PROVINCE-WISE GROWTH PATTERNS IN HUMAN CAPITAL ACCUMULATION

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Abstract:

Despite convincing evidence of disparities in the provincial labour force no satisfactory measure of human capital stock at the provincial level presently exists for Pakistan. This paper is motivated to fill the gap in policy analysis by estimating the human capital index (HCI) at the provincial level from 1982-83 to 2003-04. The accumulated human capital is estimated using the labor-income based methodology. The index is computed for the three sectors of the economy: Agriculture, Manufacturing and Services, by using data from respective Labour Force Surveys. The estimation is divided into three steps: (i) computation of the relative wage rates, a proxy for productivity, (ii) estimation of the proportion of employed labour force in each sector, by province, according to level of education, and age, (iii) multiplication of productivity with total employed labour force, by education level, and age. The analysis is disaggregated by sector, and by province.

The aggregate human capital index almost doubled in the 22 years analyzed (1982 _ 2004), growing at an average of 3.3 percent per annum. Breaking down the analysis according to the three time periods: (i) 1982 _ 1990, (ii) 1991_1999, and (iii) 2000_2004, confirms a slow down in human capital formation in the 1990s. Province-wise analysis further illustrates that the slow down in the 1990s was mostly driven by a decline in human capital accumulation in the Sindh province in the time period 1990-1999. Sindh-HCI grew at 4.8% per annum in the 1980s, but lost this momentum in the 1990s, with growth per annum declining to 1.5%. However, from 2000 onwards Sindh regained its growth momentum, and in turn, the overall national-level HCI recovered its original growth trajectory. Provincial level analysis further illustrates that human capital accumulation was most consistent in Punjab (hovering around 3.2%) during the 22 year period considered. NWFP and Balochistan posted an annual growth of 2.6% and 3.4% per annum in this time period, however, their combined share in the national-level HCI is only 13%, and therefore their contribution toward the aggregate human capital accumulation remains limited. The sector-wise analysis further demonstrates that during the period 1982-83 to 2003-04 HCI growth was largely driven by human capital development in the manufacturing and services sectors.

1. INTRODUCTION

It is apparent from various labour force surveys that during the past 20 years Pakistan's employed labour force has become more "educated". For instance, according to the Labour Force Survey 1982-83, 28 percent of the employed labour force had attained formal education.[1] In comparison, the literate employed labour force in 1999-2000 is estimated at 46 percent, while the formally educated is 43 percent. However, the pattern of growth in educated labour force is not uniform in all four provinces of the country. A closer look at disaggregated provincial level data reflects the disparity in employed labour force in the four provinces: Punjab, Sind, NWFP, and Baluchistan.

Regional decomposition of the labour force data shows that Sindh has consistently demonstrated the highest level of literacy among the four provinces over the past 20 years; Balochistan, in contrast, has demonstrated the lowest level of educational attainment for its employed labour force. However, the gap between the literacy level of Sindh as compared to the provinces of both Punjab and NWFP has gradually narrowed. This is because although Sindh started out with the highest base, in terms of growth of its educated work force, since Sindh's educated have grown at a decreasing rate, Punjab and NWFP have caught up because of much higher rates of growth in their respective literate employed labour force. In 1999-2000, 43 percent of Punjab's and 39 percent of NWFP's labour force is categorized as formally educated, as compared to 49 percent for Sindh.

Despite the convincing evidence of regional disparities no satisfactory measure of human capital stock at the provincial level presently exists for Pakistan[2]. This paper is motivated to fill the above gap in policy analysis by estimating the human capital index (HCI) at the provincial level from 1982-83 to 2003-04. This index is based on two main components: completion of education levels and age (as a proxy for experience). The index is computed for the three sectors of the economy: Agriculture, Manufacturing, and Services, by using published and micro data from the respective Labour Force Surveys. Given the recent initiative vis-à-vis the devolution of power to the local level this exercise becomes

[1] In this paper formal education is defined as primary and above.
[2] An aggregated measure of the Human Capital Index was computed by SPDC (see the Integrated, Social Policy Macro Model).

all the more relevant. Moreover, given its rapidly advancing population, Pakistan needs to count on an improvement in the quality of its labour force to compensate for the increasing pressures on its limited resources. A suitable measure of human capital per worker can be used to assess correctly the evolution of the *effective* labour force.

The paper is structured as follows: section 2 provides an overview of the different approaches associated with HCI computation elaborated in the economic literature. Section 3 provides details of the methodology adopted for the subject analysis, while estimation results are presented in section 4. Finally, section 5 offers concluding remarks.

2. METHODOLOGICAL REVIEW

This section reviews the different approaches employed to measure human capital. Broadly speaking there are three main approaches to compute human capital: the cost-based approach, output approach, and labour-income based approach. Following is a brief review of all three (for a detailed account see Laroche and Merette, *Measuring Human Capital in Canada 2000-05*).

2.1 Cost-based Approach

As the name reflects, this input-based approach estimates the stock of human capital by aggregating the depreciated value of cumulative total investment towards human capital formation, including investment in education and health; the opportunity cost of attending school is also accounted for. It must be noted however that this approach is particularly sensitive to the rate of depreciation used. Moreover, the distinction between consumption and investment also adds an element of subjectivity to the estimation.

