Primary Education Expansion, Income Inequality and Poverty Reduction

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Acknowledgment

"All praise to Almighty Allah, the Most Merciful, and And Most Gracious"

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ABSTRACT

Purpose

Economic and social development placed universal primary education and education for all at the heart of development strategies. The returns to education approach somehow widely shows the education effects on individual income. However population wide effects to expansion of primary education are still to be studied empirically to justify for primary education expansion. The very specific objective of the study was to identify and assess the relationship between primary education expansion and poverty of income reduction at micro and macro levels by building scenarios similar to Millennium Development Goals.

Design/methodology/approach

For measuring the effect of primary education expansion alone and controlling economic and social factors, an experiment is designed based on the Mincer Wage Function as used by Grimm (2003). Punjab province individual level and house hold datasets from PIHS 2001-2002 and PSLM 2004-2005 are used to test for pre-reforms and post reforms differences.

Findings

The experiment results show direct effects of primary education on income poverty reduction at earning member levels, at household levels and at per capita levels. The income distributions in the two years have variable effects at income ranges however income distributions at different percentiles of population are affected positively by primary education expansion. The experiment results show that as primary education expands, the income levels increase within income quintiles and the income inequality reduces in 2001-2002 cases. It is also observed that higher the changes in population schooling levels, higher will be the changes in income inequalities and poverty profiles. The results suggest primary education programs to be targeted at low income groups in agriculture sector specifically.

Originality/value
The full academic paper is an output resulting from a detailed research being conducted by the author as part of Master of Sciences in Management from Comsats Institute of Information Technology. The original research was supervised and guided by Dr. Qaiser Abbas. The research builds empirical evidence for implication and applicability of international development agendas. It also provides evidence based grounds for policy making as well as future researches of inferential nature.

INTRODUCTION

Background

"Poverty is an ethical concept, not a statistical one. Inherent in the term "poverty", when applied to human beings, is the notion of a life situation that should not exist. It is not only lack of roti, kapra aur makan—food, cloth and shelter. Amartya Sen aptly sums up many dimensions of poverty as lack of "capability"—capability to overcome violence, hunger, ignorance, illness, physical hardship, injustice and voiceless ness. The World Bank has argued that poverty often lies in the absence of opportunity, empowerment and security, and not just the absence of food on the table."

Poverty in Pakistan
John Wall; CD World Bank Pakistan
The News-Monday, July 10, 2006

There had been a range of efforts in the world to reduce poverty at various levels and the determinants of poverty and the vicious cycle of poverty. The most recent and worldwide endorsed are the Millennium Development Goals[i] (MDGs); which provide a vast and diverse but specific framework for poverty reduction. The MDGs provide a holistic approach of poverty reduction with each key sector and aspect addressed through specific targets within each goal. A key characteristic of the MDGs is the specific inclusion and stress on socially excluded and the vulnerable groups i.e. gender disparities and slum dwellers. Such an approach enables societal and economical mainstreaming for all levels of population characters poor or rich, young or old, men or women. Another key feature of these Goals and the respective targets is the interdependence of actual results. Put simply, if state is

progressing in achievement of one gaol and ignores the other, that the progress is temporary and not sustainable; thus an environment for poverty perpetuation have much more chances of existence.

Literature and research reveal that Poverty has been long practically approached on a uni-dimensional income approach. However researches had been working to unrevealing the multidimensional nature of Poverty.

Poverty definition varies between regions, time, context and the evaluation purpose. And thus it's difficult to identify a universally accepted definition of poverty[ii]. Consensus is emerging as to understand poverty be a violation of human dignity[iii] (Amartya Sen; 1999) which is a result of deprivation of resources, capabilities, freedoms and choices necessary for enjoyment of an adequate standard of living[iv]. Such researches and the development practice gave rise to use of multidimensional measures of poverty and some shift from absolute and relative measures of income poverty is witnessed. According to the UN World Summit for Social Development[v] *poverty is characterised by and arises from lack of income and productive resources sufficient to ensure sustainable livelihood; hunger and malnutrition; ill health; limited or lack of access to education and other basic services; increased morbidity and mortality from illness; homelessness and inadequate housing; unsafe environments; and social discrimination and exclusion. It is also characterised by a lack of participation in decision-making and in civil, social and cultural life.* This multidimensional definition of poverty does not only include the income poverty"; but also includes causing factors of poverty and deprivations for contribution to an improved living standard.

As over time, multidimensional nature of poverty has been evaluated and linkages of poverty and development have been developed. Development is the inverse of poverty; and where development enlarges opportunities the poverty denies opportunities. The denial of opportunities (to earn income and social well being) has been seen as an implication towards poverty perpetuation. Studies have revealed that increasing income levels of poor results in themselves seeking development opportunities. Here is a clear recognition of the fact that income poverty is a significant contributor to below standard living or being at risk of poverty (vulnerability). Of all the new definitions of poverty measures and poverty analyses; income has not lost its significance[vi] and is used as a comparative tool between geographical regions, over times, and between populations.

> While growth in national production (GDP) is absolutely necessary to meet all essential human objectives, what is important is to study how this growth translates—or fails to translate—into human development in various societies. Some countries have achieved high levels of human development at modest levels of per capita income. Other societies have failed to translate their comparatively high income levels and rapid economic growth into commensurate levels of human development. What were the policies that led to such results? In this line of enquiry lie promising seeds of a much better link between economic growth and human development, which is no by means automatic. (UNDP, 1990: iii HDR)

Extreme Poverty and Hunger eradication and Achievement of Universal Primary Education are first two of the seven MDGs and perhaps the most prioritised ones but as discussed earlier

there are no chances of ignoring any of the MDGs. The poverty eradication goal (MDG-1) specifically targets to reduce food and non food based income/consumption inequality by reducing population proportion living below poverty line by 50% given base year 1990. The target can also be referred as to the Purchasing Power Parity (PPP) approach counting for the head-count index based on International PPP of US $ 1.00/day or the national poverty lines. The second target takes into account dietary requirements of individuals through food poverty line and specifically targets for reduction of food related health imbalances. This goal is followed by achievement of universal primary education (UPE). Here foundation levels of formal education are targeted for 100% achievement till 2015. The goal specifically targets to increase Net Primary Enrolment Ratio (NPER) to 100%; where Primary education is the formal education of Classes 1-5 for children aged 5-9 years. For sustainability of primary education measures; it is also kept on track that by 2015 each child should have 0% drop out or inversely 100% primary completion rate (PCR).

