The Relationship between Human Development and The Gross Domestic Products GDP: Case Study Syria

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Abstract

This paper tests the relationship between economic growth and human development using annual data from Syria for the period 1970-2000. This period is chosen for two reasons; firstly because of its political and economic homogeneity which is conductive to arrive at accurate results and secondly because the significant changes in the Syrian government's policies in the fields of education and health like the opining for the first time of private universities and open learning programs and the involvement of the private sector in providing health services and health insurance. The results of the cointegration tests confirm the existence of a long-run equilibrium relationship between economic growth and the two human development variables. The long-run coefficients are statistically significant for the health variables but not for the education one. The latter result is investigated and is found to be caused by the use of a poor proxy for education and/or certain characteristics of the government education policy. The analysis of this policy highlighted some possible explanations of the above results. These explanations can be summarised as the imbalance between the supply and demand for education, absence of real improvement in the quality of education, inefficient cost-benefit analysis from students when deciding whether or not to pursue their study.

Keywords: human development, growth, time series; cointegration JEL codes: J24; O40

I. The hypotheses of the study:

The study tests two hypotheses that are:

- There is a positive relationship between health and the growth of Gross Domestic Product GDP in Syria during the period of study.
- There is a positive relationship between education and growth of Gross Domestic Product GDP in Syria during the period of study.

II. The questions of the study:

The study addresses the following questions:

- What are the relationships between human development variables (education and health) and level of Gross Domestic Product GDP in Syria during the period 1970-2000.
- What is the problem of unit root in time series analysis?; what is its impact? and how one could solve it?

III. The aims of the study:

The study aims at:

- Explaining the nature of the long-run relationship between the growth of Gross Domestic Product GDP and investment in human development in Syria.
- Focusing on the process of economic growth and its determinants during the period 1970-2000.
- Introducing the Auto-Regressive Distributed Lag (ARDL) approach of cointegration analysis and employing it empirically in the case of Syria.

IV. The methodology:

This study uses the induction approach to examine its hypotheses. The empirical analysis is conducted in two stages the first of them focused on the validity of the data by using the unit root test and the second stage includes the long-run test by applying the Auto-Regressive Distributed Lag (ARDL) technique.

1-Introduction

Growth, demography, and inequality are all important aspects of the economic development process that are closely linked with human development. Theoretically, it is now well established that human capital accumulation is a major determinant of economic performance, is an influential factor in mortality and fertility behaviour, and is an effective device in tackling inequality and reducing poverty. Empirically, there is a good deal of evidence to support these theoretical arguments. Mankiw, Romer and Weil (1992) augment the Solow model by a proxy for human capital accumulation and then test it empirically employing annual data for the period 1960-1985 and using cross-country regressions. They find the human capital proxy to be positively significant in all the regressions with a coefficient between 0.66 and 0.76. In the cross section study of 98 countries by Barro (1991) it is found that initial primary and secondary school enrolment rates play an important role in determining growth with coefficients of 0.025 and 0.0305 respectively. In another exercise where the per capita growth rate is regressed against a proxy of human capital (a linear combination of the above two variables), the results show a strong partial correlation, namely 0.75, between the two variables. The results documented in Barro and Sala-i-Martin (1995) indicate similar effects of male secondary and higher education together with life expectancy at birth with estimated coefficients of 0.016, 0.05 and 0.064, respectively, that are all highly significant. The ratio of public expenditure on education to GDP is also found to be significant, with each one standard deviation increase raising the growth rate by 0.3 percentage points. Asteriou and Agiomirgianakis (2001) conduct a time series investigation to show the existence of a long-run relationship between education (measured by enrolment rates in primary, secondary and higher education) and per capita GDP in Greece. Their results confirm that, except for higher education, the direction of causality runs from education variables to growth. Bloom et al. (2001) using a panel study for the period (1960-1990) find that output rises by 1% to 4% for each one year increase in life expectancy. Knowles and Owen (1995) incorporate a proxy for health capital in the Mankiw Romer and Weil's empirical model and estimate it using a sample of 84 countries. The

results show that, for the full sample of countries, this proxy is highly significant with an average magnitude of 0.356.[i]

This paper conducts a time series analysis of the relationship between human development and economic development in the case of Syria for the period 1970 to 2000. The study focuses on this period, which is obviously relatively old, because it is consistent and homogeneous both politically and economically as just after the end of the period i.e. the year 2000 new president was elected and a process of political and economic reform was initiated.