2.2 Output-based Approach

This approach uses outcome indicators relevant to human capital formation. The most common measures used in the literature are adult literacy, school enrollment rates, and average years of formal schooling. Although these measures are based on easily available data, thereby making cross-country comparisons possible, these indicators emphasize

quantity rather than the quality of education. In fact the quality of education is assumed to be constant across regions and over time.

2.3 Labour-income-based Approach

In order to duly address the quality issue Mulligan and Sala-i-Martin (1997) developed a labour-income-based measure of human capital. The measure is based on the assumption that the aggregate level of output is determined by an aggregate production function that depends on two inputs: the total human capital H and total nonhuman capital K in the economy.

$$Q_t = F (v_t K_t, u_t H_t) \qquad (1)$$

v is the fraction of nonhuman capital devoted to productive activities and u is the labour participation rate. Since the labour force is heterogeneous and different people contribute to production in different degrees based on their education and skills, the measure of human capital gives a larger weight to those people who are more productive. To capture this phenomenon the proposed measure of the average stock of human capital in an economy is the quality-adjusted sum of the labour of its citizens

$$\bar{H}_{ijt} = \int\int \theta_{ij}(t,s,a)\ \eta_{ij}(t,s,a)\ da\ ds \qquad (2)$$

where $\eta_{ij}(t,s,a) = \frac{N_{ij}(t,s,a)}{N_{ij}(t)}$ indicates the proportion of individuals in sector i, and region *j* with "*s*" years of schooling, and "*a*" years of age, and $\theta_{\iota\varphi}(t, s, a)$ is an efficiency parameter, indicating the contribution of each individual to the stock of human capital. The real challenge is to determine an adequate measure of this efficiency parameter. To determine the nature of the efficiency parameter, the authors assume that individuals acquire human capital through the combination of some aggregate inputs, such as the stock of physical and human capital devoted to education, and their own time and skills. Since the human and physical content of education may vary across economies and over time, a given number of years of schooling may reflect different amounts of human capital. The authors' intuition is that the quality of an individual's human capital is related to the wage rate received in the marketplace. If his/her education is particularly useful, the market will reward him/her with a higher wage.

The authors also assume that the stock of human capital of an individual with no schooling is identical always and everywhere. This assumption does not imply, however, that the productivity of zero schooling individuals is identical always and everywhere. Zero-schooling individuals' income will vary according to an economy's aggregate stock of physical and human capital as well as due to other inputs. This assumption is used to define a numeraire that enables the authors to express the human capital index in a unit that is homogenous across space and time. According to the authors, since any amount of schooling introduces intertemporal and interregional differences in an individual's level of skills, the only sensible numeraire is the zero-schooling worker.

Under the assumption that a worker's marginal product is equal to his wage, the human capital of a worker with "*s*" years of schooling and "*a*" years of age can be inferred from the wage ratio:

$$\theta_{ij}(t,s,a) = \frac{w_j(t,s,a)}{w_j(t,0,a_0)} \qquad (3)$$

wj (t,0, a_0) = wage rate of a person with zero year of schooling and 10-14 years of age
wj (t,s,a) = wage rate of a person with s years of schooling and age between 10-70 years

The worker with zero schooling and 10-14 years of age is used as a numeraire to allow the human capital index to be expressed in a unit that is homogenous across "space and time". A major limitation of the above efficiency measure, however, is that wages may change for reasons other than changes in human capital.

If value of θ from (3) is substituted in (2) than the average stock of human capital in a given economy is measured as:

$$\bar{H}_{ijt} = \iint \frac{W_{ij}(t,s,a)}{W_{ij}(t,0,a_0)} \eta_{ij}(t,s,a)\, da\, ds \qquad (4)$$

The above equation is similar to the equation (ii), however the only difference is the replacement of θ with relative wage rates. The wage rate of a zero-skilled worker is estimated by taking the exponential of the constant term from a Mincer wage regression. Similarly, respective wage rates of other workers are estimated by taking the exponential

of the sum of the constant term and other coefficients from a Mincer wage regression after multiplying with the respective values of the variables.

Mulligan and Sala-i-Martin's (1997) measure of human capital has the advantage of capturing the variation in quality and relevance of schooling across regions and over time. This approach nets out the effect of aggregate physical capital on labour income by dividing an individual's wage rate by the wage of a zero-schooling worker. Moreover, this approach allows the elasticity of substitution across workers to vary. However, this measure also has some drawbacks. First, zero-schooling individuals are assumed to be identical across regions and over time and assume to be perfect substitutes for the remaining workers in the labour force. Second, wages may vary for reasons other than changes in the marginal value of human capital. For instance, fiscal or monetary shocks may be the cause of changes in relative wages, which are, although unrelated, interpreted as changes in the marginal value of human capital.

As the objective of this paper is to better understand the unequal formation of human capital in the four provinces in the context of their consequences for regional development, there is a need to duly address quality issues.

