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Impact of Technical Education on the Labor Productivity

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ABSTRACT

This study analyzes the role of technical education in the economic development of a country like Pakistan. This is a co-relational study based on The Cobb Douglas Production Function. It was found that the skilled labor has a positive and the unskilled labor has a negative relationship with the Dependent variable Labor Productivity. The tables and diagrams were used to explain the relationship and the Productivity trend of the variables. Both of the independent variables explain the Dependent variable according to their productive capacity. Time series data were taken, in which the population size is from 1990-2011 and 21 samples were observed, and the linear regression was run upon the variables used in this study to seek the required result.

Keywords: *Technical Education, Labor Productivity, Production Function, Skilled Labor and Unskilled Labor*

1. INTRODUCTION

Pakistan is a developing and an Agrarian economy. Most of the labor force is either unemployed or unskilled. There is a need to promote the technical education to enhance the overall labor productivity in different sectors of Pakistan economy and particularly in the industrial sector, which act as the backbone for the development of any economy. The study is conducted to identify the primary component which enhances the overall all productivity levels of the labor force. For this purpose the correlation has been found between the SK, UNSK and LP, and it is observed that the skilled labor has a positive relation to the enhancement of overall labor productivity and on the other hand the unskilled labor has the negative relationship. ((Iftikhar Hussain shah 2004))

Although both kinds of labor are essential for the overall productivity but the Govt of Pakistan should focus more on the promotion of technical education and training to enhance the labor productivity in all sectors of the economy. ((Iftikhar Hussain shah 2004))

For this purpose the analysts have to come forward and should help the Government to promote the Vocational and Technical Training programs according to the need of the present world. But while doing so the Govt. should design such type of wage rate policy that a favorable and reasonable balance may maintain between the skilled and unskilled labor. Both of them are the neediest of time to boost the economy of Pakistan according to their relative capacities, none of these can be neglected. ((Iftikhar Hussain shah 2004))

1.1 Problem Statement

In this study we analyze the relation and the productivity trend of skilled labor and unskilled labor on the overall productivity of labor over a period of time in Pakistan that either the technical education is necessary to accelerate the overall economic performance of every sector of the economy. And it has enhanced the labor productivity in last two decades.

1.2 Objectives

The objective of this study is to find and analyze the influence of technical or skilled labor and unskilled labor upon the overall productivity of labor over a period of time in Pakistan.

1.3 Operational Necessities

We use (The Cobb Douglas Production Function) to check the relationship and the trend of the both skilled and unskilled labor on overall labor productivity.

1.4 Significance

The study plays an important and significant role in concluding and analyzing the impact of skilled labor and unskilled labor upon the overall production in any sector of Pakistan. It provides the valuation measures to both the producers, employers and the policy makers to either create more skilled workers according to the absorption power of the economy. It may help to take effective steps in promoting the Technical education and producing more skilled worker to uplift the every sector of the Pakistan economy.

2. LITERATURE REVIEW

C.C.Gu, Telma Gomes and V. S.Brizuella (in 2011) correlates the technical and vocational education with the strategic sustainable development. The promotion of technical and vocational education leads to improvement in labor skills, attitude and knowledge. The country moves towards sustainable development. Although there are some hurdles while implementing above mentioned type of education but individual, organizational and Govt. efforts can make it possible.

R. L. Lynch (in 2000) indicates the reform in the high school of USA through introduction of technical education at that level. He describes the motives of introduction of this education as it enhances the career planning while having the particular information and skills about the 21st century market needs. It helps the students choose the field of their career accordingly and to improve the economy's efficiency of the USA.

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IftikharH Shah (in 2004) sorts out and highlights the usefulness of technical training and also determines the hurdle in a way of proper implementation of this type of education in Pakistan. He states the policies of Govt. Regarding funding for implementation, resource allocation for improvement in every field of the economy via introduction of this type of education. He has found that the budget targets allocation for this education, the achievements and the process of releasing of funds and implementations.