Research Rationale

Primary education, literacy and gender parity in education does not provide any picture of how does education expansion in the long term would affect perpetuation of income poverty. The returns to education approach however does provide insights of the rationale in individual investment decisions but is also associated with the empirical evidence of income convergence as the level of education increases. In MDGs scenario, it’s not just the level of education at individual levels; rather it’s also the magnitude of investment at population levels. What can be the rationale of investing in education so that education opportunities are

expanded and are in reach of every single individual at primary levels at least? Coupling this with the human capital theory and accumulation of human capital insights and the production functions, it's a combination of any firm's resources that add up with human capital and determine total productivity. In terms of population and countries, economic growth and development approaches can be counted for. But still there are questions on how and at what rate does education affects a country's economic growth and development in general and poverty at specific. Researchers like Becker (1964), have put some attempts on a macro approach of human capital accumulation and returns to education, development practitioners also give weights to the return on education. Past and historical evidence of returns on education does not provide evidence and supporting framework on decisions about future returns of the education to society and privately to individuals. There is a clear rationale to assess impact of today's investments in education expansion and tomorrows stream of income for the population and assess impact of education expansion on the poverty circle and reduction of inequalities at various levels.

The Research Question

Pakistan is an EFA signatory and has committed to the MDGs achievement by 2015. The country have taken a holistic approach in bringing sector specific approaches to meet the poverty challenge through Poverty Reduction Strategy, the Medium Term Budgetary Framework (MTBF), and the Medium Term Development Framework (MTDF). Education specific policies and programs have been introduced at national, sub national, provincial, and local levels to meet the education challenge. Given country's labor market characteristics, the state of education in Pakistan, and the income dynamics it is central for building some

empirical evidence on likely effects of the EFA and UPE on poverty and the vicious cycle of poverty.

Research Objective

The very specific objective of the study is to identify and assess the relationship between primary education expansion and poverty of income reduction at micro and macro levels.

Design and Methodology

The research is designed using an already tested empirical model with modifications as to fit study objectives.

Scope and limitations

The study takes an experimental approach and builds scenarios and performs experiments within the representing years. No such attempt is made as to measure future effects of the millennium development goals and education policy options. The study ignores effects of all the other poverty reduction strategy pillars i.e. economic growth acceleration, governance and devolutions reforms, safety nets for poor and vulnerable, and human capital investments in special education and health. The study specifically ignores the variable labor market effects on individual earnings and occupational choices. In geographic terms, the study sample and population represents only Punjab province of Pakistan and excludes Islamabad from all analysis. The study is designed over experimentation and thus can report uncontrollable errors; however adequate care has been taken to eliminate such errors.

METHODOLOGY

The study is an empirical and descriptive assessment enabling an experimental perspective of the study area, the dependent variable, and the treatment variables. The study design takes a coherent approach in deploying two stage analytical methodologies and through use of multi dynamic estimations over discrete time horizons representing pre-reforms and post reforms scenarios. The study attempts to find out relationship and impact of Universal Primary Education (UPE) on Income Poverty. Thus dependent variable of the study is Income Poverty which is expected to show changes in distribution as well as income levels over a certain period; with change in primary education.

Study Area and Population

The study population for the research was rural and urban areas of the province Punjab in Pakistan. The Punjab province has been the pro reform province in the country showing its quick responsiveness to the reforms agenda in Poverty Reduction Strategy including devolution process, resource mobilisation, and education sector reforms. The Punjab government's responsiveness is acknowledged by the multilateral donors as well as is depicted by positively incremental changes in relevant goals and targets. Selecting the province for this study will enable in harmonization of provincial government reform policies i.e. somehow eliminating study unit's discrimination on basis of reforms environment and reducing economic instability biases which would result through selection of country wide data. In addition, the provincial figures for independent variable (Primary Education) show

some visible variations over the two study periods. Thus study population is Punjab Province only as far as this empirical and experimental assessment is concerned.

The data and Sampling

Sampling Unit

The study is designed around individuals as being the sampling units. For research model building and meeting study objectives it was significant to use micro data instead of macro data. So each sampling unit i.e. individual belongs to a certain household.

The Dataset

The following two micro datasets were used in this study:

1. Pakistan Integrated Household Survey-PIHS (2001-2002) Punjab Dataset: The survey was conducted by Federal Bureau of Statistics (FBS), Pakistan during 2001-2002 and consisted of a sample size of 16,180 households from through out the country excluding military administered area. The Punjab sample consisted of 6,100 HHs including 41,779 individuals (3668 rural, 2432 urban HHs). The sample size has been considered sufficient to produce estimates of key variables at provincial level at 95% level of confidence with 5% to 7% margin of error (FBS, 2003 p.21.[vii]).
2. The Pakistan Social and Living Standards Measurement Survey-PSLM (2004-2005) Punjab Dataset: The survey was also conducted by Federal Bureau of Statistics (FBS), Pakistan during 2004-2005 and consisted of a sample size of 74,420 households from through out the country excluding military administered area. The Punjab sample

consisted of 31,944 HHs including 209,378 individuals (18,912 rural, 13,032 urban HHs). The sample size has been considered sufficient to produce estimates of key variables at provincial level at 95% level of confidence with varying margin of error for different indicators (FBS, 2005[viii]).

Data Quality and Description

Data quality in the two surveys has been ensured through FBS's built in system of field enumerator's data collection and data entry at FBS headquarters Islamabad. The data entry programme used had a number of in built consistency checks (FBS, 2006).

Selection of Sample Size and Standardization

The sample size of the study is kept equal to valid Punjab data set i.e n_{t1}=41,778 and n_{t2}=205,554 Individuals. The PSLM (2004-05) dataset was evaluated for errors in terms of primary identifier missing values (HH member #, relation to HH, age, and gender) and invalid cases and Islamabad cases were excluded from original data set; in turn the 2004-2005 data was reduced from 209,378 cases to 205,554 cases with zero effect to house hold size.

