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Economic and Social Factors in Shaping Jordan's Life Expectancy: Empirical Analysis (1990-2014)

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Abstract

The current research paper seek to investigate socio-economic determinants for life expectancy in Jordan over the over the period from 1990 through 2014 using vector autoregression framework (VAR). The explanatory variables concluded that the change in life expectancy comes from per capita GDP (LGDP) with 21% and unemployment (LUNPR) with 19%. This is followed by a small change in of 6%, 5% and 2% of government expenditure on health (LGHE), secondary school enrolment (LSEER) and urban population (LURBAN) respectively. This brings about new vision for policy schemes to scrutinize economic stabilization approaches targeting productivity increase, growing economy and diminishing unemployment rates, while formulating comprehensive policy to increase health care expenditures and improve governorates development situations.

JEL Classification Number: D60,I10
Keywords: Life expectancy, VAR, Socio-economic factors, Jordan

1 Introduction

According to World Bank life expectancy at birth (LEB) refers to the newborn infants numbers of years they can live if the surrounding circumstances of mortality at their time of birth would prevail the same during their entire lifetime (The World Bank, 2017). Life expectancy at birth is an indicator of

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increased longevity and in this regard has consequences in substantial connotation at the level of patient and at social level over its association with growth of an economy, investment in human capital, healthcare innovation and quality of life, social security claims and fertility behavior (Gilligan and Skrepnek, 2015). Increase in national income resulted into gains in sanitation, urbanization, education and usually linked with the enactment of healthy behaviors, and in expanding availability of health resources, that eventually enhance quality of life and physical well-being (Austin and Mckinney, 2012).

Life expectancy reflects country quality of life and gives indicators for mortality rates of all ages, and is necessary for various actuarial measures (CIA, 2017). The health status of any country is difficult to measure directly as it requires various combinations of economic, social and environmental variables. The human development index published by United Nations as a proxy for human development through countries, uses life expectancy at birth besides to other factors indicators equally literacy rate and income (Poudyal et al., 2009). Through the previous two decades, the life expectancy at birth has been recognized to be among the most significant index for the development of an economy in both developed and developing countries, and reflects the degree of economic and social advancement in a country (Delavari et al., 2016). In addition, health care has an effect on other health care related industries in terms of rising medical and insurance costs, pharmaceuticals drugs and elderly care services. Hence, checking factors behind life expectancy in a country became a prominent matter and considered a decisive factor to consider in applying specific arrangements to fulfill sustainability advancement, especially in developing nations.

Therefrom, the leading target of public health care policy is to preserve and improve country's health position. Hence, examining factors behind population health is crucial and the literature has illustrated that demographic and socioeconomic variables are responsible for LE, that is, age, gender, education and GDP per capita (Chan, 2015). Indications of socioeconomic, demographic, and health care expenditures effects on life expectancy have been proved in previous studies, yet examining empirically life expectancy in Jordan was not found.

To that end, the current study contributes to the growing comparative literature on life decisive factors behind life expectancy. Data in the current analysis have been collected from World Bank database and the VAR analysis was incorporated in designing insights on influential variables in this study. This study intends to understand main factors affecting life expectancy, which could help policymakers to gain an efficient view on appropriate policies needed to influence health, education and employment policy purposes. The next section supply a brief theoretical framework on the association linking life expectancy and other determinants. In a following section, we introduce data and methodology adopted. Section 4 delivers the results and in the final part, we deliver conclusions and policy applications.

