Socio-Economic Development, Demographic Changes and Total Labor Productivity in Pakistan: A Co-Integrational and Decomposition Analysis

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ABSTRACT

The study has examined the relationship between the socio-economic and demographic changes with total labor productivity in Pakistan over the period of 1980 to 2013. Human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate are the selected socio-economic and demographic variables. Augmented Dickey-Fuller (ADF) unit root test is used for examining the stationarity of the variables. Autoregressive distributed lag (ARDL) model is used for analyzing the co-integration among the variables of the model. Variance decomposition is used for examining the feedback impact of each pair of variables. The results show that human development index and domestic investment have positive and significant relationship with total labor productivity in Pakistan. The calculated results show that dependency ratio, foreign direct investment and globalization has a negative and significant relationship with total labor productivity in Pakistan. Inflation rate has a negative but insignificant relationship with total labor productivity in Pakistan. Feedback effects results show that socio-economic and demographic changes play an important role in determining total labor productivity of Pakistan. Based on the empirical results, it is suggested that socio-economic and demographic factors must be improved for targeted total labor productivity in Pakistan.

Keywords: economic development, population density, environmental degradation
JEL Codes: O1, Q56, Q53

1. INTRODUCTION

A country's capability to improve its national output growth over time depends almost on its size of labor force. It increases its country's productive capacity and therefore raises productivity (Qaisar and Foreman-Peck, 2007). Social development enhances labor knowledge and economy moving to steady-state growth paths. Lucas (1988), Aschauer, (1989) and Guellec and Potterie (2001) mention socio-economic factors that play an important role in determining labor productivity. Information and Communication Technologies have also changed the entire scenario of studying the determinants of factors of production. It has, in addition, changed the employment rate as well as the productivity of labor force (Gust and Marquez, 2002). Masses health, the education and the amount of resources are the main determinants of labor productivity and economic growth (Weil, 2004). Healthy and educated labor force is the main source of wealth. This supports the saying that a healthier-nation is a wealthier-nation (Contoyannis and Forster, 1999). Ill-health has adverse effects on the productivity of labor force. In fact, health improvements can influence the pace of income growth via their effects on labor market participation and workers' productivity (Bloom and Canning, 2000 and Bloom et al., 2000). Developed countries have healthier labor force and higher labor productivity compared to developing countries. Neo-classical growth model has considered education an important factor of developing production (Mankiw et al., 1995). In fact education enables labor to understand and catch up new technological knowledge. It's the labor skills and the knowledge that help implementing new technologies from other countries and bring innovations domestically (Romer, 1990). It's the level of satisfaction that motivates the worker and improves her/his productive capacity (Khan et al., 1991; Gopaldas and Gujral, 2002). Socio-economic factors play, indeed, an important role in determining labor productivity.

The population growth is one of the key factors that have a strong effect on Pakistan's performance in achieving economic development and Millennium Development Goal targets. Pakistan continues to be the sixth most populous country in the world with 191.71 million projected population (Economic Survey of

Pakistan, 2014). Refined activity rate and crude activity rate are used for measuring labor force participation in Pakistan. Crude activity rate consists of percentage of labor force from total population. The refined activity considers the percentage of labor force from the population aged 10 years or older. Its rate is a better measurement as it gives a real picture of the active labor force from the total population. Empirics show the labor force participation rate in crude activity rate and refined activity rate. From 2008-09 to 2010-11, there has been a mixed type of trend in rural areas when crude activity rate is taken to consideration. On one hand, crude activity rate of male decreases from 49.2% to 48.6%. While on the other hand, female crude activity rate increase from 18.5% to 19.4%. In this situation net rural labor participation rate is null during this period. Therefore, and as Empirics reveal, crude activity rate of female in urban areas is increasing more than male. Refined activity rate of rural areas shows a decreasing trend during 2008 to 2011 (Economic Survey of Pakistan, 2014). Overall, Empirics reveal that female crude and refined activities are increasing in Pakistan. This may change dependency ratio and total labor productivity in coming year. Following the crude activity rate and refined activity rate of total labor force, the study of the total labor productivity in Pakistan became an interesting case. The main objective of this study is to examine the impact of socio-economic development and demographic changes on total labor productivity in Pakistan over the period of 1980 to 2015. Human development, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate are selected as socio-economic and demographic variables. This type of study is hardly available in existing literature. Therefore, this study would be a healthy contribution.

2. LITERATURE REVIEW

Macroeconomists examine the country‘s specific time series data to study the idea that states that the continuous expansion of education is positively related to per capita labor productivity (Krueger and Lindahl, 2001 and Mankiw et al, 1992). However, at this level, the identification of the proper contribution of education is complicated by the difficulty to separate–using cross country data over long time periods - the causal effect of the education of income, from the wealth driven surge of the demand for education, in particular of access to tertiary education. Card (1999) summarized various Mincer-inspired studies and concluded that the impact of a year of schooling on wages is about 10%. Similar results exist for Belgium (de la Croix and Vandenberghe, 2004) and many other member countries of the Organization for Economic Co-Operation and Development (OECD). These results are generally interpreted as a validation of Becker’s human capital theory where more educated individuals are more productive.

Pungo (1996) showed that the Mankiw et al. (1992) (MRW) human capital-augmented neoclassical specification exhibits structural breaks, such that the coefficient on human capital is insignificant for a sample of labor-abundant countries if influential observations are excluded. A possible reason for these last results is that schooling in developing economies tends to be of low and very variable quality. In Pakistan, the largest learning gaps are between primary schools. The divergence in English test scores in governmental and private schools is 12 times between children from rich and poor families (Das et al., 2006).