Study Variables

Primary Interest Variables

1. Schooling Years
2. Individual Monthly Earnings

Moderating and Intervening Variables

1. Age
2. Gender

3. Experience
4. Last Month Income
5. Last Year Total Income (All Sources)
6. Head of House Hold Fixed Effects
    a. Relationship with Head of House Hold
    b. Total House Hold Yearly income
    c. House Hold Land Assets (Agriculture Land)
    d. House Hold Size

Research Technique

Instrument: The Model

This study uses a modified version of a dynamic micro-simulation model designed to simulate at individual levels through discrete time modelling. Simulating at individual levels takes into account heterogeneous characteristics of individuals and brings into consideration the variations taking place at individual levels. Extensive literature search made available one suitable model which somehow fits the scenario of the current study. This model referred here after as ***Grimm Model*** was constructed by Michael Grimm while doing his PHD dissertation. The model is widely publicised through a paper titled ; "*The medium and long term effects of an expansion of education of poverty in Cote dÍviore*". The paper had a primary objective to analyse the distributional effects of education in Cote dÍvoire in medium and long term (1998-2015).

Grimm (2003) used a labor choice model which draws from Roy's model (1951) as formalized by Heckman and Sedlacek (1986) having competitive nature in the sense that no segmentation on job rationing prevail, but only weakly, because labor market does not

equalize returns to individual characteristics (Grimm,2003). The model assumes that each individual older than 11 years and out of school faces three kinds of opportunities: (i) family work, (ii) self employment, and (iii) wage work. Grimm (2003) formulated five potential earning functions corresponding to each of the occupational group as presented in Table 1.

Table 1 Earnings Function by Occupational Choice (Grimm-2003)

Occupation Choice	Earnings Function	Eq.
Self employment (Non Agriculture)	$\ln w_{1i}=\ln p_1+X_{1i}\beta_1+t_{1i}$	1
Wage Work	$\ln w_{2i}=\ln p_2+X_{1i}\beta_2+t_{2i}$	2
Family Work (Non Agriculture)	$\ln w_{0i}=(X_{0i}, Z_{0h})\ \beta_0+t_{0i}$	3
Self Employment (Agriculture)[ix]	$\ln \Pi_{oh}= \ln p_0+\alpha \ln L_h+Z_h\theta+u_{oh}$	4
Family Work (Agriculture) [x&xi]	$\ln \Delta\Pi_{oi}= \ln p_0+\ln(L^{\alpha}_{h+1}- L^{\alpha}_{h-1})\ Z_h\theta+u_{oh}$	5
	$\ln w_{0i}=(X_{0i}, Z_{0h})\ \beta_0+\gamma\ [\ln p_o+\ln(L^{\alpha}_{h+1}- L^{\alpha}_{h-1})+ Z_h\theta]+t_{0i}$	6

Treatment of Data with Grimm (2003) Model

The original model takes futuristic approach where natural ageing of family members, entry of new cohorts, family land ownership transfers and redistribution are involved. Secondly the model also assumes that over time, as education profile of population will change, occupational choices will also change. The current study takes an experimental approach and is simple in a sense that; labour market effects and economical stage changes have less chances of disturbing the results. Rather, all measured changes in population profile are a result of change in schooling variables and all other factors are kept constant. The following stage wise experimental approach has been adopted:

Stage 1: The Earnings Function

Step 1. Individuals aged 11 years and currently not enrolled are selected and respective earnings functions are obtained using equations (1-6) for 3 occupational types:

a. Self Employed (Agriculture sector & Non Agriculture sector)

b. Family Work (Agriculture & Non Agriculture HHs)

c. Wage worker in any of the two sectors including corporations etc

Step 2. For all the equations slight modifications were applied to Grimm equations primarily as a result of data differences from Cote dÍviore datasets and the data limitations within study samples. Simplified versions of these equations for respective occupation type are presented in Table 2.

Step 3. Each of the Earnings Function is tested for goodness of Fit by entering and eliminating several explanatory variables (instrumental variables) to estimate effect on individual yearly earnings and the monthly earnings. In each case such a model was selected where parameter variables had the capability of explaining maximum possible variation in the dependent variable (lnwi):

For each of the sets of equations OLS estimation is applied because of its simplicity and robustness.

Table 2 Modified Earnings Function by Occupational Choice

Occupation Choice	Earnings Function	**Modifications**	**Eq**
Self employment (Non Agriculture)	$\ln w_{1i}=\ln p_1+X_{1i}\beta_1+t_{1i}$	OLS Estimation	1
Wage Work	$\ln w_{2i}=\ln p_2+X_{1i}\beta_2+t_{2i}$		2
Self Employment (Agriculture)	$\ln \Pi_{oh}= \ln p_0+\alpha \ln L_h+Z_h\theta+u_{oh}$		3
Family Work	$\ln \Delta\Pi_{oi}= \ln p_0+\ln(L^{\alpha_{h+1}}- L^{\alpha_{h-1}}) Z_h\theta+u_{oh}$	Functions not used as data constrained	4
	$\ln w_{0i}=(X_{0i}, Z_{0h})\ \beta_0+\gamma \ln \Delta\Pi_{oi}+\delta Yi+t_{0i}$		5

Source: Researcher's Modifications of Grimm(2003)

Stage 2: Education Modeling

The following experimental situation is built and tested for the two years respectively:

- Individuals of age group 11-65 years are selected and completed schooling years are increased to 5 where these were below 5 originally.
- A dummy variable is introduced which equals 1 if individual has attained primary and 0 otherwise.
- Ln(Monthly) income is estimated using the respective earnings functions
- The resulting coefficients (parameters) for all occupational choices are applied to both the years respectively and the population wide incomes of individuals categorised as Self Employed and Wage Employed are estimated for each respective scenario.

Stage 3: Data Analysis

The resulting data sets are compared and analysed in following pattern:

1. The original and treated groups are profiled on schooling and income and a description of the populations is obtained
2. Dependence of populations is tested on correlation matrix and paired samples testing is found appropriate
3. T-Tests for inequality of population means are applied on the Income distributions
4. Tests for inequality of population variances are applied on the Income distributions

The CRPRID (2005) stated National poverty line of Rs. 673.54 is used for comparison of poverty estimates.