Education and health are used to represent human development. The former is measured by public expenditure on education. Two variables are used to measure the latter; infant mortality rates and life expectancy at birth. The cointegration test, namely the ARDL approach, confirms the existence of a long-run relationship among the variables in which per capita growth rate is the dependant variable. The long-run coefficients for the health variables are highly significant (negatively for infant mortality rates and positively for life expectancy) but insignificant for the education variable. In all these models the error term is negatively significant with a reasonable coefficients' sizes. The estimated insignificant impact of the education variable is found to be the result of the use of an imperfect proxy for education and/or some characteristics of the government education policy.

The econometric methodology is summarised in section 2. Section 3 discusses some issues related to the data and lists the definitions of the variables and the source of data. Section 4 documents the results of the unit root tests. Section 5 is devoted to tests for cointegration. The estimation of the error correction model is shown in section 6. Policy analysis and recommendation are documented in section 7. Concluding remarks are contained in section 8.

2-The Econometric methodology

The investigation is carried out using time series techniques that have been used extensively in empirical macroeconomics. The application of these techniques evolves through a sequence of stages. Since most macroeconomic time series in levels are not stationary, the first step is to

test for unit roots. Stationarity or unit root tests in autoregressive time-series models are essential and an important procedure for studying the long-run relationships in macroeconomic data. In the econometric literature two tests have received considerable attention: the Dickey-Fuller (DF) test and the Augmented Dickey-Fuller (ADF) (Dickey, Fuller, 1979,1981) and Phillips-Perron (PP) (Phillips, 1987, Perron 1988 and Phillips, Perron, 1988) tests. The first test is the most commonly used by researchers and was developed by (Dickey, Fuller, 1979, 1981). It involves estimating the following equation:

$$y_t = a + (1-f)dt + f\,y_{t-1} + \sum_{i=1}^{k} g_i y_{t-i} + e_t$$

$$\Delta y_t = a + r\,dt + r\,y_{t-1} + \sum_{i=1}^{k} g_i y_{t-i} + e_t \qquad \text{where t=1,2,……..,n} \quad (1)$$

where the null hypothesis is $H_0 : r = 1-f = 0$ (the unit root), *k* is the number of lags of the dependant variable and *n* is the number of observations. The next step is to test for cointegration among the variables. Cointegration tests allow one to identify the existence of long-run equilibrium relationships between non- stationary variables. There are several strategies for this test such as the Johansen- Juselius's maximum likelihood method (Johansen (1988,1991) and Johansen and Juselius, 1990), the Engle-Granger's (1987) residual-based ADF approach and the Autoregressive Distributed Lag (ARDL) method (Pesaran and Sin (1995) and Pesaran et al. (1996)) the merit of this method is that it can be used irrespective whither the variables are I(0), I(1) or a mixture of both. Following the cointegration test, the cointegrating vector(s) of the long-run relationship(s) among the variables is (are) estimated. The final step is the estimation of the error correction model that shows the causality relationship among the underlying variables.

3-Data issues

The data set used in this study is annual and spans the period (1970-2000). As mentioned above real per capita (GDP), public expenditure on education, infant mortality rates and life expectancy at birth are used to represent economic growth, education and health respectively.

There was no problem with the data collection process as regards the GDP time series where different sources are available to provide the required data for the whole period of study. However, the unavailability of complete data for human development variables was problematic.

Regarding education, it was not possible to find annual time series for literacy rates. School enrolment ratios were another option which are available on an annual basis just until 1996. As a consequence, public expenditure on education is the only variable for which data is available for the time period under consideration. Two health variables are used: the first is life expectancy at birth; and the second is infant mortality rates. Different sources were used to complete the whole time series for these two variables. The following is a list of the variables used in the study.

GDP: per capita gross domestic product, current prices, national currency, million pounds, IMF Web page, WEO, www.imf.org.

DEF: GDP deflator (1995 =100) international Financial Statistics Year Book, IMF, Different issues.

INFORM: infant mortality rates (per 1000), 1970-1989 from world Tables, different issues, 1990-1999 from Human Development Report, different issues, for the years 1995 and 2000 from (www.childinf.org /cmr/revis/db/html).