International Labour Organization (2002) mentions that the worker’s productivity and efficiency are crucial in the determination of output per worker per day, cost of production, profitability, quality of work, and volume of production. Economic variables such as investment in new technology and innovation, alone, do not fully explain the differences in the levels of productivity (Sharpe, 2004). It points out education, health and social divergence as social determinants of productivity. The ability of getting these determinants satisfied would probably motivate any kind of worker and thus improve his/her productive capacity (Khan et al., 1991; Gopaldas & Gujral, 2002). Therefore, the firm’s investment on developing employees’ skills and welfare is essential as it enhances their abilities and satisfaction level and creates a productive workforce (Koch & McGrath, 1996; Patterson et al., 2004).

Bloom and Canning (2000) analysis that health affect productivity in four ways. The first health labor is more productive as he/she has less absentees and has more mental and physical energy for work. A healthy labor force may be more productive because workers have more physical and mental energy and are absent from work less often. The second healthy labor has a longer life, he/she can easily share his /her education and work experience to younger, and greater return on investment can be achieved. Third, longer life motives the labor to postpone retirement for longer period and physical capital is accumulated

for a longer period. Fourth, better survival rate and health encourage labor to reduce the number of children and to provide health and educational labor force in the labor market. Hence, health is considered very important for labor productivity.

Bloom et al., (2001) find that increases in the size of the working age population can produce a demographic dividend to the economic growth. Kogel & Prskawetz (2001) finds a relationship between the total factor productivity and the dependency ratio. Several papers expand their scope beyond dependency ratios to examine the entire population distribution. In an empirical study of US states, Persson et al., (2002) it was found that the age structure of the entire population affects output. Sarel (1995) finds a significant effect of the age structure of the population on the output in a cross section of countries.

Bhargava et al., (2001) examine the health and labor productivity relationship by using panel data of 125 countries over the period of 1965 to 1970. The results of the study shows 1 % increase in survival rate, and 0.05% increase in GDP. Bloom et al., (2001) mention that 0.04% increase in life expectancy brings 4% increase in labor productivity. Knowles and Owen (1995) provide empirical evidence on the correlation between health and labor productivity for 84 countries. They find that elasticity of productivity growth with respect to log difference of GDP per working age person is respectively 0.381, 0.382, and 0.03. Bound & Krueger (1991) examine the relationship between labor productivity and health. The estimated results indicate that ill-health affects labor market participation of ill members and that of caring Household members.

Wickramasinghe and Cameron (2003) mention that the profitability of tea plantations can be raised through improved productivity and labor productivity can be raised through superior management policies and practices. However, the management of RPCs repeatedly stressed its concerns regarding high labor cost and low labor productivity in their tea plantations that seem to be destructive to the future growth of the Sri Lankan tea industry. This situation indicates the need for an immediate solution to uplift the social well-being of tea estate workers and to improve their performance level. On the other hand, agricultural productivity is an important determinant of poverty, and it has the potential to lift a large number of individuals out of poverty (Irz et al., 2001).

Pelkowski and Berger (2004) use working hours, kind of work and the number of employees as inputs for measuring the labor productivity across different regions. Labor health has greater impact on efficiency and labor productivity comparing to other determinants of labor productivity (Iverson & Rosenbluth, 2006). Barro and Sala-i-Martin (1995) study the relationship of labor productivity and life expectancy in 134 countries. They conclude that life expectancy has a significant and positive impact on labor productivity.

Gupta & Malhotra (2006) mention that healthy labors are efficient and more productive. Healthy labors reduce absentees and enhance output. In addition, they have larger working hours and less expenditures on medication. It encourages households to increase their food resources and education that are necessary for labor productivity. Also, lower infant and child mortality in households lowers the family size and deepens investment on each child. In addition, ill-health generates poverty.

Chaudhary et al., (2009) examine total factor productivity (TFP) in Pakistan from 1985 to 2005. They measured the total factor productivity of the agricultural sector, the manufacturing sector and of the economy as a whole. He finds that 2.4% and 1.75% growth is witnessed in the manufactured and agricultural sectors respectively. In overall productivity, labor is an important factor of production. The results show that sectoral TFP of Pakistan is lagging behind compared to East Asian countries. For the economy as a whole, TFP has increased at an average rate of only 1.1% a year in Pakistan, resulting in almost three quarters of GDP growth attributed to increases in labor and capital stock.

3. THEORETICAL MODEL

The economic theory enables us to construct economic models which help to understand the economic behavior of an individual as well as the society as a whole. The economic model gives a real picture of the economy but under some abstractions and assumptions. In social sciences, and without these abstractions, it is impossible to measure any phenomena. The basic objective behind the construction of an economic model is to analyze and predict. The predicting power, the provided information, the realism, the simplicity

of assumptions and the generality decide the validity of an economic model. This study is going to investigate the impact of human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate on the total labor productivity in Pakistan. Solow (1956, 1957) and Abramovitz (1956) provide the theoretical background for measuring total factor productivity. Following these methodologies, most of the theoretical literature have studied the determinants of productivity: Christensen et al., (1973), Kormendi and Meguire (1985) Grier and Tullock (1989), Barro (1991), Mankiw et al., (1992), Mankiw (1995), Sala-i-Martin (1997), Bloom and Canning (2000), Fernández *et al.* (2001), Krueger and Lindahl, (2001), Barro and Sala-i-Martin (2003), Hendry and Krolzig (2004) and Sala-i-Martin *et al.* (2004). Following the methodologies of above studies, the model of this study became as:

$$TLP_t = f(HDI_t, DEPR_t, DINVE_t, FDI_t, GLOB_t, INF_t) \quad (1)$$

TLP = Total Labor Productivity
HDI = Human Development Index
DEPR = Dependency Ratio
DINVE = Domestic Investment
FDI = Foreign Direct Investment
GLOB = Globalization
INF = Inflation Rate
t = Time Period