3. METHODOLOGY AND ESTIMATION

We estimate the accumulated human capital by improvising the labour-income based methodology described in the section above. To take into account provincial differences, and discrete data on education and schooling, equation (1) is modified as follows:

$$H_{ijt} = \sum \sum \frac{W_{ij}(t_0, s, a)}{W_{ij}(t_0, 0, a_0)} \eta_{ij}(t, s, a)\, L\, da\, ds \qquad (5)$$

where,

H = Accumulated stock of human capital
i = Provinces (i = Punjab; i = 2 Sind; i = 3 NWFP; i = 4 Baluchistan)
j = Sectors (j = 1 Agriculture; j = 2 Industry; j = 3 Services)
t = Time Period (Years)
t_0 = Year of Estimation of relative wages (1990-91)
s = Years of schooling
a = Age in years
a_0 = Age group 10-14 years

W = Wage Rates
η = Proportion of employed labour force in province i with s year of schooling
L = Total employed labour force

The estimation is divided into three steps: (i) computation of the relative wage rates, a proxy for productivity, (ii) estimation of the proportion of employed labour force in each sector j, by province i, according to level of education, and age, (iii) multiplication of productivity with total employed labour force, by education level, and age, in each respective sector, by province.

3.1 Computation of Wage Rates

The computation of wage rates itself requires two distinct steps: (i) Estimation of the Mincer Wage Equation which is simply the regression of the natural log of wages on education level and experience (ii) the regression results are used to compute relative wages. During 1990, relative wages vary across regions and over time due to change in technology, it is reasonable to use variable weights in different decades for each respective province. Therefore relative wages are computed for the fiscal years 1990-91 and 1999-2000.

3.1.1 Estimation of the Mincer Wage Equation

Standard Mincerian earnings function uses years of schooling as a measure of educational attainment. This crude measure will now be complemented with a more detailed investigation by looking at returns to specific degrees. Assuming that the degree gained is more important than actual years spent at school, the linearity assumption implicit in the years of schooling specification is abandoned. Similarly, there is no information about actual work experience or years of work interruption available in the *Labour Force Surveys*. Therefore, we take age as a proxy for experience, rather than potential experience (age minus years of schooling minus six) in the regression analysis. Finally, ordinary least squares method is applied to the following earnings function:

$$\ln w = \beta_0 + \beta_1(age) + \beta_2(age)^2 + \beta_3(P) + \beta_4(Mi) + \beta_5(Ma) + \beta_6(In) + \beta_7(Gr) + \beta_8(PG) + \beta_9(Ot) + u \qquad (6)$$

where, w is monthly wages, and P, Mi, Ma, In, Gr, and Pg are dummy variables indicating completion of Primary, Middle, Matric, Intermediate, Graduation and Post

Graduation levels of education of the employed labour force respectively, while Ot indicates other categories of professional education and non-professional education.

3.1.2 Data

The data sets used in the estimation of the Mincer wage equations is drawn from the *Labour Force Survey (LFS) 1990-91,* collected by the Federal Bureau of Statistics (FBS). The LFS data provides detailed socio-economic information about more than 111,000 individuals. The information on labour market activities is provided for individuals of 10 years of age and above. To adjust for seasonal variations, the data collection is spread over all the years. The survey collects comprehensive information on various activities of workers. The information about age, literacy, education, and earnings is particularly important for this study.

Since 1965, the Labour Force Surveys are the major source of information on labour market statistics in Pakistan. Province-wise labour market statistics are available since 1974-75 and micro data sets are available since 1990-91. A comparison of LFS with other data sources shows the superiority of LFS because of greater internal and external consistencies [Zeeuw (1996)]. Since 1990s, the questionnaire of the LFS has been revised twice and a number of other changes are made to improve the quality of data collection as well as coverage of different sub-groups. The first available micro data set of the *Labour Force Survey 1990-91* is used in the estimation of the Mincer Wage Equation.

3.1.3 Sample Selection Issues

The aim of the estimating the *Mincer Wage Equation* is to compute the relative wage rates; therefore, we restricted our sample to only regular wage and salaried workers of 10 to 70 years of age, including both male and female[3]. The majority of these individuals are full-time employees who work more than 35 hours per week. The data on earnings include only cash payments; other benefits such as bonuses are not included in these earnings.

[3] There is convincing evidence available on gender differentials and generally separate samples of males and females are selected for analysis. However, in Pakistan, female participation rate is very low, which may create a problem with respect to degrees of freedom in case of separate sample estimation for males and females by sector and by province.

Table - I
Sample Size of Salaried Workers in LFS 1990-91

	Agriculture	Manufacturing	Services	Total
1990-91				
Punjab	5,864	2,364	7,288	**15,516**
Sindh	2,782	1,224	4,049	**8,055**
NWFP	2,154	463	3,090	**5,707**
Balochistan	1,317	134	1,541	**2,992**
Total	**12,117**	**4,185**	**15,968**	**32,270**

Source: Authors Estimates Based on LFS 1990-91

Table – I provides summary statistics for the employed labour force used in the wage rate regression by industrial category, and by province. In 1990-91 the final sample of regular salaried workers comprised of 15,516, 8,055, 5,707 and 2,992 individuals in Punjab, Sindh, NWFP and Balochistan respectively.

Table - II
Average Monthly Wages in 1990-91

	Agriculture	Manufacturing	Services	Total
1990-91				
Punjab	1,063	1,325	1,646	**1,547**
Sindh	1,367	1,995	1,963	**1,926**
NWFP	1,234	1,386	1,643	**1,592**
Balochistan	1,549	1,522	1,799	**1,765**
	1,277	1,608	1,757	**1,698**

Source: Authors Estimates Based on LFS 1990-91

The summary statistics provided in Table – II reveals that the average wage in Sindh is 24 percent, 21 percent and 9 percent higher than the average wage in Punjab, NWFP and Balochistan respectively.