EB: government budget allocated to education from consolidated budget, current prices, national currency, million pounds, Syrian Statistical Abstract, different issues. GDP and EB were deflated using GDP deflator to get them in constant prices.

LIF: life expectancy at birth, 1970 –1992 and 1999 World Development Index, different issues, 1993-2000, Human Development Report, different issues, 1996 is the average of 1997 and 1995.

In the study all variables are used in their logarithmic forms. Appendice (B) lists the data used in the study with a summary statistics.

4-The unit root test

For comparability purposes both the Augmented Dickey-Fuller (ADF) and the Phillips- Perron tests are applied. In addition, equation (1) is estimated using OLS for all variables used in this study, both for levels and first differences. The coefficient of y_{t-1} is then compared with the usual ADF critical values. The results of the three tests for the level and first difference are reported in Table (1).

Table (1) the results of the unit root tests

Variable • Level • First diff.	ADF 95% Critical Value	DF & ADF Statistics	PP Statistics	OLS Estimation of Eq. (1)	Conclusion		
					DF&ADF	PP	OLS
LGDP							
• Level	-2.966	-3.599	-3.44	-3.11	I(0)	I(0)	I(0)
LEB							
• Level	-2.96	-2.58	-2.2	-2.31	I(1)	I(1)	I(1)
• First diff.	-2.97	-5.56	-3.00	-5.59	I(0)	I(0)	I(0)
LINFMOR							
• Level	-2.96	0.685	0.814	0.71	I(1)	I(1)	I(1)
• First diff.	-2.97	-4.11	-10.15	-4.2	I(0)	I(0)	I(0)
LLIF							
• Level	-2.96	-3.45	-3.13	-3.74	I(0)	I(0)	I(0)

The econometric tests were carries out using Microfit 3.

According to the results in Table (1) there is an overall agreement between the different tests used. Public expenditure on education and infant mortality rates are each I(1) and per capita GDP and life expectancy are each I(0).

5- The Cointegration test

In this section the cointegration test will be carried out using the ARDL method. This method involves two stages. The existence of a long-run relationship among the variables under investigation is tested in the first stage. The second stage is the estimation of the coefficients of the long-run relations and the error correction model represented by the following equation.

$$dLGDP = a_0 + \sum_{i=1}^{2} g_i dLGDP_{t-i} + \sum_{i=1}^{2} f_i dLEB_{t-i} + \sum_{i=1}^{2} b_i dLH_{t-i} + d_1 LGDP_{t-1} + d_2 LEB_{t-1} + d_3 LH_{t-1} + u_t$$

(2) where LH stands for the health variable (either infant mortality rates or life expectancy at birth). The existence of the long-run relationship between economic development and the two forms of human development is tested as follows. The null of 'non-existence of a long-run relationship' is defined by: $H_0 : d_1 = d_2 = d_3 = 0$ against $H_1 : d_1 \neq 0, d_2 \neq 0, d_3 \neq 0$

The F-statistics for the test of the joint null hypothesis that the coefficients of the level variables are zero (i.e. there exists no long-run relationship between them) are 5.39 and 4.21 where the health variable is infant mortality and life expectancy respectively. The critical value bound for this test are computed and reported by Pesaran *et al.* (1996) as Table (F). The comparison of these statistics with the critical value bounds[ii] for this test shows that the former is significant at the 5% level and the latter is significant at the 10% level. Accordingly, the model with infant mortality is shown to be better than the model with life expectancy. Thus, in the following analysis the former will be used.[iii] The estimates of the long-run coefficients are summarised in Table (2).

Table (2): Estimates of the long-run coefficients based on ARDL models selected by AIC and SBC criteria

Regressors	Model Selection Criteria	
	SBC ARDL (1,1,0)	AIC ARDL (2,1,0)
INTP	6.63	6.85
	(1.21)	(1.43)
LEB	0.004	-0.05
	(0.19)	(0.24)
LINFMOR	-0.199	-0.17
	(0.1)	(0.11)

Note: numbers in parenthesis are standard errors.

