aggregate export supply

Equilibrium Model

$$LnXs = -2.61 + 0.29\ LnZZ + 1.28\ LnY \quad [2]$$
$$(-3.44) \quad (1.54) \quad (15.06)^*$$
$$R^2 = 0.95 \quad D.W. = 1.80$$

Aggregate export supply function [Equation 2] is positively sloped though relative price is not significant. This means that Pakistan's export production is inelastic with respect to relative prices but highly elastic with respect to domestic production as the coefficient of the production conditions exceeds unity. Khan and Saqib [(1993)] also obtained positive but not significant coefficient (0.10). Eight industrial countries studied by Goldstein and Khan [(1978)], except Japan, the other seven countries had supply price elasticity greater than one and for Japan it was very high. The domestic income elasticity (1.28) in aggregate exports supply [Equation 2] is less than world income elasticity (1.63) for export demand [Equation 1] implying that Pakistan's exports are more dependent and influenced by foreign conditions than by the domestic economic situation.

Disequilibrium model

$$LnXs = -1.48 + 0.14\ LnZZ + 0.73\ LnY + 0.42\ LnXs_{t-1} \quad [4]$$
$$(-2.32) \quad (1.14) \quad (3.40)^* \quad (2.25)^*$$
$$R^2 = 0.96 \quad D.W. = 1.46$$

The estimation results show that in the disequilibrium model for aggregate exports supply, price and income elasticities are smaller than the equilibrium model [equation 2]. For export supply in the disequilibrium model, $1-\lambda = 0.42$, and thus $\lambda = 0.58$. This means that 58% of the export supply adjusts within one year. Therefore, the adjustment of the total exports supply is better than total exports demand [20%].

Primary Exports Demand and Supply

Equilibrium Model

$$LnXp_d = 9.97 - 1.28\ LnPU - 0.27\ LnZW \quad [1]$$
$$(2.05)^* \quad (-4.16)^* \quad (-0.93)$$
$$R^2 = 0.63 \quad D.W. = 1.55$$

Disequilibrium Model

$$LnXp_d = 1.56 - 0.34\ LnPU - 0.02\ LnZW + 0.54\ LnX_{pt-1} \quad [3]$$

(0.25) (-0.63) (-0.005) (2.10)*
R^2 = 0.52 D.W. = 2.14

For the demand equation [Equation 1] the relative price variable is significant and exceeds unity implying a fairly large response of primary exports to changes in relative prices. World income is not-significant but negative supporting LDCs complained of very low-income elasticity for their primary product exports. The coefficient of adjustment $1-\lambda = 0.54$, so $\lambda = 0.46$ that is 46% Primary exports are adjusted in a year. In this model, like aggregate exports relative price and world income elasticities are smaller than the equilibrium model. The estimation results for *Equilibrium and Disequilibrium Models* for primary exports supply is:

Equilibrium Model - Xp supply

LnXps = 2.55 + 0.62 LnZZ + 0.31 LnY [2]
(2.11)* (0.63) (2.33)*
R^2 = 0.39 D.W. = 1.80

Disequilibrium Model Xp supply

LnXps = 1.84 + 0.30 LnZZ + 0.13 LnY + $0.43 LnXp_{t-1}$ [4]
(1.45) (0.36) (1.06) (2.32)*
R^2 = 0.47 D.W. = 1.96

Xp supply function is positively sloped but not significant [equation 2]. The positive and not significant coefficient implies that Xp export prices do have a role in the supply of Xp but are not of much significance, because Pakistan does not enjoy a significant share in world exports.

Arize [(1986)] obtained positively sloped export supply functions in seven out of eight African countries. Khan and Saqib [(1993)] have reported positive but not significant coefficient for Xp supply. Moreover, domestic economic conditions represented by GDP have dominant influence on Xp supply. In the Disequilibrium model [equation 4], the results are according to expectations for Xp supply. The price and income elasticities are smaller compared to the Equilibrium model [equation 2] for Xp. The coefficient of adjustment is $1-\lambda = 0.43$ and thus $\lambda = 0.57$ that implies that 57% primary export supply is adjusted within a year.

Manufactured Exports Demand and Supply

Equilibrium Model

$$LnXm_d = -41.81 - 0.62\ LnPU + 2.89\ LnZW \quad [1]$$
$$(-5.88)^* \quad (-1.23) \quad (6.83)^*$$
$$R^2 = 0.97 \quad D.W. = 1.92$$

Disequilibrium Model

$$LnXm_d = -8.06 - 1.03\ LnPU + 0.22\ LnZW + 0.36\ LnX_{mt-1} \quad [3]$$
$$(-2.51)^* \quad (-2.81)^* \quad (3.71)^* \quad (1.95)^{**}$$
$$R^2 = 0.92 \quad D.W. = 1.90$$

Relative price coefficient and world income have correct and expected signs for Xm demand [Equation 1]. Moreover, unlike X and Xp the relative price variable is not significant for Xm. Anwar [(1983)] also obtained negative and not significant coefficient (-1.38) for the relative price variable for X_m demand for the period 1960-80. For many developing countries relative prices do not seem to have a significant effect on the exports of these countries [Khan (1974), Arize (1986)]. In the Disequilibrium model for X_m, the coefficient of relative price and world income are significant while world income elasticity is smaller than the Equilibrium model. This means that when past year exports are taken into account relative price of Xm assumes greater importance and shows reasonably large response of X_m to prices. The coefficient of adjustment for X_m demand is $1-\lambda = 0.36$ and therefore, 74%-Manufactured exports are adjusted in one year.

Equilibrium Model - Xm supply

$$LnX_ms = -9.12 + 0.36\ LnZZ + 1.74\ LnY \quad [2]$$
$$(-11.20) \quad (0.42) \quad (19.12)^*$$
$$R^2 = 0.96 \quad D.W. = 1.82$$

Disequilibrium Model

$$LnX_ms = -7.36 + 0.20\ LnZZ + 1.40\ LnY + 0.20\ LnX_{mt-1} \quad [4]$$
$$(-2.28) \quad (0.75) \quad (2.37)^* \quad (0.57)$$
$$R^2 = 0.97 \quad D.W. = 1.62$$

The relative price coefficient is positive but not significant whereas the domestic income coefficient is positive and highly significant for X_m

supply. Khan and Saqib [(1993)] obtained positive but not significant value for the price variable for X_m supply. A comparison of the two income elasticities for X_m [equation 1 and equation 2] suggests that manufactured exports are more dependent on world income rather than on GDP as a proxy for domestic economic activities.

Lagged X_m supply is not significant in the Disequilibrium model. But both price and income elasticities are smaller than the Equilibrium model. Mean time lag for X_m supply is 80%. That is 80% adjustment takes place in one year. Since the value of λ is closer to one, it means that adjustment in the X_m takes place sharply. The values of adjustment coefficients for Aggregate, Primary and Manufactured exports demand and supply throw adequate light on the adjustment of these exports. The comparison of adjustment coefficients indicates X_m performs fairly in terms of supply. And supports the emphasis on promoting X_m in the literature.

Equilibrium Model in Price Separation format for Xsm demand

We obtained statistically inferior, unexpected and unreliable results for demand and supply of Xsm in both the Equilibrium and Disequilibrium models [equations 1-4]. We, therefore, separated the relative price coefficient [PU] of export demand into Unit value of exports of Pakistan [UVXp] in US dollars and Unit value of Exports of the world [UVXw] in US dollars and similarly the relative price coefficient [ZZ] of export supply of Pakistan [PX] into domestic currency and the wholesale price index [WPI] in both models. We call it the Price Separation format. Therefore, the equilibrium model is:

$$LnX_{smd} = \theta_0 + \theta_1 LnUVXp + \theta_2 LnUVXw + \theta_3 LnZW \quad [5]$$

θ_1, θ_2 and θ_3, are respectively export price index of Pakistan in US dollars, export price index of the world in US dollars and world real income elasticities. The expected signs of the coefficients in equation 5 are: $\theta_1<0$, $\theta_2>0$**,** and $\theta_3>0$.

The *Disequilibrium* model for Xsm demand is:

$$LnX_{smd} = \theta_0 + \theta_1 LnUVXp + \theta_2 LnUVXw + \theta_3 LnZW + \theta_4 X_{t-1} \quad [1\text{-}G]$$

Like the export demand equation, we substitute equations 1-G in equation 1-B and get the following equations:

$$LnX_{sd} = g_0 + g_1 LnUVXp + g_2 LnUVXw + g_3 LnZW + g_4 X_{t-1} \quad [6]$$

Where

$g_0 = \lambda\theta_0$, $g_{1=} \lambda\theta_{1,}$ $g_2 = \lambda\theta_{2,}$ $g_3 = \lambda\theta_3$ and $g_{4 =} 1-\lambda$

The expected signs are:

$g_1 < 0$, $g_2 > 0$ $g_3 > 0$ and $g_4 > 0$.

The estimation results for the Equilibrium and Disequilibrium models are as under:

$$LnX_{sd} = -20.75 - 3.85\ LnUVXp + 1.89\ LnUVXw + 2.10 LnZW \quad [5]$$

(-1.14) (-2.23)* (1.52) (1.88)**

$R^2 = 0.43$ DW =1.55

Disequilibrium Model

$$LnX_{sd} = -2.10 - 1.92\ LnUVXp + 0.85\ LnUVXw + 0.52\ LnZW + 0.68 X_{t-1} \quad [6]$$

(-0.11) (-1.20) (0.79) (0.37) (1.98)*

$R^2 = 0.60$ DW =1.34

Price separation format gives desirable results for Xsm demand. This suggests that price separation format is more suitable for Xsm demand than the traditional format. The merit of this form is that it shows the relative significance of the domestic and world export prices. The significant nature of the domestic export prices in equation 5 shows the importance of domestic export prices in semi-manufactured exports demand. The world real income has the correct and expected sign and is significant at the 10% level of significance. In the disequilibrium model [equation 6], the coefficients of domestic export prices, world export prices, and world real income are smaller than the equilibrium model such as aggregate and other classification of exports. The coefficient of adjustment for Xsm demand is $1-\lambda = 0.68$ and thus 32% semi-manufactured exports are adjusted in one year.

Equilibrium Model- Price Separation Format for Xsm Supply

Equilibrium Model of the Xsm Supply in Price Separation Format is as follows:

$$LnXs = \Psi_0 + \Psi_1 LnPX + \Psi_2 Ln\ WPI + \Psi_3 LnY \quad [7]$$

Ψ_1, Ψ_2, Ψ_3 and Ψ_4 are respectively export prices of Pakistan in domestic currency rupees [Rs]; WPI and real GDP elasticities. The expected signs of the coefficients for the export supply price and GDP are positive, while for the domestic level it is negative. The expected signs of the coefficients are: $\Psi_1 > 0$, $\Psi_3 > 0$ and $\Psi_2 < 0$. The Disequilibrium model in price separation format for Xsm supply is as under:

$$LnX_{ms} = \Psi_0 + \Psi_1 LnPX_{pak} + \Psi_2 Ln\ WP_{Ipak} + \Psi_3 LnYpak + \Psi_4 LnXs_{t-1} \quad [1\text{-}C]$$

Like the export demand equation, we substitute equations 1-C in equation 1-B and get the following equations:

$$LnX_{ms} = f_0 + f_1 LnPX_{pak} + f_2 Ln\ WPI_{pak} + f_3 LnY + f_4 LnXs_{t-1} \quad [7]$$

Where

$$f_0 = \lambda\Psi_0 \quad f_{1=} \Psi_{1,} \quad f_2 = \lambda\Psi_{2,} \quad f_3 = \lambda\Psi_3 \text{ and } f_{4\ =} 1-\lambda$$

The expected signs are:

$f_1>0$, $f_2<0$, $f_3> 0$ and $f_4>0$.

The estimation results of equation 7 and 8 are:

$$LnX_{ss} = -35.91 + 0.90\ LnPX - 3.92\ Ln\ WPI + 6.18\ LnY \quad [7]$$
$$(-2.44)^* \quad (2.03)^{**} \quad (-2.20)^* \quad (2.60)^*$$
$$R^2 = 0.48 \qquad DW. = 0.88$$

Disequilibrium Model

$$LnXs = -15.68 + 0.02\ LnPX - 1.13\ Ln\ WPI + 2.69\ LnY + 0.41\ LnXs_{t-1} \quad [8]$$
$$(-3.42) \quad (0.08) \quad (-2.02)^* \quad (3.45)^* \quad (2.30)^*$$
$$R^2 = 0.95 \qquad D.W. = 2.08$$

Like the demand equation, price separation format also gives agreeable results for Xsm supply. The signs of the coefficients are correct. Domestic production conditions represented by real GDP are positive and highly significant. The domestic price index is negative and significant suggesting that low inflation is expected to increase exports. The supply price of exports is positive but not significant implying the price-taking nature of Pakistan's economy. The coefficients of the Disequilibrium model are smaller like other categories of exports than the Equilibrium model. The coefficient of adjustment for Xsm supply is $1-\lambda = 0.41$ and thus 59% Xsm are adjusted within one year.

V. Conclusions

The estimated price elasticity for aggregate and primary exports demand in the Equilibrium model is greater than unity and implies a fairly large response of these exports to changes in relative prices, while for manufactured exports this response is inelastic. Pakistan's export supply is inelastic with respect to relative prices but highly elastic with respect to domestic production as the coefficient of the production conditions exceeds unity for aggregate as well as for other categories of exports.

Important results for the Disequilibrium model for Aggregate, Primary, Manufactured, and Semi-manufactured exports were obtained. We had different results for partial adjustment process for these kinds of exports. The coefficient of adjustment λ for Aggregate, Primary, Manufactured and Semi-manufactured exports demand and supply are:

0.20, and 0.58; 0.46 and 0.57; 0.74 and 0.80; and 0.32 and 0.80 respectively. These results show that of all the categories of exports, Manufactured exports perform well as the mean time lag is minimum. This highlights the crucial importance of Manufactured exports. This confirms the previous results [Afzal (2001)] that study of exports in disaggregated form throws sufficient light on the true behavior of aggregate as well as other groupings of exports. Concentration on the examination of total export behavior conceals a number of facts. Price separation format gives desirable results for Semi-manufactured exports demand and supply and this format is more suitable for Semi-manufactured exports.

References

Afzal, M. 2001, "Exports in a Simultaneous Model – The Case of Pakistan" *Government College Economic Journal*, Vol. XXXIV, No. 1&2 pp. 53 – 66.

Anwar, Sijad 1985, "Export Functions for Pakistan," *Pakistan Journal of Applied Economics*, Vol.4. No.1, pp.29-34.

Arize, A 1986, "The Supply and Demand for Imports and Export in a Simultaneous Model," *Pakistan Economic and Social Review*, Vol.24, No.2, pp. 57-76.

Bahmani-Oskooee, Mohsen 1986, "The Determinants of International Trade Flows," *Journal of Development Economics*, pp.107-123.

Balassa, B. et al 1989, "The Determinants of Export Supply and Export Demand in Two Developing Countries: Greece and Korea," *International Economic Journal*, Spring, pp.1-16.

Dollar, David 1992, "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985," *Economic Development and Cultural Change*, pp.523-543.

Fair, R.C. 1970, "The Estimation of Simultaneous Equation Model With Lagged Endogenous Variables and First Order Serially Correlated Errors," *Econometrica*, Vol.38, pp. 507-516.

Godstein, M. and Mohsen S. Khan 1978, "The Supply and Demand for Exports: A Simultaneous Approach," *Review of Economics and Statistics*, Vol.60, No.2 pp. 275-286.

Granger, C.W.J. and Newbold 1974, "Spurious Regressions in Econometrics," *Journal of Econometrics*, pp.111-120.

Gujarati, D. 1995, Basic Econometrics, New York, McGraw-Hill Inc.

Houthakker, H.S. and Stephen Magee 1969, "Income and Price Elasticities in World Trade," *Review of Economics and Statistics*, Vol.51, pp.111-125.

IMF, *International Financial Statistics* [Various issues], Washington DC.

Kavoussi, R.M. 1984, "Export Expansion and Economic growth: Further Empirical Evidence," *Journal of Development Economics*, Vol.14, pp.241-250

Khan, Ashfaque and Najam Saqib 1993, " Exports and Economic Growth: Pakistan Experience" *International Economic Journal*, Vol.7, No.3, pp.53-64.

Khan, Mohsen S. 1974, " Import and Export demand in Developing Countries," IMF Staff Papers, Vol. 21, pp. 678-693.

Naqvi et al 1983, The PIDE Macro-econometric Model of Pakistan's Economy, Islamabad.

Pakistan, Government of, *Pakistan Economic Survey* [various issues], Islamabad, Ministry of Finance, Economic Advisor Wing.

World Bank, World Tables (various issues) Washington DC.

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Determinants of Poverty in Pakistan: A Multinomial Logit Approach

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I. Introduction

According to the World Development Report 2000-2001 almost half of the world's population – 2.8 billion out of 6 billion live on less than $2 a day; while a fifth, i.e., 1.2 billion live on less than $1 a day with 44 per cent of them living in South Asia.[1] The *Pakistan Economic Survey 2000-2001* reports that about 33 per cent of the country's population is living below the food poverty line.[2] Food poverty trends since 1990-91 shows that food poverty has been on the rise since 1990-91, with a higher increase being observed in rural areas where food poverty increased from a low of 22.5 per cent in 1992-93 to a high of 34.8 per cent in 1998-99 (Table-1).

In Pakistan, a large share of the household budget is spent on food. Approximately half of the household consumption expenditure is used to meet the nutritional requirements of the household at the national level. In rural areas this proportion is about 54 per cent, while in urban areas it is 41 per cent[3] (see Appendix Table-1). Despite such high proportions of consumption expenditure on food, the incidence of food poverty remained high, about one-third of households were living below the food poverty line and were not meeting their nutritional requirements.

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[1] South Asia accounts for 22 per cent of the global population.

[2] Poverty is more than meager physical deprivation of goods and services. It has social and psychological effects that prevent people from realizing their own potential. The incidence of poverty is generally defined as the proportion of the population that does not have enough income to purchase a reference food bundle yielding a specified amount of calories per day and to provide for a modest allowance for non-food commodities and services.

[3] According to the *Pakistan Socio Economic Survey* (PSES) 1998-99.

Poverty is closely associated with malnutrition, as previous studies have shown. Ahmed and Ludlow (1989), Mahmod *et al.* (1991) and Havinga *et al*. (1989) mention low purchasing power of money, larger household size, lower level of education, large number of dependents, age of head of household, etc as determinants of poverty.

In a more recent study, Qureshi and Arif (2001) explained the determinants of poverty by using logistic regressions. Two models were estimated, one for the determinants of food poverty and the other for determinants based on the basic needs approach. The study used the 1998-99 *Pakistan Socio Economic Survey* (PSES) data set. They found that the larger household pushes the family towards poverty. Similarly educational attainment is a critical determinant of the incidence of poverty and should be given importance in the designing and implementation of poverty alleviation programs. An increase in the level of schooling of one individual not only has an impact on that individual's productivity and hence earnings, but may also influence the productivity and earnings of others with whom that individual interacts. Landlessness in rural areas is likely to be associated with poverty. Provision of employment in rural areas may reduce the risk of poverty. In short, the study concluded that policy-influenced variables such as schooling and employment creation are important factors that can lead to a significant reduction in poverty levels.

The objective of this paper is to examine the incidence of food poverty in Pakistan at the national level and to further see its decomposition at the urban and rural level, as well as to identify its key determinants. The paper also attempts to identify the key determinants of food poverty; factors which push people to live in the food poverty situation. The impact of loans, credit and financial assets on food poverty will also be analyzed by using the multinomial logit approach which has not been attempted previously. The results achieved by our model should have an important bearing on future policy-making regarding food poverty in Pakistan. The paper is divided into 4 sections. Section 1 is the introduction while section 2 explains the methodology and the model used in our analysis. Section 3 presents data and results of the model, while section 4 concludes the paper**.**

Table-1: Trends in incidence of food poverty (%)

Year	Pakistan	Rural	Urban
1990-91	23.3	26.2	18.2
1992-93	20.3	22.5	16.8
1993-94	23.6	26.3	19.4
1998-99	32.6	34.8	25.9

Source: Jafri (1999) "Assessing Poverty in Pakistan" Mahbub ul Haq Human Development Centre and PIDE 1998-99 PSES primary data.

II. Methodology

The analysis in this paper is based on micro data taken from the 1998-99 round of the merged *Household Integrated Economic Survey* (HIES) and *Pakistan Integrated Household Survey* (PIHS), conducted by the Federal Bureau of Statistics, Government of Pakistan. These surveys provide a wide range of information at the household level such as information on household income, expenditure, employment, migration status, marriage and maternity history, transfers received and paid out, assets and liabilities. The total sample considered here comprises 14,518 households, out of which 9,048 are rural households and 5,470 are urban households.

To determine the incidence of poverty, three elements are needed: an indicator of well being or welfare (e.g. per capita caloric intake; per capita expenditure on food); a normative threshold representing the well being an individual (or household) must attain to be above poverty (e.g. a poverty line); and an aggregate measure to assess poverty across the population (e.g. head count ratio).

To explore the determinants of food poverty three multinomial logit regression models are estimated on the basis of three mutually exclusive categories of poor, non-poor and very poor households. One model is estimated overall for Pakistan and the remaining two for its rural and urban areas.

Measurement of Poverty

The per capita expenditure on food is used as an indicator of welfare in this paper. Poverty lines are generally drawn in absolute and/or relative terms. Relative poverty refers to the position of an individual or household in relation to a specific poverty line. This study uses absolute food poverty lines estimated by Qureshi and Arif (2001) that are based on the estimated cost of food consistent with a calorie intake of 2550 per adult equivalent per day for rural areas. A daily intake of 2995 calories per adult equivalent is considered for urban areas.[4] At the national level the food poverty line is Rs. 361.74 per capita per month, while at the regional level per capita per month poverty lines are Rs. 353.73 and Rs. 378.77 for rural and urban areas, respectively. In this analysis the headcount ratio, i.e. proportion of poor households among total households, is used as a measure of poverty.