For finding the responsiveness of dependent variable to independent variables, the equation can be written in the following form:

$$\mathrm{TLP}_t = \alpha_0 HDI_t^{\alpha_1} DEPR_t^{\alpha_2} DINVE_t^{\alpha_3} FDI_t^{\alpha_4} GLOB_t^{\alpha_5} INF_t^{\alpha_6} e^{t\alpha_7} \quad (2)$$

e = Represent for the Base of log

Following the log linear form of the function the model becomes as:

$$LTLP_t = \alpha_0 + \alpha_1 LHDI_t + \alpha_2 LDEPR_t + \alpha_3 LDINVE_t + \alpha_4 LFDI_{t+} \alpha_5 GLOB_{t+} \alpha_6 INF_t + e_t \quad (3)$$

Total labor productivity is measured by dividing gross national product by total labor force. The data of gross national product and total labor force is collected from various issues of the Economic Survey of Pakistan. United Nations Development Program (UNDP) has constructed Human Development Index (HDI) for all United Nations country members. The data of HDI is collected from UNDP data bases. Data of dependency ratio, domestic investment, foreign direct investment and inflation rate is assembled from the World Development Indicator (WDI) databases maintained by the World Bank. Globalization is composite index of economic globalization, social globalization and political globalization. KOF index is used for measuring globalization in case of Pakistan.

4. ECONOMETRIC METHODOLOGY

Mostly time series data has non-stationarity problem and the estimated regression results of this data became spurious for policy suggestion (Nelson and Ploser, 1982). All co-integration methods also demand the stationarity of the variables. This study is going to investigate the impact of human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate on total labor productivity in Pakistan. Dickey-Fuller (DF) (1979), Augmented Dickey-Fuller (ADF) (1981), Perron (1989), Zivot and Andrews (ZA) (1992) and Phillips Perron (PP) (1988) are well known unit roots that are available in existing literature. In this study ADF (1981) unit root test is used for examining the stationarity of the selected variables. This test has numerous advantages over the other unit root tests. The simple equation of ADF is followed as:

$$\Delta Y_t = \delta Y_{t-1} + \sum_{j=1}^{q} \phi_j \Delta Y_{t-j} + e_t \quad (4)$$

We must run OLS of the above equation for all selected variables and compute τ statistic of Y_{t-1} and compare it with critical τ values. If calculated τ is greater than the critical τ reject null hypothesis and accept alternative. We can conclude data is stationary and vice-versa is non-stationary.

After examining co-integration among total labor productivity, human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate in Pakistan over the period of 1980-2015, Engle-Granger (1987), Johansen (1991/1992), Johansen-Juselious (1990), Perron (1989, 1997) and Leybourne and Newbold (2003) are traditional methods of co-integration. Pesaran et al., (2001) develops Autoregressive Distributive Lag (ARDL) which is used in this study for examining co-integration among variables. This co-integration method has a number of advantages over others methods. Autoregressive distributed lag model follows the following procedure:

$$\Delta LTLP_t = \alpha_1 + \alpha_2 t + \alpha_3 LTLP_{t-1} + \alpha_4 LHDI_{t-1} + \alpha_5 LDEPR_{t-1} + \alpha_6 LDINVE_{t-1} +$$
$$+\alpha_7 LFDI_{t-1} + \alpha_8 LGLOB_{t-1} + \alpha_9 INF_{t-1} + \sum_{h=1}^{p} \beta_h \Delta LTLP_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta LHDI_{t-j}$$
$$+ \sum_{k=0}^{p} \phi_k \Delta LDEPR_{t-k} + \sum_{m=0}^{p} \phi_m \Delta DINVE_{t-m} + \sum_{n=0}^{p} \phi_n \Delta FDI_{t-n} \sum_{f=0}^{p} \phi_f \Delta LGLOB_{t-f} + \sum_{s=0}^{p} \phi_s \Delta INF_{t-s} + u_{it} \quad (5)$$

$H_0 : \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = 0$ (no co-integration among the variables)

$H_A : \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq 0$(co-integration among variables)

Compare the estimated F-Statistic with upper bound value of Pesaran (1997) or Pesaran et al. (2001). If calculated F-test statistic is greater than the upper bound value, the null hypothesis of no co-integration is rejected. Then it is concluded, there is co-integration among the
variables of the model. Then Vector Error Correction Model (VECM) will be used for short dynamic among the variables. VECM procedure is as under:

$$\Delta LTLP_{it} = \alpha_1 + \alpha_2 t + \sum_{h=1}^{p} \beta_h \Delta LTLP_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta LHDI_{t-j} + \sum_{k=0}^{p} \phi_k \Delta LDEPR_{t-k}$$
$$+ \sum_{m=0}^{p} \phi_m \Delta LDINVE_{t-m} + \sum_{n=0}^{p} \phi_n \Delta LFDI_{t-n} \sum_{f=0}^{p} \phi_f \Delta LGLOB_{t-f} + \sum_{s=0}^{p} \phi_s \Delta INF_{t-s} + \omega ECT_{t-1} + u_t \quad (6)$$

ECT_{t-1} represents one time period lagged error correction term. ECM explains the speed of adjustment from short run to long run. For investigating the optimal lag length Schwarz Information Criteria (SIC) or Akaike's Final Prediction Error (FPE) are used.