The results in Table (2) show that the two criterion (SBC) and (AIC) choose different order for the ARDL model.[iv] The former chooses order (1,1,0) and the latter chooses the order of (2,1,0). According to the model of the (SBC) criteria, infant mortality rate is significant at the 10% level

with the expected negative sign. Although public expenditure on education appears with the expected positive sign, it is insignificant. In the model based on the (AIC) criteria both human development variables, (education (LEB) and health (LINFMOR)), have negative signs and statistically none of them is significant.[v]

6-The estimation of the error-correction model

The estimated error correction model, equation (2), associated with the long-run estimates in Table (2) are given by:

$$dLGDP = 2dA^{**} - 0.188\ dLGDP_1 + 0.24\ dLEB^{***} - 0.05\ dLINFMOR - 0.29\ ECM_{-1}^{**} \quad (3.a)$$

(3.1) (-1.63) (4.5) (-1.37) (-2.3)

$$\overline{R}^2 = 0.67$$

$$dLGDP = 2.27\ dA^{**} + 0.245\ dLEB^{***} - 0.068\ dLINFMOR^{*} - 0.34\ ECM_{-1}^{**} \quad (3.b)$$

(3.47) (4.32) (-1.77) (-2.7)

$$\overline{R}^2 = 0.64$$

where equations (3.a) and (3.b) are associated with the models based on the (AIC) and (SBC) criterion respectively. In both of these equations the error correction term has the expected negative sign and is statistically significant at the 5% level. Its coefficient ranges between 0.29 and 0.34 which means that, once shocked, the system corrects its previous period disequilibrium by 29 to 34 percent every year. Statistically, these models are shown to have good explanatory power. The R-Bar-Squared measure ranges between 0.64 and 0.67, which means that as much as 64 to 67 per cent of changes in the per capita GDP growth rate during the period of study are explained by the models above. Concerning the short run effects, the above equations show that the main channel for this effect is coming from the education variable, which is significant in both models at the 1 per cent level. Regarding the health variable, changes in infant

mortality rate appear to be significant at the 10 per cent level in equation (3.b).

Contrary to expectations, the results of the estimates of the long-run coefficients reported in Table (2) show insignificant long-run effects of education. Since there is a strong interrelationship between health and education (Mushkin 1962, Grossman 1973), a possible explanation for these results is that the health variables capture some of the effect of education causing the statistical effect of the latter to be insignificant. To examine this proposition the analysis is repeated but without the inclusion of the health variables in the test. Now the new version of equation (2) to be tested is given by:

$$dLGDP_t = a_0 + \sum_{i=1}^{2} g_i dLGDP_{t-i} + \sum_{i=1}^{2} f_i dLEB_{t-i} + d_1 LGDP_{t-1} + d_2 LEB_{t-1} + u_t \quad (4)$$

The null hypothesis of non-existence of a long-run relationship is $H_0 : d_1 = d_2 = 0$ and the alternative hypothesis is $H_1 : d_1 \neq 0, d_2 \neq 0$. The F-statistic associated with this test is (6.71) which is greater than the upper limit of the relative critical bound value (5.76). Accordingly, the null hypothesis is rejected and statistically it can be concluded that a long-run relationship between per capita GDP and public expenditure on education exists. The estimates of the long-run coefficients of this relationship are reported in the following table.

Table (3): Estimates of the long-run coefficients based on ARDL models selected by AIC and SBC criteria

Regressors	Model Selection Criteria
	SBC ARDL (2,1) and AIC ARDL (2,1)
INTP	6.1
	(1.95)
LEB	-0.04
	(0.33)

Note: numbers in parenthesis are standard errors.

The results in Table (3) show that both the (AIC) and (SBC) criterion select the same order (2,1) for the ARDL model.[vi] Statistically, the education variable is still insignificant after dropping the health variable.

It is possible that the insignificant effect of education in the long-run equation may be due to the use of a poor proxy for this variable for the following reasons. Firstly, this proxy is not an accurate representation of education human capital because (as Mankiw e*t. al*. 1992 discuss) part of this expenditure is spent on certain educational categories (philosophy, religion and literature) that do not yield human capital and all of them are forms of consumption. Secondly, because public expenditure is financed partly by taxes this variable might express two effects that are (i) the educational human capital impact and (ii) the efficiency of government tax policy. Concerning the latter issue, Barro and Sala-i-Martin (1995) point out that tax revenue contributes to economic growth positively at a diminishing return until it reaches its peak. After this peak the impact turns to be negative. Thus, if educational expenditure in Syria during the period of study is financed by tax revenues and the level of these taxes exceeded its peak, it will result either in negative or insignificant impact of education on economic growth. Thirdly, the use of public expenditure on education as a proxy for education human capital ignores the role of the private sector in this field. In this case as Ruth, (1998) mentioned, the education variable appears statistically insignificant where it might be significant and important