The Model

To examine the determinants of food poverty we carry out a multivariate analysis. Three separate models are estimated. Model 1 focuses on the determinants of food poverty at the overall level, while model 2 and 3 analyze these determinants at the regional level. Our dependent variable in each model is categorized into three mutually exclusive categories. We assume that a typical household belongs to one of three mutually exclusive categories. These categories are (i) poor (ii) non poor and (iii) very poor. We categorize these alternatives as 1, 2 and 3, respectively. Non poor households are those whose per capita per month expenditure on food is above the poverty line, while poor households have per capita per month expenditure on food below the poverty line. Very poor households comprise those households whose per capita per month food expenditure is less than 50 per cent of the poverty line.

Assuming that the errors in each model are independently and identically distributed with Weibull distribution, then the difference between the errors has a logistic distribution [Green (1992)] and multinomial logit is the appropriate technique of estimation. The probabilities in multinomial logit model are therefore given by

[4] For details see Qureshi and Arif (2001)

$$\Pr ob\,(Y = j) = \frac{e^{\beta_j x_i}}{1 + \sum_{k=1}^{J} e^{\beta'_k x_i}}$$

$$\Pr ob\,(Y = 0) = \frac{1}{1 + \sum_{k=1}^{J} e^{\beta'_k x_i}} \qquad for\ j = 1, 2, 3 \quad \ldots \quad \ldots\ldots \quad \ldots.$$

(1)

where coefficients βs are normalized to zero and x is the vector of explanatory variables. The multinomial logit model is identified by normalizing the coefficient of one of the categories to zero. Hence we normalize the coefficient of the alternative of poor to zero.

The coefficients in our models are difficult to interpret because they only provide information on the effects of independent variables on the odds ratio. To interpret the effects of independent variables (x) on the probability of each category of poverty we calculate partial derivatives as below.

$$\frac{\partial P}{\partial X} = P_j\left(1 - P_j\right)\beta_{xj} - \sum_k P_j P_k \beta_{xk} \qquad where\ j, k = 1, 2, 3 \quad \ldots\ldots \quad .(2)$$

where P is the probability of being a member of each alternative. The log of likelihood function is defined by defining for each household d_{ij} = 1 if alternative category j is chosen for household i, and 0 if not, for the other possible outcomes. Then for each household i, one and only one of d_{ij}'s is one [Green (1992)]. The log likelihood function is given by

$$\ln L = \sum_i \sum_j d_{ij} \ln \Pr ob\left(Y_i = j\right) \qquad \ldots\ldots \qquad \ldots\ldots\ldots \qquad \ldots\ldots \qquad \ldots.$$

(3)

Our models are based on the assumption that the three alternatives available for the poverty status of a household are independent of each other. It is also assumed that for each household all three options are simultaneously open. The parameters for each category of poverty in each model are obtained from the estimation of a single maximum likelihood logit.

Measuring Independent Variable

There may be a number of demographic, economic and social factors that can cause a household to be non-poor, poor or very poor. The demographic characteristics include age of the household head, sex of the household head, household size and family type. Age of the head of household is measured in complete years. The sex of household head takes a value of one if the head is female and zero if the head is male. The family type is entered into the model as a dummy variable, taking the value of one if the family is nuclear and zero otherwise.

The social indicator of education is included in our framework of analysis. Education or literacy is an indicator of quality of life in its own right as well as a key determinant of the poor's ability to take advantage of income-earning opportunities. Four levels of educational attainment are represented by three dummy variables. The first variable takes the value of one if the head of household is educated to the primary level and zero otherwise. The second variable represents the middle level, and coded one if the head is in this category and is zero otherwise. The third variable takes the value of one if the head of household is educated to matriculation or higher level and zero otherwise.

Two economic indicators i.e., farm status and household properties are also analyzed. The farm status of the head of household is measured by a dichotomous variable taking the value of one if the occupation of the head of household is agriculture and zero otherwise. Only two types of household assets are considered, its tangible asset of land and its total financial assets (including liquid assets, savings and other). The total financial assets are measured in nominal terms and the variable of land is a dummy variable taking the value of one if land is owned by the household and is zero otherwise.

Two other indicators included in the study are migration status and amount of loans and credit taken by the head of household. The migration status is measured by a dichotomous variable taking the value of one for migrant[5]. Total loan and credit of the household are taken in rupees.

[5] Migrant is defined as a person who changes his place of residence from one district to another.

III. Data & Descriptive Analysis

The summary statistics of variables used appear in Table 2. It shows that the average age of the head of household is 45 years among the three categories of non-poor, poor and very poor households at the national as well as the rural and urban level.

At the national as well as the regional level, the proportion of female heads of household is slightly high in the non-poor category at 8 per cent as compared to 5 per cent in the poor and very poor households. In general, estimates indicate that the proportion of female heads of household is very low as compared to male heads. This is quite understandable in a society where a woman can not be considered the head of household, unless she is a widow or divorced, living or is being forced to live on her own means.

At the overall rural and urban level, the proportion of nuclear families is highest in the non-poor group – almost 62 per cent, while in poor households it is approximately 55 per cent. Almost half of the very poor households at all three levels of analysis are from non-nuclear families. In general, very poor households are less educated and due to their traditional beliefs prefer to live in joint families.

Regarding household size our summary statistics indicate that the household size is relatively smaller in non-poor households and larger in poor and very poor households. Further household size is large in rural areas as compared to urban areas.

Our statistics indicate that more than two-third households in the very poor category are illiterate at the national as well as the regional level. In urban areas, only 18 per cent of non-poor households have completed at least ten years of schooling, while this ratio is 15 per cent in rural areas. This ratio is very low in the case of poor and very poor households. Certain demand and supply side factors are responsible for this outcome together with social and cultural practices and traditions. Low human capital investment by households is mainly due to the lack of economic opportunities, parents' education, high dependency ratio, lack of accurate information to facilitate efficient schooling decision by parents especially in remote rural areas, high gender gap in earnings, lack of protective environment especially for girls and social and political culture in the country [See also Sawada (1997)]. In rural areas literacy is still lower

because of lack of schools in remote rural areas. Moreover schools in rural areas have fewer facilities, lower quality of teaching materials, high teacher absenteeism and many of them exist only on paper (ghost schools).

As concerns farm status, the summary statistics indicate that among non-poor households the proportion of farm households is larger than their counterparts – non-farm households, both at national and regional levels of analysis. Moreover, results indicate that in urban areas among poor and very poor households, the proportion of farm households[6] is larger than non-farm households; this may be the result of rural to urban migration because there are less jobs for such migrants in urban areas.

In case of household property, the results indicate that among poor and very poor households only a small proportion has land holdings. Moreover, the average amount of total financial assets of the poor households is very low as compared to non-poor households. This is an expected outcome as the poor are mostly less educated, engaged in low paid jobs and having large families and thus less likely to have the ability to purchase land and other financial assets.

mary Statistics of Variables (Means and Standard Deviations)

	Urban			Rural			
	Very Poor	Poor	Non-Poor	Very Poor	Poor	Non-poor	Very Poor
	45.320	44.943	45.184	45.484	45.173	44.981	45.181
	(13.826)	(14.717)	(5.256)	(13.991)	(14.524)	(15.224)	(14.112)
	0.062	0.045	0.084	0.052	0.051	0.082	0.052
	(0.240)	(0.207)	(0.278)	(0.224)	(0.221)	(0.273)	(0.223)
	0.502	0.560	0.619	0.499	0.553	0.624	0.511
	(0.500)	(0.497)	(0.487)	(0.500)	(0.502)	(0.484)	(0.500)
	9.073	7.476	5.810	9.992	7.973	6.841	8.372
	(4.038)	(3.139)	(3.051)	(3.931)	(3.512)	(3.602)	(3.201)
	0.189	0.221	0.227	0.174	0.180	0.191	0.209
	(0.391)	(0.415)	(0.419)	(0.374)	(0.381)	(0.392)	(0.407)
	0.066	0.091	0.120	0.064	0.092	0.101	0.070
	(0.248)	(0.278)	(0.326)	(0.232)	(0.301)	(0.312)	(0.255)
	0.053	0.08	0.184	0.035	0.051	0.151	0.042
	(0.224)	(0.284)	(0.361)	(0.203)	(0.302)	(0.362)	(0.200)
	0.453	0.601	0.587	0.422	0.473	0.597	0.638
	(0.497)	(0.489)	(0.492)	(0.490)	(0.501)	(0.611)	(0.481)
	0.183	0.257	0.370	0.161	0.272	0.382	0.156
	(0.387)	(0.437)	(0.483)	(0.323)	(0.441)	(0.494)	(0.345)
347	972.394	992.549	14853.853	787.611	1841.452	17262.032	605.139
(45)	(9135.12)	(8746.638)	(41867.94)	(7372.876)	(17715.221)	(227499.31)	(5175.760)
1	0.220	0.186	0.196	0.151	0.152	0.162	0.176
(1)	(0.414)	(0.389)	(0.397)	(0.361)	(0.362)	(0.364)	(0.381)
246	11359.29	11474.786	10932.281	9006.928	12717.627	11615.527	6446.695
(98)	49299.68	(68924.63)	(60097.16)	(51237.25)	(68260.088)	(62803.699)	(44249.80)

estionnaire: Section 9-M, Part-B

The average amount of loans and credit is slightly higher for poor households as compared to non-poor households but is very low for very poor households. Many studies have shown that the poor are disadvantaged in terms of access to credit because of the lack of collateral [Kazi and Raza (1995)]. Access of women to credit is further constrained by limited mobility, illiteracy and most importantly the lack of assets for collateral. Although legally women have the right to ownership of land but due to weak implementation, mostly women cannot get access.

Results from Multinomial Logit Model

Table-3 shows the incidence of food poverty at the national and regional levels. It can be seen that at the national level, 33 per cent of the households are poor, while 8 per cent of the households are very poor i.e., their per capita per month food expenditure is less than 50 per cent of the poverty line of Rs. 361.74. The results show that more than one third of the sampled households were living below the food poverty line in 1998-99.

Table-3: Incidence of Food Poverty by rural and urban areas

Households	Pakistan	Rural	Urban
Poor	32.5	36.6	30.7
Very Poor	7.5	9.2	10.5

Regarding the incidence of food poverty in rural and urban areas, the results indicate that 37 per cent of rural households and 31 per cent of urban households lie in the category of poor, while 9 per cent of rural households and 11 per cent of urban households lie in the category of very poor. These results suggest that food poverty is slightly higher in rural areas, 46 per cent as compared to urban areas 41 per cent.

The estimation results from the multinomial logit model are presented in Table 4. The estimated parameters for each category, i. e., poor, very poor and non poor are obtained from a single maximum likelihood multinomial logit estimation. Table 4 reports partial derivatives at the mean of the dependent variable in bold letters followed by the logit coefficients, while t-statistics are reported in parentheses.

The results indicate that the age of head of household reduces the probability of the household being poor or very poor and increases the probability of the household being non-poor. This effect is statistically significant at the overall rural and urban level and is consistent with the studies of Qureshi and Arif (2001) and Kemal *et al.* (2001). This indicates that with increase in age of head of household, his income and hence consumption increases which in turn reduces the probability of poverty.

It is evident from our results that at both the national and regional level, the sex of head of household has a significant positive effect on the probability of non-poor category and has a negative effect on the remaining two alternatives. This negative effect is insignificant for the very poor category. In general female heads spend more on the nutrition, health and welfare of the children while due to cultural and social norms males spend more on land, housing, traveling and smoking [SPDC (1997)].

Regarding the effect of household size, at the overall level our estimates indicate that with an increase in household size a household is 4 per cent less likely to be non-poor, 3 per cent more likely to be poor and 1 per cent more likely to be very poor. At the regional level, results also indicate that a household is more likely to be poor if it has a larger number of members. This result is consistent with earlier studies [e.g. Qureshi and Arif (2001) and Kemal *et al.* (2001)]

At the regional level, family type has no significant effects, while at the national level nuclear families are more likely to be non-poor. As already mentioned in nuclear families due to lower dependency ratio, less time requirement for other household activities, women can spare more time to participate in earning activities, especially with their male siblings.

Schooling of head of the household has a significant effect on poverty, both at the national as well as at the regional level. At the national level, a household whose head has at least 10 years of schooling is 27 per cent more likely to be non-poor, 16 per cent less likely to be poor and 11 per cent less likely to be very poor. At the rural and urban level, results also indicate that the higher the level of education the more likely the household is to be out of poverty. Education is a critical input into economic development and the externalities arising out of high literacy rate far exceed the benefits to the individual from attaining education. Thus developing human capabilities by imparting education is important not only in its own right but also important for overall economic growth which, in

turn, can lessen poverty and increase the empowerment of disadvantaged groups. Not only this, education also enables people to take advantage of better job opportunities, induces people to have better health and helps in reducing the mortality rate and fertility rate [See Behrman (1995)].

Table-4: Multinomial Logit Results of Poverty at the National and Regional Level

Variable	Overall			Rural			Urban		
	Non poor	Very Poor	Poor	Non poor	Very Poor	Poor	Non Poor	Very Poor	Poor
Constant	**0.289**	**-0.137**	**-0.152**	**0.249**	**-0.153**	**-0.096**	**0.240**	**-0.168**	**-0.073**
	1.187	-1.485		0.882	-1.505		0.830	-1.492	
	(12.24)*	(-9.056)*		(7.397)*	(-7.836)*		(5.312)*	(-6.288)*	
Age of head of household (years)	**0.002**	**-0.001**	**-0.001**	**0.002**	**-0.001**	**-0.001**	**0.002**	**-0.001**	**-0.001**
	0.010	-0.009		0.008	-0.006		0.010	-0.005	
	(6.680)*	(-3.258)*		(4.567)*	(-2.137)*		(4.252)*	(-1.304)	
Sex of Head Household (Female =1)	**0.056**	**-0.002**	**-0.055**	**0.111**	**-0.017**	**-0.095**	**0.137**	**-0.008**	**-0.130**
	0.309	0.188		0.524	0.045		0.697	0.244	
	(3.668)*	(1.258)		(4.951)*	(0.243)		(4.942)*	(1.058)	
Family Type (Nuclear=1)	**0.020**	**-0.0001**	**-0.020**	**0.001**	**-0.002**	**0.001**	**-0.021**	**0.001**	**0.020**
	0.111	-0.054		-0.058	-0.050		-0.105	-0.039	
	(2.586)*	(-0.713)		(-0.966)	(-0.568)		(-1.554)	(-0.370)	
Household Size	**-0.044**	**0.012**	**0.032**	**-0.044**	**0.013**	**0.031**	**-0.051**	**0.017**	**0.034**
	-0.206	0.072		-0.189	0.076		-0.223	0.086	
	(-30.191)*	(8.043)*		(-22.545)*	(7.225)*		(-18.592)*	(5.953)*	
Primary (1-5 Years of Schooling)	**0.061**	**-0.019**	**-0.042**	**0.073**	**-0.030**	**-0.043**	**0.091**	**-0.036**	**-0.055**
	0.278	-0.147		0.294	-0.234		0.385	-0.220	
	(5.260)*	(-1.650)**		(4.579)*	(-2.169)*		(4.907)*	(-1.804)**	
Middle (6-9 Years of Schooling)	**0.121**	**-0.062**	**-0.060**	**0.113**	**-0.065**	**-0.049**	**0.160**	**-0.064**	**-0.095**
	0.486	-0.685		0.414	-0.616		0.669	-0.404	
	(7.513)*	(-5.047)*		(4.867)*	(-3.669)*		(6.221)*	(-2.128)*	

(Continued.....)

Table-4 (Continued): Multinomial Logit Results of Poverty at the National and Regional Level

Variable	Pakistan			Rural			Urban		
	Non poor	Very Poor	Poor	Non poor	Very Poor	Poor	Non poor	Very Poor	Poor
Matric and Above	**0.270**	**-0.105**	**-0.165**	**0.205**	**-0.120**	**-0.086**	**0.264**	**-0.128**	**-0.136**
(10 + years of	1.172	-6.998		0.769	-1.011		1.053	-0.937	
schooling)	(19.469)*	(-6.623)*		(9.240)*	(-5.288)*		(9.354)*	(-3.908)*	
Farm Status	**0.035**	**-0.015**	**-0.021**	**0.008**	**-0.006**	**-0.003**	**0.028**	**-0.001**	**-0.027**
(Agriculture=1)	0.147	-0.156		0.054	-0.102		0.145	0.055	
	(3.429)*	(-2.116)*		(1.939)**	(-1.182)		(2.113)*	(0.522)	
Land (Own Land	**0.115**	**-0.036**	**-0.079**	**0.149**	**-0.047**	**-0.102**	**0.138**	**-0.039**	**-0.099**
=1)	0.522	-0.277		0.640	-0.285		0.621	-0.142	
	(10.697)*	(-3.059)*		(11.908)*	(-2.967)*		(8.872)*	(-1.225)	
Total Financial	**0.000**	**-0.000**	**-0.000**	**0.000**	**-0.000**	**-0.000**	**0.000**	**-0.000**	**-0.000**
Assets	0.000	-0.000		0.117	-0.001		0.001	-0.000	
	(8.040)*	(-3.064)*		(6.958)*	(-2.642)*		(3.707)*	(-1.040)	
Migration	**0.035**	**-0.017**	**-0.018**	**0.001**	**-0.004**	**0.003**	**0.012**	**-0.011**	**-0.001**
(Migrated =1)	0.170	-0.016		-0.571	-0.054		0.035	-0.102	
	(3.702)*	(-1.197)		(-0.086)	(-0.491)		(0.432)	(-0.791)	
Loan and Credit	**0.000**	**-0.000**	**-0.000**	**0.000**	**-0.000**	**-0.000**	**0.000**	**-0.000**	**0.000**
	0.000	-0.000		0.000	-0.000		0.000	-0.000	
	(1.826)**	(-1.897)**		(1.182)	(-1.688)**		(0.373)	(-2.863)*	

* Significant at 5% level of significance

** Significant at 10% level of significance.

Table-4 further shows that at the national level, farm households as compared to non farm households are 3 per cent more likely to be non-poor, 2 per cent less likely to be poor and very poor. This shows that farm households are more likely to be non-poor in terms of food poverty. This result is consistent with Qureshi and Arif (2001). The results at the regional level are similar.

Household assets of land and total financial assets have a significant effect on poverty. Results indicate that the possession of land or financial assets increases the likelihood of being non- poor and reduces the likelihood of being poor and very poor. Combining the effect of these assets and the effect of literacy the results indicate that human, physical and financial assets that poor people possess have a potent effect on their prospects for escaping poverty because their assets can enable poor people to take advantage of opportunities such as jobs, credit, public services, school and health services.

The effect of migration is significant only at the overall level indicating that migrated households are 4 per cent more likely to be non-poor and 2 per cent less likely to be very poor as compared to the non-migrated households. Migration has probably provided them with an opportunity to move out of poverty.

Regarding the effect of loan and credit at the overall level, results indicate that the availability of loans helps the poor to come out of poverty. At the rural-urban level loans and credit have a negative and significant effect on the very poor category.

IV. Conclusion

The present study examines the incidence and determinants of food poverty in Pakistan. Our results indicate that on average 40 per cent of households are poor at the national level. In rural areas, poverty is comparatively higher with 46 per cent of the households falling below the poverty line, while in urban areas 41 per cent of households are poor. Among these poor households, 8 per cent of the households at the national, 9 per cent at the rural and 11 per cent at the urban level fall into the category of very poor having per capita per month food expenditure of less than 50 per cent of their respective poverty lines.

Our analysis further indicates that the age of the head of household is an important determinant of food poverty. Where age of the head of household is high, the household is more likely to be non-poor. Moreover, large household size, lack of human assets such as education and skills, lack of other assets such as land and financial assets and lack of credit appear to be the main causes of poverty. Our estimates also indicate that non-nuclear families are more likely to be poor. We find that although there is a very low proportion of households with female heads but households with female heads are more likely to be non-poor. Moreover, migrated and farm households are likely to be less poor in terms of food poverty.

These results indicate that poverty reduction efforts should be geared towards expanding the assets of poor people so that their position and control over their lives can be strengthened. One cross-country study [Klasen (1999)] indicates that countries that invest in girls' education have a high rate of economic growth. Accumulation of physical and financial assets by the poor can be improved by taking action on three fronts. First, public spending on basic social and economic services should be increased. Secondly, public service delivery systems should be reformed to ensure good quality of service delivery. Thirdly, poor communities and households should be able to participate in the planning and monitoring of public services to keep the service providers accountable.

Easy access to and availability of credit is essential to enable the poor household to start some income earning activities such as shopkeeping, opening of public call offices and stitching schools, crockery and cutlery business, etc. Easy access to loans and credit can be made possible through micro credit schemes where small loans can be given out on the basis of group guarantees without requiring any collateral.

APPENDIX

Table-1: Distribution of Monthly Household Consumption Expenditure 1998-99 (%)

	Pakistan	Rural	Urban
Food	48.0	53.8	41.4
Clothing and Personal Care	11.0	11.5	10.5
Housing	21.3	16.8	26.3
Health	3.3	3.7	2.9
Education	2.0	1.4	2.9
Transportation	3.7	3.0	4.4
Other (Marriage and Recreation)	10.7	9.8	11.6
All	100	100	100
Average Monthly Household Expenditure (Rs.)	6546	5387	8964

Source: PIDE's 1998-99 PSES primary data

References

Ahmed, E. and S. Ludlow, 1989, "Poverty, Inequality and Growth in Pakistan." *Pakistan Development Review* 28: 4 Part II.

Behrman, J. R., 1995, "Pakistan: Human Resource Development and Economic Growth into the Next Century." Background Paper for Pakistan 2010, Washington: The World Bank.

Ercelawn, A., 1989, "Poverty in Pakistan: Choice of Poverty Criteria". Draft Paper.

Government of Pakistan, 2001, *Pakistan Integrated Household Survey* 1998-99. Federal Bureau of Statistics.

Government of Pakistan, 2001, *Household Integrated Economic Survey* 1998-99. Federal Bureau of Statistics.

Green, W. H., 1992, Econometric Analysis. Second Edition, New York: Macmillan Publishing Company, August.

Havinga, I. C.; Haanappel, F.W. Louter, A.S and van den Andel W.A., 1989, "Poverty in Pakistan 1984-85." *Pakistan Development Review*, 28: 4 Part II.