Well known Granger causality test is unable to give the relative strength of causality beyond the selected time span (Shan, 2005). This test is also unable to give the extent of feedback from one variable to the other. To overcome these shortcomings, this study uses innovative accounting approach (IAA) to examine causality between each pair of total labor productivity, human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate. IAA decomposes error variance and is used for forecasting. Normally, decomposition uses percentage variation of series error which may be due to its own shocks as well as other shocks (Enders, 1995), and the series may be strongly affected. A system of equation is used to examine the impact of one standard deviation shock to the variable on others and on the future values of the series sustaining the shock (Shan, 2005). For example if HDI affects total labor productivity significantly but a shock on the latter affects the former minimally, then, we

have unidirectional causality from HDI to total labor productivity. A bidirectional causal relationship is formed if the shocks of one variable impacts the other and vice versa. But on the other hand, if shocks of each variable do not bring changes in other variable then there is no causal relationship between variables.

5. EMPIRICAL RESULTS AND DISCUSSIONS

The descriptive statistics is used for overviewing the chronological properties of the data. This study has examined the impact of socio-economic development and demographic changes on the total labor productivity in Pakistan over the period of 1980 to 2013. Human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate are selected socio-economic and demographic variables. The results of descriptive statistics are presented in Table-1. The estimated results show that human development index, dependency ratio, globalization and inflation rate are negatively skewed while total labor productivity, domestic investment and foreign direct investment are positively skewed. The results reveal that kurtosis has a positive value for all selected variables. The estimated skewness and kurtosis are insignificant and are different from zero so null hypothesis of no normality is rejected. According to the Jarque-Bera estimated values, all variables have finite covariance and zero mean. This also confirms that the data of selected variables are normally distributed.

Table-1

Descriptive Statistics							
	TLP	LHDI	LDEP_R	LDINVE	LFDI	LGLOB	LINF
Mean	11.01471	-0.81197	4.395574	8.420875	-0.37534	3.818818	2.048650
Median	11.03985	-0.78979	4.460109	8.404873	-0.46073	3.910011	2.124291
Maximum	12.87424	-0.61889	4.487657	8.861022	1.299735	4.189709	3.009937
Minimum	9.221258	-1.06088	4.195923	7.951094	-2.27627	3.326902	1.069573
Std.dev	1.082599	0.135434	0.102616	0.168386	0.802105	0.270070	0.481069
Skewness	0.072369	-0.28888	-0.79604	0.006066	0.079367	-0.45150	-0.42902
Kurtosis	1.846676	1.893342	1.999946	4.164956	3.084617	1.944162	2.452069
Jarque-Bera	1.914066	2.207895	5.007707	1.922800	0.045839	2.734495	1.468336
Probability	0.384031	0.331560	0.081769	0.382357	0.977341	0.254807	0.479905
Observation	34	34	34	34	34	34	34

The results of correlation among variables are presented in correlation matrix. The table-2 shows the results of estimated correlation matrix. The results show that total labor productivity has positive and significant correlation with human development index, domestic investment, foreign direct investment and globalization but inflation rate have positive but insignificant correlation with total labor productivity. The estimated results reveal that dependency ratio has a negative and significant correction with total labor productivity in Pakistan. The results show that human development index has a positive and significant correlation with globalization, foreign direct investment, inflation rate and domestic investment while it has a negative and significant correlation with dependency ratio. The Dependency ratio has a negative and significant correlation with globalization, foreign direct investment and domestic investment but dependency ratio has a negative but insignificant correlation with inflation rate. There is a positive and significant correlation between domestic investment and globalization but domestic investment has a positive but insignificant correction with foreign direct investment. The estimated results reveal that domestic investment has a negative and insignificant correlation with inflation rate. The results show that foreign direct investment has a positive and significant correlation with inflation rate and globalization. The results of the correlation matrix show that globalization and inflation rate have a positive but insignificant correlation. The overall results of correction matrix give a unique picture so it's interesting to find the impact of socio-economic and demographic changes on total labor productivity in Pakistan. So this study really contributes towards respective literature.

Table-2

Pairwise Correlation							
LTLP	1.000000						
LHDI	0.988055 0.0000	1.000000					
LDEP_R	-0.900713 0.0000	-0.837854 0.0000	1.000000				
LDINVES	0.648517 0.0000	0.661322 0.0000	-0.383694 0.0251	1.000000			
LFDI	0.638235 0.0000	0.710230 0.0000	-0.483589 0.0038	0.268358 0.1249	1.000000		
LGLOB	0.976720 0.0000	0.992379 0.0000	-0.79739 0.0000	0.688543 0.0000	0.703924 0.0000	1.000000	
LINF	0.153556 0.3859	0.170611 0.3347	-0.19159 0.2777	-0.02438 0.8911	0.324770 0.0609	0.121718 0.4929	1.00000
Variables	LTP	HDI	DEP_R	INVES	FDI	GLOB	INF

It is approved fact of time series data that it contains unit root problem and regression results of this data are spurious. For the solution of unit root problem, this study uses Augmented Dickey-Fuller (ADF) unit root test, the calculated results of ADF test are presented in table-3. The results show that total labor productivity, human development index, domestic investment, foreign direct investment, globalization and inflation rate are not stationary at level. But at first difference, all the variables of the model became stationary. This shows that there is the same order of integration among the selected variables. Although this situation is the best fit for Johansen co-integration, in this study ARDL bound test approach to co-integration is used. Autoregressive distributed lag (ARDL) model is advanced compared to Johansen and it gives reliable results when there is mix as well as the same order of integration among the variables.

Table-3

Augmented Dickey-Fuller Test		
At Level		
Variables	t-statistic	Prob.
LTLP	0.329343	0.9764
LHDI	-1.734952	0.4047
LDEP_R	-1.147336	0.6844
LDINVES	-0.239066	0.9233
LFDI	-1.843665	0.3537
LGLOB	-1.629253	0.4568
LINF	-2.365488	0.1589
At First Difference		
LTLP	-5.162962	0.0002
LHDI	-3.411666	0.0179
LDEP_R	-2.297384	0.0804
LDINVES	-5.004928	0.0003
LFDI	-4.978770	0.0003
LGLOB	-5.888288	0.0000
LINF	-5.808480	0.0000

This study has examined the impact of human development index, dependency ratio, domestic investment, foreign direct investment, globalization, and inflation rate on total labor productivity in Pakistan over the period of 1980 to 2013. For co-integrational analysis ARDL bound testing method is used. The results of ARDL bound testing method is given in table-4. The calculated results show that F-statistic is greater than the critical bound, this means that there is co-integration when total labor productivity is a dependent variable and human development index, dependency ratio, investment level, foreign direct investment, globalization and inflation rate are independent variables.