3.1.4 Rate of Returns on Education

When estimating the *Mincerian Wage Equation* "illiterate" is taken as the reference category for education levels. Similarly, for the sectoral analysis, agriculture is selected as the reference sector. This selection enables us to use wage of the illiterate agrarian worker as the numeraire when computing the relative wage rates. Estimation results for the respective *Mincerian Wage Equations* for 1990-91, for all four provinces, are presented in Table-III. All the results are in line with the human capital theory.

The age variable (a proxy for experience) and its squared both are significant, and express a concave relationship between wage and experience (the linear term is positive and the quadratic term is negative) in all four provinces.

Table - III
Province-wise Estimates of the Mincer Wage Equations for 1990-91

	Punjab	Sindh	NWFP	Balochistan
Constant	5.7929	5.8922	5.9696	5.9008
	0.0694	*0.1159*	*0.1057*	*0.3121*
Age (Agriculture)	0.0408	0.0521	0.0479	0.0639
	0.0058	*0.0074*	*0.0078*	*0.0181*
Age (Manufacturing)	0.0557	0.0684	0.0491	0.1516
	0.0047	*0.0071*	*0.0076*	*0.0444*
Age (Services)	0.0497	0.0344	0.0476	0.0319
	0.0042	*0.0051*	*0.0061*	*0.0070*
$(Age)^2$ (Agriculture)	-0.0004	-0.0005	-0.0006	-0.0007
	0.0001	*0.0001*	*0.0001*	*0.0002*
$(Age)^2$ (Manufacturing)	-0.0006	-0.0008	-0.0005	-0.0022
	0.0001	*0.0001*	*0.0001*	*0.0007*
$(Age)^2$ (Services)	-0.0005	-0.0003	-0.0005	-0.0003
	0.0001	*0.0001*	*0.0001*	*0.0001*
Manufacturing	-	-	-	-1.2342
				0.7067
Services	-	0.4219	-	0.6468
		0.1453		*0.3339*
Primary	0.1511	0.0619	0.1457	0.1127
	0.0319	*0.0296*	*0.0500*	*0.0466*
Middle	0.2890	0.2385	0.3262	0.1513
	0.0318	*0.0330*	*0.0495*	*0.0476*
Matric	0.4427	0.2736	0.4038	0.2277
	0.0265	*0.0288*	*0.0369*	*0.0338*
Intermediate	0.6505	0.4202	0.5037	0.3765
	0.0379	*0.0316*	*0.0492*	*0.0464*
Graduate	0.9101	0.6711	0.7134	0.6792
	0.0432	*0.0318*	*0.0558*	*0.0701*
Post Graduate	1.1833	0.9128	1.1264	0.8539
	0.0537	*0.0500*	*0.0657*	*0.0883*
Others	1.1546	1.0412	1.0939	0.9410
	0.0580	*0.0450*	*0.0882*	*0.0683*
Adjusted R^2	0.3629	0.3887	0.3393	0.3670

The coefficients of all education dummies are positive and significant, which reflects that having no schooling can put a serious strain on career advancement. However, as expected, return to higher academic degrees rises unequivocally with higher level of

education in all four provinces. Comparison of province-wise estimates of returns to education level for 1990-91 portrays a picture of regional disparity. For instance, return to primary education is highest in Punjab and lowest in Sindh. Possible reasons for variation in returns to education may be the variation in labour supply as well as employment opportunities in both public and private sectors in a province.

3.1.5 Computation of the Relative Productivity

The goal of this section is to provide estimates of productivity with explicit statements of underlying assumptions used in the computation. An important question in this regard is: what is the initial stock of human capital in each province? We work on the assumption that the zero schooling person is the same, always and everywhere, as assumed by Mulligan and Martin 1995. The assumption does not imply that zero schooling people will earn the same income always and everywhere. Their productivity will differ across regions because the aggregate stock of physical and human capital, and other inputs will differ across the regions. The main reason for using this assumption is that we need a numeraire to express the human capital index in a unit, which is homogenous across space and time. People with any positive amount of schooling will tend to introduce interregional and intertemporal differences in the level of schooling, simply because the resources devoted to education, and the human capital of the teachers, will differ across economies. Therefore, people with any positive amount of schooling cannot be used as numeraire. Following the same argument and in the absence of any technological revolution in the agriculture sector, which might affect the productivity of the agrarian illiterate labourer, we use the illiterate agrarian labourer as numeraire. In other words, the illiterate agrarian labourer in all provinces during 1990-91 has the same productivity, which is one.

Based on the above discussion, a province-wise productivity measure for various levels of education is computed by using relative wages:

$$\theta_{ij}(t,s,a) = \frac{w_j(t_0,s,a)}{w_j(t_0,0,a_0)} \qquad (7)$$

In other words, the average worker in each province with s years of schooling at time t is assumed to be θ(t, s, a) times more productive than a worker with zero years of schooling and 10-14 years of age group. This productivity measure θ(t, s, a) is computed for each province during 1990-91.

