

Relationship among GDP, Per Capita GDP, Literacy Rate and Unemployment Rate

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Abstract

Gross domestic product (GDP) and per capita GDP (PGDP) are basic measures of the economic performance of a country. The *literacy rate* is the percentage of people with the ability to read and write. Unemployment rate is the percentage of the total labour force that is unemployed but actively seeking employment and willing to work. This paper investigates the relationship among GDP, PGDP, literacy rate and unemployment rate. It is observed that GDP is not significantly related with PGDP, *literacy rate or*, unemployment rate. There exist significant positive relationship between PGDP and literacy rate but significant negative relationship between PGDP and unemployment rate and between literacy rate and unemployment rate. Therefore taking proper initiative to increase literacy rate of a country will reduce its unemployment rate and increase PGDP resulting development of the country.

Keywords: GDP, *literacy rate*, unemployment rate, correlation coefficient, rank correlation, test of hypothesis.

1. Introduction

GDP is a basic measure of the economic performance of a country and is the total market values of all final goods and services produced in a country in a given year. GDP is widely used by economists to measure the health of an economy, as its variations are relatively quickly identified (Samuelson and Nordhaus, 1989). PGDP is the GDP divided by the population as of 1st July of the same year. Differences in PGDP across countries in the world are vast (Knowles and Weatherston, 2007). Literacy has traditionally been described as the ability to read and write. It is a concept claimed and defined by a range of different theoretical fields. The United Nations Educational, Scientific and Cultural Organization (UNESCO) define literacy as the "ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society." Many policy analysts consider literacy rates as a crucial measure to enhance a region's human capital. This claim is made on the grounds that literate people can be trained less expensively than illiterate people, generally have a higher socio-economic status and enjoy better health and employment prospects. Policy makers also argue that literacy increases job opportunities and access to higher education. In Ireland in 2009, the National Adult Literacy Agency (NALA) commissioned an economist to do a cost benefit analysis of adult literacy training in Ireland. He reported that there were economic gains for the individuals, the companies they worked for, the Exchequer, as well as the economy, for example, increased GDP, and society at large. The unemployment rate is defined as the number of unemployed persons divided by the labor force, where the labor force is the number of unemployed persons plus the number of employed persons. GDP, per capita GDP, literacy rate and unemployment rate varies from country to country and over time. This paper analyses the GDP, per capita GDP data, literacy rate and unemployment rate of Arab league countries, and OECD countries to test whether there exist any relationship between these variables. This paper also finds out the strategy that a country should take for her development.

2. Data

The following World Bank data given in Table 1 is the GDP, PGDP, Literacy rate (LR) and Unemployment rate (UR) of Arab league countries obtained from internet.

Table 1: GDP, PGDP, LR and UR for Arab league countries

Country	GDP (millions of USD) 2009	GDP per capita (USD) 2009	LR	UR
Algeria	140,848	4,026	72.6	30.0
Bahrain	20,214	19,455	90.8	2.0
Comoros	532	798	73.6	14.3
Djibouti	1,049	1,304	67.9	60.0
Egypt	187,954	2,450	66.4	11.0
Iraq	65,838	2,107	77.6	30.0
Jordan	22,929	3,828	92.2	13.0
KSA	369,671	14,486	85.5	7.0
Kuwait	111,309	31,482	94.5	3.0
Lebanon	33,585	8,706	89.6	11.0

Libya	60,351	9,529	88.4	30.0
Mauritania	3,029	975	56.8	32.0
Morocco	90,815	2,864	56.4	14.0
Oman	53,395	18,013	86.7	7.0
Qatar	83,910	68,871	93.1	3.0
Somalia	2,763	795	51.6	66.0
Sudan	54,677	1,397	69.3	17.0
Syria	52,524	2,578	83.6	11.0
Tunisia	40,168	3,851	78.0	14.0
UAE	229,971	46,856	90.0	2.0
Yemen	25,131	1,060	60.9	17.0

The following World Bank data given in Table 2 is the GDP, PGDP, LR and UR of OECD countries obtained from internet.