Supachet Chansarn (in 2010) analyzes the impact of Health, Education and technological progress on the labor productivity growth. For This purpose he estimates the labor productivity of 30 countries including G7 countries from 1981-2005 and study the impact of health, education and technological progress on the rate of growth of labor productivity. While doing so he comes to a conclusion that the eastern developed countries have more growth ratio of labor productivity. The rest of the western countries, G7 countries and the eastern developing countries are ranked respectively by the researcher.

Daron Acemoglu (in 2000) identifies the ratio of inequality in getting employment due to the technological revolution since the 20th century. The skilled labor is dominating the labor market and the low skilled or less educated labor is being exploited badly through inequality in employment opportunity and income distribution. He also characterizes the 19th century as the "Skill-Replacing" era and the 20th century as "Skill-Biased" era.

Unel (in 2008) develops a production analysis framework in which both the skilled and unskilled labor is found imperfect substitute. He follows the periodic analysis while studying the impact of skilled and unskilled labor, and wage inequality effect on the growth of economy of US during 1950-2005. While doing so he comes across the twin findings. Initially the skilled labor efficiency has grown slowly and steadily, while in the beginning of 1970s he observes an absolute decline in the efficiency of unskilled labor. So this significant impact of both skilled and unskilled labor has been observed in the overall productivity slowdown and substantial spread in the wage structure of U.S.

Chinkook Lee and G. E.Schluter (in 1998) uses a U.S I/O model to testify the effect of trade, domestic consumption on the separate and interactive effects of trade, technology and Labor productivity on the demand for skilled and unskilled labor for the periods of 1972, 1987 and 1993. The concluding results of the model declare that the trade has not been the major contributor to change in demand for skilled vs. unskilled labor during the examined period. They find that the ratio of high skilled labor to low skilled labor is higher for exports than imports and is rising over time. Their findings also suggest that the U.S is moving towards more skilled labor

intensive exports. Their analysis also shows that trade makes a little fractional contribution to widening the wage gap between skilled and unskilled labor.

Daron Acemoglu and Fabrizio Zilibotti (in 1999), develop a theory in which they identify that most of the modern technologies used by LDC's are developed in the OECD or by the technologically advanced economies, and are also designed to make the optimal use of the skills of these advanced countries' workers. They also find that due to differences in the supply of skills, some of the tasks which are performed by the skilled workers in OECD may carry out by unskilled labor in LDC's. Moreover that the technological tasks are being designed for the skilled labor of the OECS, and when the unskilled labor of LDC's use it, ultimately it generate low productivity. They also find that due to a high difference in the skills and mode of technologies may lead to a sizeable difference in both factor productivity and output per worker. Their theory also suggests that productivity differences should be highest in medium-tech sectors, and that the trade regime the degree of intellectual property right enforcement in the LDC's have an important effect on the direction of technical change and on productivity differences.

M. T. Kiley(in 1997), in his paper identifies the rising inequality in the relative wage rates of skilled and unskilled labor via adopting a model, in which skilled and unskilled biased technologies are shown endogenous in nature. It is observed that the increase in the supply of skilled labor in the economy may lower the relative wages of both skilled and unskilled labor. The Model shows that increase in the supply of skilled labor leads to temporary stagnation in both labor wages and creates a distinct gap between the wages of both labors. It is because the increase in the supply of labor accelerates the adoption of skilled biased technological changes, and it may produce a lower growth rate temporary in different economies depending on the economic situation prevailing over there.

Alfred Greiner and W.Semmler (in 2002)extends the endogenous growth model of the Murphy, Riddell and Romer. They assume that the technical progress leads to wage differences between highly skilled labor and unskilled labor. They conclude that as the technical progress occurs the relative marginal productivity of different inputs changes, but also observe that if there is sufficient linkage between skills and new technology the demand for educated employees rises too and it may generate an increase in their wage rates relative to unskilled labor.

