

# Trends of Rural Poverty and Total Factor Productivity Growth in Pakistan's Agriculture: A Time Series Analysis

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## ABSTRACT

The agrarian bonanza of Pakistan is witness to rapid growth since the dawn of Green Revolution. The average annual growth of about 4% over the last half a century has been above the average population growth rate of about 2.8%. Since agriculture is facing a substantial challenge in 21<sup>st</sup> century in terms of food security and survival in the globalized world under WTO scenario, maintaining this optimal performance is vital for food and raw material demand of the rapidly growing population and for alleviating poverty among the rural masses. In the present research endeavor, we have undertaken a trend analysis of Total Factor Productivity (TFP) for the agriculture sector from 1960 to 2002 by employing indexing procedure. The results so obtained were tallied with the trends of poverty in rural areas of Pakistan. Medium and long term TFP elasticity of poverty was estimated for the whole time series. We have seen that TFP in Pakistan's agriculture grew at a substantial rate during 1960 to 2002. But such a high growth rate in TFP could not trickle down to the poor. The productivity gains in 1980's and 1990's are comparably much lower but poverty decreases in the former case, while increases in the later case. Even a good proportion of TFP growth could not be translated to the poor in the event of inequality among the masses.

**Key words:** Rural poverty; Productivity growth

## INTRODUCTION

Agriculture is the jugular vein of the economy of Pakistan. It has experienced robust economic growth since the dawn of Green Revolution. Generally periods of flourishing agriculture have been associated with prompt overall economic performance and visa-versa (World Bank, 1992). The average annual economic growth rate of about 4% during the last few decades has been above the mean population growth rate (GOP, 2002). Agriculture growth has made significant contribution to the overall economic growth during this period. The sustainable rate of growth in agriculture sector owes a great extent to technological progress along with public investment in irrigation, agriculture research and extension. Some statistics reveal that the real benefit of such a growth could not be translated to the poor particularly in 1990s. The failure of agriculture growth in trickling down the poor is generally visualized in the background of income inequality during the same growth period. The empirical diagnostic of this generalization is difficult to find in the body of development literature - particularly in Pakistan's scenario.

Pakistan has witnessed over the last three decades periods of high economic growth, as in 1960s, along with increasing poverty levels, periods of low economic growth in 1970s accompanied by reduction in poverty levels, periods of high economic growth leading to decline in poverty in the 1980s and periods of low economic growth with high extent of poverty as in the 1990s. The growth rate declined from 6.1% during the 1980s to 4.2% during the 1990s (Amjad, 2004).

Since agriculture is facing a considerable challenge in 21<sup>st</sup> century in terms of food security and survival in the

globalized world under WTO scenario, maintaining this performance is vital for food and raw material demanded by the growing population and for alleviating poverty among the rural masses. The demand for food in the country is likely to grow rapidly given the low intensity of per capita income. Without an appropriate policy response to this scenario, the quantum of imports of essential food items is likely to inflict a serious burden on foreign exchange earnings of the country. Productivity growth in agriculture sector assumes a central role in meeting the challenges of the future particularly when there are bleak chances of expansion of cultivated land. Amidst limitations in expansion of cultivated area, a great deal of future agriculture productivity has to be generated from increased farm productivity (Zaidi, 1999). There is a two pronged challenge in the agrarian economy of the country; one stands for growing and sustaining the level of TFP, while other stresses the need for estimating trickled down impact of this TFP growth.

In this context, this paper quantifies the growth trends in TFP in Pakistan over the last 42 years from 1960 - 61 and 2001 - 02. This leads to the conclusion that a significant part of the rise and fall in growth rate during the last four decades is highly attributed to the high and low momentum of the growth in TFP in agriculture. In the present research endeavor, we have estimated Total Factor Productivity (TFP) for the agriculture sector from 1960 to 2002 by employing arithmetic technique. Ours is the opening study in Pakistan that has estimated TFP growth and analyzed how such a growth in TFP ultimately trickles down to the poor.

The paper is organized as follows: Section 2 presents a review of literature on the elements of TFP and rural

poverty. Section 3 develops a methodological framework of methods and procedures for the estimation of TFP. Section 4 highlights the results and confers implication in the agrarian economy of Pakistan. Finally, in Section 5 are presented the concluding remarks.

## METHODS AND PROCEDURES

Productivity measurement in agriculture is generally manipulated by employing indexing procedure. A partial productivity index is of high advantage when there is a single limiting factor of production the supply of which is relatively elastic. But an index developed on the basis of single factor productivity is considered weak for the contribution of other factors of production that does not come in the purview of final estimation. It is therefore replaced with the more comprehensive Total Factor Productivity (TFP) indices, which are extensively used in the realm of agriculture and productivity studies.