Table 2: GDP, PGDP, LR and UR for OECD countries

Country	2008GDP	2008PGDP	LR	UR(2008)
Australia	847234.2	39148.0	99.0	4.2
Austria	332202.7	39849.0	99.0	3.8
Belgium	394900.0	36879.0	99.0	7.0
Canada	1295869.2	38883.0	99.0	6.1
Chile	244217.4	14568.0	96.5	7.8
Czeck republic	269555.4	25845.0	99.0	4.4
Denmark	216901.7	39494.0	99.0	3.3
Estonia	29234.6	21802.0	99.8	5.6
Finland	200821.2	37795.0	99.0	6.4
France	2178484.5	33963.0	99.0	7.8
Germany	3052457.3	37171.0	99.0	7.6
Greece	337975.4	30077.0	97.1	7.7
Hungary	207789.5	20700.0	99.4	7.8
Iceland	12508.0	39166.0	99.0	3.0
Ireland	189463.7	42644.0	99.0	6.3
Israel	202302.3	27679.0	97.1	6.1
Italy	1990547.9	33269.0	98.9	6.8
Japan	4316608.2	33805.0	99.0	4.0
Korea	1306387.2	26877.0	99.0	3.2
Luxembourg	43803.0	89742.0	99.0	4.9
Mexico	1629595.0	15291.0	92.8	4.0
Netherlands	705069.5	42887.0	99.0	3.1
New Zealand	124478.4	29077.0	99.0	4.2
Norway	288428.4	60480.0	99.0	2.5
Poland	688458.2	18062.0	99.3	7.2
Portugal	265100.0	24957.0	94.9	8.5
Slovak Republic	125638.1	23245.0	99.0	9.5
Slovenia	59083.9	29221.0	99.7	4.4
Spain	1512485.1	33173.0	97.9	11.4
Sweden	363958.0	39475.0	99.0	6.2
Switzerland	351514.8	45586.0	99.0	3.2

Turkey	1063519.1	14962.0	88.7	9.7
UK	2260520.4	36817.0	99.0	5.7
USA	14296900.0	46901.0	99.0	5.8

3. Methodology

In order to study the relationship among GDP, PGDP, literacy rate and unemployment rate, we first calculate the Pearson's Product moment correlation coefficient (Johnson and Bhattacharyya, 2001) pair-wise for all four variables using the following formulae and presented in Table 3 and Table 5 for Arab League countries and OECD countries respectively.

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

In order to test the significance of the correlation coefficient the following null (H_0) and alternative (H_1) hypotheses are considered.

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0$$

where ρ is the population correlation co-efficient between two variables.