B. F. Jones (in 2011) presents a research paper in which a model is developed, where human capital explains the nomenclature of world economy. He explains that the human capital is reflected in the sense of quality and quantity of the skilled labor. According to his study low quality occurs when the skilled labor fails by having a lack of advanced technical knowledge. The study may

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explain the price, wage and income difference between different countries and further suggests an interpretation of immigration outcome, poverty trap and the brain drain.

Klaus Wa'ld(in 1999), in his research paper investigates one reason why some countries have experienced a strong increase in wage inequality over the last decades while others have not. The study is based on the link between the quality of education and induced technological change. Any country possessing qualitatively better-educated and skilled workers relative to unskilled workers has a higher ratio of human capital to labor than a country where the quality of education is more equal across education levels. These differences approach to different paths of induced technological change across countries, which in turn include different histories of the distribution of labor income.

SIMION DALIA, T. DANIEL and S. MARIAN in their paper aims to treat problems of the main labor productivity growth in Romania, trying to highlight the link between labor productivity and a series of economic indicators. They believe that during the current era, deeply explained by the global crisis, labor productivity growth can play a vital role in the recovery of our country. Labor productivity manifestation as an expression of the development of productive forces, is characterized by multiple technical aspects and correlation. They stress the mutual influence of the dynamic elements of productive forces, Indicating a number of technical reports: the subject of work and means of labor, of technology and means of working mechanism, the various elements of technique and the interaction between technical and manpower at work.

H. J. M.Boedo(in 2007) observes that Skill intensive technologies seem to be adopted by rich countries rather than poor countries. According to his observations, the ratio of wages of skilled to unskilled workers – the skill premium, shows two important features over time and in different countries. In the US the skill worker wages decreased during the first half of the 20th century and it increased after 1950, according to a U shaped pattern. On the other hand, the same observations across countries around 1990 are hump shaped when countries are ordered by GDP per worker. This paper gives a systematic explanation as to why we see ever more skill intensive technologies being adopted both over time in the US and by different countries. The model developed here endogenously generates predictions for the skill premium that are consistent with both the US and international observations under the same set of parameter values.

F. CASELLI and W. J. COLEMAN II, study the cross-country differences in the aggregate production function when skilled and unskilled labor is imperfect substitutes. They find that there is a skill bias in cross-country technological differences. Most of the Higher-income countries use skilled labor more efficiently than the low-income countries, while they use unskilled labor

relatively and, possibly, absolutely less efficiently. They also propose a simple explanation for their findings that developed countries, which are equipped by skilled-labor, adopts the technologies that are best suited to skilled workers; poor countries, which are mostly relying on the unskilled-labor, choose technologies more appropriate to unskilled workers. They have given some alternative explanations, like capital-skill complementarity and differences in schooling quality.

3. METHODOLOGY

3.1 Data and Methodology

According to the variables the nature of the study will be correlational. Time series data has been taken and the data collection source is secondary. The main variables taken for research will be technical or skilled labor, unskilled labor and the overall productivity of labor. In this study technical or skilled labor and unskilled labor will be taken as independent variable and overall labor productivity as the dependent variable. The Data will be regressed to seek the relationship between these variables.

3.2 Population Size and Sampling

The total range of the population will be from 1990 to 2011, and 21 samples will be taken to develop our Model and to study the correlation between the dependent and independent variables.

3.3 Hypothesis Development

For this purpose the following set of hypothesis has been taken to analyze the data.

H₁= Technical or skilled labor enhances the overall productivity of labor.

H₂= Unskilled labor does not enhance the overall productivity of labor.

H₃= Technical or skilled labor and unskilled labor does not enhance the overall productivity of labor.