2 Theoretical views

The studies on life expectancy have focused on countries as a unit of analysis. For example, Sede and Ohemeng (2015) utilized VAR and VECM technique and found that conventional economic variables used in studies of life expectancy just as income per capita, government expenditures on health and education are not significant in the Nigerian case. Gilligan and Skrepnek (2015) disclosed that no significant predictors existed for non-industrialized/least developed countries (as in Eastern Mediterranean Region) between domestic product, average of vaccines, urbanization and life expectancy. They also illustrated that physician density on the other hand, GDP, literacy, health expenditures and vaccination in more industrialized countries differs in life expectancy through advantaged and disadvantaged regions in Canada and concluded that it was induced by a relatively few reasons of death(for example heart disease, cancer, and un-intentional injuries. Kabir (2008) regressed life expectancy against economic and non- economic variables. Results from the study reports that pertinent socio-economic variables such as income per capita health expenditures, education, availability of safe water, and urbanization are not always crucial in measuring life expectancy among developing countries.

Fang et al. (2010) pointed out that widening health inequality is usually associated with accelerated growth economy and a surge in life expectancy; in addition, it showed that primary health care has a crucial influence than hospital services in reducing regional inequalities in health. Rosero-Bixby et al. (2005) asserted the weak effect of socioeconomic status on life expectancy in Costa Rica. Other researchers studied life expectancy determinants and found a positive impact linking life expectancy and other factors Blazquez-Fernández et al. (2017) acknowledged that income per capita, unemployment rate and exchange rate improve health outcomes measured in life expectancy among OECD countries. Audi and Ali (2016) ended up that food availability, school enrolment at the secondary level; CO2 emissions; per capita income and population growth in Lebanon have significant impact on life expectancy. However, Delavari et al. (2016) revealed that the significant positive effect of per capita GDP, literacy rate, number of doctors per 10,000 f population and access to food have all a significant statistically effect on the Life expectancy at birth (LEB) in Iran, whilst inflation rate, urbanization quality and CO2 emission were not significant on LEB.

Shahbaz et al. (2016) focused on life expectancy determinants in Pakistan in if economic misery was present and concluded that rural–urban inequality in income and economic misery have a substantial negative impact on life expectancy at birth, and that urbanization support life expectancy while illiteracy declines it. Alam et al. (2016) noted that economic poverty and rural–urban inequality in income have a considerable negative effect, while education expenditure and economic growth have a positive and significant impact on life expectancy. For countries as in Singapore, Malaysia and Thailand, Chan and Devi (2015) concluded that having extra health care resources and considerable levels

of socioeconomic benefits are most likely to raise life expectancy. The findings of Chan and Devi (2015) are coincidental with Chan (2015) findings, but for Vietnam Indonesia and Philippines. Heiman and Artiga (2015) concluded that in USA socioeconomic position, employment, education, social backing networking and physical environment and the availability of health care are determinants for health outcomes such as life expectancy. According to Jalal and Khan (2015) with an increasing GNI per capita and GDP improvement in life expectancy was associated together; Keita (2013) revealed that GDP per capita adult literacy, having ability to acquire improved sanitation and safe water are strongly and positively correlated with more life expectancy (labeled as a proxy for global health empowerment at the country level). For East Mediterranean, countries, Bayati et al. (2013) declared that employment ratio; per capita income, education index, food availability and level of urbanization were specified as determinants for health situation (an indicator for life expectancy at birth). On another stride, Sufian (2013) concluded that infant mortality rate is the ultimate effective variable in discriminating between countries with low values of life expectancy at birth (LEB); countries near medium values of life expectancy at birth; and countries with considerable values of life expectancy at birth, whilst poverty is the second affecting variable.

Lin et al. (2012) pointed out to the small influence of democratic policies on augmenting life expectancy in the short-run compared to the consequences of other socioeconomic variables. Iacobuta and Cuza (2012) regressed life expectancy across per capita health expenditure, GNI per capita, gender equality, good governance, chances of education and a healthy environment and confirmed a positive correlation while a negative on was found linking life expectancy and population growth.