Data Analysis Methodology

The datasets are stored and transformed using SPSS (Version 14.0). Data analysis productivity of the programme is used to estimate the best fitting equations and respective coefficient

values. Microsoft Excel (Professional edition 2003) is occasionally used for summarising tables and building custom graphs.

RESEARCH FINDINGS AND RESULTS

Background Information

Individuals of age group ranging from 11 years to 65 years are included in the study as a treatment group. The overall samples mean age is 24 years for both years with mean monthly income of 3,095 Rs and 4,814 Rs respectively (Table 3). The average schooling years of education in 2002 is 2 years which increased to 4 in year 2005.

Table 3 Background information of All Individuals (All Ages)

Year		N	Minimum	Maximum	Mean	Std Deviation
2002	Age	41778	0	99	24	19
	Schooling	41778	0	18	2	4
	Income	41778	5	100000	3095	3342
2005	Age	197115	0	99	24	19
	Schooling	197115	0	18	4	4
	Income	197115	2	1759000	4814	12269

Source: Calculations from PIHS 2001-2002 & PSLM 2004-2005.

The treatment group have average age of 30 years and 29 years respectively with mean schooling of 3 and 4 years respectively. On average the monthly income is 3,101 Rs and 4,826 Rs respectively (Table 4).

Table 4 Background information of Treatment group (Ages: 11-65)

Year		N	Minimum	Maximum	Mean	Std Deviation
2002	**Age**	27236	11	65	30	15
	Schooling	27236	0	18	3	4
	Income	27236	5	100000	3101	3341
2005	**Age**	130907	11	65	29	15
	Schooling	130907	0	18	4	4
	Income	130907	2	1759000	4826	12411

Source: Calculations from PIHS 2001-2002 & PSLM 2004-2005

Treatment Groups Schooling Profile

A large number of treatment group members have either been educated to pre primary levels or to some primary schooling. 67.0% and 44.7% in 2002 and 2005 respectively even have not completed 1st year of primary schooling. Only 13.2% in 2002 and 24.9% in 2005 have attended primary education. 0.8% in 2002 and 1.0% in 2005 have completed some sort of higher education.

Treatment Groups Occupations

A large proportion of sample is either studying or not employed. This contained 56.1% individuals in 2002 and 57.5% individuals in 2005. Wage workers comprise of highest proportion for both years respectively followed by non agriculture self employed. Only 5.7% and 9.9% are self employed in the agriculture sector in 2002 and 2005 respectively. The total employed individuals comprise 32.6% and 33.5% of both years respectively.

The Experimental Treatments

The completed schooling years are treated for up gradation in both years through and expansion of primary education in the treatment groups. Only those schooling levels are treated which were below primary. In treatment age groups, schooling years were raised to 5 for all individuals who had less than 5 years of schooling.

As a result of data treatment for 11-65 ages, class five completions were raised from 8.2% to 73.8% in 2002 and from 12.1% to 60.9% in 2005. The treatments have an effect only at primary levels and pre-primary levels (Table 5).

Table 5 Experimental Treatment Summary (Schooling Years)

Schooling Years	Before Treatment		After Treatment	
	Years			
	2002	2005	2002	2005
<1	59.5%	39.8%	.4%	1.6%
1-4	6.50%	10.00%		
5	8.2%	12.1%	73.8%	60.9%
6	1.7%	3.6%	1.7%	3.6%
7	2.0%	3.5%	2.0%	3.5%
8	4.9%	7.9%	4.9%	7.9%
9	2.4%	3.7%	2.4%	3.7%
10	8.0%	11.1%	8.0%	11.1%
11	.3%	3.7%	.3%	3.7%
12	3.0%	3.2%	3.0%	3.2%
13	.3%	.2%	.3%	.2%
14	2.1%		2.1%	
15	.0%		.0%	
16	1.0%	1.2%	1.0%	1.2%

>16	.0%	.0%	.0%	.0%
Total	100.0%	100.0%	100.0%	100.0%

The Experiment Results

Primary Education Effects on Average Income (Individuals)

The mean individual income in primary education treated scenario is higher than that of original estimated mean incomes in 2002 cases. The 2005 original estimated values are slightly above the primary education treated income estimates. Same trend is seen in the median values. The mode shows different central tendencies as income of individuals below mean has increased in both years after primary education treatments. In both years, income distribution has changed towards left tale i.e. lower income groups (Table 6).

Table 6 Income Distribution Measures (Original Estimated and Treated)

Year		Mean	Median	Mode	Minimum	Maximum	Std Deviation
2002	T0	2406.24	2136.60	1824.30	151.90	57461.75	1617.35
	T2	2864.36	2593.26	2627.16	157.47	56911.35	1907.78
2005	T0	3648.72	3380.46	1675.58	331.82	13961.80	1908.35
	T2	3752.14	3551.62	1793.21	329.97	14252.53	1902.01

T0: Untreated Group Estimated Monthly Income (Rs)
T2: Treated Group Estimated Monthly Income (Rs)

Testing for Differences of Income Means

Before Treatment & After Treatment Group Differences:

Strong positive Pearson's correlation coefficient between the respective income populations provided baselines for testing difference of means. The 2005 T0 & T2 values have correlation of 0.999 and the 2005 values are correlated at 0.997.

The paired samples t test for difference of means show significant differences in Ln(Monthly Income) before and after primary education treatment. The mean difference 95% confidence interval for 2002 data set ranges from -0.0411 to -0.0384. The 2005 dataset also conforms to significant means differences in before treatment and after treatment estimated values. The lower and upper bound for 95% confidence interval are -0.0197 and -0.0173 respectively.

Before Treatment Primary Attained or Not Group Differences:

Independent samples t-test is used to test the hypothesis that income levels of individuals without primary completion differ from income levels after primary completion. Ln(Estimated Monthly Income) in both the years is tested for effects of primary education completion against a dummy variable prim equals 1 if primary education attained and 0 otherwise.

In both 2002 and 2005, the Levene's test for equality of variances shows a very low significance level implying that income variance without primary completion and after primary completion, differ significantly.

The independent samples t test for difference of means show significant differences in Ln(Monthly Income) with and without primary education completion. The mean difference

95% confidence interval for 2002 data set ranges from -2.0839 to -1.9156. The 2005 dataset also conforms to significant means differences with and without primary education completion. The lower and upper bound for 95% confidence interval are -0.4651 and -0.3951 respectively .