Jafri, S. M. Younis, 1999, "Assessing Poverty in Pakistan." In A Profile of Poverty in Pakistan. Islamabad: Mahbub ul Centre of Human Development.

Kazi, Shahnaz and Bilquees Raza, 1995, "Rural Women's Access to Credit and Extension: Strategy for Change" *Pakistan Development Review*, 34: 4 Part II PP.753-65.

Kemal, A. R; M. Irfan and G.M. Arif, 2001, "MIMAP Synthesis Report: Major Conclusions and Policy Implications" MIMAP Technical Papers Series No. 3. Pakistan Institute of Development Economics, Islamabad, Pakistan.

Mahmod, S., Shiekh, K.H. and Mahmod, T., 1991, "Food Poverty and its Causes in Pakistan" *Pakistan Development Review*, 30:4.

Qureshi, S. K and G.M. Arif, 2001, Profile of Poverty Pakistan, 1998-99. MIMAP Technical Paper Series No. 5. Pakistan Institute of Development Economics, Islamabad, Pakistan.

Sawada, Y., 1997, "Human Capital Investment in Pakistan: Implications of Micro-Evidence from Rural Villages." Paper Presented at Thirteen Annual General Meeting of Pakistan Society of Development Economists.

SPDC, 1997, "Review of Social Action Program". Social Policy and Development Centre, Research Report,

World Bank, 2000, World Development Report 2000-2001. Washington DC

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The Knowledge Divide: Education Inequality in Pakistan

Haroon Jamal and Amir Jahan Khan*

As economic activity becomes increasingly knowledge based, disparities in educational opportunity play a more important role in determining the distribution of income and poverty. A greater equity in the distribution of educational opportunities enables the poor to capture a larger share of the benefits of economic growth, and in turn contributes to higher growth rates. In contrast, large-scale exclusion from educational opportunities results in lower economic growth and persistent income inequality. This research appraises education inequalities in Pakistan at the district level. To summarize district performance in terms of education, a District Education Index (DEI) is prepared. Further, it explores the socioeconomic inequalities in education by linking DEI with the level of district economic development.

I. Introduction

> *"I go to school because I want to learn. People with education have a better life. But our school has many problems. The classes are very crowded, and there are no blackboards or chalk. Some children have textbooks, but the parents of the poor children cannot afford books, notepads, or pencils. It is hard for my parents to pay school fees. Many children in my village do not go to school because their parents are too poor. My brother and sister have both dropped out of primary school because my parents had no money."*

The voice is that of a twelve year-old Tanzanian girl in the third grade of primary school (Watkins 2001, The Oxfam Education Report).

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These words summarize more powerfully than any statistics the reality behind the education crisis in poor countries.

Education helps to improve living standards and enhance the quality of life, and can, thereby, provide essential opportunities for all. Many of the world's states, through international conventions and commitments, have recognized education as a human right. In a rapidly changing world, education has become more important than ever. Faced with increasing globalization, the rapid spread of democracy, technological innovation, the emergence of new market economies, and changing public/private role, countries need more highly educated and skilled populations, and individuals need added skills and information to compete and thrive.

Typically, poverty and inequality are perceived of in terms of income. Differences in income and wealth matter because they define opportunities for reducing poverty. But differences in income reflect deeper inequalities in life-chances, including inequalities in education. Wide income disparities tend to coexist with under-investment in human capital, that translates into lower long-run economic growth. The empirical evidence suggests that there is a high correlation between income and education levels, as well as between income and educational inequalities.

The relationship between education and income equality is linked to the returns associated with education. Consider the present situation where the nature of technological change and the globalization trend are manifested by a rapidly increasing relative demand for technologically skilled workers. If the demand for unskilled labor is contracting or growing at a slower rate than the demand for skilled labor, then wage inequalities will increase. The gap between rich and poor will then start to widen and income inequality will continue to grow. Moreover, if there is a large disparity in the educational opportunities between the rich and poor, mainly educated workers capture the benefits of economic growth. This, in turn, exacerbates income inequality.

Beyond the discussion on the importance of education for economic growth, the value of education to the individual is so high that access to education is recognized as a human right in international law. Countries ratifying the United Nations (UN) convention on the Rights of the Child recognize the right to education "on the basis of equal opportunity". Therefore to promote this right to education, access should be provided without any discrimination.

The characteristics to which discrimination in education provision could be linked are wide-ranging. Gender, ethnicity and disability are obvious examples and are explicitly mentioned by the UN Convention. But the list should also include spatial discrimination in terms of low or no provision of education facilities.

This research follows this direction and touches the surface by appraising education inequalities in Pakistan at the district level. To summarize district performance in terms of education, a District Education Index (DEI) is prepared which is explained in the following section. This section also describes the methodology and indicators for constructing the Index of Economic Development (IED). Principle findings are reported in Section 3, while the last section is reserved for concluding remarks.

2. Measuring Performance and Inequality

Education performance in its broader sense cannot easily be captured. In developing countries, even to get a simple 'input' factor such as enrollment poses problems. The most basic data is often unreliable, or in fact unavailable. There are questions regarding school attendance or enrollment data which is collected and published by various provincial authorities. To make the exercise less disputable or debatable as far as the data source is concerned, all education indicators are selected from the Population Census (Pakistan Census Organization, 1998). This approach makes the analysis somewhat restrictive (in the absence of educational attainment and quality) but is preferred so as to avoid any reservations regarding the quality of education data.

2.1 District Education Index (DEI)

Districts' educational status is measured through enrollment in various age cohorts and adult literacy rates. The Census provides age-wise student population. Three levels were chosen for the development of DEI – student population or enrollment in age groups of 5-9 years, 10-14 years and 15-24 years. These levels represent primary, secondary and tertiary grades. Tertiary grade is further divided into general (arts or science) and technical (includes education programs of engineering, medicine, public health, commerce and business administration, teaching, agriculture and law) enrollment ratios. Adult literacy rate is defined as the ratio of literate persons (can read a newspaper and write a simple letter in any language) to the population of 10 years and above.

The above five indicators are simple rates (enrollment or literacy) and may easily be combined. Instead of assigning equal weight to each indicator, Principal Component Technique (PCA) of Factor Analysis is used to generate weights. The PCA searches for the linear combinations of the variables selected that account for the maximum possible variance in the data. This statistical procedure assigns the greatest weight to the variable which has the greatest variance (or dispersion). Similarly, the indicator with the lowest level of inequality will have the lowest weight. DEI is, therefore, the weighted average of five indicators with weights derived through a statistical procedure. To observe the provincial, regional and gender differences, DEI is computed separately for provinces, for rural and urban areas, and for male/female populations.

2.2 Index of Economic Development (IED)

The socioeconomic dimension can be included in the analysis through the calculation of the Concentration Index or Concentration Curve if the geographic units are ordered by socioeconomic status. Thus, pure inequalities in education are linked to economic development with the help of IED. Various attributes or indicators have been integrated to develop a composite Index of Economic Development. These indicators[1] measure the economic potential and achieved levels of income and wealth; extent of mechanization and modernization of agriculture; housing quality and access to basic residential services; and development of transport and communications. A brief description of individual indicators is given below.

Household income and wealth is the most discussed welfare attribute in literature. Direct income data at provincial or district levels are not available; therefore various proxies are used to estimate the income and wealth position of a district. For the rural economy, *cash value of agricultural produce per rural person* and *livestock per rural capita* are used. All major and minor crops are considered to estimate the district's cash value from agriculture. This indicator is based on the aggregation of 43 crops, including fruits and vegetables. Different types of livestock have been aggregated by assigning weights as recommended by the FAO (Pasha

[1] Diverse sources are used to gather data for the above indicators. Major sources include; District Census Reports, 1998, Provincial Census Reports, 1998, Agriculture Statistics of Pakistan, 1998-99, Provincial Development Statistics, Crop Area Production 1997-98, Census of Manufacturing Industries, 1995-96 etc. Further, to fulfill the missing gaps or for updating various information, unpublished data are obtained from the provincial Bureaus of Statistics, State Bank of Pakistan and the Ministry of Agriculture.

and Hassan,1982) to reflect the capital value of various animals and poultry. For the urban part of a district, *per capita value added in large-scale manufacturing* is used to proxy the level of urban income. Value added by the small-scale component could not be included due to lack of data. On the assumption that there may be a direct link between the number of bank branches in a district and the volume of bank deposits, *number of bank branches per capita* is used as a crude measure of the district's wealth. *Per capita car ownership* is also used to proxy the district's income and wealth in the urban areas.

Modernization of agriculture is another area of development which has direct or indirect effects on the prosperity and standard of living of the rural population. To capture the process of mechanization in agriculture, *tractors per 1000 acres of cropped area* is used. *Consumption of fertilizer per 100 acres of cropped area* is also used as the indicator of modernization in agriculture. In addition, *irrigated area per 100 acres of cropped area* is used to capture the access to canal irrigation systems and tube-wells.

Shelter is one of the basic needs, and housing conditions are one of the key determinants of the quality of life. For IED, the *proportion of households using electricity, gas and inside piped water connections* is used. The quality of housing stock is represented by the *proportion of houses with cemented outer walls and RCC/RBC roofing*. *Rooms per persons* is used to proxy adequate housing in a district.

Three indicators have been included to portray the level of development of the transport and communication sector in a district. Roads and the transportation network have a significant impact on socialization and modernization. Therefore, *metalled road mileage per 100 square miles of geographical area* of a district is included in the index. With regard to the availability of transport vehicles, a summary measure, viz., *passenger load carrying capacity* is included. Different vehicles are aggregated assigning weights as recommended in Pasha and Hassan (1982). *Number of telephone connections per 1000 persons* is also used to observe the distribution of this important indicator of the standard of living.

The index is also constructed using the Principal Component Analysis[2]. The exercise was undertaken on the full sample (100 districts) and principal components were used to rank districts according to their economic level of development.

2.3 Inequality Measures

The measurement of disparities is an arduous task and no single statistical measure is able to capture its myriad dimensions. Recognizing these difficulties, various measures to highlight diverse dimensions of inequalities are used in this study. The selected measures are briefly described in the following paragraphs.

Maximum to Minimum Ratio (MMR)

The highest to lowest ratio of DEI provides a measure of the range of national or provincial educational disparities. If this ratio is small (close to 1), then it would mean that the districts have a relatively equal level of education. If this measure is large, then the interpretation is more problematic, as it does not tell us if the high ratio is due to substantial variation in the distribution of DEI or the presence of outliers. Nevertheless, MMR provides a quick, easy to comprehend and politically powerful measure of regional inequality.

Coefficient of Variation (CV)

The coefficient of variation is one of the most widely used measures of regional inequality in the literature. The CV is a measure of dispersion around the mean. This dispersion can be calculated in a few different ways. The simple coefficient of variation is an un-weighted measure as given below:

$$CV_u \equiv \frac{1}{\bar{I}}\left[\sum_{i=1}^{n}\left(I_i - \bar{I}\right)^2\right]^{1/2}$$

where I_i is the value of District Education Index, $\bar{I}$ is the mean value of DEI and n is the number of districts. CV_u varies from zero for perfect

[2] Similar methodology is adopted by Filmer and Pritchett (1999) for exploring the effects of household wealth on educational attainments.

equality to $\sqrt{n-1}$ for perfect inequality. Although this measure can be used for comparisons of regional disparities across time, it is problematic for comparisons between provinces because the inequality value is sensitive to the number of districts in the province.

This problem is somewhat overcome by the 'weighted coefficient of variation', where each regional deviation is weighted by its share $\left(\frac{p_i}{P}\right)$ in the national or provincial population. This measure is calculated as given below:

$$CV_w \equiv \frac{1}{\bar{I}}\left[\sum_{i=1}^{n}\left(I_i-\bar{I}\right)^2\frac{p_i}{P}\right]^{1/2}$$

Here CV_w varies from zero for perfect equality to $\sqrt{\frac{p-p_i}{P_i}}$ for perfect inequality. This is better then CV_u for provincial comparison as the measure of inequality depends not on the number of districts but on the population proportion.

Gini Index (Gini)

The Gini Index like the coefficient of variation is also widely used in the inequality literature. Following Kakwani (1980), the Gini is computed as follows:

$$Gini \equiv \left(\frac{1}{2\bar{I}}\right)\left(\frac{1}{n(n-1)}\right)\left[\sum_{i=1}^{n}\sum_{j=1}^{m}\left|I_i-I_j\right|\right]$$

The Gini Index provides a measure of resource inequality within a population. It is the most popular measure of inequality and summarizes the extent to which actual distribution of resource differs from a hypothetical distribution in which each person/unit receives an identical share. Gini is a dimensionless index scaled to vary from a minimum of zero to a maximum of one; zero representing no inequality and one representing the maximum possible degree of inequality.

Concentration Curve (CC)

To grasp the education inequalities with respect to the economic status of districts, concentration curves have been plotted for various levels of enrollment. A Concentration Curve or Index is closely related to the relative index of inequality, which is widely used in the literature of socioeconomic inequality in education and health. The curve plots the cumulative enrollment (on the y-axis) against the cumulative relevant population (on the x-axis), ranked by the Index of Economic Development. The idea is very much similar to the famous Lorenz Curve. But in contrast to the case of the Lorenz Curve, districts are not ranked by the distribution that is under investigation. Since the concern here is with economic inequalities in education rather than pure inequalities, enrollments are grouped according to economic status. If the curve coincides with the diagonal or line of equality, all children, irrespective of their socioeconomic status, enjoy the same enrollment ratios. If, as is more likely, the curve lies above the diagonal, enrollment rates are higher among the better-off and hence inequalities that favor the rich. The further the Concentration Curve lies from the diagonal, the greater the degree of inequality across socioeconomic groups.

3. Major Findings

Major findings are grouped in the three sub-sections. The first two sub-sections discuss socioeconomic inequalities in education, while the last sub-section explains pure inequalities in education through the DEI.

First, some comments on the education indicators chosen for this analysis warrant attention. Tables-1 and 2 summarize levels as well as dispersion for these indicators. As we have taken student population in various age cohorts, a clear boundary between primary, secondary and tertiary levels is not feasible. Enrollment in the age cohort 5-9 indicates net primary enrollment rate. However, enrollment in the age cohort 10-14 represents both, over age primary students and net enrollment in secondary level. Similarly, over age secondary student and net tertiary enrollment are included in the age cohort 15-24. This goes to explain why the average level in enrollment 10-14 is high as compared with net primary enrollment rate (Table-1). Therefore, primary, secondary and tertiary levels are

indicatives and this caveat should be kept in mind while discussing enrollment rates[3].

Table-1: Average Value of Components of DEI [Overall Scenario]

	Mean	Minimum	Maximum
Enrollment 5-9 Years [Primary]	33.56	3.74	74.78
Enrollment 10-14 Years [Secondary]	43.93	6.81	84.61
General Enrollment 15-24 [Tertiary]	17.53	2.14	44.18
Technical Enrollment 15-24 Years [Tertiary]	0.34	0.00	3.28
Adult Literacy Rate	34.90	10.37	70.45

[3] An alternative option was to compute combined enrollment rate for the 5-24 age cohort. But this option does not allow substitution among various levels of education. For instance, a shortfall in tertiary education may be substituted with primary level. A weighted average index with enrollment at various levels is, therefore, preferred.

Table-2: Dispersion in Components of DEI [Overall Scenario]

	Maximum to Minimum Ratio	Coefficient of Variation (%)	Gini Index (%)
Enrollment 5-9 Years [Primary]	20	62.58	29.79
Enrollment 10-14 Years [Secondary]	12	43.75	23.43
General Enrollment 15-24 [Tertiary]	21	47.46	22.85
Technical Enrollment 15-24 Years [Tertiary]	3	166.63	43.13
Adult Literacy Rate	7	51.46	23.34

Overall only 18 percent enrollment is evident in the age cohort 15-24 years, which is reflective of tertiary education. The average technical enrollment rate is insignificant (0.34 %) with a maximum of 3 percent.

One can easily grasp the dismal situation in terms of gaps in enrollments between districts. Even with primary enrollment (5-9 age cohort) the range goes from 4 to 75 with MMR of 20. Adult literacy rate varies from 10 to 70 with MMR of 7. Highest CV and Gini appeared in technical enrollment rates. With low levels and high dispersion, the enrollment beyond age 14 indicates a disturbing situation.

3.1 Education and Economic Development

Figure-1 plots average literacy for each development quintile. Two observations emerge. First, female literacy rate is quite low as compared with male literacy at all levels of development. Second, the gap reduces as one moves along the development axis from the lowest (I) to the highest (V) quintile. Another important visual interpretation from this figure is the strong association between economic development and female literacy rate. This phenomenon is much sharper than the male literacy rate.

Figure-2 depicts the movement of the average enrollment rate in various age cohorts and economic development. Although all enrollment rates are positively related with economic development, a sharp reduction of gaps among various enrollment rates is not visible. To some extent, a

synchronized movement of development and tertiary enrollment is visible from the figure.

Figure-1: Average Adult Literacy Rate by Development Quintiles

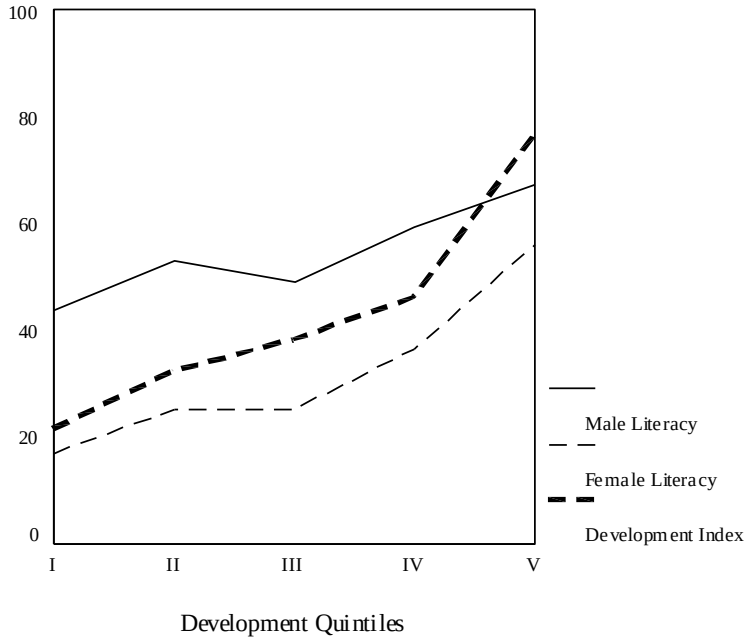
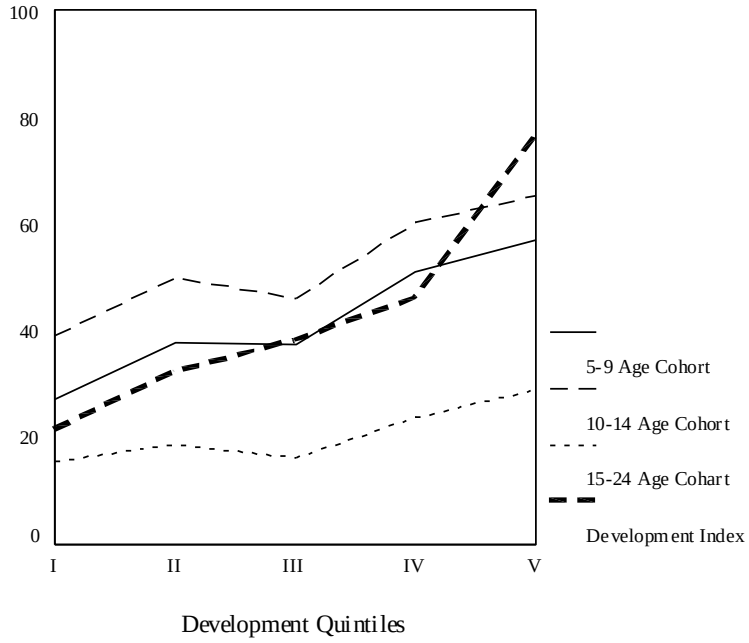


Figure-2: Average Enrollment by Development Quintiles



In the absence of district-wise investment or infrastructure data, it would be naïve to estimate a multivariate district production function. District labor force may be used as a proxy for the level of physical endowments. Nonetheless and albeit crude, regressing literacy, technical enrollment rates and district labor force participation on the level of economic development reveals interesting information. Table 3 provides these results.

Table-3: Regression Result
Dependent Variable Index of Economic Development

Explanatory Variables	**Coefficient**	**t-Statistics**	**Significance**
Adult Literacy Rate	0.235	2.93	0.004**
Technical/Professional Enrollment	9.115	3.62	0.000**
District Labor Force Participation	0.071	6.51	0.000**
(Constant)	15.345	6.48	0.000**
R^2		0.66	
Adjusted R^2		0.65	
F-Statistics		61.39**	

** Significant at 1 percent level of significance.

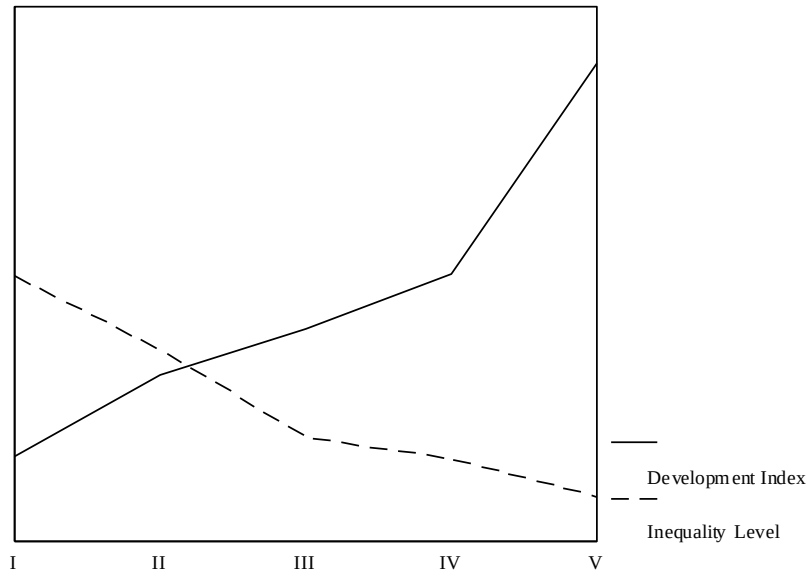
This exercise indicates that coefficients are significant and positively related with the level of economic development. All regression statistics are satisfactory and significant. An important finding of this exercise is the largest marginal effect of technical/professional enrollment. According to the results, a one percent increase in the technical/professional enrollment approximately causes a nine percent increase in the level of economic development.