3.4 Model

We will use 'The Cobb Douglas Production Function' for this analysis.

$$\ln LP = \beta_0 + \beta_1 \ln SK + \beta_2 \ln UNSK$$

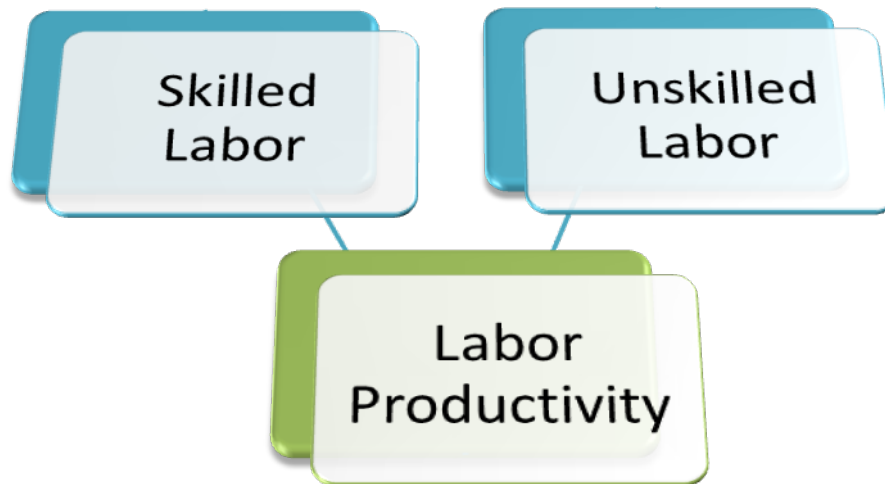
Where:

LP=Labor productivity

SK=Technical or skilled labor

UNSK=Unskilled labor

Schematic Design:



4. RESULTS AND DISCUSSION

4.1 Data Analysis and Results

To find the correlational relationship between technical or skilled labor, unskilled labor and labor productivity we apply The Cobb Douglas Production Function, which helps to analyze the trend and relation of independent variables (Skilled and Unskilled Labor) upon Dependent Variable(Labor productivity) . Before to

translate the production function we took the natural log of the whole data and have run Regression upon the Model, so we have obtained the following 3 results. First and second results are the individual effects of skilled labor on overall labor productivity and unskilled on overall labor productivity respectively, and the third one is the combine results of their effects on the dependent variable.

Result-01:

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.716581615
R Square	0.513489211
Adjusted R Square	0.48788338
Standard Error	0.049906896
Observations	21

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	0.049947479	0.049947479	20.05360464	0.000257666

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Residual	19	0.047323268	0.002490698		
Total	20	0.097270747			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	3.329909179	0.291543655	11.4216486	5.93945E-10	2.719701297	3.94011706	2.719701297	3.94011706
2.985681938	0.43627161	0.097422827	4.478125125	0.000257666	0.232363291	0.640179931	0.232363291	0.640179931

Explanation: Regression has run on the data of independent variable (Skilled labor) and the dependent variable labor productivity. The result shows that if the independent variable (skilled labor) increases 1% the productivity increases by 43.6%

Result-02:

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.763256467
R Square	0.582560434
Adjusted R Square	0.53617826
Standard Error	0.047495414
Observations	21

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	0.056666088	0.028333044	12.5600071	0.000384895
Residual	18	0.040604658	0.002255814		
Total	20	0.097270747			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.020188829	1.017964901	4.931593247	0.00010768	2.881523937	7.158853721	2.881523937	7.158853721
2.985681938	0.372459734	0.099816472	3.731445575	0.00152781	0.162753108	0.582166361	0.162753108	0.582166361
3.933784497	-0.392434634	0.227394162	-1.725790281	0.10151023	-0.870172039	0.085302771	-0.870172039	0.085302771

Explanation: Regression has run on the data of independent variable (Unskilled labor) and the dependent variable labor productivity. The result shows that, if the independent (unskilled labor) increases 1% then the labor productivity decreases by 70.6%

Result-03:

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.509563557
R Square	0.259655018
Adjusted R Square	0.220689493
Standard Error	0.061564647
Observations	21

