

## A linkage between Human Capital and Demographic Externalities

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### Abstract

The Industrial Revolution and the Demographic Transition are the two great forces that explain the upward march of modern economy. What is the general effect of increase in Human Capital Intensity (HCI) on major demographic factors? Despite the universal agreement on socio-economic return of Human Capital (HC), much less is known about the demographic return of HC. This study attempts to explore major demographic externalities of overall increase in HCI. This paper mainly utilizes the published data of International Labor Organization and United Nations. In this study, both bivariate and multivariate analyses have been performed. From this study, It is observed that, HCI is robustly associated with the productivity of the country. Our findings reveal that, a negative relation exists between HCI (PWSI) and Population Growth Rate, Total Fertility Rate, Crude Birth Rate and Crude Death Rate, and a positive correlation appears between HCI and Net Migration Rate. Formation of HC is very important in different aspects for a nation, as well as the individual. Every nation should emphasize HC formation for prosperity of the nation. Besides this, HC formation should also be stressed as an indirect measure of population control, which is very important for well-being of all nations.

**Key Words:** Human Capital, Occupation, Productivity, Demographic Factor, Population Dynamics.

### INTRODUCTION

The Industrial Revolution and the Demographic Transition are the two great forces that explain the upward march of modern economy. In modern era, Human Capital (HC) has become very important for economic growth of a country. Exploitation of natural resources of a country largely depends upon the manpower of a country. Processing of the inputs of a production system also depends upon the labor employed in the system. But the effective and optimum production (exploiting the physical inputs) entirely relies upon the skill and knowledge level of manpower, i.e. HC of the system. The population of a country and its dynamics are closely associated with the formation of HC of the country. For example, to meet the demand of labor force in the country, she must contain the population consistent to demand. But if the population grows higher compared to its resources, it will not be possible for the Government to provide all with education and training, consequently, such growth will obviously impede HC formation.

These days, the modern high income countries can be characterized by low fertility, lots of education, HC as an important source of income, and high rates of productivity growth. But in the countries, which have not experienced industrial revolution yet, a contrary is

observed: high fertility rates, little education, the dominance of physical over human capital, and low rates of productivity growth. Pakistan is a country that falls in this category.

Pakistan is an over populated country (990 persons/square km; BER 2010); around 36.3 percent of whom live below poverty line (CIA 2008) and average per capita income of the country is only US\$ 750 (BER 2010). The country is passing through a very high fertility (Total Fertility Rate: 2.5; WPDS 2009). Annual population growth rate of the country is 1.29 percent (CIA 2009) which is considered high for such a small country. Annual GDP growth rate is 4.9% (CIA 2008). The government is overwhelmed with such high population (146.1 millions; BER 2010), and it has become very difficult for the government to provide all with educational support by its limited resources. Recently, government of the country has lifted primary education to class 8, instead of class 5. In the 40<sup>th</sup> (last) national budget of the country, second highest allocation (13.9% of the total volume; about US\$ 2.66 Billion; BER 2010) is given to the education and technology sector. However, the allocated resources can not be utilized efficiently due to widespread corruption (Corruption Perception Index 2008: 2.1; GCR 2009) in the country. Though the country is making progress in socio-economic, demographic and Human Resource Development sector, but the pace is very slow. The country is also lagging behind in producing HC, which (HC) is supposed to play dominant role in bringing expected change in the socio-economic sector of the country.

From a number of studies, it is evident that, there is a positive correlation between overall production and level of Human Capital. Some studies have also chalked out the social impact of HC. Despite the universal agreement on economic and social return to HC, much less is known about the demographic return of HC. This study attempts to explore major demographic externalities of overall increase in the HCI. It is very important to know the relationship between HCI and major demographic components for efficient manpower planning, which is considered most important in economic development of a country. Though formation of HC and demographic factors are interrelated, this study is directed to investigate the changes in demographic factors with the change in the HCI rather than the reverse impact.