The appropriate test statistic to test the above hypothesis is

$$t = \frac{r\sqrt{(n-2)}}{\sqrt{(1-r^2)}}$$

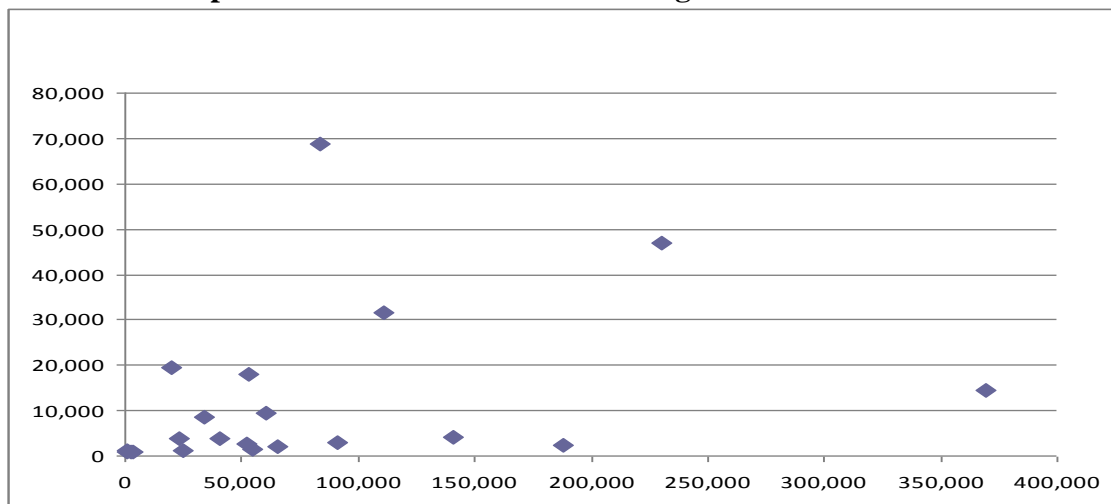
The values of the test statistic and P-values are given in Table 4 and Table 6. In order to study the relationship among GDP, PGDP, literacy rate and unemployment rate, we also calculate the Spearman's rank correlation (Conover 1980) pair-wise for all four variables using the following formulae and presented in Table 8 for Arab League countries.

$$\rho_s = 1 - \frac{6T}{n(n^2 - 1)} \quad ; \quad \text{where, } T = \sum_{i=1}^n [R(X_i) - R(Y_i)]^2, \quad R(X_i) \text{ be the rank of } X_i \text{ and } R(Y_i) \text{ be the rank of } Y_i \text{ where } i = 1, 2, 3, \dots, n.$$

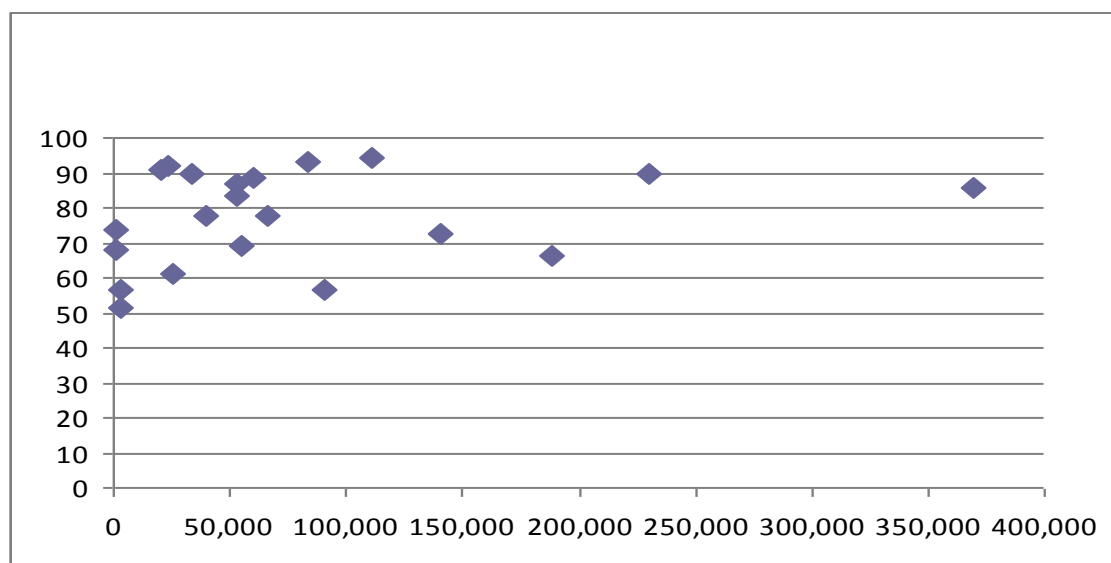
4. Results and Discussion

In order to study the relationship among GDP, PGDP, Literacy rate (LR) and Unemployment rate (UR) first we construct pair wise scatter diagram for Arab league countries and presented in the following Graphs (Graph 1 to graph 6).