There are various approaches to measure the TFP but the simplest one is the computation of indices of total output and factor inputs. The most common practice is the use of arithmetic indices to compute the input and output aggregates. For this purpose both Laspeyres index (on the basis of base - year weights) and Paasche index (taking last-year weights) are used. Sometimes geometric indices are used for the same purpose. There are some advanced indices of TFP measurement but for the present study arithmetic approach was employed so as to compare the estimated indices with that of poverty indices. Moreover, when the objective is to explore the growth trend of productivity and its subsequent tricking-down impact on the farming community, simplest indexing approach is considered appropriate for all means and purposes.

**Arithmetic index.** It is the ratio of the total output index to total input index. This simplest index can easily be derived, given a homogenous production function of linear nature and of purely competitive labor markets. There are some theoretical restrictions affixed to this index nevertheless it is not as difficult to estimate as others'. The formulaic expression of TFP Index can be stated as:

$$TFPI = \frac{100 * (GVAO \text{ Index})}{\alpha + \beta + \delta + \emptyset}$$

GVAO: Gross Value of Agricultural Output

$\alpha$ : Land Index

$\beta$ : Capital Index

$\delta$ : Labor Index

$\emptyset$ : Material Index

$\alpha$ ,  $\beta$ ,  $\delta$ , and  $\emptyset$  expressions show proportionate contribution of each factor input in total input cost in the base year.

**TFP elasticity of poverty.** Time series estimates given by Federal Bureau of Statistics (FBS, 2002) and (Ali & Tahir, 1999) have been taken as reference statistics for estimating TFP elasticity of poverty in the rural sector of the economy.

Arc measurement of elasticity is the ratio of proportionate change in rural poverty to proportionate change in TFP in agriculture. It has been used to estimate the proportion of increase or decrease in rural poverty due to some percentage change in TFP both for the short run and long run period of time.

## RESULTS AND DISCUSSION

In this study, the TFP index was computed by employing arithmetic approach with a gross output index that includes both crops and livestock products and the aggregate input index that includes purchased inputs like fertilizers and pesticides for the period 1960 - 2002. The input index was developed on the basis of land, labor, capital and material inputs. The output and input indices were set at 100 for the year 1960 - 61. Using the simplest indexing procedure, the estimated values of TFP indices were computed as shown in Table I. The estimated annual growth rates of agricultural GDP (GVAO) and arithmetic TFP were given in Table I.

There is highest growth rate of TFP in the early Green revolution period and the lowest in the first half of 1970s. The estimated TFP growth rates (Table I) for the period under consideration clearly indicate a strong performance in the second half of the 1960s. This corresponds with the dawn of the Green revolution as the hybrid varieties of rice and wheat were introduced in Pakistan. During the period between 1960 - 65 the coefficient of elasticity of poverty was found to be positive, which reflected that with one % increase in the growth of TFP, there was rise in poverty by 0.1%. It shows that an excellent growth in TFP could not be translated to the poor. Poverty situation worsened in the last half of 1960s even when the average growth in TFP was 9.5%.

Growth in productivity was shattered in the first half of 1970s as a result of experimentation in political institutions, drought conditions, heavy rains and accompanying floods in 1973 - 74. There was a recovery, though slow, in productivity growth in the late 1970s and the early 1980s, with the exception of a brief downturn in 1983 - 84 largely due to adverse weather. The first half of 1980s and last half of 1970s were unique in the sense that poverty was substantially reduced. For the same period, one % increase in TFP led to 0.808 and 0.56% decrease in poverty in rural areas thereby has a fine trickle down impact on the poor (Table II).

During the Eighth Plan period (1992 - 93 to 1997 - 98), TFP appears to have demonstrated brilliant results in the agricultural sector. In the same period the coefficient of elasticity was found to be - 1.006 thereby increase in TFP led to fall in rural poverty. The productivity gains in 1980's and 1990's are comparably much lower (Khan, 1994) but early years of 21<sup>st</sup> century revealed a sustained growth in TFP. But even in this period the TFP growth is not being translated to the poor (Table II).

There has been limited research on trends in TFP in

**Table I. Growth Trends (%) in TFP Arithmetic Index, 1960-2002**

YEAR	GVAO	TFP
1960-65	7.78	5.2
1966-70	11.42	9.5
1971-75	3.20	2.5
1976-80	3.39	3.3
1981-85	5.40	4.9
1986-90	6.97	3.5
1991-95	4.90	2.5
1996-2001	6.18	4.8
2001-02	6.88	5.5
1960-2002	6.23	4.6