Table-4

ARDL Bounds Test Null Hypothesis: No long run relationships exist		
Test Statistic	Value	K
F-statistic	11.79727	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
1%	3.15	4.43

The estimated long run results are reported in table-5. This study uses total labor productivity as dependent variable whereas human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate are selected independent variables. The coefficient of human development index shows that total labor productivity has positive and significant relationship with HDI. The results show that a 1 percent change (increase/decrease) in the human development index causes (9.8925) percent change (increase/decrease) in the total labor productivity. Our estimated results support the findings of Sarquis and Arbache (2002), Guillaumont et al., (2003) and Zheng and Hu (2006). However, our results opposite Barro and Lee (1997), Temple (2001), Sachs and Warner (1995) and Self and Grabowshi (2004) when they claim that education has an insignificant role in determining labor productivity. Estimated results favor Mincer (1957-1958), Becker (1964), Schultz (1961), Harbison and Myers (1965), Denison (1971), Dixon and Macdonald (1992), Brandolini and Cipollone, (2001), Gust and Marquez (2004), Belorgey et al., (2006), Rice et al., (2006), Bourles & Cette (2007) and Choudhry (2009) as they mention that health has a positive and significant relationship with labor productivity. The coefficient of dependency ratio shows that the dependency ratio has a negative and significant relationship with total labor productivity. One percent increase in dependency ratio means a (-2.3512) percent decrease in total labor productivity. Our results support Durlauf and Quah (1999), Little and Triest (2002) and Feyrer (2007) when they claim there is a negative and significant relationship between demographic changes and labor productivity. The estimated results reveal that domestic investment has a positive and significant impact on total labor productivity in Pakistan. A one percent change (increase/decrease) in domestic investment brings (.62309) percent change (increase/decrease) in total labor productivity. In addition, total labor productivity has a negative and significant relationship with foreign direct investment in Pakistan. The estimated results show that one percent increase in foreign direct investment means a (-.055379) percent decrease in total labor productivity. There also is a negative and significant relationship between globalization and total labor productivity in Pakistan. The coefficient of the globalization shows that a one percent increase in globalization decreases (-2.0502) percent in total labor productivity. The estimated results show that the inflation rate and the total labor productivity have negative but significant long run relationship. Our estimated results support the findings of Choudhry (2009). She mentions that inflation has a negative impact on labor productivity. The overall long run results of the model show that human development index and domestic investment have a positive and significant relationship with total labor productivity. The results show that dependency ratio, foreign direct investment and globalization have negative and significant impact on total labor productivity. These results justify our idea that socio-economic and demographic factors play an important role in determining total labor productivity in Pakistan.

Table-5

Long Run Results Dependent Variable-LTLP			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LHDI	9.8925	1.4716	6.7222[.000]
LDEP_R	-2.3512	.30574	-7.6901[.000]
LDINVES	.62309	.25133	2.4792[.029]
LFDI	-.055379	.027286	-2.0296[.065]
LGLOB	-2.0502	.81955	-2.5016[.028]
LINF	-.0077621	.025721	-.30179[.768]

C	32.2535	2.9525	10.9241[.000]

The short run results of the model are reported in table-5. Vector error correction model has been used for investigating the short run relationship among total labor productivity, human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate in Pakistan. The estimated results of the model show that human development index and domestic investment have positive and significant impact on total labor productivity in Pakistan. These short results are same as in the long run. The estimated results show that dependency ratio foreign direct investment and globalization have positive and significant relationship with total labor productivity in Pakistan. Inflation rate has a positive but insignificant relationship with total labor productivity both in short and in long run. Overall short run results reveal that selected socio-economic and demographic factors play an important role in determining total labor productivity in Pakistan. The negative and significant value of ECM is theoretically correct. ECM value shows the speed of adjustment from short run towards long run equilibrium. The estimated value of ECM shows that the short run needs one year and two months to converge in the long run equilibrium. Moreover, sixty-nine percent of the current period variation in the data is corrected in the next period.

Table-6

Error Correction Representations Dependent Variable: LTLP			
Regressor	Coefficient	Standard error	T-Ratios (Prob)
LHDI	1.5502	.64605	2.3995[.029]
LDEP_R	-1.6383	.38412	-4.2651[.001]
LDINVES	.21039	.096344	2.1838[.044]
LFDI	-.059631	.011020	-5.4114[.000]
LGLOB	-.62444	.27051	-2.3084[.035]
LINF	-.0054086	.018166	-.29772[.770]
ECM(-1)	-.69679	.13242	-5.2618[.000]
R-Squared .93237 R-Bar-Squared .83092 S.E. of Regression 019211 F-stat. F(14, 16) 11.8166[.000] Mean of Dependent Variable .10898 S.D. of Dependent Variable .046720 Residual Sum of Squares .0044287 Equation Log-likelihood 93.2442 Akaike Info. Criterion 74.2442 Schwarz Bayesian Criterion 60.6213 DW-statistic 2.6485			

The diagnostic tests are presented in table-6. According to the estimated results of lagrange multiplier test of residual serial correlation, there isn't, or weakly, serial correlation among the variables of the model. According to the Ramsey's RESET test using the square of the fitted values, the model is in correct functional form. The tests of skewness and kurtosis show that the time series data of all the variables is normally distributed. The estimated results based on the regression of squared residuals on squared fitted values show that there is no problem of heteroscedasticity.