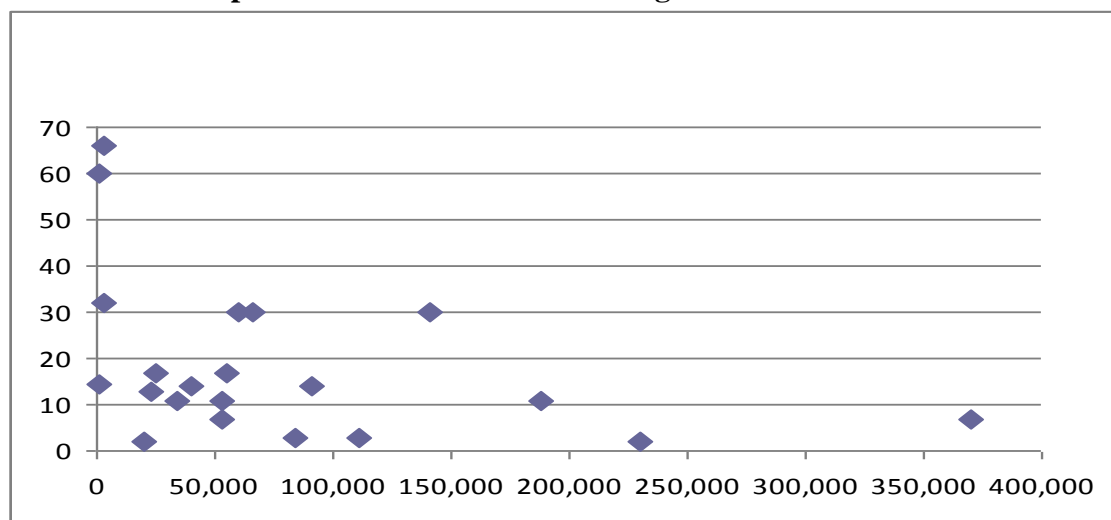
Graph 1: PGDP VS GDP for Arab league countries



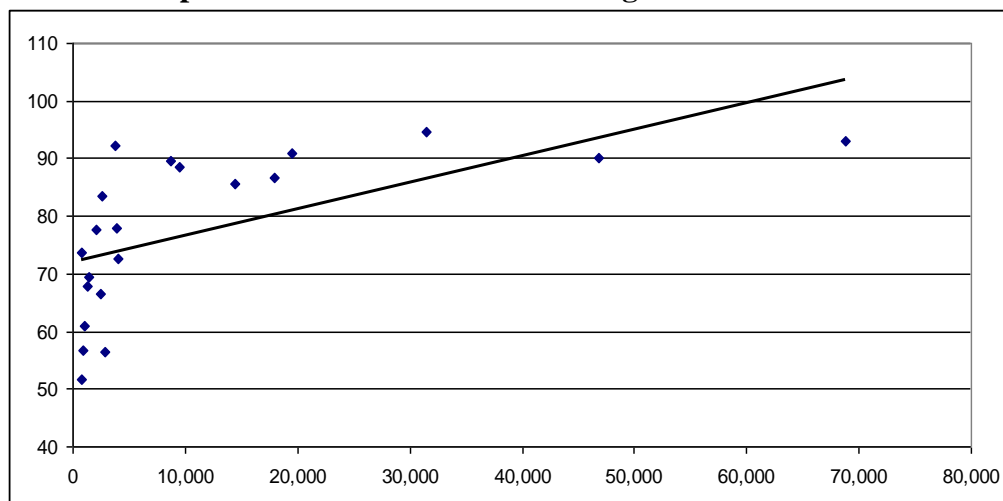
Graph 2: GDP VS LR for Arab league countries