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	0.025256838	0.025256838	6.663711471	0.018295773
Residual	19	0.072013909	0.003790206		
Total	20	0.097270747			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	7.3349912	1.046187964	7.011159993	1.12196E-06	5.14529463	9.52468777	5.14529463	9.52468777
	-0.706751508	0.27378437	-2.581416563	0.018295773	-1.279788779	0.133714237	-1.279788779	0.133714237

Explanation: Regression has run on the data of independent variables (Skilled and Unskilled Labor) and the dependent variable labor productivity. The result shows that, if the skilled labor increases by 1% then the labor productivity increases by 37.2% and if the unskilled labor increases 1% then the labor productivity decreases by 39.2%

4.2 Interpretation of Results

After applying and running the linear Regression upon The Cobb Douglas Production Function, following results were found.

- Independent Variable (Skilled Labor) explains 51% the dependent Variable (Labor Productivity). For which the value of R square is (0.513489211).

- Independent Variable (Unskilled Labor) explains 26% the dependent Variable (Labor Productivity). For which the value of R square is (0.259655018)
- Both the Independent Variable (Skilled and Unskilled Labor) collectively explains 58% the dependent Variable (Labor Productivity). For which the value of R square is (0.582560434)
- Regression was run on the data of independent variable (Skilled labor) and the dependent variable labor productivity. The result shows that if the skilled labor increases 1% then the labor productivity increases by 37.2% and if the unskilled labor increases 1% then the labor productivity decreases by 39.2%.

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- Regression was also run on the data of independent variables (Skilled and Unskilled Labor) and the dependent variable labor productivity. The result shows that if the skilled labor increases 1% then the labor productivity increases by 37.2% and if the unskilled labor increases 1% then the labor productivity decreases by 39.2%.

5. DISCUSSION

The results of the analysis are divided into two parts. The 1st part of the results show growth in labor productivity due to both skilled and unskilled labor. The 2nd part of the results show the regression analysis and tells us that the skill labor is increasing the overall labor productivity, and unskilled labor (which has less impact) decreased the overall labor productivity. So we accept the hypothesis H₁ and reject the rest.

5.1 Growth Trend of Labor Productivity

From the taken data and their results it is observed that the overall productivity of the labor is increasing due to the share of technical or skilled and unskilled labor in different sectors of the economy. We have observed the labor productivity trend from 1990 to 2011. A 4.2% increase in labor productivity has been observed in the era of 1990-2000, while from 2001-2011 this growth rate has attained 6% of labor productivity. So the overall impact of the SK and UNSK on the labor productivity has been increasing.

5.2 Correlational Impact of Skilled and Unskilled Labor on the Labor Productivity:

From the result and given the data we have observed that the skilled labor positively enhancing the LP. So the share of SK in increasing the LP is more than the UNSK, and the UNSK is negatively correlated with the overall LP due to decline in its share. All of these effects and relations can be well understood by the table and graphs which are given in the Appendix section.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

After conducting the whole study and obtaining the individual and collective results of the taken variables we conclude that although the Skilled labor enhances the overall labor productivity positively and on the other hand the Unskilled labor does enhance the overall labor productivity but at a low pace and have a negative relationship with the dependent variable. But both the independent variables do enhance the overall labor productivity in the case of Pakistan economy. So it proves that the technical education helps to address the problem of low productivity which is due to excess supply of the un-educated and unskilled labor in the economy.

6.2 Recommendations

It is recommended that the technical and vocational education should be strongly encouraged. More and more diploma and short courses should be designed and more technical institutions should be established to increase the availability of skilled labor and to strengthen the every sector of Pakistan economy.

- Shorthand courses at lower cost for the duration of 3-6 months should be designed according to the need of particular sector e.g. Drafting, AutoCAD, Welding, refrigeration and air conditioning, Motor winding, electrical wiring, turning, CNC machine operator, boiler engineering, Drilling etc.
- Skill development councils should be established in every city of Pakistan.
- The syllabus of 3 years diploma courses should be revised and improved according to the international standards.
- Training and information seminars should be arranged frequently.
- Research and development process should be accelerated with collaboration and technical help of Multinational corporations and Foreign Technical Institutes.
- Better Health, Education Environment, flexible wage rate, and recreational facilities should be provided in the labor to enhance its productivity efficiency.