Table-7

Diagnostic Tests		
Test statistics	LM-Version	F-Version
A-Serial correlation CHQ(1)	1.3583[.244]*F(1,13)	.59573[.454]*
B-Functional Form CHQ(1)	.76761[.381]*F(1,13)	.33008[.575]*
C-Normality CHQ (2)	2.3475[.309]*	Not applicable
D-Heteroscedasticity CHQ(1)	.0072580[.932]*F(1,29)	.0067914[.935]*
A Lagrange multiplier test of residual serial correlation B Ramsey's RESET test using the square of the fitted values C Based on a test of skewness and kurtosis of residuals D Based on the regression of squared residuals on squared fitted values		

Figure-1

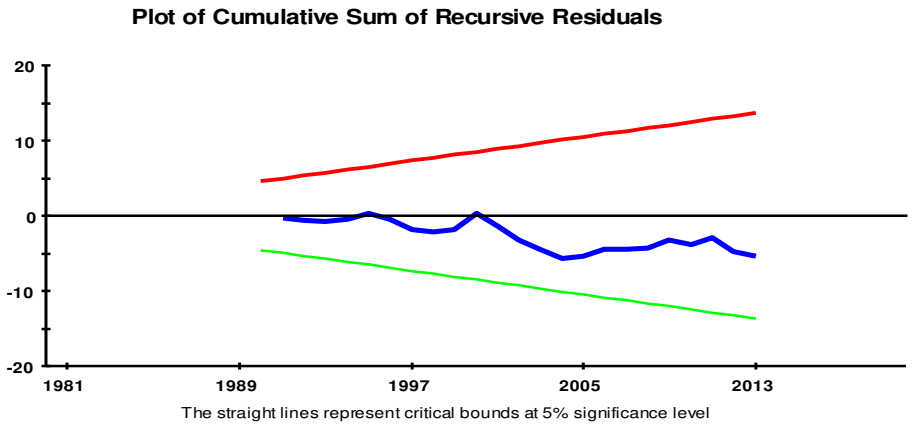
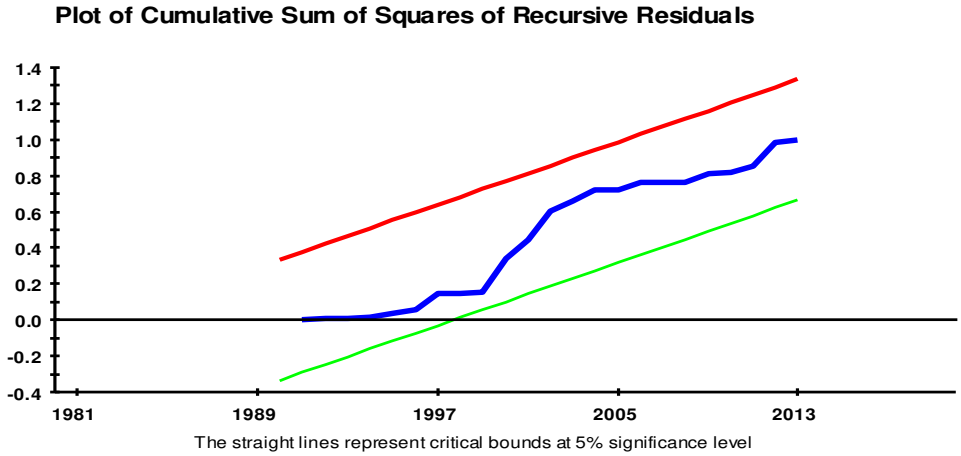


Figure-2



Estimated results of variance decomposition approach are given Table-8. The results reveal that 51.17% as a part of the total labor productivity is explained by its own created shocks. Whereas shocks of human development index contribute to total labor productivity by 32.49%. The results show that innovative shocks of domestic investment contribute to total labor productivity by 9.84%. The role of dependency ratio, foreign direct investment, globalization, and inflation rate is very minimal when it comes to explaining total labor productivity in Pakistan. These variables, according to their shocks, contribute to total by 3.84%, 2.09%, 0.40% and 0.25% respectively. The results show that 78.35% variation of human development index is explained by itself. 16.66% shocks in human development index is explained by total labor productivity in Pakistan over the selected time period. The estimated results show that dependency ratio, domestic investment, foreign direct investment, globalization and inflation have very minimal part in explaining human development index in Pakistan. 55.66% shocks in dependency ratio are explained by itself. Human development index is contributing 27.49% part in explaining dependency ratio in Pakistan. Whereas total labor productivity, domestic investment, foreign direct investment, globalization and inflation rate are contributing 8.54%, 4.49%, 3.47%, 0.10% and 0.22% in explaining dependency ratio in Pakistan respectively. The results show that 14.89% shocks in domestic investment are explained by itself. Larger amount of shocks in domestic investment are explained by human development index (34.81%) and dependency ratio (37.80%) in case of Pakistan. 5.89%, 3.02%, 1.22% and 2.33% shocks in domestic investment are explained by total labor productivity, foreign direct investment, globalization and inflation rate respectively. The estimated results reveal that 22.19% of the shocks in foreign direct investment are explained by themselves. 53.36% of the shocks in foreign direct investment are explained by human