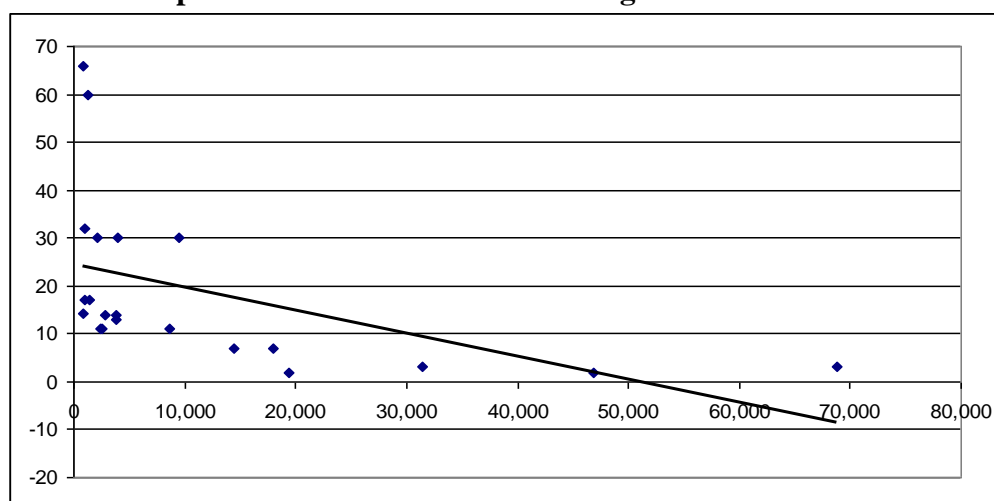
Graph 3: GDP VS UR for Arab league countries



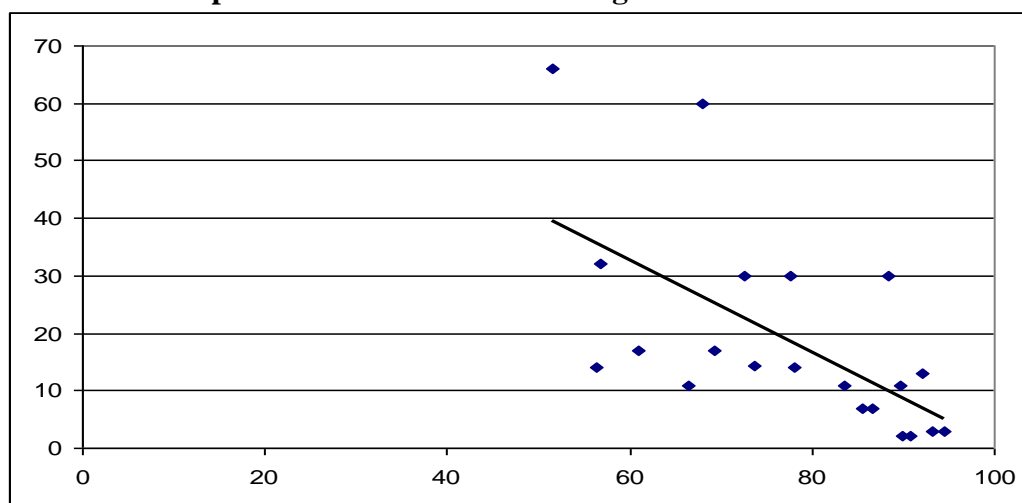
Graph 4: PGDP VS LR for Arab league countries



Graph 5: PGDP VS UR for Arab league countries



Graph 6: UR VS LR for Arab league countries



From the Graphs it seems there is no relation or weak relation between PGDP and GDP, GDP and LR, GDP and UR. There may be positive relationship between PGDP and LR, negative relationship between PGDP and UR and between LR and UR. Similar pattern

also observed for OECD countries. Then we find the correlation matrix for GDP, PGDP, LR and UR for Arab league countries and presented in Table 3.