From the estimates of the mincer wage equations we compute average monthly earnings for each schooling group, for each province, in the three respective sectors, for 1990-91. Average monthly earnings are estimated by dividing the civilian labour force, aged 10-70 years into eight schooling categories, starting from no schooling to professional education. However, nursery school and kindergarten are not counted as educational levels, therefore, an individual qualifies for the no schooling category if he attended nursery school or kindergarten, or even if he attended, but did not complete primary education. Similarly, for other levels only those workers have been included that have completed the particular level of education. The details of education levels are as follows:

0. No schooling
1. Primary (completed 5 years of schooling)
2. Middle (completed 8 years of schooling)
3. Matric (completed 10 years of schooling)
4. Intermediate (completed 12 years of schooling)
5. Graduate (completed 14 years of schooling)
6. Post Graduate (completed 16 years of schooling)
7. Professional (possessing a professional degree[4])

As in the case of education levels, we also computed relative wage rates for twelve age groups, beginning from 10-14 and ending at 65-69 years. However, for comparison, only the estimated relative wage rates for the age group 25-29, during 1990-91, in three sectors, for four provinces, as a ratio of the reference group (employed inexperienced illiterate agrarian labour) are presented in Table IV[5].

[4] Generally Professional degrees require 4 or 5 years of schooling after Intermediate.
[5] See age categories wise detail table in Annex,.

As expected, education level plays a significant role in wage determination, in all sectors, and regions. In Punjab the relative wage rate for postgraduates is more than three times the relative wage rate of the illiterate workers of the same age group, in each sector. In fact, it is nearly eight times the wage rate of the agrarian illiterate labourer of age group 10-14 years.

Table - IV
Province-wise Estimates of Relative Productivity - 1990-91

Level of Education	Agriculture	Manufacturing	Other Sectors
	Punjab		
No Schooling	1.4	1.9	1.7
Primary	1.7	2.2	2.0
Middle	1.9	2.5	2.3
Matric	2.2	2.9	2.7
Intermediate	2.8	3.6	3.3
Graduate	3.6	4.7	4.3
Post Graduate	4.7	6.2	5.6
Professional	4.6	6.0	5.5
	Sindh		
No Schooling	1.6	2.1	1.8
Primary	1.7	2.3	1.9
Middle	2.0	2.7	2.3
Matric	2.1	2.8	2.4
Intermediate	2.4	3.2	2.7
Graduate	3.1	4.1	3.5
Post Graduate	4.0	5.3	4.5
Professional	4.5	6.0	5.1
	NWFP		
No Schooling	1.4	1.6	1.5
Primary	1.6	1.8	1.7
Middle	1.9	2.2	2.1
Matric	2.1	2.4	2.3
Intermediate	2.3	2.6	2.5
Graduate	2.9	3.2	3.1
Post Graduate	4.3	4.9	4.6
Professional	4.2	4.7	4.5
	Balochistan		
No Schooling	1.7	1.8	1.9
Primary	2.0	2.1	2.1
Middle	2.0	2.1	2.2
Matric	2.2	2.3	2.3
Intermediate	2.5	2.7	2.7
Graduate	3.4	3.6	3.6
Post Graduate	4.1	4.3	4.3
Professional	4.5	4.7	4.7

Note: Estimates are only for age group 25-29 years, See Annex for all age groups

However, return on professional education is less than post graduation, which may be because of the wider coverage of the professional education category; professional education also includes degrees based on only three years of education after matric. Another noticeable point with respect to the return on education is the higher growth in relative wages after intermediate; this indicates the non-linearity in returns to completed years of schooling.

Similarly, in Sindh the relative return to education increased with the level of education, and the highest jump occurred in the case of graduation in all sectors, and in both years. During 1990-91, return on post-graduation was also very high.

As in the case of Sindh and Punjab, relative wage rates disproportionately increased with the level of education in NWFP. The highest jump occurred in relative wage rates between graduation and post-graduation. In 1990-91, this increase was more than 50 percent, as compared to no schooling, the relative wage rate for post graduation is three times higher.

In Balochistan also, relative wage rates increase disproportionately with level of education, and the highest increase in the relative wage rate is from intermediate to graduation.

3.2 Estimation of Proportion of the Employed Labour Force

For the period, prior to 1990-91, in the absence of micro-data, estimation of employed labour force by education levels, age and sectors, in each province is a challenge. The labour force surveys did not publish specific tables containing all the desired information. Therefore, the estimation of the employed labour force by education level, age, and sector, for each respective province, involves three steps: (i) sector-wise proportion of employed labour force by education levels is computed using tables “Percentage distribution of employed persons of 10 years age and above by major industry Divisions and major occupation groups” and “Percentage distribution of employed persons of 10 years age and above by Literacy & Level of Education and major Occupation Groups” published in respective Labour Force Surveys; (ii) population of 10 years and above is

categorized into 12 age groups 10-14,15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 54-59, 60-64, and 65-70 for eight education levels: no schooling, primary, middle, matric, intermediate, graduate, post-graduate, and others, for the time period 1982-83 to 1999-2000 by using the table "Percentage Distribution of Population by Age, Sex, Literacy and Level of Education"; (iii) the proportion of employed labour force by sector, education level and age is computed by using the matrices describes in steps (i) and (ii) (iv) above and finally, these proportions are multiplied by the total employed labour force to obtain the number of employed labour force by sector, education level and age for each province.