3.2 Education Inequality and Economic Development

Figures 3 to 5 are plotted to visualize the links between education inequality and the level of economic development. For these graphs, coefficient of variation (CV) is computed for each development quintile as a measure of inequality. The figures clearly indicate that education inequality is inversely related with development. Inequality in education is

decreasing with an increase in the development level. This phenomenon is much sharper in the case of female literacy. To summarize the enrollment inequality, combined enrollment rates (5-24 years) are plotted with development in Figure-5. The trends are similar to those of the overall literacy rate but not as sharp as the case of female literacy.

Figure-3: Development Level and Inequality in Adult Literacy Rate



Another method of visualizing socioeconomic inequality in education is to draw a Concentration Curve (CC). As discussed in Section 2, in plotting the Concentration Curve, geographical units are ranked according to the socioeconomic status and not according to the educational status. Perfect equality irrespective of socioeconomic status is achieved if the Concentration Curve coincides with the diagonal or line of equality. The further the Concentration Curve lies from the diagonal, the greater the degree of inequality across socioeconomic groups. Figures 6 to 9 demonstrate the extent of socioeconomic inequality with respect to various enrollment rates.

Few observations emerge. For all enrollment rates, socioeconomic inequalities exist and are to the disadvantage of the poor - rates are lower in poor groups.

Inequality in urban areas is high as rural curves are relatively much closer to the line of equality. Rural inequalities if considered alone are relatively higher in primary or secondary levels rather than the tertiary level. It is worth mentioning that these curves represent the dispersion in the distribution of indicators and not the level of indicators. Of course, all education indicators related to rural areas have a much smaller magnitude as compared with their urban counterpart.

Comparatively the highest socioeconomic inequality is observed in the enrollment of technical/professional education (Figure-9), while the lowest inequality appears in the age cohort of 5-9 (net primary).

Figure-4: Development Level and Inequality in Female Literacy Rate

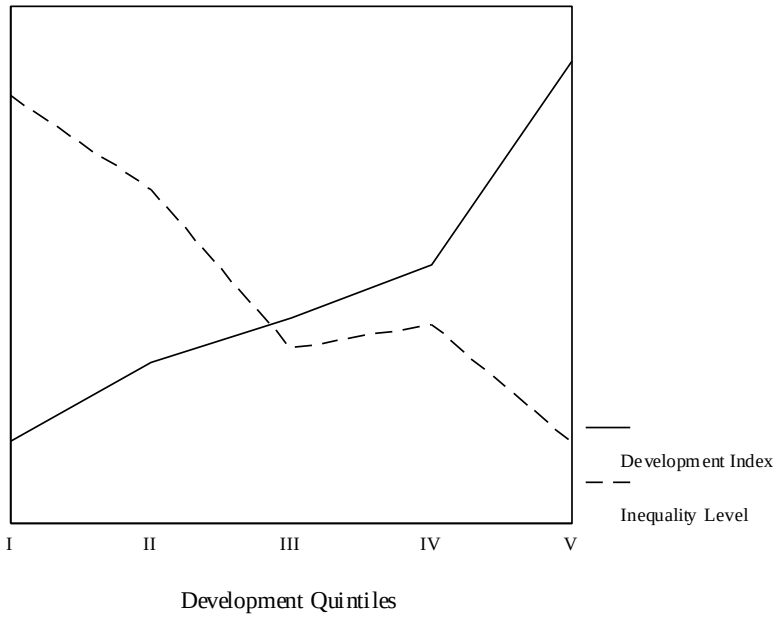


Figure-5: Development Level and Inequality in Combined Enrollment Rate

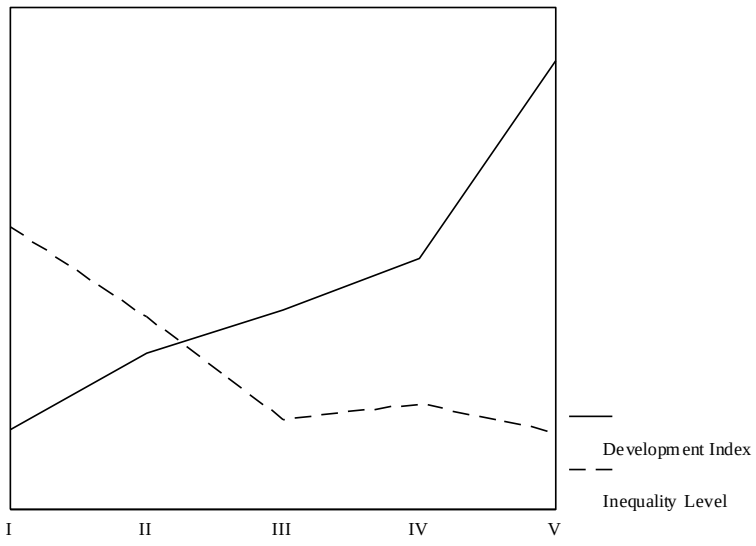


Figure-6: Concentration Curve for Enrollment in 5-9 Age Cohort

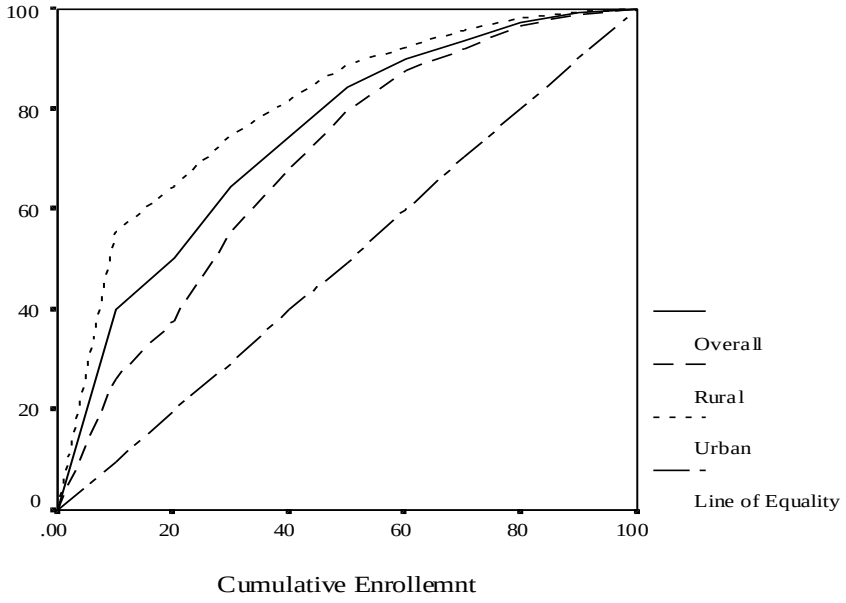


Figure-7: Concentration Curve for Enrollment in 10-14 Age Cohort

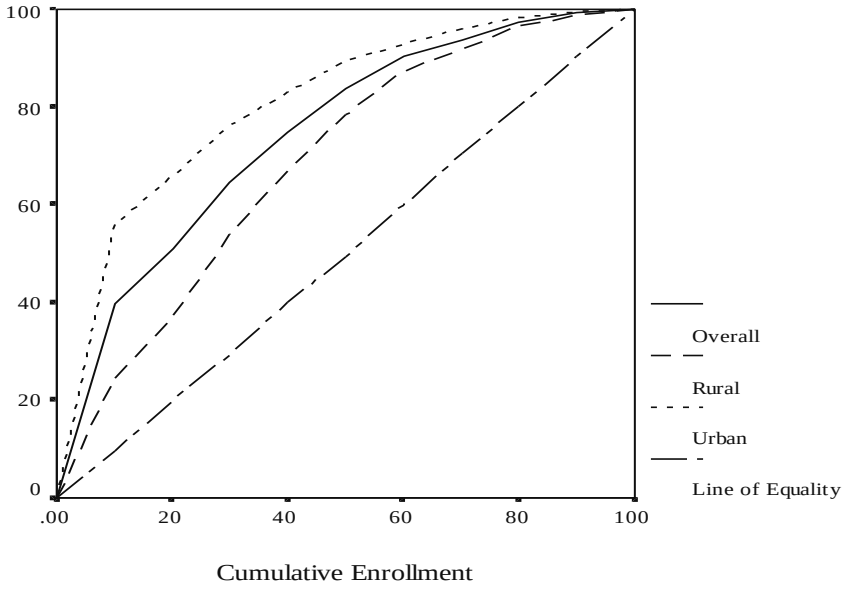


Figure-8: Concentration Curve for General Enrollment in 15-24 Age Cohort

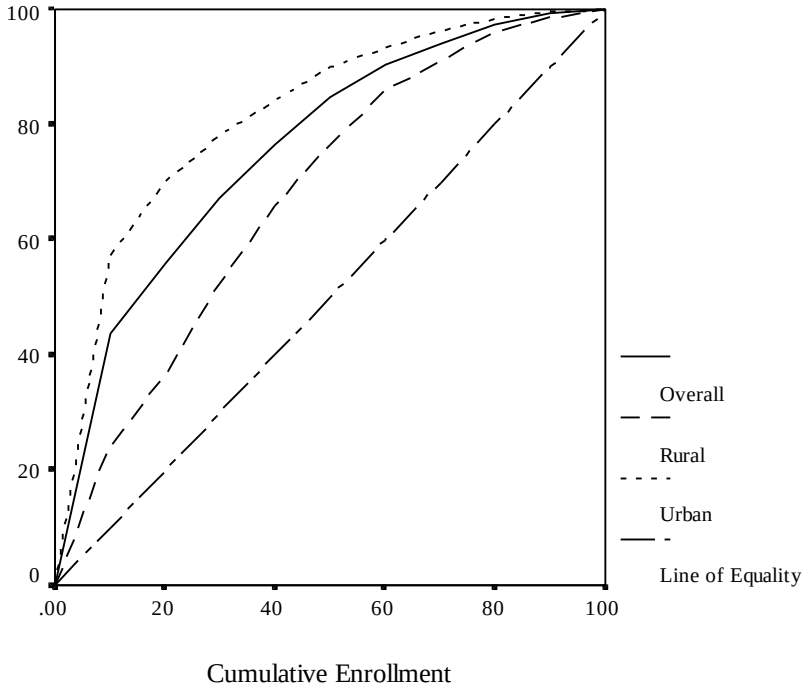
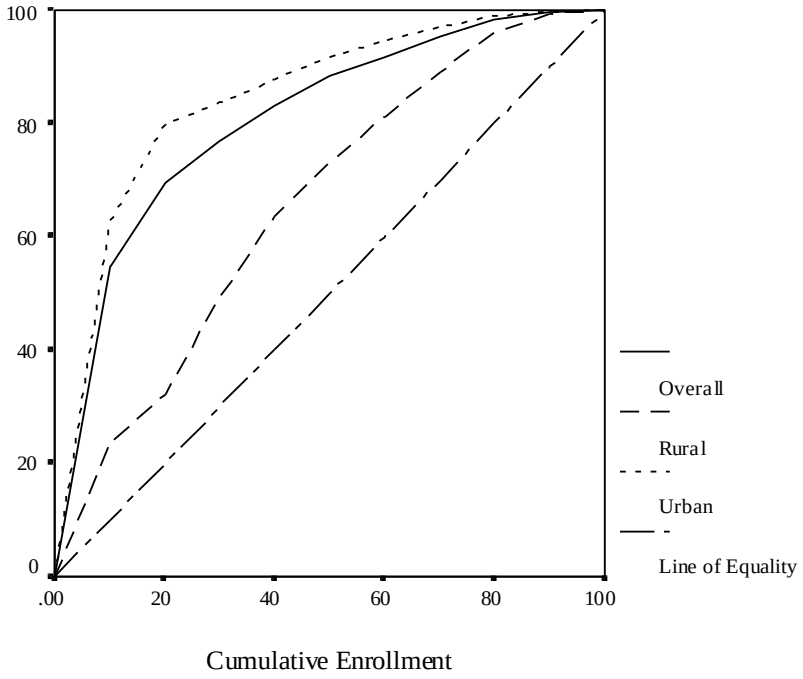


Figure 9: Concentration Curve for Technical Enrollment in 15-24 Age Cohort



3.3 The District Education Index

Pure inequalities in education are analyzed with the help of DEI. In contrast to socioeconomic inequalities, DEI investigates the dispersion in the educational status of districts irrespective of their economic status and measures the average shortfall from a perfect score of 100 percent.

Table-4 presents an overall national picture of education access and inequality. On the average, the value of DEI indicates a shortfall of 64 percent (100-36). In terms of access, females are 14 percentage points behind males thereby indicating that inequality is higher among females than males. The MMR is 29 for female DEI as against 8 for male DEI. Similarly, the coefficient of variation is more than double in the case of female DEI.

Table-4: District Education Index – National Scenario
[Average Level and Inequality Measures]

	Population Weighted Average	Minimum → Maximum	Maximum Minimum Ratio	Coefficient of Variation (%)	Gini Index (%)

All Areas					
Combined	36	$6 \rightarrow 61$	10	49	24
Male	44	$8 \rightarrow 67$	8	35	20
Female	30	$2 \rightarrow 57$	29	79	34
Rural Areas					
Combined	32	$4 \rightarrow 57$	14	50	26
Male	41	$6 \rightarrow 66$	11	37	23
Female	23	$1 \rightarrow 48$	48	83	38
Urban Areas					
Combined	51	$14 \rightarrow 70$	5	21	13
Male	56	$25 \rightarrow 73$	3	14	10
Female	44	$3 \rightarrow 64$	21	33	19

Note: Figures are rounded.

Table-5: District Education Index – Provincial Scenario
[Average Level and Inequality Measures for All Areas]

	Population Weighted Average	Minimum → Maximum	Maximum Minimum Ratio	Coefficient of Variation (%)	Gini Index (%)
Male-Female Combined					
Punjab	40	20 → 61	3	29	16
Sindh	34	13 → 52	4	57	19
NWFP	31	7 → 48	7	34	20
Balochistan	23	6 → 51	9	65	29
Male					
Punjab	47	26 → 67	3	22	13
Sindh	40	18 → 55	3	39	16
NWFP	42	12 → 58	5	25	26
Balochistan	29	9 → 58	6	53	34
Female					
Punjab	35	14 → 57	4	41	21
Sindh	29	7 → 50	7	92	25
NWFP	20	2 → 39	20	60	34
Balochistan	15	3 → 45	15	100	38

Note: Figures are rounded.

A low level of educational status with high inequality[4] is evident in rural areas. With MMR 48, Gini 38 and with approximately 50 percent lesser average value of DEI, the misery of rural females is also apparent from the table. The position of urban females is also vulnerable, however, to a lesser

[4] These are pure inequalities in education. Socioeconomic inequalities in education for rural areas are relatively smaller than socioeconomic inequalities for urban areas.

extent. The highest access and lowest inequality emerged in DEI for urban males.

Table-5 portrays the overall provincial picture, while Tables-6 and 7 furnish provincial comparison for rural and urban areas respectively. Punjab province is leading with relatively higher values of DEI and lesser inequality. The range between minimum and maximum DEI is also lowest in the Punjab province. Except for female educational status, Sindh lags behind NWFP. However, inequality is relatively higher in NWFP than Sindh. Balochistan, as expected depicts a depressing picture both in terms of average levels and inequality.

There is a pronounced disparity in the provision of education in urban and rural areas. According to Tables-6 and 7, barring Punjab, the average values of urban DEIs are more than double than the rural DEIs. Similarly, magnitude of MMR and other inequality indicators for rural and urban areas are far-off.

Table-6: District Education Index – Provincial Scenario
[Average Level and Inequality Measures for Rural Areas]

	Population Weighted Average	Minimum → Maximum	Maximum Minimum Ratio	Coefficient of Variation (%)	Gini Index (%)
Male-Female Combined					
Punjab	37	16 → 57	4	31	18
Sindh	27	12 → 40	3	53	19
NWFP	28	8 → 47	6	31	20
Balochistan	19	4 → 41	10	65	32
Male					
Punjab	45	23 → 66	3	24	14
Sindh	35	18 → 47	3	38	16
NWFP	41	12 → 59	5	24	16
Balochista	25	6 → 52	9	54	29

n					
Female					
Punjab	28	8 → 48	6	45	25
Sindh	18	5 → 32	6	94	26
NWFP	15	2 → 35	17	56	35
Balochistan	11	1 → 31	31	103	44

Note: Figures are rounded.

Table-7: District Education Index – Provincial Scenario
[Average Level and Inequality Measures for Urban Areas]

	Population Weighted Average	Minimum → Maximum	Maximum Minimum Ratio	Coefficient of Variation (%)	Gini Index (%)
Male-Female Combined					
Punjab	54	42 → 70	2	12	7
Sindh	48	36 → 55	2	14	6
NWFP	48	27 → 65	2	25	14
Balochistan	39	14 → 58	4	32	17
Male					
Punjab	58	48 → 73	2	10	6
Sindh	54	41 → 58	1	9	5
NWFP	56	35 → 69	2	17	10
Balochistan	48	25 → 64	3	25	14
Female					
Punjab	49	34 → 63	2	15	9
Sindh	40	29 → 50	2	24	8
NWFP	39	19 → 58	3	38	21
Balochistan	28	3 → 49	16	47	24

Note: Figures are rounded.

In a rural context, Balochistan, as expected, lags behind and all magnitudes are far-off from other provinces. Rural NWFP's performance in terms of access is much better than Sindh as average levels of DEIs are higher. Population adjusted coefficients of variation are also lower than in Sindh. The situation in rural Sindh is, therefore depressing. Rural Punjab is ahead in terms of higher access and lower inequality. More or less similar patterns or trends are observed in urban areas with different magnitudes (higher value of DEI and lower level of inequality).

For public intervention and policy purposes[5], an indicative exercise is carried out. Districts, which are at the bottom of DEI (lowest three deciles), are grouped in Table 8. Out of 26 districts of Balochistan, 14 are in 9th and 10th deciles. In NWFP only 2 districts out of 24 are in the 10th decile. In Punjab, the position is relatively better and only 1 district out of 34 appeared in the table, which is in the 8th decile. In Sindh province, 5 districts out of 16 are at the bottom of DEI (lowest 30 percent).

Table-8: Distribution of Districts Across Three Lowest Deciles of DEI

	Districts Position		
Province	**Third Lowest 8th Decile**	**Seocond Lowest 9th Decile**	**Lowest 10th Decile**
Balochistan	Killa Saifullah	Zhob	Jhal Magsi
	Lasbela	Killa Abdullah	Kohlu
	Sibi	Kalat	Dera Bugti
		Bolan	Nasirabad
		Khuzdar	Musa Khel
		Barkhan	Awaran
		Jafarabad	Kharan
		Loralai	
NWFP	Upper Dir	Batagram	Kohistan
	Buneer		Shangla
	Tank		

[5] Full ranking of districts of Pakistan according to DEI is available and may be provided on request.

Sindh	Badin	Thatta	Tharparkar
	Jacobabad		
	Shikarpur		
Punjab	Rajanpur		

Note: Districts are sorted in ascending order (lowest to highest) according to the value of DEI in each category and province. There are 26, 24, 16 and 34 districts in Balochistan, NWFP, Sindh and Punjab provinces respectively.

4. Concluding Remarks

Policy makers, researchers and academics have increasingly recognized the links between inequality in education and other social and economic phenomena. As economic activity becomes increasingly knowledge based, disparities in educational opportunity play a more important role in determining the distribution of income and poverty. A greater equity in the distribution of educational opportunities enables the poor to capture a larger share of the benefits of economic growth, and in turn contributes to higher growth rates. In contrast, large-scale exclusion from educational opportunities results in lower economic growth and persistent income inequality.

Countries ratifying the United Nations (UN) convention on the Rights of the Child recognize the right to education "on the basis of equal opportunity". Therefore to promote this right to education, access should be provided without any discrimination.

This research appraises education inequalities in Pakistan at the district level. Pure inequalities in education are examined through the District Education Index (DEI). DEI is a composite index and includes enrollments at various levels and adult literacy rates. In developing DEI, only Population Census data are used to avoid any reservations regarding the quality of education data. Socioeconomic inequalities are also studied by linking DEI with the level of economic development of districts. For this purpose, a composite Index of Economic Development (IED) is constructed with various welfare indicators related to income and wealth, modernization of agriculture, transport and communication, housing quality and housing services.

Results indicate low levels of educational status with high inequality. The most vulnerable groups are rural areas, Balochistan province, and rural females. More than half of the districts have a value of DEI less than average, which is reflective of the gravity of the situation. This condition of knowledge divide demands national education action, which must be effective and not merely an exercise in tokenism. Socioeconomic inequalities in education also require integration of education into national poverty reduction strategies.

References

Filmer, Deon and Pritchett, Lant, 1999, "The effect of household wealth on educational attainment: evidence from 35 countries" *Population and Development Review*, 25(1): 85-120.

Kakwani, Nanak, 1980, Inequality and Poverty - Methods of Estimation and Policy Applications, The World Bank, Oxford University Press

Pakistan Census Organization, 1988, *District Census Reports*

Pasha H. A. and Hassan, T., 1982, "Development Ranking of the Districts of Pakistan", *Pakistan Journal of Applied Economics*, (12).

Watkins, Kevin, 2001, "The Oxfam Education Report", Oxfam International.