Table 3: Correlation Matrix for GDP, PGDP, LR and UR for Arab league countries

	GDP	PGDP	LR	UR
GDP	1			
PGDP	0.3217	1		
LR	0.2445	0.5961	1	
UR	-0.3823	-0.4815	-0.6236	1

Table 4 represents the test statistic values and P-values for testing the significance of correlation coefficient between four variables of Arab league countries.

Table 4: Test statistic and P-values for testing the significance of correlation coefficient

Relation between	r	t-ratio	P-value
PGDP and LR	0.5961	3.2361	0.0043
PGDP and GDP	0.3217	1.4809	0.1550
LR and GDP	0.2445	1.0992	0.2854
PGDP and UR	-0.4815	-2.3946	0.0271
GDP and UR	-0.3823	-1.8033	0.0872
LR and UR	-0.6236	-3.4769	0.0025

There exist significant positive relationship between PGDP and LR, significant negative relationship between PGDP and UR and between LR and UR. However, no significant relationship exists between PGDP and GDP, GDP and LR, GDP and UR.

Table 5 represents the correlation matrix for GDP, PGDP, LR and UR of OECD countries.

Table 5: Correlation Matrix for GDP, PGDP, LR and UR for OECD countries

	GDP	PGDP	LR	UR
GDP	1			
PGDP	0.1130	1		
LR	0.0345	0.3985	1	
UR	0.0309	-0.3750	-0.3418	1

Table 6 represents the test statistic values and P-values for testing the significance of correlation coefficient between four variables of OECD countries.

Table 6: Test statistic and P-values for testing the significance of correlation coefficient

Relation between	r	t-ratio	P-value
PGDP and LR	0.3985	2.4581	0.0198
PGDP and GDP	0.1130	0.6431	0.5249
LR and GDP	0.0345	0.1953	0.8464
PGDP and UR	-0.3750	-2.2886	0.0291
GDP and UR	0.0309	0.1750	0.8622
LR and UR	-0.3418	-2.0574	0.0481

There exist significant positive relationship between PGDP and LR, significant negative relationship between per PGDP and UR and between LR and UR. However, no significant relationship exists between PGDP and GDP, LR and GDP, GDP and UR.

We also apply non-parametric test for more confirmation. The values of the four variables GDP, PGDP, LR and UR for Arab league countries are replaced by their corresponding ranks and presented in Table 7.

Table 7: Ranks of GDP, PGDP, LR and UR for Arab league countries

GDP	PGDP	LR	UR
18	13	8	17
5	18	18	1.5
1	2	9	13
2	5	6	20
19	8	5	8
14	7	10	17
6	11	19	10
21	16	13	5.5
17	19	21	3.5
8	14	16	8
13	15	15	17
4	3	3	19
16	10	2	11.5
11	17	14	5.5
15	21	20	3.5
3	1	1	21
12	6	7	14.5
10	9	12	8
9	12	11	11.5
20	20	17	1.5
7	4	4	14.5

Spearman's rank correlation between GDP and LR, PGDP and LR, PGDP and UR, LR and UR are calculated for Arab league countries and tested. The test results are given in Table 8.

Table 8: Spearman's rank correlation test results for Arab league countries

Relation between	P_s	5% Critical value	Conclusion
GDP and LR	0.2442	0.4351	Insignificant
PGDP and LR	0.8260	0.4351	Significant
PGDP and UR	-0.7847	-0.4351	Significant
LR and UR	-0.7198	-0.4351	Significant

This test also indicates that there exist significant positive relation between PGDP and LR, significant negative relation between PGDP and UR and between LR and UR.

5. Summary and Concluding Remarks

There exist significant positive relationship between PGDP and LR but significant negative relationship between PGDP and UR and between LR and UR. GDP is not significantly related with PGDP, *LR or*, UR. Therefore, PGDP plays a significant role for changing LR and UR. In order to develop a country the government of that country can easily take some proper initiative for example increase education budget, making primary/secondary education compulsory, etc. to increase LR. Increasing LR will reduce UR and increase PGDP resulting development of the country.

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