7.Education policy

An analysis of Syrian education policy might help explain the above statistical results with regards to the education proxy. It should be mentioned that this policy has been dominated more by the government's social and income distribution objectives than by its economic aims. Education is considered a basic right for every citizen and powerful tool in empowering the poor and increasing their share in national income, thus improving the distribution of this income. Until the early nineties key sectors like education had been presumed to be better run by the government rather than by the market and the private sector. This had led to complete absence of private investment in higher education and very little at lower levels. Although they are important, the social and other

objectives of the education policy in Syria are not considered in this study. The focus here is on the economic aspect of this policy.

The following are the main features of Syrian education policy during the period 1970-2000 (i) comprehensive, free and compulsory education for the first six years (recently extended to the first twelve years i.e. the elementary and preparatory education) (ii) subsidised education for the secondary and post secondary (high) levels, (iii) all graduates of the secondary school are guaranteed a place either in a university or a "medium" institute depending on their grades and (iv) higher education is confined to the state. The private sector was not allowed to invest in this field until 2003 which is after our study.

The first two features results in a heavy financial burden on the government. Consequently this may have led to an increase in the taxation needed to finance this expenditure. This may have led to taxes beginning to have a negative effect on the level of GDP and economic growth - as discussed above -. This negative impact of the taxation policy could be being picked-up by the education proxy (public expenditure on education). Moreover, this heavy and growing burden may also explain the fact that teaching and academic staff are low-paid. University lecturers in Syria receive less than a fifth of the annual income of lecturers in neighbouring countries like Lebanon or Jordan. The third feature, the guaranteeing of each secondary school graduate the opportunity for higher education, combined with the fact that post-secondary education is highly subsidised may induce more students to continue their education even if they do not possess the required abilities. Economic cost-benefit calculations by some of these graduates are likely to have been biased by the subsidies.

To complete the analysis it is necessary to examine the data on public expenditure on education in Syria during the period of study. As shown in Figure (1) below, there was an increase in real total government expenditure on education during the seventies and the first half of the eighties. From the mid-eighties and for half a decade this expenditure declined continuously. In spite of the up-ward trend during the nineties, its level in the year 2000 was almost the same as in the year 1985.

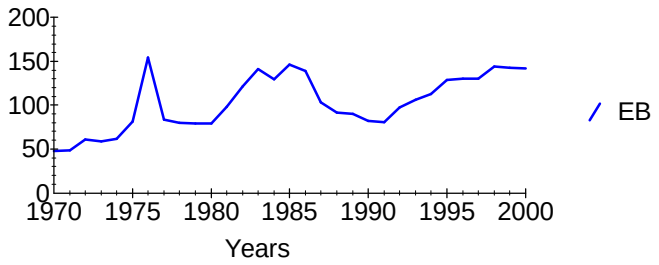

Figure (1) Public Expenditure on Education

We should also look at the per-student[vii] public expenditure on education which is good quality measure of education. Figure (2) shows the change in this variable during the period of study.

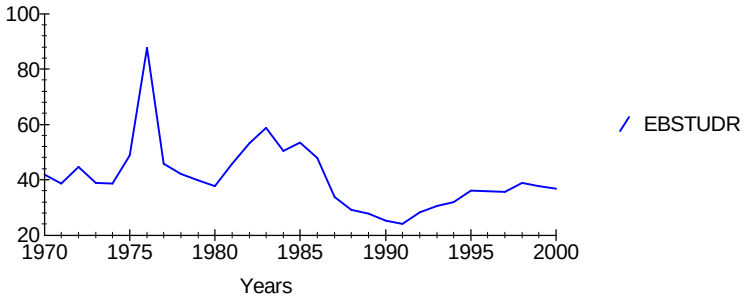

Figure (2) per student public expenditure on education in Syrian Pounds

Figure (2) offers a good explanation of the observed empirical result concerning the education variable. According to the Figure there is hardly any improvement in the quality of the education system between 1970 and 2000 with a noticeable decline in the per-student education expenditure during the period 1982-1991 which followed a period of fluctuation between 1970 and1980.