Effects on Individual Monthly Income Quintiles and Income Distribution

In both years respectively, the income distribution changes its symmetry towards left tale of the distribution. In 2002 estimates the after primary education treatment individual incomes skewness decreases to 3.632 from 5.289. In 2005 estimates, the after treatment skewness decreases from 1.133 to 1.060. In both years the stand errors of skewness are approximately equal.

Table 7 Total Monthly individual income quintiles

Descriptive	2002		2005	
	T0	T2	T0	T2
Skewness	5.289	3.632	1.133	1.060
Std. Error of Skewness	.025	.025	.012	.011
Q1	1138.897	1306.491	2071.239	2136.320
Q2	1834.807	2139.120	3012.798	3150.291
Q3	2419.195	2980.243	3675.250	3918.092
Q4	3444.759	4050.113	4992.669	5124.765
Q5	57461.747	56911.346	13961.801	14252.534

The income quintiles of 2002 estimates show that the first four quintiles of population experience increment in monthly income. The last quintile income levels decrease in after primary education treatment estimates. The income quintiles of 2005 show income level increasing in all the quintiles in post treatment scenario.

Effects on Yearly per Capita House Hold Income

Yearly per capita house hold income is computed by multiplying total monthly house hold income with 12 and then dividing by household size.

Table 8 Yearly Per capita income quintiles

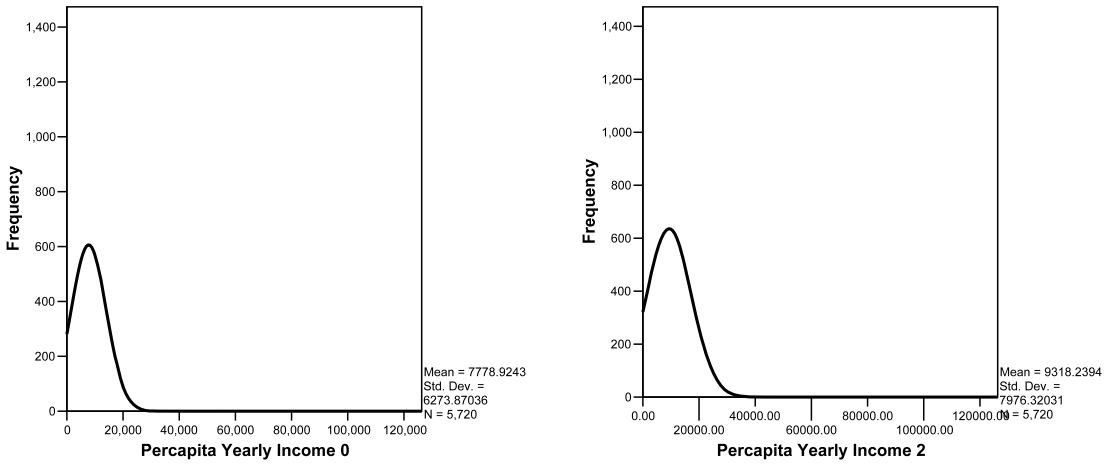
Descriptive	2002		2005	
	PCY0	PCY2	PCY0	PCY2
Mean	7778.924	9318.2394	12144.079	12534.798
Median	6075.499	7347.5156	10001.608	10393.202
Mode	3674.94	3213.12	6988.67	7455.51
Minimum	307.04	403.05	926.91	920.92
Maximum	77097.75	100744.88	155114.94	157293.17
Skewness	3.865	3.888	3.152	3.114
Std. Error of Skewness	.032	.032	.015	.015
Q1	3783.516	4214.699	6410.134	6778.004
Q2	5284.512	6268.995	8733.564	9105.515
Q3	7089.587	8580.054	11529.673	11992.152
Q4	10507.697	12650.025	16335.771	16721.541
Q5	77097.749	100744.879	155114.943	157293.167

PCY0= Untreated Estimated Yearly Per capita HH Income
PCY2= Primary Education Treated Yearly Per capita HH Income

In both years on average the after primary education treatment per capita yearly income is higher than the original estimates. The most common value in 2002 data set is below the before treatment estimated values. The 2005 most common value is higher than the original estimates after treatment. The maximum value in both years after treatment is above the original estimates.

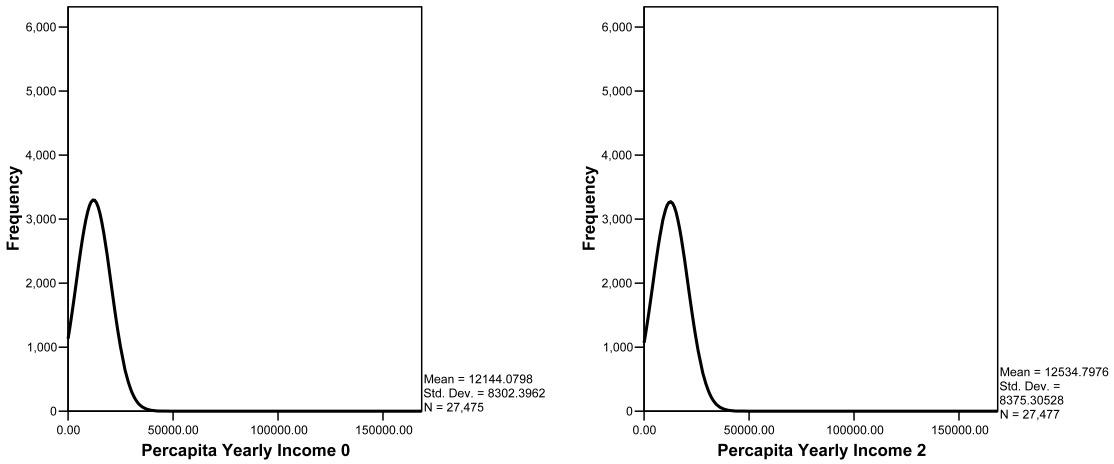
A closer look into skewness and income quintiles provides evidence on changes in income distribution. The skewness of 2002 data increased to 3.888 from 3.865 after primary education treatment. This point towards changes in income profiles of high income groups in 2002. The income quintiles show that the income level has increased by primary education treatment in all the five quintiles.