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Milk Production Response in Pakistan

Mohammad Pervez Wasim*

Abstract

In third world countries, where the level of mechanization in agriculture is low, livestock rearing is mainly for draught purpose. On the other hand, the use of animals for draught purpose is low in developed countries owing to the high level of farm mechanization and the animals are mainly reared for the consumption of meat and milk. Milk production in Pakistan is an important enterprise for over five million households owning buffaloes and cattle. Supply response of livestock has been undertaken mostly in developed countries. In developing countries livestock farming is not done on a large scale basis. This study is an attempt to obtain the best estimates of the response of milk producers while making a decision about production allocation of milk in Pakistan. The main objectives of the study are: (1) to test whether Pakistani milk producers respond to price movements (2) to estimate the elasticities of production with respect to milk producers: (a) relative price (b) credit and lagged production (c) to make a comparison of short-run and long-run price elasticities with that of developed and underdeveloped countries (d) to identify policy measures. The study is based on secondary data at the Pakistan level and covers a period of 31 years, starting from 1971-72 to 2002-03. Marc Nerlove's (1958) partial adjustment lagged model is used for the study. The result of the analysis reveals that in the process of making the production decisions for milk production, all the variables (relative price, credit availability and lagged milk production) are equally important.

The results of the study indicate a positive response of milk resource allocation to relative price. This means that the producers can find it possible to make adjustments on production allocation under milk through the manipulation of the price of milk and its competing products.

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Introduction

Livestock is an important sector of agriculture in Pakistan, and accounts for 39 percent of agricultural value added and about 9.2 percent of the GDP (2002-03). From time immemorial livestock rearing has been given much importance not only in developing countries but also in developed countries. In third world countries, where the level of mechanization in agriculture is low, livestock rearing is mainly for draught purpose. On the other hand, the use of animals for draught purpose is low in developed countries owing to the high level of farm mechanization and the animals are mainly reared for the consumption of meat and milk.

Milk production is a major part of agriculture in Pakistan. More specifically, it is an important enterprise for over five million households owning buffaloes and/or cattle. The net foreign exchange earnings from livestock were to the tune of Rs.51.5 billion in 2001-02, which is almost 11.4 percent of the overall export earnings of the country. The importance of the role of livestock in the rural economy may be realized from the fact that 30-35 million of the rural population is engaged in livestock raising having household holdings of 2-3 cattle/buffalo and 5-6 sheep/goat per family, deriving 30-40 percent of their income from it. The livestock production includes milk, beef, mutton, poultry meat, wool, hair, bones, fats, blood, eggs, hides and skins.

In 2002-03, the total milk production from buffaloes/cows was 27811 thousand tons. Out of this production 55 percent was consumed as fresh milk. The per capita monthly consumption of fresh milk was 7.00 litres in 2001-02. The per capita availability of milk was 83.14 kgs per annum.

Producer prices in most United States fluid milk markets are regulated by either federal milk marketing orders or state milk control programs. Thus, any price change should be evaluated, at least partially, for its impact on the quantity of milk produced. Estimates of the responsiveness of milk production to price changes provide useful information for administrators who try to provide an adequate supply of milk to consumers and at the same time maintain a “reasonable” balance between milk production and consumption.

During the last few decades, many quantitative studies of milk production response in developed countries have been conducted. In a well known paper, Brandow (1958), used single equation regression analysis to estimate supply relationships for milk produced in the United States. Halvorson (1955), also using single equation Ordinary Least Squares, estimated milk production per cow as a function of the milk-feed price ratio, hay production, and cow numbers and found production to be highly price inelastic. In another study, Halvorson (1958), using a Nerlovian distributed lag model, estimated by Least Squares the short-run and long-run price elasticities of United States milk production to be in the range of 0.15 to 0.30 and 0.35 to 0.50, respectively. For both periods the Nerlove formulations explain more of output variation than the static model. A notable difference in price elasticities and output adjustment coefficient is apparent for the later time period. Producers, Halvorson argued, became more price responsive and quicker at adjusting output as the stabilization programs of the 1930s took root. Beef prices also seemed to have gained in importance. Halvorson concluded that the Kinked Response hypothesis, while not disproven by these results, was somewhat shaken and that further analysis in this regard was required. Although much of this work has incorporated current and/or lagged prices as key variables explaining short and long-run production response, it has been limited to specifying non-flexible price lag structures. This implicitly assumes that the greatest increase in output from a price increase is forthcoming in the first period. However, if monthly time periods are considered, a linear programing analysis suggests that this is a highly questionable assumption.

Chen, Courtney and Schmitz (1972) in their study were particularly interested in identifying the pattern of past price effects on current output. They hoped to formulate lag distribution for prices that would show greater flexibility than a Nerlove partial adjustment formulation. They postulated that (quarterly) milk output was a function of the ratio of the producer's price for milk to the average price of protein - enhanced dairy feed lagged one year, technology, and a dummy variable standing for the particular quarter and compared this with a Nerlove Method that omitted technology and included lagged output. They estimated milk production response for both a polynomial and a geometrically declining distributed lag price structure. Although the coefficients of determination were marginally higher when technology was included, the authors felt there was no strong basis to prefer one specification over another. In comparison they said that the cumulative elasticity for all eight periods is 2.53, almost identical to the

long-run elasticity calculated from the Nerlove formulation. They argued that distributed lag analysis is better when a quarterly supply analysis is desired. Buckwell (1982), adapted a theory of farm size demonstrated by Kislev and Peterson (1982), to model milk production behavior in England and Wales. Burton (1984), used a model of UK dairy sector to determine simultaneously herd size, number of culls, replacement heifer price, and milk price. In a recent study, Chavas and Kraus (1990), developed a dynamic model of a dairy cow population and milk supply response and applied it to the US Lake States. The authors also calculated dynamic supply elasticities and found the response of supply to market prices to be very inelastic in the short-run.

Supply response of the livestock study has been done mostly in developed countries. A majority of them are for Canada, USA, UK and Australia. The reason behind this is that livestock farming in these countries is done on commercial basis. In developing countries livestock farming is not done on a large scale basis.

In Pakistan there are only two studies which analyze the determinants of milk production. Anjum, Raza, Walters and Krause (1989) estimated a simple two equation simulation model for milk production. The model includes one price equation which is explained by per capita production and per capita income. The other equation aims at explaining changes in milk production with the help of changes in the retail price of milk. Their concluded price elasticity of milk was 0.7 in the short-run. Akmal (1993) in his study of milk production response for Pakistan used a dynamic model of milk supply response.

More specifically, lags of explanatory variables are introduced within the context of Polynomial Distributed Lag Model and one period lag of the dependent variable within the context of the Stock Adjustment model. They considered only three explanatory variables, real wholesale price of milk deflated by consumer price index, real credit availability and time. Due to the limited number of observations he did not include input prices. The response function had been estimated for lag lengths of 6 through 8 year periods. The estimates of long-run elasticities indicate that milk production response in Pakistan has been inelastic to changes in milk price and credit availability in the short-run as well as the long-run. Estimates of aggregate price elasticity range between 0.3 through 0.6.

This study of "milk production response" is an attempt to include more explanatory variables than Akmal's study. The earlier two studies in Pakistan did not include beef price as an independent variable in their model. We know that increase or decrease in beef price will effect the dependent variable (milk production). The omission of this variable can seriously bias the estimated coefficients.

Keeping in view the limitations of the previous investigation especially on Pakistan, this study is an attempt to obtain the best estimates of the response of milk producers while making a decision about production allocation of milk.

Specifically, this study attempts to explain the production allocation behavior of milk producers in terms of their responsiveness to price and non-price factors.

The main objectives of the study are:

1. To test whether Pakistani milk producers respond to price movements.

2. To estimate the elasticities of production with respect to milk producers: (a) price (b) credit (c) beef price (d) time and (e) lagged production.

3. To make a comparison of short-run and long-run price elasticities with that of other developed and under-developed countries.

4. To identify policy measures in respect of price, credit, and beef price, so that milk production can be increased.

Data Sources

To build an economic model on the objectives given above, it is necessary to have adequate data relating to the production of milk and the said stimuli in order to make a quantitative assessment possible. The study is based on secondary data at the Pakistan level. It covers the time period starting from 1971-72 to 2002-03 for which published data on production, price, credit and beef price were available from the *Pakistan Economic Survey*, published by the Government of Pakistan, *Pakistan Statistical Yearbook* published by the Government of Pakistan and *Agricultural Statistics of Pakistan* also published

by the Government of Pakistan. After losing one year due to lagged milk production the data cover a period of 31 years spanning 1972-73 to 2002-03.

Mathematical Model and Estimation Process

The milk production farmers/producers decisions play an important role in agriculture, but the transformation process involved in it, depending as it does on a number of uncontrolled natural inputs and human labor, is more unpredictable than in industry. The producer allocates his production of milk, depending upon his expected revenue from them. It is very seldom that they are able to make hundred percent adjustment while responding to various economic factors. Lagged price of milk and its competing variable is available to milk production farmers/producers. This indicates that producers do not have to form any expectations about future output prices, but they might experience some institutional constraints in the procurement of requisite inputs (nutritional feed, and water) in such a case. Under such conditions the partial adjustment lagged model is considered appropriate for milk producers and is widely used by researchers like Halvorson (1965), Chen, Courtney and Schmitz (1972), Gardner (1962), Gardner and Walker (1972), Jones (1961), and Buttimer and MacAirt (1970) to measure the milk producer's behavior. So the basic model used in this study is the Nerlove partial adjustment lag model [Nerlove (1958)].

Since the milk producers have lagged price of livestock they can easily formulate their production. Assuming that the desired production is linearly related to the price of milk, a typical specification comes up as follows:

$$Q^*_t = a + b\, P_{t-1} + U_t \qquad (1)$$

where Q^*_t is desired or long-run production and P_{t-1} is the lagged price of milk. Since the desired production Q^*_t is an unobservable variable, the Nerlove formulation suggests that it can be specified as:

$$Q_t - Q_{t-1} = \beta\,(Q^*_t - Q_{t-1})\ 0 < \beta < 1 \qquad (2)$$

The current supply then is:

$$Q_t = Q_{t-1} + \beta\,(Q^*_t - Q_{t-1}) \qquad (3)$$

β is the coefficient of adjustment, which accounts for the forces which cause the difference between the short-run and long-run supply price elasticities. $Q_t – Q_{t-1}$ is the actual change and $Q^*_t – Q_{t-1}$ is desired or long-run change. The first equation is a behavioral relationship, stating that the desired production of milk depends upon the relative prices in the preceding year. The second equation states that the actual production of milk in period t is equal to the previous actual production of milk plus a proportion of the difference between desired milk production in period t and actual milk production in t-1. This hypothesis implies that milk producers cannot fully adjust their actual production to the desired production in response to changes in explanatory variables due to constraints such as physical buffalo/cow conditions, low quality of nutritional feed, and habitual production patterns of milk farmers. 'β' is therefore, an indication of how fast the milk producers are adjusting themselves to their expectations. The value of 'β' close to zero would mean that the producers are slowly adjusting to the changing prices and yield etc. The value of 'β' close to one would mean that the milk producers/farmers are quickly adjusting to the changing levels of prices and yield, etc. almost instantaneously. When adjustment is perfect, β=1. In the real world however, the value of 'β' lies between 0 and 1.

Relations with equation (1) and (2) give the reduced form which eliminates the unobserved variable (Q^*_t) by an observed variable (Q_t).

$$Q_t = A + B P_{t-1} + C Q_{t-1} + V_t \qquad (4)$$

Equation(4) provides a simple version of the partial adjustment model and the parameters of this model can be estimated using OLS if the original Ut's are serially uncorrelated (Gujrati, 1995). There are also other Autoregressive models other than the partial adjustment model such as Koyck and Adaptive expectation. In the Koyck model as well as the adaptive expectations model the stochastic explanatory variable Y_{t-1} is correlated with the error term V_t. If an explanatory variable in a regression model is correlated with the stochastic disturbance term, the OLS estimators are not only biased but also not even consistent. Therefore estimation of the Koyck and Adaptive expectation models by the usual OLS procedure may yield seriously misleading results. The partial adjustment model is different, however. In this model V_t of equation (4) is βU_t. Therefore if U_t satisfied the assumptions of the classical linear regression model such as zero mean value of U_t, no autocorrelation

between the U's, homoscedasticity or equal variance of U_t, and zero covariance between U_t and X_t, so will βu. Therefore, OLS estimation of the partial adjustment model will yield consistent estimates although the estimates tend to be biased (in finite or small samples)[1]. Although Q_{t-1} depends on U_{t-1} and in spite of all the previous disturbance terms, it is not related to the current error term U_t. Therefore, as long as U_t is serially independent Q_{t-1} will also be independent or at least uncorrelated with U_t, thereby satisfying an important assumption of OLS, namely, non-correlation between the explanatory variable(s) and the stochastic disturbance term (Gujrati, 1995). The reduced form would basically remain the same if we include more independent variables than the ones included in equation (4). Equation (4) is the basic frame of our model, but more explanatory variables are included in the model. The model will be in log form. The logarithmic form provides estimates of short-run and long-run supply elasticities directly.

Using the adjustment lag model as the basic frame for analysis, the response relationship in the study will be estimated with the following short-run equations:

$$\text{Log } Q_t = \log C_0 + C_1 \log RP_{t-1} + C_2 \log CRDT_{t-1} + C_3 \log Q_{t-1} + \log V_t \quad (5)$$

$$\text{Log } Q_t = \log C_0 + C_1 \log RP_{t-1} + C_2 \log CRDT_{t-1} + C_3 \log Q_{t-1} + C_4 \log RBP_t + \log V_t \quad (6)$$

$$\text{Log } Q_t = \log C_0 + C_1 \log RMGP_{t-1} + C_2 \log CRDT_{t-1} + C_3 \log Q_{t-1} + \log V_t \quad (7)$$

Q^*_t = Desired or long-run production of milk which will be different from planned production in the period due to the partial accounting of producer's expectations in the planning.

Q_t = Milk production in year t,

RP_{t-1} = Milk price, deflated by consumer price index in year t-1,

$RMGP_{t-1}$ = Milk price with respect to ghee price in year t-1,

[1] For proof see J. Johnston, Econometric Methods, 3rd edition.

$CRDT_{t-1}$ = Credit[2] provided to the dairy sector in year t-1,

Q_{t-1} = Production of milk in t-1,

RBP_t = Beef price deflated by consumer price index in year t,

Vt = Error term in year t,

β = Coefficient of Adjustment

In the relative price ratio variable, input prices or best substitute price of milk (price of protein-enhanced dairy feed) should have been used in the denominator. The data on input prices of milk (for example fodder price and concentrates price) and protein are not available.

We have estimated the equations using Ordinary Least Squares (OLS) method with all the variables in their log-linear form. The log form of the function was chosen because it yielded consistently better results with respect to signs, values and levels of significance of the regression coefficients. Besides, the logarithmic forms also provide ready-made estimates of short run elasticities.

Because of the presence of lagged values of the dependent variable on the right hand side of equations (5), (6) and (7), the Cochrane - Orcut technique was employed in the Ordinary Least Square regression procedure in order to account for possible autocorrelation problems.

The long-run elasticities were calculated by using the short run elasticities.

$$\text{Long-run price elasticity} = \frac{\text{Short-run elasticity}}{\text{Coefficient of adjustment}}$$

Whether the model suffers from the auto-correlation problem or not, it can not be tested by using the DW d-statistics, since the model includes a lagged dependent variable in the set of regressors. In the presence of a lagged dependent variable (lagged production for example) in a regression equation, the DW d-statistics is likely to have reduced power

[2] Credit provided by Agricultural Development Bank of Pakistan is being used because total credit provided to the dairy sector is not available.

and is biased toward the value 2. [Durbin (1970) and Nerlove (1966)]. For such an equation, Durbin suggested an alternative test statistic known as Lagrange Multiplier Test or the h-statistic, defined as;

$$h = \left(1 - \frac{1}{2} d \sqrt{\frac{n}{1 - n\hat{v}(\hat{c}_3)}}\right)$$

where,

$\hat{v}(\hat{c}_3)$ = least squares estimate of variable C_3

d = usual DW d-static

n = number of observations

Under the null hypothesis of no autocorrelation, 'h' is asymptotically normal with zero mean and unit variance. The test statistic can also be used to test the hypothesis of no serial correlation against first-order-auto-correlation, even if the set of regressors in an equation has higher order lags of the dependent variable. However if $\hat{v}(\hat{c}_3) > \frac{1}{n}$, it cannot be computed (Green 1990). Cochrane-Orcutt iterative process was applied where the existence of auto-correlation was detected. "Intercorrelation of variables is not necessarily a problem unless it is high relative to the overall degree of multiple correlation" (Klein 1962). If there are strong interrelationships among the independent variables, it becomes difficult to disentangle their separate effects on the dependent variable. If there are more than two explanatory variables, it is not sufficient to look at simple correlations. Thus the term "Intercorrelations" should be interpreted as multiple correlation of each explanatory variable with the other explanatory variables. Thus, by the 'Klein' rule multicollinearity would be regarded as a problem if $R^2_y < R^2_i$, where R^2_y $x_1.x_2.x_i$ and $R^2_i = R^2_{xi}$. other x's. With the non-experimental data, it would be impractical to ascertain a priori that the multicollinearity problem among the explanatory variables is not severe. Therefore, a categorical test of intercorrelations among the explanatory variables is conducted and results are presented in Appendix Table 1.

Analysis of the Results

The results of the regression analysis of equations 5, 6, and 7 are presented in Table 1. Due to the presence of multicollinearity and autocorrelation in equations 6 and 7 (see Table 1 and Appendix 1) their results were further calculated. It is evident from Table 1 that the variables that are included in equation 5 of the model are capable of explaining 99 percent of the variation in the production of milk, which is indicated by the high value of R^2. The results of the multicollinearity indicated that there was no serious problem of multicollinearity (Klein rule) in equation 5. Since $\hat{v}(\hat{c}_3)$ is $< \frac{1}{n}$, the computation of the 'h'-statistic is possible. The computed Durbin's h-statistic (<±1.645) indicates no serial correlation, hence, the null hypothesis was accepted in favor of the absence of serial correlation. Equation 5 is preferable to Equations 6 and 7 because of the highly significant coefficients, no multicollinearity and autocorrelation and higher R^2 values (0.99) as compared to insignificant or low degree of significance, presence of multicollinearity and autocorrelation and lower R^2 values (0.68 and 0.59). Our subsequent analysis is, therefore, based on the results of Equation 5.

Relative Price

The impact of the economic incentives on milk production is found to be significant, as is evident from the significant positive impact of relative price (Table 1). The variable is significant at the 1 percent level. This means that producers of milk in Pakistan do respond to economic incentives, the milk price has potential to increase milk production. A given price change has the highest effect on production.

Credit

A given change in credit availability has a larger impact on milk production in the earlier period because the variable is significant at the 5 percent level. The elasticity is very low (0.1). Low credit elasticity is perhaps due to the fact that only a small fraction of total milk production comes from the dairy sector which utilizes credit facilities.

				Price Elasticity	
				Short run	Long run
		Durbin 'h' statistic		SRE	LRE
			'h'		
			0.715 (NSC)	+0.258	+2.081
			1.647 (SC)	–	–
			1.703 (SC)	–	–

Milk Production

The elasticity estimates of lagged milk production is found to be positive and significant at the 1 percent level. The magnitude of the coefficient of this variable is 0.876, indicating a low rate of adjustment on the part of producers.

The Delayed Adjustment and Short-Run and Long-Run Price Elasticity

As our model is based upon Nerlove's adjustment hypothesis, it will be interesting to know how far the estimated equation for actual milk production supports this argument. The rapidity with which the producers adjust the production of milk in response to movements in factors discussed above, is seen from the numerical values of the coefficient of adjustment (β). The coefficient of adjustment is found to be 0.124, indicating that production was influenced more by technological and institutional rigidities and that price inducement operated slowly and gradually only. The value is within the assumed range of zero to one. As is obvious, the long-run elasticity with respect to the relative price is higher than short-run elasticity, which is indicative of the long-run adjustment of milk production. This also means that milk producers of Pakistan have more time to adjust their production of milk in the long-run than in the short-run.

Table-2: Price Elasticities for Some Developed and Developing Countries

Country	Period	Price Elasticity		Source
		Short-Run	Long-Run	
Pakistan	1971-2001	+0.258	+2.081	Our Estimates
Pakistan	1971-89	+0.298	–	Muhammad Akmal
United States	1927-57	+0.42	+1.35	Jones
United States	1941-57	+0.18 to +0.31	+0.15 to +0.89	Halvorson
United States	1953-68	+0.38	+2.54	Chen, Caurtney and Schmitz
Australia	1947-64	+0.19	+0.42	Powell and Gruen
Ireland	1951-68	+0.25 to	–	Bultimer and

		+0.30		MacAirt
United Kingdom	1958-64	+0.17 to +0.23	+0.27 to +105	Jones
United Kingdom and Wales	1948-58	+0.0.13	+1.42	Gardner and Walker

Comparison of Price Elasticities of Milk in Some Developed and Developing Countries

To make a relative comparison of Relative Price elasticities of milk production obtained, we present Table 2 along with the elasticities of production estimated by other researchers in some developed and developing countries. The result indicates that our estimated milk production elasticity in the short-run and long-run compares favorably with Muhammad Ali (Pakistan) and Chen *et al*. (United States) estimates. The only study in Pakistan by Muhammad Akmal has not calculated the long-run elasticity. Our study is the only study which calculated the long-run elasticity of milk production in Pakistan.

Conclusion and Policy Suggestions

To test the hypothesis relating to the factors influencing the producers' production allocation, the Nerlove adjustment lagged model has been used. The result of the analysis reveals that in the process of making the production decisions for milk production, all the variables (relative price, credit and lagged milk production) are equally important. The producers in Pakistan responded positively and significantly to relative price. This means that a given price change has the highest effect on production. This also means that milk price has the potential to increase milk production. A given change in credit availability has larger impact on milk production in the previous period. This also means that as credit availability increases the livestock farmers will purchase more buffaloes in milk and will extend their herd size. Low credit elasticity is perhaps due to the fact that only a small fraction of total milk production comes from the dairy sector which utilizes credit. Milk lagged by one year is found to be positive and significant at the 1 percent level. The coefficient of adjustment is found to be 0.124, indicating that production was influenced more by technological and institutional rigidities and that price inducement operated slowly and gradually only. As is obvious, the long-run elasticity with respect to the relative price is higher than short-run elasticity, which is

indicative of the long-run adjustment of milk production. This also means that milk producers in Pakistan have more time to adjust in the long-run than in the short-run. Our estimated milk production elasticity in the short-run and long-run compares favorably with Mohammad Ali (Pakistan) in the short-run and Chen *et al*. (United States) estimates in the short-run and long-run.