## MATERIALS AND METHODS

Data used in this study has been collected from different sources, as there is no unique survey that covers all the topics. The occupational data (i.e. data on different categories of labor) and the information on economically active population<sup>1</sup> were extracted from LABORSTA, a labor Statistics Database released by the International Labor Organization (ILO). Such Database mainly relies on the labor force survey by the local statistical agencies. The data on Gross National Income (GNI) PPP (Purchasing power Parity) comes from National Accounts of Main Aggregates (NAMA) database, which is maintained by Economic Statistics Branch of United Nations Statistics Division (UNSD). The remaining Demographic Data, viz. Population Growth Rate (GR), Total Fertility Rate (TFR), Crude Birth Rate (CBR), Crude Death Rate (CDR), and Net Migration Rate (NMR) were pulled out from World Population Prospect. In this paper, percentage of Labor has been used instead of their absolute numbers.

The percentages of the labor by different categories are calculated in respect of total population aged 15 years and above, instead of total population of all age. This is done to generalize the percentage.

$$PWSI = (0.717X_0 + 0.44X_1) \times 1000 \quad \dots\dots\dots (i)$$

Where,  $X_0$  = Percentage of professional, technical and related workers to the total population aged 15+ years, and

$X_1$  = Percentage of Administrative, executive and related workers to the total population aged 15+ years.

Other categories of labor are not included in the estimation of PWSI, because they were not found significantly associated with the productivity. In calculating PWSI, percentage is used instead of absolute number, this is done to standardize and concise the index.

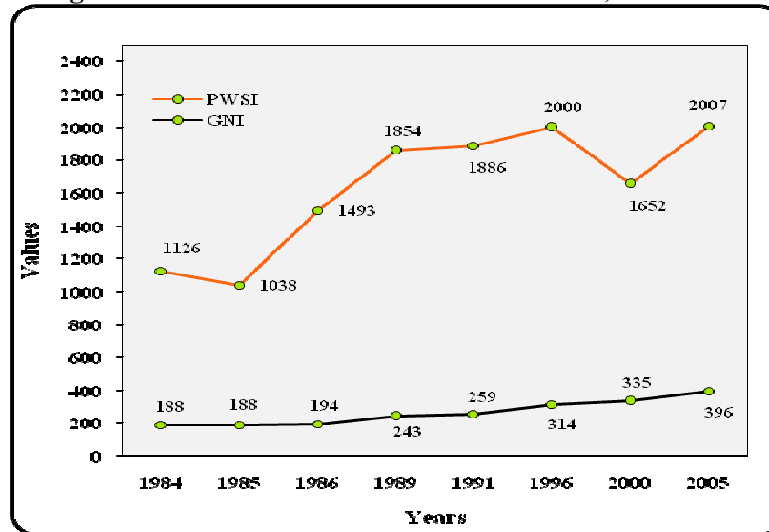
Here, to investigate the relationship between PWSI and GNI PPP, Linearized Simple Regression Function has been used with necessary transformation (Chatterjee, S. & Hadi, A. 2006) of incorporated variables (i.e. PWSI and GNI PPP) to ensure linearity. In the second portion of analysis, the single year PWSI is converted into grouped data by averaging the values corresponding to single year. The reason for that is matching the single year PWSI with the grouped demographic data. Moreover, such grouped data is helpful to understand the turn (upward/downward) of the trend, as it is very difficult to understand and conclude from data corresponds to single year (short time interval). Again, to explore the relationship between HC intensity and major demographic variables, Linearized Simple Regression function has been used with the transformation of PWSI. Besides the linear regression analysis, correlation analysis is also performed to study the nature (positive or negative) of the relationship between HCI and major demographic variables. In analyzing the data, SPSS-15.0 computer software has been used.