Figure 1 Yearly Per capita Income Distributions (2001-2002)



The skewness of 2005 data decreased to 3.114 from 3.152 after primary education treatment. This point towards changes in income profiles of low income groups in 2005. Like 2002 income quintiles, the 2005 income quintiles also show increasing income levels in all the five income quintiles.

Figure 2 Yearly Per capita Income Distributions (2004-2005)



Effects on Population Below and Above Poverty Line

As an initial estimate it is assumed that the monthly 673.54 Rs. national poverty line prevails in both years without inflation effects. A dummy variable is created which equals zero if per capita monthly house hold income is above the poverty line and equals 1 if it is below the poverty line.

Table 9 House Holds Below and Above Poverty Line

		Year	
		2002	**2005**
PCY0	**Not Poor**	26.3%	58.4%
	Poor	73.7%	41.6%
PCY2	**Not Poor**	37.4%	61.6%
	Poor	62.6%	38.4%

Poverty Line= 673.54 Rs / Month in 1998-1999 Prices
PCY0= Per capita HH Income before treatment
PCY2= Per capita HH Income after Primary Education Treatment

Proportions of households below and above the poverty line are computed which show changes in per capita poverty profiles of both years. In 2002 the proportion of poor house holds decrease from 67.7% to 56.7%. In 2005 the proportion of house holds living below poverty line decrease from 34.2% to 31.4%.

Table 10 Proportion of Population Living Below Poverty Line

		PCY0	PCY2
2001-2002	Not Poor	79.0	82.6
	Poor	21.0	17.4
2004-2005	Not Poor	79.0	81.7
	Poor	21.0	18.3

P-Line (2001-2002) = 3645.299
P-Line (2004-2005) =6000.965

The median constructed poverty line (60% of median) shows that in post treatment scenario both years have 79% of population living above the poverty line. In 2001-2002 primary education expansion increases the non-poor population to 82.6%. In 2004-2005 the median constructed head count poverty reduces to 18.3% from 21.0% as effect of education expansion.

The above findings provide some baseline for effects of primary education on poverty profiles. Further information is sought while looking at per capita household differences by considering different measures of poverty. In both years the treatment groups have changes in poverty profiles with reductions in poverty measures as a result of primary education expansion.

Table 11 Household Yearly Per capita Income and Poverty Statistics

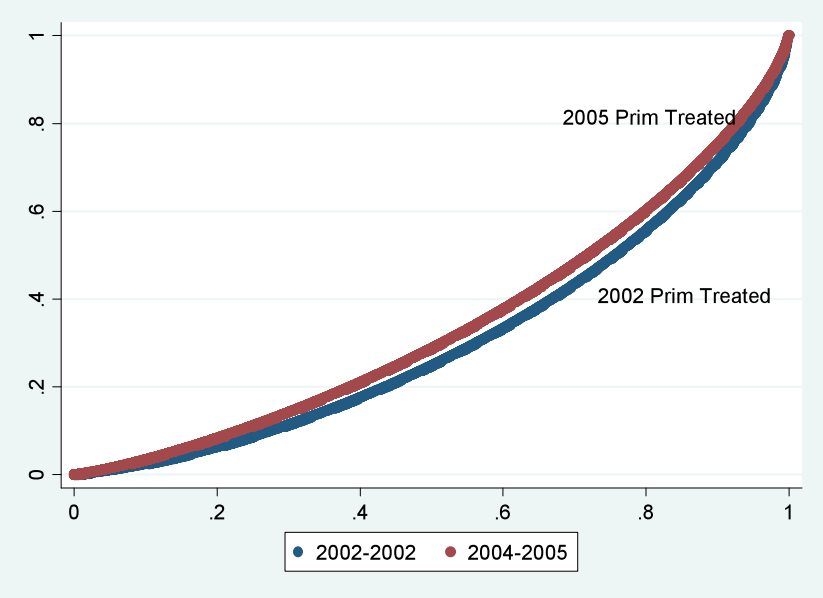
Poverty Measure	Years	
	2002	2005
Poverty Gap (Original Estimates)	0.0247	0.0509
Poverty Gap 2 (Prim Treated)	0.0128	0.0427
Squared Poverty Gap (Original Estimates)	0.0095	0.0191
Squared Poverty Gap (Prim Treated)	0.0053	0.0158
Watts Index (Original Estimates)	3.2535	6.5924
Watts Index (Prim Treated)	1.7183	5.493

Effects on Income Inequality

As an initial estimate simple inequality ratio[xii] is computed for both years before and after treatments. In 2002, individual level estimates the income inequality reduced from 50.45 to 43.56 as a result of primary education treatments. In 2005, the inequality at individual levels reduced from 6.74 to 6.67 as a result of primary education treatments.

At household levels the per capita yearly income inequality shows different results as from those at individual levels. In 2002, the per capita income inequality is fairly below the individual levels. It however tends to increase from 20.38 to 23.90 as result of primary education treatments. In 2005, the per capita inequality is significantly higher than those of individual levels. As similar to individual levels, the income inequality at per capita house holds levels tend to decrease (from 24.198 to 23.206).

Figure 3 Lorenz Curve for Per Capita Income After Treatment (Both Years)



DISCUSSION

The rationale behind this research was to assess likely impact of primary education investments on tomorrow's streams of incomes. The research technique employed provided simple but straight answers to the research question and the underlined impacts of primary education. The experiment results exposed many interesting findings. The two data sets (PIHS & PSLM) provided with a large sample to measure controlled results of isolated effect of primary education on income streams and poverty at individual as well as household levels.

The study reaffirms that completed schooling years is one of the key variables in explaining individual income differences. Likewise previous studies using data from Pakistan, the returns to schooling years vary between different occupation groups. The returns to schooling years are increase from 5.2% to 7.3% in 2004-2005 for self employed individuals in non-agriculture sectors. In agriculture sector the returns to schooling years reduces from 10% to 5.1% in 2004-2005.

In the formal wage sector the returns to schooling years decrease slightly from 9.3% to 9.1% in 2004-2005. In both years it is the formal wage sector that shows some consistency in returns to schooling. The returns to schooling highlight that it is the formal wage sector that is responding positively to government's investment on education.