The results obtained in this study lead to important implications that seem to be relevant from the point of view of policy implications. First, the results of the study indicate a positive response of milk resource allocation to relative price. This means that the producers can find it possible to make adjustments on production allocation under milk through the manipulation of price of milk and its competing products. In order to bring about an effective adjustment in production allocation, the prices announced for milk and other dairy products should carry a long-run guarantee. This policy will not only enable the producers to plan their production programmes better but might also help to correct the inter-commodity imbalance to some extent. To increase milk production the following measures are suggested.

a) Establishment of milk production cooperatives.

b) Providing mobile veterinary medical facilities.

c) Dairy farming should be encouraged in the private sector with adequate credit facilities. Introduction of good quality milch animal breeds with longer milking periods and also higher milk yields is necessary. This will greatly help to overcome the existing milk shortage in the country. The farmers may also be motivated to venture into milk production enterprises along with farming. Modern artificial insemination facilities be extended to larger areas for breeding better milch animals.

d) A little less than three fourths of the total milk supply is produced within the city boundary at the spot under un-economical and insanitary conditions. On account of the high cost of maintenance of dry animals, good milch cattle are consequently sold to be slaughtered at the end of their lactation. This results in decrease in the number of milch animals and creates the problem of adulteration due to reduced supply. This slaughtering should be legally stopped since it discourages urban milk production. It is also suggested that good milch breeds should be marked so that they may not be

slaughtered. The milch animals should also be well-fed. To reduce the high cost of feeding milch animals, fodder production for the cities of Pakistan should be expanded and an adequate fodder supply be maintained throughout the year.

e) Bulls of good pedigree be maintained in adequate number and breed improvement programs rigorously followed through artificial insemination.

f) The breeders should be encouraged to maintain adequate number of good milch animals instead of maintaining large number of low quality animals.

Second, the results of the study indicate positive and significant impact credit facilities on milk production. The credit facilities to milk producers should be extended to maintain better dairy herds and facilitate marketing of larger milk supplies.

Indirectly the study also indicates that a proper distribution of milk plays a vital role in milk supply.

Appendix Table – 1

Test of Multicollinearity of the Explanatory Variables (By Klein's Rule) Used in the Regression Analyses of Milk Production

Equation No.	Total R^2	Partial R^2 (Each Explanatory Variable as a Dependent Variable)					
		Relative Price of Milk Consumer Price Index	Relative Price of Milk to Ghee	Credit	Milk Production	Relative Price of Beef to Consumer Price Index	Comment on Severe Correlation
5	0.99	> 0.47	–	> 0.59	> 0.35	–	No severe correlation
6	0.88	–	< 0.90	> 0.38	> 0.41	–	Price of milk and ghee are severely correlated
7	0.59	> 0.56	–	> 0.53	> 0.43	< 0.63	Price of beef and CPI are severely correlated

Note: Each explanatory variable used as dependent variable, in turn, on other explanatory variables (according to the model type of the Table Equation). If the partial R^2 is greater (>) than the actual R^2, then there is harmful multicollinearity of the variable on the other variables. Conversely, (i.e. R^2 total > R^2 partial), the collinearity problem is not serious (see Maddala, 1977). The associated symbol of the explanatory variables indicates whether the multicollinearity problem is severe or not (> on the left indicate less than the total R^2, < on the left indicates greater than the total R^2.) All the variables are in natural logarithms.

References

Akmal, M., 1993, A Dynamic Model of Milk Production Response for Pakistan, Ninth Annual General Meeting, Pakistan Institute of Development Economics, January 10, Islamabad.

Anjum et al., 1989, Pakistan Dairy Industry: Issues and Policy Alternatives, Economic Analysis Network Project, Special Report Series No.14.

Brandow, A.E., 1958, "A Note on the Nerlove Estimate of Supply Elasticity", *Journal of Farm Economics*, 40.

Buckwell, A., 1982, "Herd Structure and Milk Supply Response", *Journal of Agricultural Economics*, 35(3), pp.341-353.

Burton, M., 1984, "Simultaneity in the UK Dairy Sector", *Journal of Agricultural Economics*, 35(1), pp.61-71.

Buttimer, D.J. and MacAirt, J.G., 1970-71, "Supply Response in the Irish Creamery Herd 1951-1970", *Irish Journal of Agricultural Economics and Rural Sociology*, 3(3).

Chavas, J.P. and Kraus, A.F., 1990, "Population Dynamics and Milk Supply Response in the US Lake States", *Journal of Agricultural Economics*, 41(1), pp.75-84.

Chen, D., Courtney, R. and Schmitz, A., 1972, "A Polynomial Lag Formulation of Milk Production Response", *American Journal of Agricultural Economics*, 54, pp.77-83.

Durbin, J., 1970, "Testing for Serial Correlation in Least Squares Regression When Some of the Regressors are Lagged Dependent Variables", *Econometrica*, 38(3), pp.410-421.

Gardner, T.W., 1962, "The Farm Price and Supply of Milk", *Journal of Agricultural Economics*, 15.

Gardner, T.W. and Walker, R., 1972, "Interactions of Quantity, Price and Policy: Milk and Dairy Products", *Journal of Agricultural Economics*, 23.

Government of Pakistan (various issues), Agricultural Statistics of Pakistan, Ministry of Food, Agriculture and Livestock, Food, Agriculture and Livestock Division, Economic Wing, Islamabad.

Government of Pakistan, (various issues), *Economic Survey*, Economic Adviser's Wing, Finance Division, Islamabad.

Government of Pakistan, (various issues), *Pakistan Statistical Yearbook*, Federal Bureau of Statistics, Statistics Division.

Green, W.H., 1990, Econometric Analysis, New York.

Gujrati, N.D., 1995, Basic Econometrics, McGraw-Hill Book Company, 2nd Edition, Singapore.

Halvorson H.W., 1955, "The Supply Elasticity of Milk in the Short-Run", *Journal of Farm Economics*, 37.

Halvorson, H.W., 1958, "The Response of Milk Production to Price", *Journal of Farm Economics*, 40.

Johnston, J., 1984, Economics Methods, Third Edition, McGraw-Hill Book Company, Singapore.

Jones, G.T., 1961, "The Response of the Supply of Agricultural Products in the United Kingdom to Price and Other Factors: Including Consideration of Distributed Lags", *Farm Economist*, Part 1, 9.

Kislev, V. and Peterson, W., 1982, "Prices, Technology, and Farm Size", *Journal of Political Economy*, 90, pp.578-595.

Klein, R.L., 1962, An Introduction to Econometrics, Prentice-Hall Inc., New Jersey.

Koyck, M.L., 1954, Distributed Lags and Investment Analysis, North-Holland Publishing Company, Amsterdam.

Maddala, G.S., 1977, Introduction to Econometrics, Second Edition, MacMillan Publishing Company, New York.

Nerlove, M., 1958, "Distributed Lag and Estimation of Long-Run Supply and Demand Elasticities: Theoretical Considerations", *Journal of Farm Economics*, 40(2), pp.301-311.

Nerlove, M., 1966, "Use of the Durbin-Watson Statistic in Inappropriate Situations", *Econometrica*, 34(1), pp.235-238.

Powell, A.A. and Gruen, F.H., 1967, "The Estimation of Production Frontiers: The Australian Livestock/Cereals Complex", *Australian Journal of Agricultural Economics*, 11.

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Arbitrage Pricing Theory: Evidence From An Emerging Stock Market

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The development of financial equilibrium asset pricing models has been the most important area of research in modern financial theory. These models are extensively tested for developed markets. This paper examines the validity of the Arbitrage Pricing Theory (APT) model on returns from 24 actively trading stocks in Karachi Stock Exchange using monthly data from January 1997 to December 2003. Explanatory factor analysis approach indicates two factors governing stock return. Pre-specified macro economic approach identifies these two factors as the anticipated and unanticipated inflation and market index and dividend yield. Some evidence of instability is found. The overall finding of two significant priced factors at least for a sub period supports APT for an emerging capital market.

1. Introduction

The applications of financial equilibrium models have been very intensively investigated. These applications are used for various purposes such as predicting common stock systematic risk and defining the cost of capital. The traditional equilibrium model, the capital asset pricing model (CAPM) of Sharp (1964), Linter (1965) and Mossin (1966) assume that stock returns are generated by a one-factor model, where the factor represents the market portfolio of all risky assets. Empirical tests of the CAPM have produced mixed results. The critical point in the estimation of the CAPM is the difficulty of measuring the true market portfolio. Due to the severe problems in the testing the CAPM (Copeland and Weston, 1988) a number of the other models have been proposed.

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Arbitrage pricing theory, developed by Ross (1976) proposes that there are several sources of risk in the economy that cannot be eliminated by diversification. These sources of risk can be thought of as related to economy wide factors such as inflation and changes in aggregate output. Instead of calculating a single beta, like the CAPM, arbitrage pricing theory calculates many betas by estimating the sensitivity of an asset's return to changes in each factor.

The arbitrage pricing theory assumes that a security return is a linear function, not only of one, but also a set of common factors. The APT thus indicates that the risk premium for an asset is related to the risk premium for each factor and that as the asset's sensitivity to each factor increases, its risk premium will increase as well. The APT predicted that the prices of all risky assets in the economy conformed to the condition of no arbitrage. No arbitrage mean that an individual holding a well-diversified portfolio could not earn any additional return merely by changing the weights of the assets included in the portfolio, holding both systematic and unsystematic risk constant. The APT states that there is a set of underlying sources that influence all stocks returns. The stock return is a linear function of a certain number; say k, of economic factors, while these factors are unobservable and not meaningful.

According to Chen *et al.* (1986), these risk factors arise from changes in some fundamental economic and financial variables such as interest rates, inflation, real business activity, a market index, investor confidence etc.

The APT thus starts with the assumption that returns on any stocks, R_{it}, are generated by a k-factors model of the following for

$$R_{it} = E(R_i) + b_{i1}F_1 + b_{i2}F_2 + \ldots + b_{ik}F_k + \varepsilon_i \qquad \text{---} \qquad (1)$$

Where $E(R_i)$, i=1,2,3…n, is the expected return of the stock i. F_j (j=1,2,3…k,) are unobserved economic factors. b_{ij} is the sensitivity of the security i to the economic factors j and ε_i are the unique risks of the stocks (uncontrolled factor) i-e a random error term with mean equal to zero and variance equal to σ_{ei}^2.

Ross (1976) showed that if the number of stocks is sufficiently large, the following linear risk-return relationship holds.

$$E(R_i) = \lambda_\circ + \lambda_1 b_{i1} + \lambda_2 b_{i2} + ... + \lambda_k b_{ik} \quad \ldots \quad (2)$$

Where $\lambda_\circ$ is a constant risk less rate of return (the common return on all zero-beta stocks), and $\lambda_j, j = 1,2,...,k$ represents, in equilibrium, the risk premium for the jth factor. The mean zero random common factors can be thought of as representing unanticipated changes in fundamental economy-wide variables. The sensitivity coefficients measure the magnitude and direction of the reaction in asset returns.

In order to test the APT empirically, there are two main approaches. First, one can simultaneously estimate the asset sensitivities and unknown factors by exploratory factor analysis on stock returns. In that case a theory does not predict the exact content or even the number of relevant factors. Alternatively, we could try to specify prior general factors that explain pricing in the stock market. Such macroeconomic variables could be those affecting either future cash flows on companies or future risk-adjusted discount rates. It is generally accepted that the trend of pre-specifying factors seems to be a promising avenue of research in the search for meaningful factor structure.

The factor analysis-based empirical tests of the APT on US data have produced relatively mixed results. In their seminal paper, Roll and Ross (1980) tested the APT for the period 1962-72. They used daily data for individual equities listed on the New York Stock Exchange. They concluded that at least three and probably four priced factors were found in the return generating process.

Chen (1983) discovered that the APT seems to outperform the traditional CAPM when evaluated by explanatory power on stock returns. He investigated stocks using daily return data during the 1963-1978 period from the New York Stock Exchange. He compared the empirical performance of the APT with that of the CAPM.

More studies have found a number of critical issues when testing the theory. For example, it has been found that the number of factors seems to increase when the number of investigated securities increases. There is a paucity of research evaluating the validity of the APT in non-US stock markets. The sparse European results of the APT include these reported in Diacgiannis (1986), Abeysekera and Mahajan (1988), Rubio (1988), Ostermark (1989), Yli-Olli and Virtanen (1989), and Yli-Olli *et al.* (1990).

Concerning the Scandinavian results, Ostermark (1989) reported APT-dominance on Finnish as well as Swedish data. Yli-Olli *et al.* (1990) found three stable common factors across these two neighbouring countries, for the period 1977-1986, using monthly data. They used the principal component analysis to get the factor loadings, then cross-sectional OLS regressions were applied for the three factor solutions to test how many factors were priced in the two countries.

An alternative to the traditional approach is to specify a priori, on the basis of the theory, the general factors that explain pricing in the stock market. In this case the common factors are first measured using pre-specified macroeconomic variables, and asset sensitivities to these factors are estimated using time series regressions. In their seminal paper, Chen *et al.* (1986) found that the spread between long-term and short-term interest rates, expected and unexpected inflation, industrial production and spread between high and low-grade bonds are priced in the generating process of stock returns in the US stock market. These state variables have also been found to be important in a number of other studies on US data such as Chen (1989).

Martikainen *et al.* (1991) tested APT for the Finish Stock Market using monthly data. They used two different approaches: an exploratory factor analysis and a pre-specified macroeconomic factor approach. They tested how many factors there were that affected finish stocks in the two time periods 1977-81 and 1982-86. In the first step of the test they used principal components analysis and varimax rotation to get the factor loadings. Then, OLS regressions were made where factor loadings were independent variables and the average return on stock was the dependent variable. The purpose was to find how many factors that were priced in the market. In the second step of the test they used 11 pre-specified macroeconomic factors to test the APT model. They used different stock market indices, price indices, interest rates and other national economic variables such as the GNP and money supply. They could find only one priced factor for the first subperiod. In the second subperiod all of the factors become priced. This was an encouraging result that supported the theory that the equilibrium stock returns were generated by an economic factor model.

Loflund (1992) found that international factors such as unanticipated changes in real exchange rates, inflation and unanticipated changes in future foreign economic activity or export demand should be important. National factors such as unexpected inflation, unanticipated changes in the short-term interest rate, the term structure of interest rates and unexpected changes in domestic real production should be important.

Booth *et al.* (1993) tested the APT for US, Finnish and Swedish stock returns during the 1977-86 period, using monthly data. They tested the intra-country stability of the factor patterns over time and across different samples. They investigated the cross-sectional similarities of the factor patterns of twelve 30-stock samples. They used transformation analysis to test the stability. The empirical evidence indicated that two stable common factors in different samples could be found. An interesting observation was that the factors were very often produced in different order in different samples. Another important finding was that there existed two common factors across the first US sample and Finnish and Swedish samples. Thus, the two common factors obtained have been international by nature. The results implied that for Finland the APT performed relatively poorly and for US and Swedish data one to two priced factors were identified.

For developing capital markets in general and Pakistani markets in particular empirical evidence on equilibrium models are few. Khilji (1993) and Hussain and Uppal (1998) investigated the distributional characteristics of stock return in the Karachi Stock Exchange concluding that the return behavior cannot be adequately modeled by a normal distribution. Hussain (2000) found no evidence of the day of the week anomaly and concluded that for the period January 1989 to December 1993 the absence of this predictability pattern implied efficiency of the market. Ahmad and Zaman (2000) using sectoral monthly data from July 1992 to March 1997 found that some of the CAPM implications are valid in the Karachi Stock Market. They found evidence in favor of positive expected return for investors but speculative bubbles were also indicated. Khilji (1994) found that the majority of return series are characterized by non-linear dependence. Ahmad and Rosser (1995) used an ARCH-in-Mean specification to study risk return relationship using sectoral indices. Attaullah (2001) tested APT in the Karachi Stock Exchange using 70 randomly selected stocks employing monthly data from April 1993 to December 1998. Out of 11 macroeconomic factors he found unexpected inflation, exchange rate, trade balance and world oil prices were sources of systematic risk. He used Iterative Non Linear Seemingly Unrelated Regressions technique. The present study provides another more recent evidence from monthly data from January 1997 to December 2003. With a relatively greater sample this study employs two different factor analysis techniques and stability analysis is also performed. Moreover macroeconomic variables used are also greater in number and regional market indices are also included.

The remainder of this paper is organized as follows. Section II, the data used in this research effort is introduced. The empirical part of the

study is divided into two sections. Section III includes testing the APT using traditional exploratory factor analysis approach. In Section IV macroeconomic factors are identified using 16 pre-specified macroeconomic variables by reducing the dimensionality of these variables using factor analysis. The APT is also tested using these macroeconomic factors. Section V concludes.

II. The Data

The data consist of 24 actively traded stocks from the Karachi Stock Exchange and the general market index (KSE-100), covering the period from January 1997 to December 2003. Data on individual stocks regarding closing prices was obtained from the Karachi Stock Exchange. These 24 stocks are the most active stocks with approximately 80% weight of aggregate market capitalization of KSE 100 index companies. We have collected the monthly data. In order to analyze the stability of the factors in the APT, the period is divided into two subperiods

The first subperiod is from January 1997 to December 1999; the second is from January 2000 to December 2003. One reason for breaking the sample is stability testing of our results. Moreover the second period is more volatile. In this period KSE attained its highest level of index value and market capitalization. It is claimed to be the best performing capital market in the world. Therefore we need a large sample for reliable estimates, while the first period January 97 to December 99 is relatively smooth. The break up of the sample can also be seen as pre-Musharaf government and the current government. President Musharaf Government's intended or unintended economic, financial and foreign policies due to the 9/11 event have brought drastic changes in the economic horizon. So it will also be tested whether stock return behavior has changed in the two subperiods.

The returns have been measured using the first difference of monthly logarithmic price indices. There are 16 macroeconomic variables, including inflation measured by Consumer Price Index and Wholesale Price Index, a measure of real economic activity. Ideally GDP should be used for this purpose but the monthly data on GDP are not yet available for Pakistan therefore manufacturing production index has been used to capture real economic activity. Interest rate measured by 90 day T-bill of SBP, Money market rate, a long-term interest rate yield on 10-year Pakistan Investment Bond are also investigated in the analysis. When selecting the macroeconomic variables, they

have been chosen using the criterion that they should affect the rate of return or future cash flow expectations of the firm share. All the variables are studied using the first differences of the logarithmic forms of indices.

Inflation has been proxied by two indices measuring the wholesale prices and the consumer prices. These variable are included in the study since the classical Fisherian theory implies that the common stocks should serve as an effective inflation hedge during expected inflation (see Mishkin, 1997). It is generally observed that stock returns are negatively related to expected inflation, unexpected inflation and change in expected inflation in several countries (Asprem, 1989; Wasserfallen, 1989). When expected inflation rises, interest rates will rise. Fama (1981), Geska and Roll (1983), Ram and Spencer (1983), Stulz (1986), and Kaul (1987) all attempt to explain the negative association between stock returns and inflation; and Fama and Gibbons (1982) attempt to explain the negative association between inflation and real interest rates.

Interest rates are among the most closely watched variables in the economy. Their movements are reported almost daily by the news media. They directly affect our everyday lives and have important consequences for the health of the economy. The higher the interest rate, the higher the discount factor, and lower the stock prices. Martikainen *et al* (1991) used this variable in testing the APT model. The stock returns and production growth, as outlined in Barro (1990) and Fama (1990), may be affected by interest rates. Recently the boom in the Pakistani Stock Market (KSE 100 index in all time highest in the recent past) is partly due to the fact that interest rates in defense certificates and other interest-bearing instrument have declined. Therefore investors are now coming to the stock market, as a result demand for stock market securities is rising which increase stock prices.

The regional market may have an effect on returns in the Karachi Stock Exchange. In empirical studies many authors have used regional market return as an independent variable, for example, for the case of the Finland capital market (Helsinki Stock Exchange) Martikainen *et al* (1991) have used the Stockholm Index.

Emerging Stock Market Factbook (1999) indicates that for the Pakistani capital market the highest correlation of returns are with the Indian capital market (0.40) and Malaysian capital market (0.36). Therefore in our

analysis we have used the Bombay Stock Index (BSE-30) and Kuala Lumpur Composite Index (KLSE).

The U.S. stock market was by far the largest and most influential capital market in the world. Therefore we have used Standard and Poor 500 index. S & P index reflects the worldwide expectations for all firms. The S & P index has been selected since it is expected that the Pakistani stock returns follow the global cash-flow expectations of firms. Rozeff (1984), Shiller (1984) and Campbell and Shiller (1988) present evidence that dividend yields forecast stock returns, Fama and French (1989) suggest that dividend yields can explain cyclical variation in expected returns. Chen *et al.* (1985) find that changes in aggregate production, inflation, and short-term interest rates can explain the equilibrium pricing of equities, and Chen (1991) shows that the cyclical behaviour of T-bill rates captures the cyclical variation in equity risk premiums.

The money supply has typically been seen as a leading indicator, and it is usually assumed that money supply and demand influence equity prices (Fama, 1981; Geske and Roll, 1983; Kaul, 1987). The rise in money supply can be expected to raise the stock prices (Martikainen *et al.*, 1991). Kaul (1990) also indicates significant association between monetary rule and the relationship between stock returns and inflationary expectations. Monetary policy influences stock returns by increasing future cash flows or by decreasing the discount factors at which those cash flows are capitalized (Binswanger, 2000).

III. Exploratory Factor Analysis Approach

Our exploratory factor analysis approach is based on intuition, which was presented by Chen *et al.* (1986) and which has been applied further by several researchers. First, the factor scores and factor loadings from the return series were estimated separately for the two subperiods and the whole period. The estimation of factors was based on the principal component method. Second, an orthogonal varimax rotation was applied. In the following table, factors appear in decreasing order of variance explained by the factors.