7. LIMITATIONS

While conducting this study some sort of unavailability of the required data has been faced. The exact data of unskilled labor have not found registered to any statistical department. So, it is not an easy job to collect the data of unskilled labor exactly according to the requirement of this study. To justify the model, the agricultural productivity has been taken as a proxy for unskilled labor. It is assumed that the productivity in this sector is mainly by the unskilled labor. So, the reader has to observe the trend and the relationship of the independent variables with respect to the Dependent variable.

8. FUTURE GAP

Further study can be conducted in this regard. Primary Data Collection Methods will be preferred. Furthermore other Professional education and skills like M.B.A, C.A professionals etc. can be included to check and analyze the impact of both the technical education and professional education on the overall labor productivity.

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APPENDICES

Appendix-1:

Years	Labor Productivity	Skilled labor	Unskilled labor
2011	112.9	26.3	45.2
2010	113.5	24.8	46.1
2009	113.1	23.5	46.1
2008	114.9	20.1	44.7
2007	113.5	21	43.6
2006	110.4	20.7	43.4
2005	108.4	20.3	43
2004	105.6	20.3	43

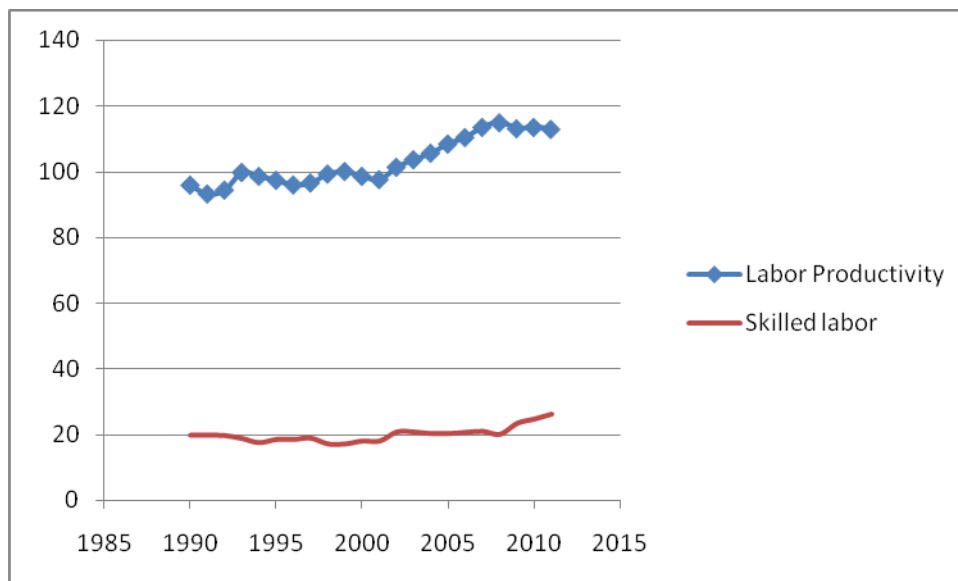
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2003	103.6	20.8	42.1
2002	101.3	20.8	42.1
2001	97.5	18	48.4
2000	98.5	18	48.4
1999	100	17.1	47.3
1998	99.2	17.1	44.2
1997	96.5	18.9	46.8
1996	95.9	18.5	46.8
1995	97.3	18.5	45.3
1994	98.5	17.5	50
1993	99.7	18.8	47.5
1992	94.3	19.7	48.3
1991	93.1	19.8	47.4
1990	95.8	19.8	51.1

Sources: trading economies and FBS (labor force employment trend of Pakistan 2011)

Appendix-2:

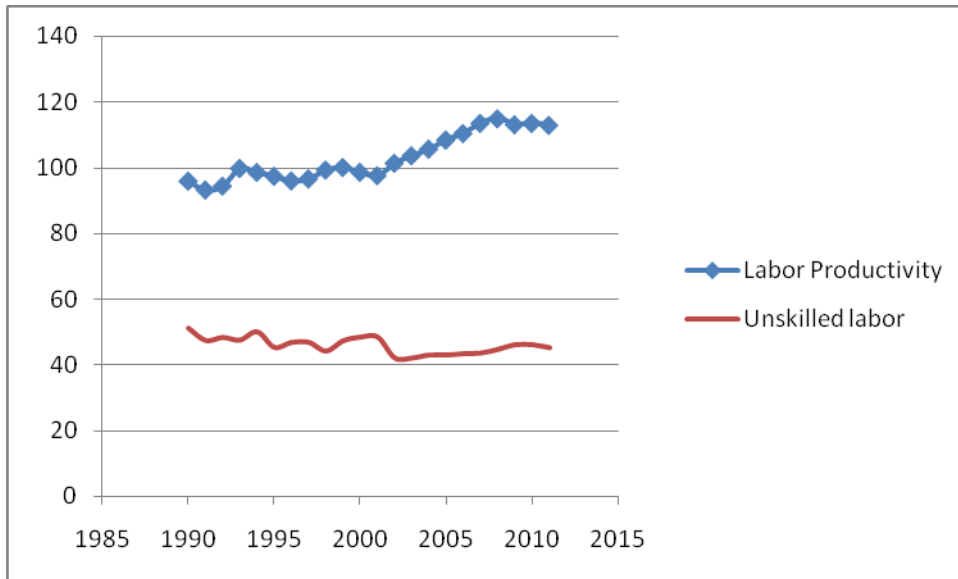
Productivity trend of skilled labor



Source: (MS- Excel Generated Graph)

Appendix-3:

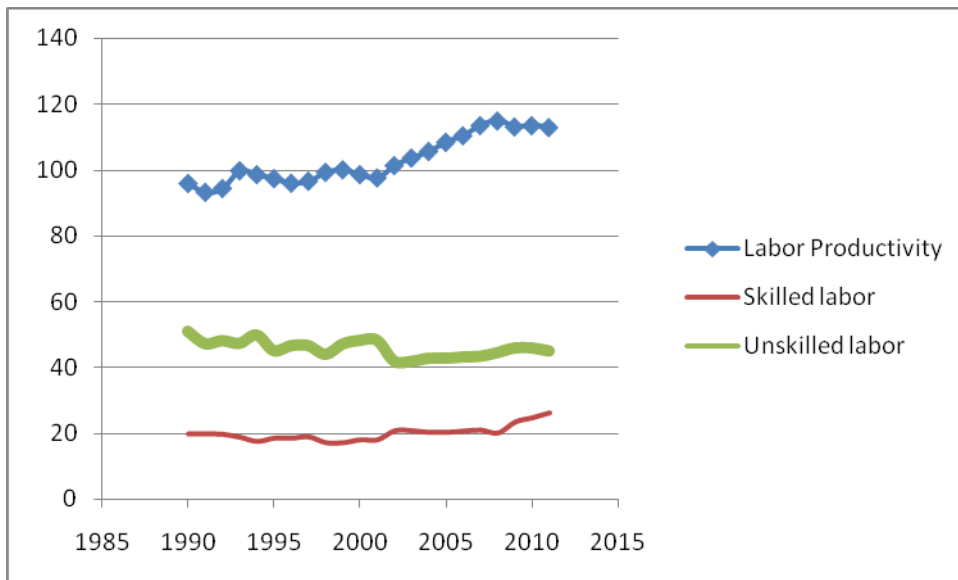
Productivity trend of Unskilled Labor



Source: (MS- Excel Generated Graph)

Appendix-4:

Productivity trend of both skilled laborand Unskilled Labor



Source: (MS- Excel Generated Graph)