Statistical database of Pakistan is not rich enough; the practices of different surveys have just started in recent past. A limitation of this study is scanty observations, as data are not available for long time period. Moreover, the data of NMR is available only for 3 time period, statistical analysis with such small number of observations might not give accurate results.

### **PWSI AND ITS ASSOCIATION WITH GNI PPP**

As described in the previous section, the PWSI has been calculated using the relation (i) for single year data and has been plotted with GNI PPP per capita in figure 1. From figure 1, we observe a positive relationship (Pearson Correlation Coefficient: 0.76; significant at 5% level) between PWSI and GNI PPP per capital.

Figure 1. PWSI and GNI Trend in Pakistan; 1984-2005



In regression analysis, the considered line can be given as:

$$\ln W = b_0 + b_1 \ln H + e \quad \dots \dots \dots (ii)$$

Where, W=GNI PPP per capita and H=PWSI

Result of the regression analysis (Table 1) shows that, a strong relationship exists between PWSI and GNI PPP per capita. HC is directly related with productivity of the labor.

Table 1. Result of Regression Analysis of PWSI and GNI PPP

Model	Coefficients	R <sup>2</sup>	F	Significance Level
b <sub>0</sub> (Constant)	-0.917	0.622	9.892	0.020
b <sub>1</sub> (lnH)	0.876*			

**Dependent Variable:** Logarithm of GNI PPP; \* Significant at 5% level All the analyses (bivariate, correlation and regression) in this section demonstrate a positive robust relationship between PWSI and GNI PPP per capita. Thus, it can be concluded that, the estimation of PWSI is realistic and reflects the real intensity of HC of the country.

**FINDINGS**

Figure 2 represents the trend of PWSI/100, GR, TFR, CBR, CDR, NMR of Pakistan. In the graph, before plotting PWSI, it has been divided by 100 and then the value of PWSI/100 has been plotted in the graph instead of PWSI, this has been done to facilitate the comparability of HCI with the major demographic variables. It is obvious from the figure that, with the passage of time, the intensity of HC (PWSI) increases, but all the demographic trends shows downward trend except NMR. NMR data is found only for three time period, it is very difficult to draw any inference from such scanty data.

Figure 2. PWSI/100, GR, TFR, CBR, CDR and NMR

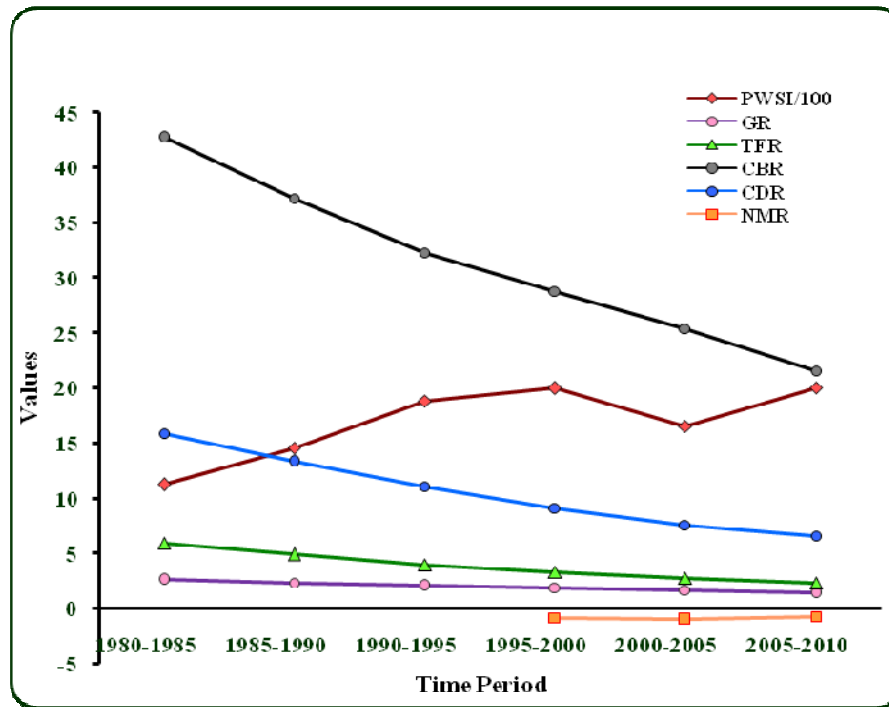


Table 2 represents the result of linear regression analysis; the regression line can be given as follows:

$$Y=b_0+b_1\ln H+e \dots\dots\dots (iii)$$

Where, Y=any one of GR, TFR, CBR, CDR and NMR, and

$$H=PWSI$$

From table 2, it is observed that, all the demographic factors (GR, TFR, CBR, and CDR) are significantly associated with PWSI, except NMR. The NMR is found insignificant due to very small number of observations (N=3).

Table 2. Result of Linear Regression Analysis of PWSI and GR, TFR, CBR,

**CDR and NMR**

Model	Coefficients $b_i(\ln H)$	R <sup>2</sup>	F	Significance Level
GR*	-1.576	0.681	8.525	0.043
TFR*	-5.127	0.742	11.496	0.028
CBR*	-28.856	0.703	9.469	0.037
CDR*	-13.238	0.708	9.705	0.036
NMR	1.300	0.903	9.264	0.202

Independent Variable: lnH; \* Significant at 5% level

Table 3 represents the correlation matrix between PWSI and GR, TFR, CBR, CDR and NMR. From table 3, all the demographic factors, except NMR, are negatively correlated with PWSI and the correlation coefficients were found significant at 5 percent level, again NMR is found insignificant, due to extremely small N (=3). While NMR is found positively correlated with PWSI, but the coefficient is found insignificant. Since, all NMR found were negative value, this is because the emigration surpasses immigration.

**Table 3. Correlation Coefficient between PWSI and GR, TFR, CBR, CDR and NMR**

Variables		GR	TFR	CBR	CDR	NMR
PWSI	<b>Pearson Correlation</b>	-0.817*	-0.850*	-0.830*	-0.830*	0.951
	<b>Sig. (2-tailed)</b>	0.047	0.032	0.041	0.041	0.201
	<b>N</b>	6	6	6	6	3

\* Correlation is significant at 5% level (2-tailed).

## DISCUSSION AND CONCLUSION

Main objective of this study was to explore the impact of HC intensity on major Demographic factors. In this view, bivariate and multivariate analyses have been performed between HC intensity, GR, TFR, CBR, CDR and NMR. It is observed that PWSI having robust association with the productivity of the country. Obviously, best utilization of the resources depends upon the human capital of the country, which is very important for the optimum production. In the later portion of the analysis (both in correlation and regression analyses), the PWSI is found significantly associated with the major demographic factors (except NMR), selected in this study. The NMR become insignificant due to extremely small N (=3).

In this study, we found that, a negative relation exists between PWSI (HC intensity) and GR, TFR, CBR and CDR. It is apparently clear that, as PWSI is directly related with productivity, with the increase in PWSI, the economy of the country improves; consequently, there will be more investment in health sector and in population control, which will in turn result into decreasing mortality and fertility, which ultimately have impact on GR. Besides these, increasing PWSI is the result of increasing education and increasing job opportunities (as PWSI is concerned), which engage the people more in income generating activities and people get lesser time to engage themselves in the activities responsible for higher fertility (eg. early marriage, early child bearing, etc.). All these factors are also responsible for decreasing fertility. It is evident from the last century that, as nation become industrialized and as their income increased, the fertility rate went down (Goni M. A. & Saito O. 2008). Such education and job opportunities also enhance the standard of individual life, which results into better attitude towards health and increased expenditure behind healthcare, ultimately results into lesser morbidity and decreasing mortality. The findings also reveal that, a positive correlation exists between PWSI and NMR, but the relationship found, is insignificant. Despite insignificance of the relationship between PWSI and NMR, the relationship is realistic. The result suggests that, as PWSI increases, NMR also increases with that. We have already explained that, as PWSI is concerned, increased PWSI means increased education, increased training and better job opportunities. Many of the countries (KSA, Kuwait, Qatar, Dubai, etc.) are hiring manpower from Pakistan to fill up the shortages of their labor force. They are

mainly importing the manpower due to the reputation of Pakistani labor force in different skill categories. Though there is a lot of bilateral factors that influences the labor export to foreign countries, yet HC is an important influencing factor in manpower export.