The study uses a dummy variable (prim) which equals 1 if individual has completed primary education otherwise zero. The study reveals that the returns to 5 complete years of schooling are not necessarily a positive contributing factor to individual income differences. The self employment in non-agriculture sector returns -4.2% to primary completion and these returns further decline to -21.9% in 2004-2005 from 2001-2002.

In previous studies the returns to primary education have always been lower than the returns to higher levels to education. Monazza Aslam (2007) and Asma Hyder (2007) in two different studies and samples reaffirm primary education returns being lowest of all education levels.

The returns to primary completion increase to -14.1% from -62.7% in 2004-2005 for the self employed agriculture sector individuals. The wage sector in 2004-2005 show primary completion returns to be improving from -38.9% to -38.2%. In all the three sectors it is the self employed agriculture sector that returns the highest to individuals who have at least completed primary education. This suggests that government programs aiming at agriculture sector for improving crop harvesting etc and for primary education interventions in such communities do offer changes in income profiles of individuals.

It is evident from previous studies and this study that schooling years (education) has been the key instrumental variable in explaining changes in population wide wealth (income). The influence of other moderating variables like, experience, rural or urban regions, and earners gender play significant role in final results generation. However since experimental design

made it possible to keep these effects constant at individual levels; the final results depict role of primary education mostly.

Primary education has been the significant area of intervention in almost every macro level poverty reduction program, strategy or policies (PRSP[xiii]s, MDGs etc). Significance of primary education has long been acknowledged as basic source of literacy and individual's personality development. At national levels, provision of education facilities is a social service which leads to economic well being of the society as a whole. A major beneficial source is indirect impact of education on technology, skills, and abilities of earning members of the society. Due to multi-dynamic nature of education benefits, it's quite difficult to grasp all benefits through a few angles only. However restricting the experimental treatments to labor force participants (Age 11-65) controls for biasing effects of individual age on experience and ultimately on incomes. Similarly other variables like, regional representation and gender are not provided with a chance to vary during the experiment and all the four resulting income distributions are equally comparable.

At earning member levels, expansion of primary education changes income levels of low earning members of the labor force. Expansion of primary education to 73.8% of labor force participants has increased the average income of these individuals by 19.4%, the median by 21.37%, and the most common income by 44.01% in 2001-2002. The minimum income of the labor force participants increase by 3.67% as result of primary education expansion to more 65.6% individuals. The maximum income, of individuals decreases by 9.58% as result of primary education expansion. These changes in post treatment income distributions are

reconfirmed by evidence from paired samples t-test for 2001-2002. Most interestingly the standard deviation changes by 17.95% revealing that the differences between individuals have increased as result of primary education expansion.

In 2004-2005 data treatments the primary completion has been raised to 60.9% from 12.1% i.e. 48% labor force participants have shifted from pre-primary to primary levels. On average the income of these individuals increase by 2.83%, the median by 5.06%, and the most common income by 7.02%. The minimum income of the labor force participants decrease by 5.57% and the maximum income, of individuals increase by 2.08%. These changes in post treatment income distributions are reconfirmed by evidence from paired samples t-test for 2004-2005. The standard deviation changes by -33.22% revealing that the differences between individuals have decreased as result of primary education expansion.

The labor force effects show that if general economic growth has increased it is not necessary that the labor force participant will get same schooling returns as in pre growth situations. Moreover a 65.6% expansion of primary education returns more as compared to a 48.8% expansion. The results at earning member levels are quiet significant as results show statistical evidence of income mean differences with and without primary completion.

The labor force participants' income quintiles show positive changes in 2001-2002 with changes in first four quintiles. However the 2004-2005 post treatment results do not show significant positive changes. The income inequality in 2001-2002 reduces by 6.89 points as compared to 0.07 points change in 2004-2005. This implies that there are some unobserved

labor market effects that should be changed after 2004-2005 to reduce income inequality in labor force participants. However it is of significance to consider house hold effects for overall impact on poverty and inequality.

Labor force participants contribute to overall wealth of the households and the income is then distributed among individuals in a household. The per capita income is representation of differences between house holds. As a result of primary education treatments the 2001-2002 per capita household income 19.79% (on average) with the mid value raising by 20.94% and decreasing income levels of most households by 12.57%.

These changes highlight changes in income distributions especially through changes in mode. The minimum and maximum values of per capita household income increase by 31.2% and 30.67% respectively. This shows that the lowest income group must have been impacted most positively than the upper most quintile. The per capita household income quintiles show income levels of upper most quintile to be increasing by 30.67%, the middle quintile by 21.02%, and the fourth quintile by 20.39%. The lower two quintiles show least effects to income level increase i.e. 11.40% and 18.63% respectively. The positive effects of primary income expansion to the fifth quintile result into income inequality increasing from 20.38 to 23.9.

In 2004-2005 as a result of primary education treatments the per capita household income 3.32% (on average) with the mid value raising by 3.92% and increasing income levels of most households by 6.68%. Like the 2001-2002 results, these statistics also highlight changes in

income distributions especially through changes in the value mode. The minimum value of per capita household income decreases by 0.65% however the highest income increases by 1.4%. This shows that the lowest income group must have been impacted positively but less than the upper most quintile.

The per capita household income quintiles show income levels of upper most quintile to be increasing by 1.40%, the fourth quintile by 2.36%, and the middle quintile by 4.01%. The lower two quintiles show most effects to income level increase i.e. 5.74% and 4.26% respectively. The positive effect of primary income expansion to the lowest two quintile results into income inequality decreasing from 24.198 to 23.206. Income inequality between 2^{nd} the 5^{th} quintile also decreases as result of primary education expansion and equals 17.761 and 17.274 in pre-post treatment scenarios.

The after treatment income inequality at per capita households levels is higher in 2001-2002 as compared to 2004-2005 post treatment distribution. It is evident that as the environment gets pro-reforms the primary education helps reduce income inequalities faster than a pre-reform environment (see Lorenz Curve). In a pre reforms scenario the income inequality tends to increase as attempts are made to increase primary schooling levels. However in a post reforms scenario the income inequalities tend to decrease as attempts are made to increase primary schooling.