Table-1: Cumulative Proportions Of The Total Variance Explained By Principal Components

Period	Fact 1	Fact 2	Fact 3	Fact 4	Fact 5	Fact 6	Fact 7	Fact 8	Fact 9

Jan-97--Dec-03	0.456	0.526	0.583	0.631	0.675	0.713	0.749	0.782	0.812
Jan-97--Dec-99	0.478	0.557	0.622	0.677	0.726	0.773	0.811	0.846	0.875
Jan-00--Dec-03	0.467	0.543	0.604	0.659	0.71	0.749	0.787	0.818	0.845

The cumulative proportions of the total variance explained by the estimated factors are presented in Table 1. The results indicate that the figures are quite stable over the two subperiods. We concentrate on nine factors solution. This selection is based on the criteria of more than 80% variance explained by the factors extracted. Using this criteria the Pre-specified macroeconomic factors also support the existence of nine factors. The results of the other estimated factor solutions are available from the authors on request.

Thus, the following nine-factor models were estimated for the stocks to obtain asset sensitivities and unknown factors in the APT.

$$R_{it} - \mu_i = b_{i1}F_{1t} + b_{i2}F_{2t} + ... + b_{i9}F_{9t} + e_{it}$$

Where $R_{it}, i = 1,2,...,24$, is the return of the stock i at month t, μ_i represent the mean return of the stock i, $F_{1t}, F_{2t}, ..., F_{9t}$ are the estimated unknown common factors (factor scores), $b_{i1}, b_{i2}, ..., b_{i9}$ are the asset sensitivities (factor loadings) of the security i to the nine unknown factors, and e_{it} are the unsystematic return components of the stocks.

To test the linear risk-return relation implied by the APT, Table-2 presents OLS regressions where the estimated factor loadings are used as independent variables, and the average returns of securities as dependent variables.

Table-2: Regression Analysis Estimates For The Exploratory Factor Analysis-Unrotated 9 Factors In The Model

Period	Const	Fact 1	Fact 2	Fact 3	Fact 4	Fact 5	Fact 6	Fact 7	Fact 8	Fact 9	R^2-adj
Jan-97--Dec-	-0.0008	-0.007	0.0133	-0.0045	0.00303	0.0252	0.0112	-0.0095	-0.005	0.0197	41.20%

03 T-value	-0.09	-0.55	1.45	-0.77	0.38	3.57***	1.42	-1.31	-0.62	2.12*	
Jan-97--Dec-99	0.0197	0.02	-0.014	-0.007	0.0055	0.0109	0.0126	0.0094	-0.012	-0.006	16.10%
T-value	1.67	1.27	-1.26	-0.7	0.78	1.46	0.93	0.91	-1.06	-0.65	
Jan-00--Dec-03	0.0155	0.015	-0.002	-0.0093	0.008	0.0124	-0.01	-0.007	-0.017	0.0053	42.00%
T-value	1.91*	1.35	-0.28	-1.56	1.38	1.7	1.29	-0.98	-2.18**	0.65	

Dependent variable: average monthly return for security; independent variables: factor loadings.

* Significant at 0.10 level.
** Significant at 0.05 level.
*** Significant at 0.01 level.

The results indicate that in the whole sample period we can find two priced factors according to this exploratory factor analysis approach; in the first subperiod none of the factors seems to be priced, and in the second subperiod we can find only one priced factor at the 5% significance level. The number of priced factors seems to be very low and the results of this approach indicate substantial instability of the explanatory power of the APT. This instability may be due to a number of reasons as explained in section II.

IV. Pre-Specified Macroeconomic Factors Approach

Table-3 presents the principal components analysis on the 16 pre-specified macroeconomic variables- the rotated solution. According to 80 % of the variance explained criteria, the original variables were converted to 9 orthogonal time series. There are two reasons for the conversion. Firstly this eliminates all problems with multi-colinearity and secondly it reduces the dimensionality of the original variables and makes it easier to work with time-series.

The factors in Table-3 appear in decreasing order of variance explained by the factors, i.e. according to the eigenvalues of the factors. The figures in the table are factor loading. Factor 1 indicates the real economic activity, which are positively correlated. Factor 2 and factor 3 represented the anticipated change and unanticipated change of inflation,

which are also positively correlated. Factor 4 represented stock index factor namely Bombay Stock Exchange (BSE) and Karachi Stock Exchange (KSE) and dividend yield with factor loadings 0.760, 0.509 and –0.834 respectively. Factor 5 and factor 8 indicate clearly interest rate factor. Factor 6 indicates the stock index factor Standard and Poor's index (S&P) and BSE showing negative correlation that is -0.906 and –0.487 respectively. Factor 7 represented the money supply factor. Exchange rates are represented by factor 9 having factor loading 0.976.

Tabel-3. Factor Pattern of the Macroeconomic Variables January-97 to December-03

Variable	F1	F2	F3	F4	F5	F6	F7	F8	F9
Dmanu	0.89	-0.07	-0.08	-0.01	0.13	0.02	-0.20	0.04	-0.06
ddManu	0.87	0.03	-0.14	-0.10	0.00	-0.09	-0.11	-0.24	0.12
DKSE	-0.11	0.02	-0.08	0.76	0.07	-0.15	-0.03	-0.19	0.07
dS&P	0.03	-0.03	0.04	0.04	-0.01	-0.91	0.01	0.15	-0.07
DBSE	0.12	-0.17	-0.07	0.51	-0.06	-0.49	-0.40	-0.09	-0.02
DKLSE	0.02	-0.07	-0.15	0.20	-0.01	-0.03	-0.06	0.02	-0.06
dCPI-95	-0.02	0.17	0.91	-0.05	-0.15	0.03	0.03	0.10	-0.08
DdCPI	-0.19	0.11	0.90	-0.01	0.09	-0.06	-0.11	-0.01	0.01
dWPI-95	0.10	0.89	0.17	0.08	-0.07	0.07	0.05	0.05	-0.03
ddWPI	-0.15	0.91	0.09	0.06	-0.01	0.00	-0.10	-0.01	0.03
dExch.R	0.04	0.00	-0.06	0.01	-0.14	0.08	0.01	0.04	0.98
dT-bill	-0.01	-0.01	-0.02	0.01	-0.82	0.18	-0.14	0.30	0.10
dGovtB	-0.13	0.11	0.08	-0.08	-0.82	-0.22	0.13	-0.21	0.08
dMoneyM	-0.16	0.04	0.08	-0.19	-0.05	-0.15	0.02	0.89	0.04
dDividen	0.03	-0.20	-0.04	-0.83	-0.01	-0.12	-0.17	-0.01	0.07
dMoneyS	0.30	0.08	0.09	-0.09	-0.01	-0.02	-0.88	-0.01	-0.01
Variance	1.7746	1.7621	1.7501	1.6468	1.415	1.221	1.0746	1.0555	1.0156
Proportion of Variance	0.111	0.11	0.109	0.103	0.088	0.076	0.067	0.066	0.063

DManu = The change in the "real economic activity (manufacturing index)".

DdManu = The differentiated dmanu. This variable measures the unanticipated change in the manufacturing index.

DKSE = The change in the "Karachi Stock Exchange".

dS&P = The change in the "Standard and Poor 500 index"

dBSE = The change in the Bombay Stock Exchange.

DKLSE = The change in Kuala Lumpur Stock Exchange.

dCPI-95 = The change in the Consumer Price Index

ddCPI = The differentiated dCPI-95. This variable measures the unanticipated change in the Consumer Price Index.

dWPI-95 = The change in the Wholesale Price Index.

DdWPI = The differentiated dWPI. This variable measures the unexpected change in the Wholesale Price Index.

dExch.R = The change in the exchange rate between Pakistani rupee and US dollar.

dT-bill = The change in the Pakistani 90-day government treasury bills return.

DGovtB = The change in the Pakistani 10 years government bond return.

DMoneyM =The change in the money market rate.

DDividen = The change in the dividend yields.

DMoneyS = The change in the money supply.

The data have been obtained from various issues of International Financial Statistics and Monthly Bulletin of State Bank of Pakistan. Stock index data Bombay Stock Exchange and Karachi Stock Exchange data have been obtained from www.scsecurities.com

To test the APT using pre-specified macro-economic factors, the following time-series regressions were first estimated for the stocks to obtain asset sensitivities and unknown factors in the APT.

$$R_{it} = \alpha_i + b_1 F_1 + b_2 F_2 + ... + b_k F_k + e_{it}$$

Where R_{it} is the return of the stock i at month t, α_i is the intercept term of the stock i, F_j ($j = 1,2,...,k$) are in the above factor analysis estimated macroeconomic factors (factor scores), b_{ij} ($j = 1,2,...,k$) are the sensitivities of the return of the security i and e_{it} are the unsystematic return components of the stocks. In this OLS factor scores are used as independent variables and stocks return for each stock as dependent variable. From this we estimate factor sensitivity (factor loading).

Using these factor sensitivities as independent variable and stock average returns as dependent variable, the following regression was run

$$\overline{R}_i = L_\circ + L_1 b_1 + L_2 b_2 + ... + L_K b_K$$

This estimated risk premium L's and tested which factors were priced. The results of this regression are reported in Table-4.

Table-4: Regression Analysis Estimates For The Pre-Specified Factors Approach:- Rotated

Period	Const	Fact 1	Fact 2	Fact 3	Fact 4	Fact 5	Fact 6	Fact 7	Fact 8	Fact 9	R^2-adj
Jan-97–Dec-03	0.0171	0.0423	-0.0725	0.4283	-0.2313	0.1842	0.0316	0.0589	0.0650	0.2164	39.30%
T-value	3.8***	0.31	-0.574	2.38**	-3.7***	0.96	0.24	0.48	0.48	1.61	
Jan-97–Dec-99	0.0177	0.0453	-0.1689	0.1366	0.2598	-0.0186	0.0306	0.0441	-0.0095	-0.0152	48.20%
T-value	5.04***	0.4600	-1.1100	3.9***	2.3300**	-0.1500	0.2300	0.4500	-0.1000	-0.1800	
Jan-00–Dec-03	0.0134	-0.1575	0.1429	-0.0358	-0.2275	0.1082	0.0590	0.1196	0.0389	0.0782	7.40%
T-value	1.7000	-1.4700	0.8300	-0.1900	-1.0000	0.7800	0.2200	0.9600	0.3100	0.3700	

Dependent variable:- average monthly return for security.

Independent variables:- sensitivities of asset returns to changes in macroeconomic factors.

* Significant at 0.10 levels.
** Significant at 0.05 levels.
*** Significant at 0.01 levels.

The results imply that we can find two priced factor in the whole sample period when factor 3 and 4 become priced. The first sample period also shows the same result but this time the only change is the significance level is reversed. We know from the analysis in the preceding step that the third factor is the anticipated and unanticipated inflation and the fourth factor is the stock market index and dividend yield. The second sample period shows no priced factor. As value of the intercept is significant, it is likely that there are other factors which are not included in our study, that affect stock returns and also are priced. Again, quite a high level of instability is found in the results.

V. Conclusions

The results of two different testing methods for the Arbitrage Pricing Theory (APT) are nearly the same because in the whole sample period two priced factors are found. This is an encouraging result, which supports the theory. But the number of priced factors seems to be very low and the results of both approaches indicate substantial instability of the explanatory power of the APT. Explanatory factor analysis approach indicates two factors governing stock return. Pre-specified macro economic approach identifies these two factors as the unanticipated and anticipated inflation, market index and dividend yield. The former factor was also identified by Attaullah (2001). Some evidence of instability is found. In the second subperiod namely January 2000 to December 2003 that is more volatile, the APT based on exploratory factor analysis on stock returns performs relatively well. In the first subperiod extending from January 1997 to December 1999 the APT based on pre-specified macroeconomic variables is supported.

References

Abeysekera, S. P. and Mahajan, A., 1988, A test of the APT using UK stocks, *Journal of Business Finance and Accounting*, 14, 377-391.

Ahmad, E. and Rosser, B.J., 1995, Non-linear speculative bubbles in the Pakistan stock markets *Pakistan Development Review*, 34 (1), 25-41.

Ahmad, E. and Zaman, B.U., 2000, Risk, uncertainty and return at Karachi Stock Exchange, *The Lahore Journal of Economics*, 5(2) 107-126.

Asprm, M., 1989, Stock prices, asset portfolios and macroeconomic variables in ten European countries, *Journal of Banking and Finance*, 13, 589-612.

Attaullah, A., 2001, Macroeconomic variables as common pervasive risk factors and empirical content of the Arbitrage Pricing Theory in Pakistan, *The Lahore Journal of Economics*, 6 (1) 55-77.

Barro, R., 1990, The stock market and investment, *Review of Financial Studies*, 3, 115-31.

Binswanger, M., 2000, Stock returns and real activity: is there still a connection?, *Applied Financial Economics*, 10, 379-387.

Booth et al., 1993, On the Existence of Common Factors in the Arbitrage Pricing Model: Internaltional Evidence From US and Scandinavian Stock Markets, *Applied Financial Economics,* 3.

Campbell, J.Y. and Shiller, R., 1988, The dividend-price ratio and expectations of future dividends and discount factors, *Review of Financial Studies,* 1, 195-228.

Chen, N., 1991, Financial investment opportunities and macroeconomy, *Journal of Finance*, 46, 529-54.

Chen, N., Chan, K. and Hsieh, D., 1985, An exploratory investigation of the firm size effect, *Journal of Business*, 56, 383-403.

Chen, N.F., 1983, Some Empirical Tests of the Theory of Arbitrage Pricing, *Journal of Finance,* Vol XXXVIII, No 5.

Chen, N-F., 1989, Financial investment opportunities and the real economy. Paper presented to the 16th Meeting of the European Finance Association.

Chen, N-F., Roll, R. and Ross, S.A., 1986, Economic forces and the stock market, *Journal of Business*, 59, 383-403.

Copeland, T. E. and Weston, J. F., 1988, Financial theory and corporate policy, Addison-Wesley, Reading, Ma.

Diacogiannis, G. P., 1986, Arbitrage Pricing Model: a critical examination of its empirical applicability for the London Stock Exchange, *Journal of Business Finance and Accounting*, 12, 489-504.

Emerging Stock Market Factbook, 1999, International Finance Corporation, Washington.

Fama, E. F., 1981, Stock returns, real activity, inflation, and money, *American Economic Review,* 71, 545-65.

Fama, E. F., 1990, Stock returns, expected returns, and real activity, *Journal of Finance*, 45, 1089-180.

Fama, E. F. and French, K. R., 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics*, 25, 23-49.

Fama, E. F. and Michad, R. Gibbons, 1982, Infaltion , real returns and capital investment, *Journal of Monetary Economics*, 9, 297-323

Geske, R. and Roll, R., 1983, The fiscal and monetary linkage between stock returns and inflation, *Journal of Finance*, 38, 1-38.

Hussain, F., 2000, The day of the week effect in the Pakistan equity market: An investigation, *The Lahore Journal of Economics*, 5(1), 93-98

Hussain, F. and Uppal, J., 1998, Distribution of stock returns in an emerging market: The Pakistani market, *Pakistan Economic and Social Review,* 36 (1), 47-72.

Kaul, G., 1987, Stock returns and inflation. The role of the monetary sector, *Journal of Financial Economics*, 18, 253-276.

Kaul, G., 1990, Monetary regimes and the relation between stock returns and inflationary expectations, *Journal of Financial and Quantitative* Analysis, 25, 307-321.

Khilji, N. M., 1993, The behaviour of stock return in an emerging market: A case study of Pakistan. *Pakistan Development Review,* 32 (4), 593-604.

Khilji, N. M., 1994, Nonlinear dynamics and chaos: Application to financial market in Pakistan. *Pakistan Development Review,* 33 (4), 1417-1429.

Lintner, J., 1965, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *Rev. Econ. Statistics*, 47(1).

Loflund, 1992, Arbitrage Pricing Theory in a Small Open Economy-Empirical Evidence from the Swedish Stock Market, *Forskningsrapport, Svenska Handelshogskolan, Helsingfors.*

Martikainen, T., Yli-Olli, P. and Gunasekaran, A., 1991, Incremental significance of pre-specified macroeconomic factors in testing the arbitrage pricing theory: empirical evidence with Finnish data, *Applied Financial Economics*, 1, 139-147.

Mishkin, F. S., 1997, The Economics of Money, Banking, and Financial Market, Addison Wesley Longman Inc.

Mossin, J., 1966, Equilibrium in a Capital Asset Market, *Econometrica,* 34,5.

Ostermark, 1989, Arbitrage Pricing Models for Two Scandinavian Stock Markets, *Omega International Journal of Management Science.*

Ram, R. and David E. S., 1983, Stock returns, real activity, inflation, and money: comment, *American Economic Review*, 73, 463-470.

Roll, R. and Ross, S. A., 1980, An empirical investigation of the Arbitrage Pricing Theory, *Journal of Finance*, 35, 1073-1103.

Ross, S. A., 1976, The Arbitrage Pricing Theory of capital asset pricing, *Journal of Economic Theory*, 13, 341-360.

Rozeff, M., 1984, Dividend yields are equity risk premiums, *Journal of Portfolio Managemen*t, 68-75.

Rubio, G., 1988, Further international evidence on asset pricing: the case of Spanish capital market, *Journal of Banking and Finance*, 12, 221-242.

Sharpe, W. F., 1964, Capital Asset Prices: A theory of market equilibrium under conditions of risk, *Journal of Finance 19(5)*.

Shiller, R. J., 1984, Stock prices and social dynamics, *Brookings Papers on Economic Activity*, 2, 457-510.

Stulz,R. M., 1986, Asset pricing and expected inflation, *Journal of Finance*, 41, 209-223.

Wasserfallen, W., 1989, Macroeconomic news and the stock market. Evidence from Europe, *Journal of Banking and Finance*, 13, 613-626.

Yli-Olli, P. and Virtanen, I., 1989, Arbitrage Pricing Theory and its empirical applicability for the Helsinki Stock Exchange, *European Institute for Advanced Studies in Management*, Working Paper 89-07.

Yli-Olli, P., Virtanen I. and Martikainen, T., 1990, Common factors in the Arbitrage Pricing Model in two Scandinavian countries, *OMEGA International Journal of Management Science*, 18, 615-624.

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Note:

Intra-Model Employment Elasticities (A Case Study of Pakistan's Small – Scale Manufacturing Sector)

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Abstract

In the paper we have estimated elasticities of employment with respect to the expansionary factors. According to our finding, in the small scale manufacturing sector size of employment is negatively related with wage elasticity, positively related with capital elasticity and also positively related with value of product elasticity.

Introduction

In Pakistan investment and registration status are used to distinguish the small scale manufacturing sector. The Federal Bureau of Statistics has classified all registered factories as large scale and unregistered establishments as small scale. For administrative purposes the definition of small scale is based on the value of fixed assists, irrespective of its registration status. Industrialized countries define small-scale firms as those employing less than 200-300 workers. In the National Income Accounts, firms employing less than 10 persons are classified small. However, the definition of small scale industry is quite arbitrary and changes from country to country and from time to time.

Small-scale industry is defined as an industry whose firms or farms operate with small-sized plant, low employment, and hence small output capacity. Economies of scale do not normally exist for such firms or farms.

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But they often tend to utilize their limited physical, human, and financial capital more efficiently than many large firms or farms. Whereas a small farmer is defined as a farmer owning a small family-based plot of land on which he grows subsistence crops and perhaps one or two cash crops, relying almost exclusively on family labor.

As the size of an industry is defined on the basis of employment in this paper, we have divided employment elasticities in small-scale industry into two groups. First, employment elasticities in small-scale firms employing 1 to 9 workers, second, employment elasticities in small-scale firms employing 10 to 19 workers, and also we have taken combined employment elasticities in small-scale firms employing 1 to 19 workers.

The paper is organized as follows. Firstly, we have reviewed the available literature about small-scale industries and their employment contribution. Secondly, a discussion about methodology used and data availability and its limitations Thirdly, we discuss the empirical findings, and fourthly, conclusions and policy proposals are drawn.

Review of Literature

Small Scale and Household Manufacturing Industry can contribute to economic development by providing employment creating jobs with low capital costs. In Pakistan, the importance of the small scale manufacturing industry has been given its due recognition. The various five-year plans mention small-scale industry and focus their main attention in the area. For example, to quote from the First Five Year Plan (1955-1960). "Small industries have a specific contribution to economic development. In the first place it can contribute to the output of needed goods without requiring organization of large new enterprises or the use of much foreign exchange to finance the import of new equipment. Second, it can provide opportunities for employment beyond the narrow boundaries of urban centers. Finally, as history shows, it can perform an important function in promoting growth, providing a training ground for management and labor and spreading industrial knowledge over wide areas".

According to Khalid Nadvi (1990), the informal sector consisting of small enterprises and household units appears to be expanding more rapidly than the formal sector and more than the formal sector provides employment to the majority of those engaged in urban manufacturing in Pakistan. Informal sector units are characterized by extremely low levels of

employment and a high incidence of unwaged family workers. As to capital intensity there appears to be a distinct technology hierarchy on the basis of which household units are the most labor intensive and formal sector concerns the most capital intensive. Furthermore, capital intensity is in real terms growing more rapidly in the formal sector leading to a net displacement of labor. As a result labor productivity is substantially greater in the formal sector while capital productivity is inversely related to unit size.

According to Asad Sayeed (1995), the large scale capital goods sector can create the appropriate linkages for the embodiment of technical change in equipment, which can then enhance the productivity of the small sector accordingly. Secondly, because of economies of scale, the large scale sector can contribute towards reducing the cost of intermediate and capital goods for the small scale sector. Thirdly, with large firms subcontracting to the small, productivity enhancement and technical up-gradation is further encouraged through user producer interactions, quality standards, specification requirements etc. Syed Akbar Zaidi (1999) maintains there is no denying the fact that the small -scale sector plays, and is going to play, an increasingly important role in Pakistan's economy.