Table V presents the estimates of overall total labour force working in three sectors by education level, and by province. The share of employed labour force with no schooling has declined markedly over the years, in each province. In Punjab the share has declined from over 70 percent to roughly 56 percent. In Sindh and NWFP it is down to 51 percent and 61 percent respectively in 1999-2000, from around 74 percent in 1982-83. Moreover, the employed labour force, with education level matric and intermediate, has grown at a faster pace as compared to the other educational categories.

Table - V
Educational Attainment of Employed Labour Force (in 000)

	No Schooling	Primary	Middle	Matric	Intermediate	Graduate	Post Graduate	Professional
				Punjab				
1982-83	11,288	1,973	1,362	1,150	65	168	69	44
1990-91	12,142	2,488	1,582	1,586	446	212	76	88
1999-2000	13,315	3,623	2,598	2,576	767	410	202	99
				Sindh				
1982-83	4,160	780	433	171	23	23	23	23
1990-91	3,964	1,117	505	582	317	251	70	91
1999-2000	3,805	1,074	579	797	475	473	142	96
				NWFP				
1982-83	2,280	310	196	230	8	44	24	3
1990-91	2,303	358	216	252	78	45	19	15
1999-2000	2,442	526	299	414	148	92	50	19
				Balochistan				
1982-83	791	56	57	64	1	14	4	6
1990-91	853	58	38	45	15	5	3	5
1999-2000	991	76	78	87	27	22	13	6

3.3 Computation of the Human Capital Index

Finally, sector-wise stock of human capital for each province is computed by multiplying relative wage rates categorized according to education level and age with comparable categories of the employed labour force. This sector-wise stock is aggregated at provincial and national levels to compute provincial as well as national stock of human capital. Moreover, to compare the growth of human capital between provinces, the human capital index is based on the stock of human capital in 1982-83.

4. TREND IN PROVINCIAL/NATIONAL HUMAN CAPITAL

The national and regional human capital stock measures presented in this paper are in the form of indices. These indices describe the evolution of Pakistan's human capital stock at both the provincial and national level over time.

Table - VI: Human Capital Index

	Punjab	Sindh	NWFP	Balochistan	Pakistan
1982-83	100.0	100.0	100.0	100.0	100.0
1983-84	104.0	105.2	102.1	102.8	104.0
1984-85	108.1	110.4	104.1	105.5	108.1
1985-86	107.2	110.3	104.0	101.5	107.4
1986-87	115.3	119.9	114.8	111.8	116.1
1987-88	115.5	121.7	112.7	112.7	116.5
1988-89	120.2	129.7	114.0	111.4	121.4
1989-90	125.1	138.5	115.5	110.3	126.6
1990-91	130.3	148.2	117.1	109.3	132.2
1991-92	138.2	149.0	116.4	122.7	137.8
1992-93	142.5	162.7	125.2	120.5	144.5
1993-94	145.9	157.2	132.9	127.1	146.4
1994-95	151.9	161.8	143.2	118.5	151.9
1995-96	157.2	165.5	141.3	121.9	156.0
1996-97	162.5	169.3	139.4	125.3	160.2
1997-98	166.0	173.8	149.8	144.8	165.3
1998-99	169.7	171.6	149.4	146.2	167.1
1999-00	173.5	169.4	148.9	147.7	169.0
2000-01	177.9	186.1	156.0	162.7	176.9
2001-02	182.2	202.8	163.0	177.8	184.8
2002-03	188.2	213.3	167.3	189.3	191.9
2003-04	194.2	223.9	171.7	200.8	198.9
Annual Cumulative Growth Rate					
1983-1990	3.3%	4.8%	2.1%	1.4%	**3.4%**
1991-2000	3.2%	1.5%	2.7%	3.4%	**2.8%**
2000-2004	3.0%	6.3%	3.2%	7.3%	**4.0%**
1983-2004	**3.2%**	**3.9%**	**2.6%**	**3.4%**	**3.3%**
Regional Distribution of Human Capital Stock					
Average Share	**63%**	**24%**	**9%**	**4%**	**100%**

Table - VI presents the results of the estimated provincial and national human capital indices. The national estimates show that Pakistan's human capital stock almost doubled during 1982-83 to 2003-2004 growing at an annual compound growth rate (ACGR) of 3.3 percent.

Based on the trend in the growth of the human capital index the analysis may be divided into three periods: (i) 1982-83 to 1989-90 and (ii) 1990-91 to 1999-2000 (iii) 2001-2004. During the time period 1982-83 to 1989-90, the national human capital index grew at 3.4 percent per annum, largely driven by higher growth in Punjab (3.3 percent) and Sindh (4.8 percent).

During the second period of analysis (1991-2000), a slowdown in the growth of Pakistan's overall stock of human capital is observed. This is mainly the reflection of slower growth of only 1.5 percent per annum in Sindh (as compared to 4.8 percent in 1982-90). However, post-2000 human capital accumulation in Sindh recovered to 6.3% per annum, manifesting in an overall ACGR for the national-level HCI of 4% for the last period of analysis 2000-2004. Sindh accounts for 24% of the overall HCI, while Punjab contributes 63%. Province-wise disaggregation further shows that growth in Punjab has consistently hovered around 3.2%-3.3% per annum. In contrast, the performance by Sindh, as discussed above, was relatively erratic, with the 1990s emerging as a very difficult decade. Further, the remaining 2 provinces, NWFP and Balochistan, post a ACGR of 2.6% and 3.4% respectively over the 22 years of analysis; but given the very small base of the two provinces (together they account for only 13% of the overall stock of human capital) their impact on the overall national HCI is limited.