**Table II. TFP Elasticity of Poverty in Pakistan**

YEAR	Average Rural Poverty (Head Count Ratio)	Coefficient of Elasticity of Poverty
1960-65	40.2	0.094
1966-70	46.5	0.248
1971-75	38.4	0.163
1976-80	30.7	-0.808
1981-85	24.6	-0.565
1985-90	22.1	0.321
1991-95	31.0	-1.006
1996-2000	32.7	0.085
2001-02	37.8	1.064
1960-2002	33.8	0.002

Pakistan. Wizarat (1982) showed that for the period, 1955 - 56 to 1980 - 81, TFP contributed only 7% to growth of the large-scale manufacturing sector, despite the fact that the sector grew rapidly during this period. Beyond this, there is no published research on what happened to TFP during the decade of the 80s and 90s. Shujat (2000) used two approaches to measure TFP. The estimates show that TFP has grown at an average annual rate of 2.3% for the entire period with 58% of the total output growth attributable to productivity. Since 1985, TFP growth has been sustained at an average annual rate of 2.4%. In the second approach, he used a Cobb Douglas production function for the agriculture sector. Mixed estimation was used with prior information on input coefficients incorporated in the estimation procedure as linear stochastic restrictions. The estimated rate of growth of neutral technological growth was reasonably close to the productivity growth rate estimated with the first approach. Ravallion and Chen (1997) estimated on average, on a sample of developing countries, the growth elasticity of poverty, as measured by the number of individuals below the conventional \$ 1-a-day threshold, was around 3 namely - a 1% increase in mean income or consumption expenditures in the population reduces the proportion of people living below the poverty line by 3%.

We have found that TFP in Pakistan's agriculture grew at the rate of 4.66% during 1960 to 2002, while the coefficient of elasticity was only 0.002, which is the clear indication of the fact that even this high level of TFP could not be translated to the poor most likely due to the high level of inequality among the poor masses in the rural areas. Elasticity of poverty with reference to TFP depicted partial analysis because non-farming sector plays a pivotal role in the ups and downs of poverty statistics in the rural areas. It can be examined that abundant growth rates of TFP in conjunction with adequate employment in non-farming

sector contribute substantially in mitigating poverty in the rural areas. It is observed that if coefficient of elasticity of poverty is reasonably high, poverty reduction strategies almost exclusively relying on high TFP growth are justifiable. But the findings of this research work reflect that ambitious poverty reduction strategies might have to combine both TFP growth and some kind of redistribution.

## CONCLUSION

In the present research endeavor, we have undertaken a trend analysis of Total Factor Productivity (TFP) for the agriculture sector from 1960 to 2002 by employing indexing procedure. The results so obtained were tallied with the trends of poverty in rural areas of Pakistan. We have seen that TFP in Pakistan's agriculture grew at an annual rate of 2.5% during 1960 to 2002. But such a high growth rate could not trickle down to the poor. The productivity gains in 1980's and 1990's are comparably much lower but poverty decreases in the former case, while increases in the later case. In the late 70s and early 80s the coefficient of elasticity of poverty in terms of TFP was found to be negative reflecting translating of growth in TFP to the poor. A good TFP growth could not be transformed to the poor in the years when the incidence of income inequality among the masses was high. Early years of 21<sup>st</sup> century revealed a sustained growth in TFP in the agriculture sector accompanied by a little decrease in rural poverty. It is suggested that ambitious poverty reduction strategies might have to combine both TFP growth and some kind of redistribution.

## REFERENCES

- Amjad, R., 2004. Solving Pakistan's Poverty Puzzle: Who should we believe? What should we do?, *PIDE, 19<sup>th</sup> Annual Conference*, 13<sup>th</sup> - 15<sup>th</sup> January, Islamabad
- GOP, 2002. *Economic Survey 2002-03*, Finance Division, Economic Advisor's Wing, Government of Pakistan, Islamabad
- Khan, M.H., 1994. "Structural Adjustment Process and Agricultural Change in Pakistan in the 1980s and 1990s." *The Pakistan Development Review*, 33 Part I: 533-91
- Ravallion, M. and S. Chen, 1997. What can new survey data tell us about recent changes in distribution and poverty. *The World Bank Economic Review*, 11: 357-82
- Shujat, A., 2000. Productivity Growth in Pakistan's Agriculture 1960 - 2000, *Ph.D. Dissertation*, Department of Economics, Simon Fraser University, Canada
- Thirtle, C. and P. Bottonley, 1992. "Total Factor Productivity in U.K. Agriculture, 1967 - 90". *J. of Agric. Econ.* 43: 381-400
- Wizarat, S., 1982. "The Nature of Technological change and Aggregate Production Function in Pakistan's Agriculture." *PIDE Report No. 137*. Islamabad. Pakistan Institute of Development Economics
- World Bank, 1992. *World Development Report 1992*. Oxford University Press, New York
- Zaidi, S.A., 1999. *Issues in Pakistan's Economy*, Oxford University Press, Karachi

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