In total, the economic effects of the education policy in Syria during the period 1970-2000 could be summarised by four points

1. Supply and demand: this policy has led to a huge imbalance between the supply of and demand for education. On the supply side, there is only the public sector as a major provider of this service with a very low "cheap" price. On the demand side, there have been considerable increases in student numbers between 1970 and 2000 motivated by the high government subsidy for this service.

2. Competition: the exclusion of the private investment of the education sector (mainly at the university level) prevented any competition with the public sector, thus, many incentives for improvements and developments.

3. Cost-benefit analysis: many students did not consider this analysis seriously as schooling has been almost free at all levels.

4. Quality and efficiency: the above analysis of per-student education expenditure shows the absence of any real increase in this expenditure in year 2000 compared to 1970. This means no real improvement in the quality of the education during the period of study. The importance of this quality issue is discussed by many authors: e.g., Card and Krueger (1992); Hanushek *et. al* (1996); Behrman and Birdsall (1983) and Behrman *et. al* (1996).

8. Conclusion

This paper studied the relationship between the level of income, education and health human development in Syria for the period 1970 to 2000. Using the ARDL method a cointegration analysis was performed to identify the long-run interactions among the variables.

The results show significant statistical relationships between economic growth and health variables (infant mortality rate and life expectancy at birth). However, the long-run estimate of the education variable (public expenditure on education) is statistically insignificant. The latter result holds after repeating the test and dropping out the health variables. The short-run dynamics show a highly significant role for the education and health variables at the 1 per cent level for the first and 10 per cent level for the second.

The discrepancy between the theory and the empirical results concerning the education variable in the long-run may be caused by the use of a poor

proxy for education and/or certain characteristics of the government education policy. The analysis of this policy revealed several issues that could explain the above statistical results. Based on this analysis some policy recommendations were made.

Based on the results and the analysis this paper recommends the following:

1. Education policy makers in Syria may need to consider changing the balance between its different objectives e.g. social, economic and income distribution.

2. Free or subsidised education could be justified at low education levels, but at the higher levels this policy looks inefficient and increases the financial burden on the government. Thus, from economic viewpoint, the level of subsidisation at the university level needs to be gradually decreased.

3. The income of the teaching staff, including technicians and other employees, needs to be increased gradually.

4. Education expenditure needs to be increased especially on research-enhancing services like libraries, academic conferences and workshops, producing academic journals and improving access to international academic material.

5. If the government is unable to provide the required education services at the higher level, appropriate programmes should be designed to attract and monitor private investment in this sector.

Appendices (A): The results of the ARDL model with life expectancy.

The (SBC) criterion chooses the ARDL model of order (1,1,0). The long-run estimates are

$$ECM = LGDP - 0.0157\ LEB - 1.1\ LLIF - 1.14 \quad \text{(A1)}$$

The error correction representation of the selected ARDL model is given by

$$dLGDP = 0.38\ dA + 0.25\ dLEB^{***} + 0.37\ dLLIF - 0.33\ ECM_{-1}^{**} \quad \text{(A2)}$$

(0.49) (4.37) (1.54) (-2.6)

$$\bar{R}^2 = 0.63$$

where numbers in parenthesis are T-Ratios.

The (AIC) criterion chooses order (2,1,0) and the long-run estimates are

$$ECM = LGDP + 0.0435\ LEB - 0.86\ LLIF - 2.53 \quad \text{(A3)}$$

The error correction model is given by:

$$dLGDP = 0.7\ dA - 0.187\ dLGDP_1 + 0.252\ dLEB^{***} + 0.239\ dLLIF - 0.27\ ECM_{-1}^{**} \quad \text{(A4)}$$

(0.89) (-1.54) (4.53) (0.93) (-2.1)

$$\bar{R}^2 = 0.65$$

Replacing the health variable infant mortality rate by life expectancy at birth does not alter the results in the original model.