4.1 Trend in Sectoral HCI

It would be interesting to compare the pattern of human capital in the different sectors of the economy, as this will in turn provide us an insight into the causative factors behind the provincial and national HCI growth patterns. Tables VII, VIII and IX, present the sector-wise HCI at both the provincial and the national level. Our analysis reveals that the main driver of growth in HCI, in all provinces, is the services sector, which grew at a

much higher rate compared to the manufacturing and agricultural sectors. In the provinces of Sindh, and Punjab, human capital in the services sector more than doubled during the period under review (see Table-VII).

4.1.1 Trend in HCI- Services

In this section we again break our analysis of HCI – services into the three time periods: (i) 1982-83 to 1989-90 and (ii) 1990-91 to 1999-2000, and (iii) 2000-2004. Table-VII shows that during 1982-83 to 1989-90, the province of Sindh took the lead in terms of growth in the HCI-services sector, which almost doubled in this period growing at an annual compounded growth rate of 9.8 percent. In comparison, HCI-services for Punjab, NWFP and Balochistan, grew by 6 percent, 3.8 percent and minus 0.9 percent, respectively, for the same time period. However, in the decade of the 1990s, we find a reversal in the hierarchy vis-à-vis human capital growth in the services sector, with Sindh losing its steam and falling behind the other three provinces. The highest increase in HCI-services, in the 1990s, was observed in Balochistan, followed by NWFP, and Punjab. Post 1999, Sind regained its growth momentum, and a convergence in the respective provincial growth trajectories is observed.

Table - VII
Human Capital Index: Services

	Punjab	Sindh	NWFP	Balochistan	Pakistan
1982-83	100.0	100.0	100.0	100.0	100.0
1983-84	114.3	119.6	100.5	100.4	113.1
1984-85	128.5	139.3	100.9	100.8	126.2
1985-86	116.2	131.7	96.4	72.8	115.1
1986-87	135.7	155.4	125.3	103.3	137.2
1987-88	133.1	162.4	119.9	90.3	135.8
1988-89	141.4	176.7	124.8	92.2	144.7
1989-90	150.3	192.2	129.8	94.1	154.3
1990-91	159.7	209.0	135.1	96.0	164.4
1991-92	166.9	211.4	124.0	110.7	168.8
1992-93	180.8	241.4	149.5	108.9	186.8
1993-94	178.6	236.4	145.9	110.7	184.1
1994-95	197.6	241.9	175.5	122.1	200.9
1995-96	209.6	252.8	177.2	127.5	211.2
1996-97	221.7	263.8	179.0	133.0	221.5
1997-98	218.3	261.6	182.4	145.1	219.9
1998-99	214.6	253.1	182.3	152.9	216.2
1999-00	211.0	244.6	182.2	160.8	212.5
2000-01	225.0	280.2	194.2	181.3	231.3
2001-02	239.0	315.7	206.2	201.9	250.0
2002-03	245.2	325.9	219.7	225.4	258.8

2003-04	251.4	336.1	233.1	249.0	267.6
Annual Cumulative Growth Rate					
1983-1990	6.0%	9.8%	3.8%	-0.9%	**6.4%**
1991-2000	3.1%	1.8%	3.4%	5.9%	**2.9%**
2000-2004	3.8%	6.3%	6.3%	11.1%	**5.0%**
1983-2004	**4.5%**	**5.9%**	**4.1%**	**4.4%**	**4.8%**
Regional Distribution of Human Capital Stock					
Average Share	**60%**	**26%**	**10%**	**3%**	**100%**

4.1.2 Trend in HCI- Manufacturing

With respect to growth in HCI-manufacturing, a similar pattern as in the case of services is observed. During the first period of our analysis i.e. 1982-83 to 1989-90 growth is led by Sindh; HCI-manufacturing grew at an annual compound growth rate of 6.7 percent, followed by Punjab, which demonstrated a moderate growth of 1.5 percent during the same period. In comparison, both Balochistan and NWFP, show a de-accumulation in their human capital in the manufacturing sector, in the time period 1982-83 to 1989-90. In comparison, during the second period of analysis, 1990-91 to 1999-00, we observe NWFP HCI-manufacturing making a leap jump from negative 0.5% growth on average per annum, in 1982-83 to 1989-90, to almost 5 percent CAGR in the 1990s, while Punjab, Sindh and Balochistan grew by 3, 0.3 and minus 3 percent respectively (see Table VIII). In 2000-2004, Sindh made a comeback, and posted an annual average growth rate of 10.9%, while Punjab grew at 4.9%, NWFP at 3.2%, and Balochistan at 20.6%, which appears to be an aberration; moreover, given Balochistan's small base, contributing only 1% toward the national-level manufacturing sector HCI, this result is not very meaningful).