J.H. Powr (1962), Bhalla, A.S (1973) and J.N. Bhagwati (1978) worked on small industrial enterprises in Bombay, Delhi and Karachi and argued that "the development of small scale industries, on the other hand, is not expected to make inefficient utilization of resources. The small industries have relatively high employment per unit of capital and short term advantage of lower capital output ratio". This implies that maximization of employment opportunities as an objective of industrialization in developing economies can best be achieved by promotion of labor-intensive small-scale enterprises. Semin Anwar (1975) stated "small scale manufacturing sector has a number of output and employment characteristics". Viqar Ahmed and Rashid Amjad (1984) state "Viewed by the expansion in small scale we can create more employment." Malik and Cheema's (1986) study's main conclusion is that small scale provides employment opportunities to a large number of workers, require less technical skills, depend mostly on indigenous resources, and have better linkages with the other sectors of the economy. *Economic Survey* (1986-87, page 97) writes "the small scale industry account for 5.5 per cent of GDP, 30 per cent of value added in manufacturing sector, more than 80 per cent of employment in manufacturing sector and about 18 per cent of

Pakistan's total exports". Mahmood and Sahibzada (1988), found that small scale and Household Manufacturing Industry can contribute to economic development by providing employment with low capital costs. The small-scale industry is extremely labor intensive and its growth can be of help in absorbing the rapidly expanding non-agricultural labor force. Moreover, small scale industry is an efficient user of capital and investment and it adds more to value added than it does large scale industry. Also small scale industry uses domestically produced machinery on the one hand, generates feed-back effects and further strengthens the country's capital goods manufacturing capability and on the other hand, requires little foreign exchange and thus relaxes an important constraint on the country's economic development. Infact, the expansion of small-scale industry probably has a favorable impact on the distribution of income in the country. (The Asian Employment Programme, ILO-ARTEP, January 1983, Employment and structural change in Pakistan. A report for the Pakistan Planning Commission for the Sixth Five Year Plan, 1983-88). The small-scale industry has greater domestic linkages in the form of employment and demand for local machinery, is efficient in the use of capital (scarce resources) and generates an investible surplus (per unit of capital) as large, if not larger, than that generated by large scale capital intensive industry. In brief it is intended to demonstrate that there is a strong case for promoting the growth of small-scale industry. Ghulam Kibriya (1991) has estimated that the whole small industries sector has an investment of over Rs. 20,000 million providing goods and services worth Rs. 40,000 million to Rs. 50,000 million and 1.3 million to 1.5 million jobs. Lyberaki (1988) coded in Hubert Schmit, discussion paper no 261, May 1989, found that some small scale industrialists had successfully embarked on the high tech-high quality route. However the terms on which their workers were employed were as poor as those in enterprises (the majority) who made do with old technology and used cheap inputs. Dawson (1988), coded in Hubert Schmit, discussion paper no 261, May 1989, suggests that the gain of new economic space was outpaced by the flood of entrants. They were young people who completed their apprenticeship, who could not find suitable wage employment and hence set up their own workshops. K.B.Suri (1989) concluded that small scale industry plays a vital development role by spreading industry in the underdeveloped areas, by encouraging entrepreneurship and providing employment. Gharless Brown, James Hamiltion, and James Modoff (1991) argue that small firms do not generate the vast majority of jobs. But they produce a majority of new jobs.

Methodology and Data

We have formulated a model to study the employment elasticities (in the small scale sector) with respect to average wage, capital labor ratio and value of product. For this purpose, we have constructed a model that includes the following variables and their logarithmic variables are as follows:

$$\text{Log (DL)} = f\,[\text{Log (W)}, \text{Log (K)}, \text{Log (O)}]$$

Where: DL = Average daily person engaged, W = Average wage, K = Capital labor ratio, O = Value of product.

To estimate the elasticities of employment with respect to different employment groups, we have divided small-scale employment size into two groups (1) employment elasticities in 1 to 9 workers employed in small-scale (2) employment elasticities in 10 to 19 workers employed in small-scale. For employment elasticities in employment generating (1 to 9 workers) small scale industries we have used the following model.

$$\text{Log (DLa)} = f\,[\text{Log (Wa)}, \text{Log (Ka)}, \text{Log (Oa)}] \quad (1)$$

Where: Dla = Average daily person engaged in (1 to 9), Wa = Average wage in (1 to 9)

Ka = Capital labor ratio in (1 to 9), Oa = Value of product in (1 to 9),

Log (DLa) = L_{11}, Log (Wa) = L_{12}, Log (Ka) = L_{13}, Log (Oa) = L_{14}

For employment elasticities in high employment generating (10 to 19 workers employed) small scale, we have used the following model.

$$\text{Log (DLb)} = f\,[\text{Log (Wb)}, \text{Log (Kb)}, \text{Log (Ob)}] \quad (2)$$

$$L_{21} = f\,[L_{22}, L_{23}, L_{24}]$$

Where: DLb = Average daily person engaged in (10 to 19), Wb = Average wage in (10 to 19)

Kb = Capital labor ratio in (10 to 19), Ob = Value of product in (10 to 19),

Log (Db) = L_{21}, Log (Wb) = L_{22}, Log (Kb) = L_{23}, Log (Ob) = L_{24}

The combined elasticities model of both groups (elasticities in low employment generating small scale and elasticities in high employment generating small scale) is as follows.

$$\text{Log (DL2)} = f\,[\text{Log (W2)}, \text{Log (K2)}, \text{Log (O2)}] \qquad (3)$$

$$L_{31} = f\,[L_{32}, L_{33}, L_{34}]$$

Where: L_{31} = Log (DL2) = Log (DLa + DLb)/2

L_{32} = Log (W2) = Log (Wa + Wb)/2

L_{33} = Log (K2) = Log (Ka + Kb)/2

L_{34} = Log (O2) = Log (Oa + Ob)/2

To estimate the model, data were taken from the Census of Manufacturing Industries (CMI, 1986) and it covers the industries listed at the endfooter. In this paper we have estimated employment opportunities by expansion in the small-scale sector in Pakistan on the basis of their elasticities for the period 1976 to 1986. We had to depend on the date of 1976 because the last four years data were not available in the Census of Manufacturing Industries. We have 275 observations, while the remaining industries data were not available. We have divided each industry into two groups [low employment generating group (employing 1 to 9 workers) and high employment generating group (employing 10 to 19 workers)]. Data were collected on the variables such as value of product "the yearly production multiplied by price", average wages obtained by dividing, "labor cost divided by average daily persons engaged", capital labor ratio i.e "total fixed assets divided by average daily person engaged". Data on two variables, government policy about small scale sector and capacity utilization in small scale sector were not available in the census, so we have dropped these two variables from the model. By the use of the data at hand, we are able to explain how the average daily person engaged is affected by per cent changes in one of the above explanatory variables.

Findings

In this paper we have analyzed elasticities of employment in Pakistan's small scale manufacturing sector. The model formulated in the methodology section was applied to Pakistan's small scale manufacturing sector data. By using three identical models [employing (1 to 9), (10 to 19), and (1 to 19) workers], the empirical results are as follows.

Table-1: Comparison Intra-Model Elasticities

Identical models	Wage elasticity	Capital ratio elasticity	Value of Product elasticity
First model (1 to 9)	-0.47	-0.24	0.66
Second model (10 to 19)	-0.37	-0.29	0.69
Third model (1 to 19)	-0.42	-0.43	0.72

The results are interesting and provide the elasticities of employment with respect to wages, capital labor ratio and value of output. The results are in line with other studies carried out in this area. For the analysis, we have applied an identical model for both employment groups and computed their elasticities, which are shown in Table-1. With the help of the computed table's results a comparison has been made between the elasticity of employment with respect to wages in both groups and also in the combined group. The elasticities of employment with respect to capital labor ratio in both groups, and also in the combined group, and elasticity of employment with respect to value of output in both groups, and also in the combined group have been calculated.

In the low employment generating group (employing 1 to 9 workers) wage elasticity is more negative than the high employment generating small-scale group [employing 10 to 19 workers]. This indicates that when employment size increases wage sensitivity decreases and value of output sensitivity also increases. In the combined models, the elasticities of employment with respect to wage is less than the elasticity of employment with respect to the capital labor ratio and elasticity of employment with respect to value of output, respectively. From these results it appears that in the small scale-manufacturing sector, size of employment is negatively related to wages, positively related with capital labor ratio and value of product. In these three identical models, elasticity

of employment with respect to output is greater than the other two elasticities (elasticities of employment with respect to wage and capital labor ratio). Value of product is expanded by two factors i.e. output and price of output. In our paper we have taken data of value of product and we have supposed that output price within a year is constant. The literature discussed earlier supports our view by the three identical models explained by us.

The above results point to certain subsequent facts when there is an increase in the wage of labor. The average number of daily persons engaged declines with the rate of elasticities. From the theory we are aware that labor wages are inversely related with the firm's profits and any increase in wages, consequently demand for labor will decline. Further, the rate of elasticity varies with the size of employment of a unit. If unit size is larger (10 to 19 or 1 to 19) elasticity is less affected as compared to smaller unit (1 to 9). Employment elasticity with respect to the capital labor ratio also shows a negative relation with labor demand. If there is an increase in capital only in the units and not increase in labor in the units, its relation shows a decline in labor demand. When we compare smaller and larger units, it shows more decline in larger units as compared to smaller units. This also implies that marginal product of capital is more than marginal product of labor, which indicates that in the production process more capital is being combined as compared to labor. Employment elasticity with respect to value of product is positively related with labor demand, and shows that with an increase in value of product, labor demand also increases. This increase is higher in larger units as compared to smaller units. This result also shows that for one rupee increase in value of output (an increase in firm output or its price) 0.69% goes to labor demand.

Table-2: Employment and Labor Productivity Growth in Small-scale and Large-scale Industries.

	Industry Sector	
	Large-scale	**Small-scale**
Employment Growth		
1971/ 72 to 1978/ 79	0.7	6.1
1978/ 79 to 1986/ 87	0.0	2.4
Employment Elasticity		

1971/ 72 to 1978/ 1979	0.21	0.80
1978/ 79 to 1986/ 87	0.00	0.28
Labor Productivity		
1971/ 72 to 1978/ 79	2.6	1.0
1978/ 79 to 1986/ 87	10.4	5.9

Sources: Hyder (1994), Workforce Situation Report 1993 (1995) and *Statistical Yearbook* 1994.

The employment patterns of the industrial sector (Small-scale and large-scale industries) can be judged through the employment growth in both industries, employment elasticities in both industries and labor productivity in both industries.

The employment elasticity measures the relationship between employment (or quantity of labor) and output of a specific sector or economy and labor productivity explains the relationship between quality of labor and output. Labor productivity reflects the effects of improved education, higher technical knowledge, and technological advancement etc. in both labor forces. From Table-2 we are clear that employment growth and employment elasticities are both comparatively high in small-scale industries, while labor productivity is nearly double in large-scale as compared to small-scale industries. In this paper our concern is to compare employment elasticities in both industries, as the values of elasticities indicate that employment elasticities in the small-scale sector were higher during 1971/ 72 to 1978/ 79 and 1978/ 79 to 1986/ 87. From the literature about small-scale and large-scale employment elasticities, we are well aware that small-scale industries are labor intensive as compared to large-scale industries, because in the small-scale less capital is combined with more labor in the production process, while comparatively in large scale industries capital intensive techniques are used for production because usually the capital labor ratio in large-scale is higher.

One reason for this difference is that small-scale industries are located in rural areas, while large-scale are located in urban areas, and in the rural areas there is a large part of the labor force as compared to urban areas. Another reason is that small-scale use skilled and unskilled labor, while large scale industries prefer to utilize skilled labor because skilled labor is more efficient (as productivity differences in Table-2). Small-scale

use old and traditional technology with more labor intensive techniques, while large-scale use modern and latest technology where less labor is needed in the production process.

Regarding the WTO agreement, small-scale must develop in line with large-scale industries. However in the earlier literature we have the following argument regarding small-scale and large-scale. The small-scale industries based on domestic traditional technology using labor intensive techniques provide more jobs with much less investment. Large-scale industries are highly capital intensive requiring huge investment but providing relatively less jobs. Capital intensities are substantially lower in small-scale industries as compared with large scale industries and as such, much greater employment can be generated with the same investible resources. Small-scale manufactures tend to have strong backward linkages to domestic agriculture and are least dependent on imported raw-materials and equipment. Large-scale industries find it extremely difficult to operate close to their optimal capacities because of limitations of the domestic market and lack of indigenous technological capability to maintain and run the units, while small-scale industry is not affected by similar demand and technological constraints.

Conclusion and Policy Proposals

- The results are interesting and provide the elasticities of employment with respect to wages, capital labor ratio and value of output.

- The results are in line with other studies carried out on this issue (1994).

- If labor becomes expensive, consequently less labor will be combined in the production processes.

- More use of capital intensive technology will reduce labor demand and if quantity of both (capital and labor) increases proportionately that will remain as a positive impact on employment.

- Output and its value are very effective employment generating factors. The increase is higher in larger units as compared to smaller units. The result shows that one rupee increase in value of product (output or price) leads to 0.69 percent going to labor demand.

For policy making if we want an expansion in small-scale manufacturing sector, we must concentrate on these three factors for expansion purposes: wages of labor, capital labor ratio of production process and value of product but at the same time as the employment elasticity with respect to value of product is greater than the other two elasticities. As such employment elasticity with respect to value of product is a more convenient factor for expansionary purposes i.e. with price incentive we could encourage the producer to produce more in the short-run, which becomes a source of labor demand in the long-run. With this perception new small-scale units may be planned.

There will be a question that the consumer is affected by this measure (if the government increases the prices of output so, through price incentive, more investment takes place and in the production process more labor is combined). On the other hand the consumer is paying higher prices, so the government has the option of complementing or supplementing policy to compensate the consumer and producer also. Employment elasticity which is much higher suggests that 1 rupee value increase in production or its price, the firm allocates 72% of this revenue for demanding more of labor. The supply of labor is also highly dependent on wages and this is also proved with the results. An increase in wages may increase saving if the sector of the economy is not at the subsistence level, savings increase capital that increase investment and labor's share as an input in the process. Therefore, employment increases. Regarding the WTO agreement, the small-scale sector must be within the framework of large-scale industries planning for the development of Pakistan.

Endfooter

Group of Industries

1) Food Manufacturing, Beverage Industries and Tobacco Manufacture.
2) Manufacture of Textiles.
3) Manufacturer of Footwear (except rubber footwear).
4) Manufacture of Leather & Leather Products (except footwear).
5) Ginning, Pressing & Baling of Fiber.
6) Manufacture of Wood & Cork Products (except Furniture).
7) Manufacture of Furniture and Fixtures (except primarily metals).
8) Manufacture of Paper and Paper Products.
9) Printing, Publishing & Applied Industries.
10) Manufacture of Drugs & Pharmaceuticals.
11) Manufacture of Industrial Chemicals.
12) Manufacture of other Chemical Products.
13) Manufacture of Rubber Products.
14) Manufacture of Plastic Products NEC.
15) Manufacture of Pottery China & Earthen Ware.
16) Manufacture of Glass Products.
17) Manufacture of other Non-Metallic Mineral Products.
18) Iron & Steel Basic Industries.
19) Non-Ferrous Metal Basic Industries.
20) Manufacture of Fabricated Metal Products (except machinery & equipment).
21) Manufacture of Machinery except electrical.
22) Manufacture of Electrical Machinery Apparatus, Appliances & Supplies.
23) Manufacture of Transport Equipment.

24) Manufacture of Scientific Precision & Measuring Instruments & equipment.

25) Other Manufacturing Industries.

References

Ahmad Viqar and Rashid Amjad, 1984, The Management of Pakistan Economy (1947-1982) Oxford University Press, Karachi, New York, Delhi.

Akhtar.S.M., 1983, Economic Development of Pakistan, Publishers United Ltd, Lahore, Pakistan.

Aslam Muhammad, 1991, Development Planning in Pakistan, Bilal Books Lahore. Pakistan.

Government of Pakistan, *Pakistan Economic Survey* Various issues.

Government of Pakistan, 1987, Survey of Small and Household Manufacturing Industries, Federal Bureau of Statistics.

Hashmi Badr, 1976, Essay on the Economy of Pakistan, Published by Raza Mehdi, Fisco Progressive Publishers Press, Lahore, Pakistan

Kemal, A.R., 1999, Patterns and Growth of Pakistan Industrial Sector, in Fifty Years of Pakistan's Economy.

Mehmood, Mir Annice and Shamim A. Sahibzada, 1988, The Economic rate of return in small scale and household manufacturing industries, *The Pakistan Development Review*, Vol. XXXII. No.4.

Nadvi, Khalid, 1990, Employment Creation in Urban Micro-Enterprises in manufacturing in Pakistan, ILO/ARTEP, Bangkok.

Pakistan Federal Bureau of Statistics, 1982, Surveys of Small and Household Manufacturing Industries, 1976-77, Karachi, Pakistan.

Pasha, Hafiz. A and Zafar.H. Ismail, 1989, Determinants of Success of Industrial Estate in Pakistan, Discussion Paper No. 103, AERC, Karachi, Pakistan.

Pasha, Hafiz. A and Zafar H. Ismail, 1988, Determinants of success of Industrial Estate in Pakistan, PESR, 26 No. 1, Pakistan.

Pakistan Planning Commissions, first seven Five Year Plans.

Qureshi, M.L., 1984, Planning and Development in Pakistan, Vanguard Books Ltd, Lahore, Pakistan.

Sahibazada, Shamim, A and Mir Annice Mahmood, 1986, Social rate of return in Pakistan's large scale manufacturing sector, *Pakistan Development Review*, Vol. XXV. No. 4, Pakistan.

Sayeed, Asad, 1995, "Political Alignments, the State of Industrial Policy in Pakistan: A comparison of performance in the 1960s and 1980s, unpublished Ph. D. Thesis, University of Cambridge 1995.

Sandesara, J.C., 1984, Efficiency of investments of small scale industries, Industrial Development Bank of India, Bombay, India.

The Asian Employment Programme ILO-ARTEP, January, 1983, Employment and Structural Change in Pakistan, Issues for the Eighties, A Report for the Pakistan Planning Commission for the Sixth Five Year Plan, (1983-88).

Zaidi, Syed Akbar, 1999, Issues in Pakistan's Economy, Oxford University Press, Karachi.

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Book Review

Shahrukh Rafi Khan, *Pakistan Under Musharraf (1999-2002): Economic Reform and Political Change*, Vanguard Books, Lahore. Pages 178. Price: Pak Rs. 495/-.

Dedicated to Omar Asghar Khan, this book can be seen as a continuation of the author's previous *Reforming Pakistan's Political Economy*, published by Vanguard in 1999. Using findings from research done by the Sustainable Development Policy Institute (SDPI), when the author was its Executive Director, Shahrukh Rafi Khan takes us through the political and economic reforms undertaken by the present military government.

The book is then divided into eight sections: the first, which the author calls "the mother of all reforms", addresses the issue of agrarian (and land) reforms; the second deals with the first, most important and most talked about reform undertaken by the military government – devolution of power; the third, fourth and fifth sections have in common the concept of participatory rural development in education (and more importantly in primary rural education), in activating and formalizing social capital, and in sustainable development and the environment; the following section links up nicely with the previous, with trade and environment and the country's role in WTO negotiations; the structural adjustment reform policies, both before and after the military takeover, and the latter's experience with structural adjustment and privatization are covered in section seven; and finally the last section deals with other reforms including Islamic finance, NGO registration, child labor, and the need for peace in the India-Kashmir-Pak nexus.

By starting with land, and more importantly, agrarian reforms, the author sets the stage for what are considered the imperative reforms to be done in the country, which unfortunately, the military government is not keen on pursuing. The data presented in this section, along with the author's analysis, make us see that without a concerted effort by the State to enact such reforms, other reforms (including devolution of power) will

have limited or no impact in eradicating poverty and improving the well-being of all Pakistani citizens, particularly the rural poor.

In *Devolution of Power*, Shahrukh Rafi Khan explains how the present reform was created and what are its major flaws. Within this section, readers can find SDPI adapted briefings and research on a possible working model for devolution, the lack of devolution of power to the grassroots level, the (negative) effect of landed power and *baraderi* in local government elections, power dynamics in smaller land holding constituencies, using theatre as a tool to get feedback and suggestions on the reforms at the grassroots level, and law and order within the context of power devolution. Two other interesting essays appear in this section: one on the costs of the devolution plan; and the other related to electoral reforms in the devolution context.

Participatory Rural Development is the constant theme in sections three (Education), four (Social Capital), and five (Environment and Sustainable Development). The concept is that without a serious effort by both the State and local population to involve the latter not only during the implementation of programmes, but also in decision-making and evaluation, sustainable rural development will not happen in the country. The state of education in Pakistan is, to say the least, abysmal. Taking into consideration that it is worse in rural areas (where the majority of the population and the majority of poor people live) and at the primary level, the author focuses on rural primary education, presenting a proposed educational action plan using several tools supposedly in place due to the devolution plan (e.g., parent teacher associations and school management committees), and showing the results of a comparative study of government, NGO and private sector rural primary schools. The following section deals in particular with the formalization of social capital, the early success of the Human Development Foundation (HDF) and obstacles to social mobilization. Finally, the section on environment and sustainable development looks into the State of Environment Report that the Ministry of Environment should produce annually, an analysis of the second budget of the military government and their seriousness towards this topic, a case study of the Kirthar National Park, and a final essay on the author's vision of sustainable development.

Trade and Environment is one of SDPI's core themes and section six shows us some of the research done related to Pakistan's stance in WTO-related issues and the link between trade and the environment.

Structural Adjustment shows how the military government is willing to deal with what some people call the "macroeconomic" issues of the country, which the author correctly identifies as a free-market ideology and in keeping with IMF/World Bank reforms, which will just make the rich richer, and the poor poorer (do keep in mind that the Finance Minister's approach towards developing Pakistan is the infamous and erroneous "trickle-down approach). The final section deals with other reforms that should be undertaken, but as we all know, are still lagging, i.e., Islamic financing, regularization of NGOs, child labor, and peace with India.

Shahrukh Rafi Khan's breakdown of the military government's first four years is definitely brilliant. One of the interesting aspects of *Pakistan Under Musharraf* is its excellent quality of qualitative data and very good analytical work done by the author. Together with a well-written and easy-to-read text, it makes this book readable not only as an academic work, but also as bedside reading.

This book is definitely a must read for undergraduate and post-graduate students interested in political economy, academics, journalists, individuals working in both PIOs (Public Interest Organizations) and government agencies, donor agencies, Pakistani citizens, and members of the present military government.

Lahore University of Management Sciences **Miguel Loureiro**
Lahore

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