Appendices (B):

Table (B1): The sample data

YEAR	GDP	LIF	EB	EBSTUDR	STUDNO	INFMOR	GDP-DIF
1970	195.4074	55.8	47.6754	41.9372	1136829	95.6	5.4
1971	204.569	56.4	48.424	38.6781	1251974	91.8	5.8
1972	259.9815	57	61.1681	44.5785	1372145	88	5.4
1973	250.8413	57.6	58.4659	38.8001	1506847	83.8	6.3
1974	259.1111	58.2	61.5054	38.5491	1595509	79.6	8.1
1975	311.2386	58.8	81.1762	48.6942	1667062	75.4	8.8
1976	376.9294	59.4	154.3878	87.6489	1761434	71.2	8.5
1977	320.717	60.1	83.8027	45.9012	1825720	67	10.6
1978	345.8362	60.6	80.0102	42.1034	1900326	65.4	11.6
1979	342.8667	61.1	79.1449	39.8545	1985845	63.8	13.5
1980	370.6352	61.6	79.1528	37.7209	2098382	62.2	15.9
1981	392.9355	62.1	98.4862	45.7084	2154665	60.6	18.6
1982	387.2565	62.6	121.2308	53.2125	2278241	59	19.1
1983	381.325	63	141.1706	58.7176	2404230	56.8	20
1984	354.5467	63.5	129.8595	50.3574	2578759	54.6	21.4
1985	363.3946	64	146.2572	53.384	2739722	52.4	22.3
1986	344	64.5	139.0742	47.9544	2900135	50.2	28.2
1987	328.8672	65	103.5537	33.723	3070711	48	35.4
1988	360.578	65.4	91.5452	29.1128	3144502	46.2	45.5
1989	317.7094	65.9	90.0652	27.8585	3232949	44.4	56.1
1990	321.3251	66.3	82.1536	25.1153	3271054	44	68.9
1991	335.1862	67	80.5456	32.9822	3358555	42	74.1
1992	367.4429	67.2	97.4819	28.2888	3445954	40	77.9
1993	373.2206	67.3	106.2383	30.5089	3482209	39	82.5
1994	388.8826	67.8	112.7716	31.8531	3540659	37	93.7
1995	402.085	68.1	128.3998	36.006	3566070	30	100
1996	417.8048	68.5	129.9688	35.9608	3614181	28	112.7
1997	414.4928	68.9	130.3355	35.5351	3662648	27	118.7
1998	434.7921	69.2	143.788	38.8075	3705164	26	116.9
1999	411.5194	69.5	142.4985	37.744	3775390	25	123.8
2000	401.525	70.5	141.5538	36.6781	3859356	24	132

Table (B2): Variables summary statistics

Variable	Description	Minimum	Maximum	Mean	Std. Dev.
GDP	Real Per capita (Million Syrian Pounds)	195.41	434.79	346.36	59.286
LIF	Life expectancy at birth	55.8	70.5	63.642	4.24
EB	Real public expenditure on education (Million Syrian Pounds)	47.675	154.39	102.96	31.391
INFMOR	Infant mortality rate (per 1000)	24	95.6	54.129	20.33
EBSTUDR	Per-student public expenditure on education (Syrian Pounds)	25.115	87.649	41	11.68

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End notes:

i These results are confirmed by Knowles and Owen (1997) cross-country study of 77 countries.

iiThe critical value bounds at the 5% and 10% levels are (2.711, 3.8) and (3.219, 4.378) respectively.

iii For comparability purposes the model with life expectancy is estimated and the results are almost the same as in the original model. See Appendix (A).

iv A general to specific test was carried out to check the appropriate order of the ARDL model. The results confirm the order chosen by the (SBC) criteria namely (1,1,0).

v The same results were obtained when the level of these variables, rather than their logs, were used. Specifically, the long-run relationship is significant at 10 per cent level. In the estimates of the long-run coefficients, the education variable is not significant in any of these models, infant mortality is negatively significant at 5 per cent level and life expectancy is positively significant at 10 per cent level. Moreover, the coefficients of the error correction term were negative and significant at 5 per cent level with magnitude ranges between 0.29 and 0.33. Also the results pass all the relevant statistical tests.

vi The results of general to specific test show that (1,1) is the appropriate order for the ARDL model. However, using the new order does not alter the conclusion obtained above based on the order (2,1).

vii Because of data limitation I considered here just the number of pre-university students. The data source is the Syrian Statistical Abstract, different issues.

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