The experiment is performed in a controlled environment where inflation is assumed to have zero effect when within years data is compared. The post experiment results show that

proportion of population living below 673.54Rs decreases by 11.10% in 2001-2002 as a result of primary education treatments. However in 2004-2005 the population living below 673.45Rs decreases by 3.20%.

With the complexities of inflation trends in Pakistan, moving base years, and absence of provincial inflation rates it was appropriate to get a poverty line from existing data sets. In both years a poverty line was constructed which is equal to 60% of the per capita HH yearly income. The poverty line for 2001-2002 equals 3645.299 and is 6000.965 for 2004-2005.

In 2001-2002 the proportion of population above median constructed poverty line rose to 82.6% from 79.0% as result of primary education expansion. In 2004-2005 the population above median constructed poverty line rose to 81.7% from 79.0%. Using the median constructed poverty line the poverty measures depict clear situation of poverty before and after primary education treatments.

The Poverty gap measurements show that it decreases to 0.0128 from 0.0247 in 2001-2002 after treatment by primary education expansion. Here the poverty gap reduces by 0.0119 points showing that if primary education would have been expanded in 2002 on average the individual/per capita poverty profile would have been much better. The 2004-2005 poverty gap indexes depart from 0.0509 to 0.0427 as result of primary education expansion. Here the poverty gap reduces by 0.0082 points, showing that primary expansion can result positively.

The severity to poverty measure (squared poverty gap index) in 2001-2002 reduces to 0.0053 from 0.0095 as a result of primary education expansion. This implies that primary education treatment reduces the inequalities among the poor as well. The 2004-2005 poverty severity index also reduces as result of primary education expansion. The index reduces by 0.0033 pints from 0.0191 to 0.0158. In both the years the severity to poverty reduces as result of primary education expansion.

At this point where there is much evidence built on positive effects of primary education expansion on poverty and inequality, it is somehow essential to look into some poverty measure which supports the three axioms essential to any good measure of poverty. And Ravallion and Chen (2001) argue these three axioms as focus, monotonicity, and transfer. Under the focus axiom, the measure should not vary if the income of the non poor varies; under the monotonicity axiom, any income gain for the poor should reduce poverty; and under the transfer axiom, inequality reducing transfers among the poor should reduce poverty. According to World Bank's Poverty Manual; Watts index satisfies all the three axioms unlike poverty gap and head count poverty.

The Watts index takes different values in post primary education expansion scenarios as compared to previous states. In 2001-2002 the Watts index decreases significantly from 3.2535 to 1.7183. In 2004-2005 the Watts index decreases from 6.5924 to 5.4930 as a result of primary education expansion. These trends show that primary education expansion does not only affect overall income poverty in the population but also have positive impact in reducing inequalities among the poor.

These above poverty measures in both years show very interesting results. In 2001-2002 the primary education expansion by 65.6% accounts for 48% change in poverty gap, 44.2% change in severity of poverty, and 47.19% change in the Watts index. In 2004-2005 the primary education expansion by 48.00% accounts for 16.11% change in poverty gap, 17.28% change in severity of poverty, and 16.68% change in the Watts index. In both years the primary education expansion has approximately equal effects to the respective poverty measures.

CONCLUSION

The study results show different effects of primary education expansion in 2001-2002 and 2004-2005. These differences are caused by many variables either observable or unobservable. From observable factors, it is the change in proportion in the primary education profile of the data set. This also implied that higher the changes to primary education profiles, higher will be the returns to the economy.

In Both pre-reforms (2001-2002) and post reforms (2004-2005) scenarios, the primary education frameworks have potentials for direct implications on individual earners in the labor force, the households, and the population in general. As more and more individuals complete primary education, more income is available to large population members and income poverty levels tend to decrease more from lowest 20% and middle 20% of population representatives.

The experiment has resulted into significant differences of income mean and variance in present situation and post primary expansion scenarios. These differences underline that primary education changes does cause income level changes in the population as a whole.

Primary education has significant impact in increasing income levels at lower and middle income groups (2001-2002) and reducing inequality at household levels. Both the MTDF and MDG scenarios rightly take primary education as a poverty reduction strategy and primary education expansion to low income groups and a futuristic sustainable measure to reduce chronic poverty and the vicious cycle of income poverty.

The inequalities in 2001-2002 tend to decrease faster as result of education expansion than those of 2004-2005. The differences in effects are not only caused by primary education expansion but also by yearly differences in overall income levels. The study systematically concludes that a pre-reforms scenario has more room for primary education private returns as compared to a pro-reforms situation. However in a pro-reforms situation the income inequalities at individual levels tend to decrease less fast than a pre-reforms scenario. Such differences can be explained by the fact that on overall accounts the pre-reforms income profiles are more in-equal than the post reforms scenario. Since income inequality already reduces as results of reforms the marginal effects caused by primary education are minimized.

The research proves that as the primary education expands the proportion of population below poverty line decreases in both the pre reforms and post reforms scenarios. Likewise inequality, the marginal effects on poverty decrease and primary education expansion contributes less to

poverty reduction. The study also reveals that primary education alone can contribute positively to poverty reduction as well as severity to poverty reduction.

This is a simple study which used simple OLS estimates to reach estimated income functions. Research avenues are open for predictive studies on future streams of income through time series analysis. In the present context, it will also be significant to find variables in post reforms which change the income streams more positively than primary education.

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[viii] Appendix B; PSLM (2004-2005), FBS GoP, Islamabad. June 2005.
[ix] Equation (4) is a farm production function derived using Cobb-Douglas technology.
[x] γ stands for the (non-unitary) elasticity of the value of family work in agricultural households to the price of agricultural products.
[xi] Grimm (2003) implies Head of HH occupation as a farmer to directly affect occupational choice of the member to depend on this. Individual's contribution to farm profits is calculated holding fixed other member's decision and global productivity of the farm u_{0h}. Where $L_{h+1=} L_h$ and $L_{h-1=} L_h - 1$ if individual is actually working on the farm and $L_{h+1=} L_h + 1$ and $L_{h-1=} L_h$ alternatively.
[xii] Income Inequality is a simple ratio Income in Highest Income Quintile to that of Income in Lowest Income Quintile.
[xiii] Poverty Reduction Strategy Papers