Table - VIII
Human Capital Index: Manufacturing

	Punjab	Sindh	NWFP	Balochistan	Pakistan
1982-83	100.0	100.0	100.0	100.0	100.0
1983-84	108.0	104.5	106.4	121.2	107.2
1984-85	115.9	109.0	112.8	142.4	114.4
1985-86	105.4	106.8	90.1	104.9	104.8
1986-87	119.0	110.4	104.0	122.5	116.2
1987-88	103.1	117.6	109.2	70.2	106.5
1988-89	107.1	136.1	102.8	78.4	113.1
1989-90	111.2	157.5	96.7	87.6	120.6
1990-91	115.5	182.3	91.0	97.8	129.0
1991-92	128.7	175.8	90.4	116.2	136.9

1992-93	114.7	170.8	84.8	114.9	125.5
1993-94	113.6	148.0	85.2	88.7	119.4
1994-95	126.3	153.4	75.3	83.7	129.0
1995-96	130.8	168.4	91.6	74.8	136.4
1996-97	135.2	183.4	107.9	65.9	143.8
1997-98	129.8	164.3	121.2	72.5	136.6
1998-99	140.3	175.4	129.3	72.5	147.0
1999-00	150.7	186.6	137.4	72.5	157.3
2000-01	171.6	208.0	152.4	122.4	178.3
2001-02	192.5	229.4	167.4	172.3	199.2
2002-03	195.4	256.6	167.6	193.5	207.5
2003-04	198.3	283.8	167.7	214.7	215.9
Annual Cumulative Growth Rate					
1983-1990	1.5%	6.7%	-0.5%	-1.9%	**2.7%**
1991-2000	3.0%	0.3%	4.7%	-3.3%	**2.2%**
2000-2004	4.9%	10.9%	3.2%	20.6%	**6.6%**
1983-2004	**3.3%**	**5.1%**	**2.5%**	**3.7%**	**3.7%**
Regional Distribution of Human Capital Stock					
Average Share	**68%**	**27%**	**5%**	**1%**	**100%**

4.1.3 Trend in HCI- Agriculture

Growth in agriculture is mainly led by Punjab, which is not surprising given the province's large agrarian base. Though both NWFP and Balochistan show reasonable overall growth in HCI-Agriculture, in terms of actual contribution toward the national HCI, given the narrow base of the agriculture sector in the two provinces, this growth is not meaningful. Sindh, on the other hand, showed a lackluster performance in HCI-agriculture in the time-period 1983-2000, however, annual average growth picked up in 2000.

Table - IX
Human Capital Index: Agriculture

	Punjab	Sindh	NWFP	Balochistan	Pakistan
1982-83	100.0	100.0	100.0	100.0	100.0
1983-84	94.5	94.8	102.8	103.7	95.8
1984-85	89.0	89.6	105.5	107.5	91.6
1985-86	100.5	95.8	113.4	126.3	101.9
1986-87	97.5	96.7	107.1	118.6	99.2
1987-88	105.6	93.2	106.6	134.6	104.1
1988-89	107.7	93.5	106.0	130.1	105.1
1989-90	109.7	93.8	105.5	125.8	106.2
1990-91	111.8	94.1	105.0	121.6	107.3
1991-92	118.5	95.8	114.0	133.5	113.3
1992-93	121.4	103.0	109.9	130.9	116.3
1993-94	130.8	102.0	129.3	143.5	124.3

1994-95	123.9	105.7	125.5	117.5	119.4
1995-96	124.1	101.0	116.8	119.8	117.6
1996-97	124.3	96.3	108.2	122.0	115.9
1997-98	136.5	112.4	124.7	148.7	130.1
1998-99	143.8	111.0	122.4	144.7	133.8
1999-00	151.2	109.6	120.1	140.7	137.6
2000-01	142.1	111.3	121.1	148.9	132.9
2001-02	133.1	112.9	122.1	157.2	128.2
2002-03	140.0	118.9	118.7	157.7	133.5
2003-04	146.8	124.9	115.4	158.2	138.9
Annual Cumulative Growth Rate					
1983-1990	1.3%	-0.9%	0.8%	3.3%	**0.9%**
1991-2000	3.4%	1.7%	1.5%	1.6%	**2.8%**
2000-2004	1.1%	3.9%	-1.6%	2.0%	**1.5%**
1983-2004	**1.8%**	**1.1%**	**0.7%**	**2.2%**	**1.6%**
Regional Distribution of Human Capital Stock					
Average Share	**64%**	**21%**	**10%**	**5%**	**100%**

5 CONCLUSION

This paper reviews the trend in the growth of human capital in the provinces of Pakistan by estimating sector-wise human capital indices. This measure of human capital stock is based on the completion of education levels, as well as on work experience. This is the first attempt to compute a measure of human capital by province, and by sector, and may fall short of an ideal measure. Nonetheless, this measure of HCI builds upon and improves existing national-level measures, and hopefully will attract attention and stimulate future efforts for the development of what may become an important instrument for the understanding of regional economic performance. In the near term, this measure will be used in various regional/national applications.

To consolidate, the province-wise sectoral analysis provides a better insight into the overall trend demonstrated by the aggregate national-level human capital index. In the 1980s Sindh and Punjab were the leaders in terms of human capital growth, which was largely driven by human capital growth in the manufacturing and services sectors. However, with the passage of time, in the decade of the 1990s, we observe a loss of momentum in terms of human capital development in Sindh. Punjab, NWFP and even Balochistan grew at a faster pace than Sindh in the 1990s. But, by 2000, Sindh had regained its original trajectory, posting a CAGR of 6.3% in the last phase of the analysis: 2000-2004.

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