Finally, formation of HC is very important in different aspects for a nation, as well as the individual. Every nation should emphasis on the HC formation for the optimum production. Besides that, the densely populated countries like Pakistan should take adequate steps to educate and train their population according to the demand of the labor shortage countries, so that the surplus manpower can be exported to those countries. Such export of manpower will have two fold impact, on the one hand, the remittance sent by the overseas workers will have great contribution to the country economy, on the other hand, such emigration will help (to smaller extent) keep the population under control. It was believed that, there is a positive relationship between income growth and population growth. The international evidence over the last hundred years clearly contradicts this prediction. As nations become industrialized and as their incomes increased, the fertility rate went down. It is generally argued that a negative association between fertility and income is evident for the incompatibility of rearing children and more engagement in the economic activity than those responsible for high fertility (Engelhardt *et al.* 2004). Thus considerable emphasize should be given to the HC formation as an indirect measure of population control, which is very important for prosperity of all nations.

**APPENDIX A: DATA AND CALCULATION**

**Table A1. Occupational Data, Calculated PWSI and GNI PPP (Per Capita), LABORSTA, NAMA**

Years	a <sub>0</sub> <sup>*</sup>	a <sub>1</sub> <sup>*</sup>	X <sub>0</sub> <sup>**</sup> (% of a <sub>0</sub> )	X <sub>1</sub> <sup>**</sup> (% of a <sub>1</sub> )	PWSI <sup>***</sup>	GNI PPP US\$ (Per Capita)
1984	700	185	1.35	0.36	1126	188
1985	636	222	1.19	0.42	1038	188
1986	990	285	1.77	0.51	1493	194
1989	1433	157	2.42	0.27	1854	243
1991	1460	187	2.44	0.31	1886	259
1996	1823	183	2.63	0.26	2000	314
2000	1595	189	2.15	0.25	1652	335
2005	2231	223	2.64	0.26	2007	396

Source: LABORSTA, National Accounts of Main Aggregates (NAMA)

\*a<sub>0</sub>=Professional, technical and related workers, a<sub>1</sub>=Administrative, executive and related workers

\*\* Percentage to the total population of age 15<sup>+</sup> years

\*\* PWSI has been calculated by using Equation (1)

**Table A2. PWSI, GR, TFR, CBR, CDR and NMR, World Population Prospect (2008)**

Time Interval	PWSI	GR (%)	TFR (Per Annum)	CBR (Per 1000 Population)	CDR (Per 1000 Population)	NMR (Per 1000 Population)
1980-1985	1126	2.61	5.92	42.7	15.9	-
1985-1990	1459	2.32	4.89	37.2	13.3	-
1990-1995	1886	2.05	3.96	32.3	11.1	-
1995-2000	2000	1.89	3.3	28.8	9.1	-0.8
2000-2005	1652	1.68	2.8	25.4	7.6	-1
2005-2010	2007	1.42	2.36	21.6	6.6	-0.7

Source: World Population Prospect; The 2008 Revision

- Not Available

<sup>1</sup>The economically active population comprises all persons of either sex who furnish the supply of labor for the production of goods and services during a specified reference time period (ILO).

In this study, Productivity Weighted Skill Index (PWSI) is employed to measure the intensity of HC. The PWSI is estimated by using following relationship (Autar S. Dhesi 1979, 34-37):

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