development index in Pakistan. 7.06%, 8.60%, 4.97%, 1.57% and 2.21% of the shocks in foreign direct investment are explained by total labor productivity, dependency ratio, domestic investment, globalization and inflation rate respectively. 10.47% of the shocks in globalization are explained by themselves in Pakistan. 58.39% shocks in globalization are explained by human development index over the selected time period. The results show that 16.44%, 8.96%, 3.49%, 1.80% and 0.42% shocks in globalization are explained by total labor productivity, dependency ratio, domestic investment, foreign direct investment and inflation rate respectively. 12.73% of the shocks in inflation rate are explained by themselves whereas 58.32% of the shocks are explained by human development index in Pakistan over the selected time period. 3.15%, 8.77%, 4.25%, 6.18% and 6.56% of the shocks in inflation rate are explained by total labor productivity, dependency ratio, domestic investment, foreign direct investment and globalization respectively. The results show that there is a bidirectional causal relationship between total labor productivity and human development index in Pakistan. Unidirectional causality is running from total labor productivity to dependency ratio, from total labor productivity to domestic investment, from total labor productivity to foreign direct investment and from total labor productivity to globalization and there is no causal relationship between total labor productivity and inflation rate in Pakistan. The results are run by the unidirectional causality from human development index to dependency ratio, from human development index to dependency ratio, from human development index to domestic investment, from human development index to foreign direct investment, from human development index to globalization and from human development index to inflation rate in Pakistan. However, there is no significant causal relationship among domestic investment, foreign direct investment, globalization and inflation rate in Pakistan over the selected time period. Overall, the feedback effects the results showing that the socio-economic and demographic changes play important role in determining total labor productivity in Pakistan.

Table-8

Variance Decomposition of LTLP:

Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.048451	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.063507	90.74027	0.023404	0.320632	5.920033	1.480166	1.213611	0.301881
3	0.075793	79.24288	5.913033	0.345254	8.193050	5.161220	0.911956	0.232604
4	0.090049	68.60565	16.15303	0.367595	8.480852	5.262536	0.849820	0.280526
5	0.103076	62.79939	22.21956	0.430580	9.179717	4.223002	0.700977	0.446769
6	0.114681	59.50083	25.62484	0.739598	9.739711	3.411861	0.598489	0.384671
7	0.125457	57.06512	27.80063	1.353993	10.03908	2.865192	0.545801	0.330180
8	0.135397	54.81458	29.70953	2.160713	10.06589	2.474478	0.468609	0.306200
9	0.145099	52.71509	31.43241	3.030505	9.841188	2.269692	0.429215	0.281894
10	0.154531	51.17613	32.49629	3.842777	9.727652	2.098090	0.404143	0.254915

Variance Decomposition of LHDI:

Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.008693	11.97609	88.02391	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.014308	11.73366	87.37880	0.031381	0.731960	4.78E-05	0.002894	0.121251
3	0.018666	11.11499	87.19202	0.052827	1.400829	0.120583	0.016676	0.102080
4	0.022003	11.26446	85.65237	0.057457	2.067788	0.717128	0.015510	0.225287
5	0.024311	11.75710	84.15072	0.063936	2.577917	1.079457	0.027782	0.343085
6	0.025946	12.55403	83.12150	0.065003	2.715683	1.043911	0.057404	0.442476
7	0.027212	13.61009	82.03659	0.066737	2.761310	0.954379	0.084111	0.486786
8	0.028226	14.66872	80.84595	0.082968	2.912285	0.887301	0.112143	0.490628
9	0.029078	15.66528	79.60865	0.127431	3.147582	0.836244	0.133728	0.481083
10	0.029830	16.66043	78.35769	0.200637	3.378779	0.794636	0.142274	0.465551

Variance Decomposition of LDEP_R:

Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.003403	0.028331	8.901917	91.06975	0.000000	0.000000	0.000000	0.000000
2	0.007177	0.201112	9.813840	89.22112	0.071743	0.541615	0.010741	0.139833
3	0.011297	0.696559	11.25356	86.44134	0.478824	0.890954	0.026635	0.212120
4	0.015473	1.330267	13.88012	82.11506	1.250249	1.136398	0.101187	0.186717

5	0.019556	2.156339	17.15681	76.92487	2.002114	1.459934	0.164522	0.135408
6	0.023434	3.251093	20.55456	71.47851	2.606186	1.838984	0.176289	0.094381
7	0.026978	4.492579	23.59304	66.29994	3.129996	2.242026	0.160893	0.081524
8	0.030048	5.783289	25.84343	61.85470	3.608114	2.669581	0.140373	0.100513
9	0.032555	7.129011	27.12041	58.32791	4.055210	3.096109	0.122233	0.149124
10	0.034497	8.545674	27.48872	55.66953	4.492075	3.474263	0.108868	0.220866
Variance Decomposition of LDINVES:								
Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.058201	3.097695	1.846597	18.79952	76.25619	0.000000	0.000000	0.000000
2	0.083452	6.274737	5.821169	34.14844	51.97453	0.855348	0.880430	0.045349
3	0.103817	9.360856	10.63235	41.84696	34.10733	1.851644	0.582072	1.618786
4	0.118357	9.424582	11.77245	46.29228	26.35864	2.453428	0.859078	2.839534
5	0.125973	8.645735	10.39921	50.38720	23.51971	2.403972	1.518614	3.125553
6	0.132427	7.836173	12.39961	51.44606	21.43138	2.180031	1.673460	3.033287
7	0.140662	7.141918	19.00251	48.36289	19.14866	2.065795	1.543017	2.735210
8	0.149268	6.541127	26.56442	43.69655	17.17844	2.186849	1.402918	2.429699
9	0.156211	6.120671	31.99305	39.92389	15.77317	2.603048	1.301950	2.284214
10	0.160866	5.898172	34.81655	37.80064	14.89519	3.024468	1.227983	2.336998
Variance Decomposition of LFDI:								
Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.441772	14.72684	26.77799	0.505622	7.015833	50.97372	0.000000	0.000000
2	0.560470	11.02692	41.15383	1.142303	4.373869	41.80770	0.205292	0.290086
3	0.652674	8.174705	49.49748	4.051859	5.582023	31.01654	0.691402	0.985989
4	0.712156	6.936109	53.08740	6.540022	5.138797	26.10146	0.638840	1.557375
5	0.746277	6.417737	54.40272	7.540964	4.817666	23.93341	0.928053	1.959450
6	0.762244	6.160556	54.39553	7.794343	4.888168	23.09942	1.463472	2.198511
7	0.765962	6.329438	53.94716	7.825461	5.014679	22.98171	1.629092	2.272467
8	0.770372	6.730593	53.81583	7.746157	5.083635	22.72820	1.626102	2.269482
9	0.776896	6.978283	53.83840	7.892682	5.055838	22.39997	1.601141	2.233680
10	0.783714	7.067814	53.36340	8.603386	4.978115	22.19823	1.579697	2.209360
Variance Decomposition of LGLOB:								
Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.021189	0.447770	0.480727	11.75368	2.945019	7.870982	76.50182	0.000000
2	0.024642	6.493051	14.83559	9.431233	5.858928	6.482730	56.77322	0.125256
3	0.030655	19.39964	26.38639	6.592754	3.793038	4.597429	38.63480	0.595947
4	0.035967	19.23630	37.30718	6.100089	5.029982	3.424000	28.08552	0.816931
5	0.041851	16.62883	47.06061	6.771014	4.831293	2.663310	21.35289	0.692049
6	0.047292	16.07492	52.71542	7.519395	4.079857	2.127787	16.93657	0.546042
7	0.051494	16.66315	54.61563	8.241304	3.811175	1.914103	14.28579	0.468845
8	0.054794	16.89153	55.42440	8.768104	3.829397	2.012589	12.64683	0.427145
9	0.057616	16.74963	56.68204	9.006241	3.726737	1.959569	11.44146	0.434317
10	0.060244	16.44266	58.39472	8.964122	3.499798	1.801102	10.47273	0.424876
Variance Decomposition of LINF:								
Period	S.E.	LTLP	LHDI	LDEP_R	LDINVES	LFDI	LGLOB	LINF
1	0.284581	5.480417	4.130734	2.032295	19.55785	2.434785	6.429552	59.93436
2	0.340795	3.830134	17.95000	2.841250	13.63969	4.354350	11.21289	46.17169
3	0.451768	2.367091	42.36442	1.948623	8.980860	3.688876	14.30509	26.34504
4	0.535141	2.274607	52.64271	1.980838	6.479536	7.289526	10.46652	18.86626
5	0.606915	3.703139	58.47716	2.674536	5.061160	6.669188	8.263278	15.15154
6	0.659034	3.469002	61.04584	4.314565	4.653070	6.024542	7.062425	13.43056
7	0.681866	3.272685	60.41351	6.200902	4.355238	6.203936	6.648745	12.90498
8	0.691537	3.211938	58.94198	7.696725	4.315088	6.345835	6.569552	12.91889
9	0.697606	3.157606	58.16003	8.580092	4.308598	6.257625	6.585300	12.95075

10	0.704908	3.159867	58.32089	8.779487	4.259238	6.183012	6.567442	12.73007
Cholesky Ordering: LTLP LHDI LDEP_R LDINVES LFDI LGLOB LINF								

Conclusions and Policy Suggestions

The study has investigated the impact of socio-economic and demographic changes on total labor productivity in Pakistan over the period of 1980 to 2013. Human development index, dependency ratio, domestic investment, foreign direct investment, globalization and inflation rate are selected as socio-economic and demographic variables. Augmented Dickey-Fuller unit root test is used for examining the stationarity of the variables. Autoregressive distributed lag model is used for analyzing the co-integration among the variables of the model. The estimated results of ADF unit root test show that all the variables of the model are stationary at first difference. The long run results show that the human development index and domestic investment have a positive and significant relationship with total labor productivity in Pakistan. The calculated long run results show that the dependency ratio, the foreign direct investment and the globalization have a negative and significant relationship with the total labor productivity in Pakistan. The Inflation rate has negative but insignificant relationship with the total labor productivity in Pakistan. Short run estimated results have same direction of relationship as in they have with the long run. The results of ECM show short run converge in the long after one year and two month. Feedback effect results show that total labor productivity has bidirectional causal relationship with human development index in Pakistan. Moreover, other variables of the model have unidirectional causal relationship with total labor productivity in case of Pakistan. Sarquis and Arbache (2002), Guillaumont et al., (2003), Zheng and Hu (2004), Barro and Lee (1997), Temple (2001), Sachs and Warner (1995) and Self and Grabowshi (2004) support that social development do not enhance labor productivity. Whereas Mincer (1957-1958), Becker (1964), Schultz (1961), Harbison and Myers (1965), Denison (1971), Dixon and Macdonald (1992), Brandolini et al (2001), Gust and Marquez (2004), Belorgey et al, (2006), Rice et al., (2006), Bourles et al., (2007) and Choudhry (2009) mention that socioeconomic development enhances labor productivity. Durlauf and Quah (1999), Little and Triest (2002) and Feyrer (2005) support that demographic changes impact labor productivity. Based on the estimated results, it is concluded that socio-economic and demographic changes affect remarkably total labor productivity in Pakistan. Therefore, if the government of Pakistan wants to increase its total labor productivity, it must increase social development in the form of HDI. In addition, better health, education and resources encourage labor to work hard and enhance the overall labor productivity. Dependency ratio has a negative relationship with the total labor productivity. That's why the government should encourage households to put family member in the labor market. This step will increase overall total labor productivity in Pakistan. Domestic investment create more opportunities for employment, and more employed labor enhances the overall labor productivity. In short, socio-economic and demographic changes must be improved for targeted total labor productivity in Pakistan.

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