Modernization was found to be an extra leading factor in life expectancy determination as in Austin and Mckinney (2012) among less-developed countries and HIV was the most influential variable for life expectancy in Sub-Sahara in African countries. Halicioglu (2011) discussed that food availability, nutrition and health expenditures are related in improving longevity, while Biggs et al. (2010) argued that wealthier are quite truly healthier. Khang et al. (2010) proved amelioration in life expectancy with an increased income. A considerable number of studies have focused on health quality benefits and environmental means on their effect on life expectancy. Poudyal et al. (2009) for example looked at the importance of the reservation of natural resources, environmental convenience and outdoors entertainment chances with longer expectancies at birth. Johansson et al. (1999) claimed that personal priorities are as the same importance as for enjoying a healthy diet. Shaw et al. (2005) stated that lowering tobacco consumption intake around two cigarettes in a day or increasing vegetables fruit and consumption by 30% would increase life expectancy roughly one year for 40-year-old females in developed countries. In addition, the pharmaceutical consumption has a positive influence on life expectancy among middle and advanced ages, but is sensitive to the age distribution in a given country. However, for Polish women

unemployment, marital status, educational level, living conditions, smoking and life style are strongly associated with a large difference in life expectancy across their working ages (Wroblewska, 2002).

Other studies have focused on people's own perceptions as a driver for LEB as in Popham et al. (2007), as for the lifetime Socio-Economic Position (SEP) emerge to deliver something over and above present health status and smoking practices. In the same vein, Swanson et al. (2009) concluded that high Socio-Economic Status (SES); populations in seven of an eight states in US have extra additional life expectancy over low SES populations throughout 1970 and 1990. In Beijing, ample availability of floor space per rural resident and GDP per capita were also found to be positively correlated with life expectancy according to Lei et al. (2009), whilst illiteracy rate and rural population proportion correlated negatively with life expectancy. Singh and Siahpush (2006) explored variations of inequalities in life expectancy at birth and other ages in the US throughout 1980 and 2000 by gender and socioeconomic deprivation criteria and concluded that people in less-deprived groups have longer life expectancy at each age than their counterparts in more-deprived ones. The study concluded that between 1980 through 2000, people in high socioeconomic class groups witnessed larger benefits in life expectancy than those in more-deprived groups leading eventually to widening the gap.

A number of studies have analyzed social economic variables and found their negative impact on life expectancy. For example, in Ukraine the decrease in control rising from increasing political and economic environment uncertainties, in addition to deficiency in material wealth and stress of change all might have a role in life expectancy reduction in transition countries as found by Gilmore et al. (2002). CRE´MIEUX et al. (1999) reported that health care expenditures sre related with a statistically significant increase in infant mortality and a decrease in life expectancy in Canada. Ali et al. (2015) confirmed that ratio of dependent population, births per 1,000 population, infant mortality rate, and deaths per 1,000 population all have negative relationship with life expectancy at birth in forty-three countries of Asia and Sargolzaie et al. (2017) observed the association between low life expectancy and less developed conditions in Zahedan (Iran).

3 Methodology and Data

The study in this paper shall check socio-economic determinant of life expectancy in Jordan through a Vector Autoregression (VAR) framework. The VAR will offer information about the association liking socio-economic variables and life expectancy in Jordan. The VAR will contain several procedures for evaluating the causality between socio-economic factors and life expectancy. In this regard, five socio-economic variables will be considered. These variables are log of GDP per capita (LGDP), log of secondary school enrolment (LSEER), log of government expenditure on health per capita (LGHE), log of unemployment

(LUNPR) and log of urban population (LURBAN). The log of life expectancy at birth (LLIFE) and of five socio-economic data are annually and gathered through World Bank database over the time horizon from 1990 to 2014. The time series illustration of all variables are illustrated in Figure 1. Rather Table 1 display the descriptive statistics of such series. Figure 1, all the series except LUNPR and LSEER demonstrate upward trend throughout 1990 until 2014. It appears that LSEER start to move downward from 2009 before increase steadily in 2012. Meanwhile, LUNPR depicted fluctuation from 1990 through 2014. Therefore, all series (from Tables 1) have leptokurtic peak with lack of symmetry and that means non-normality.

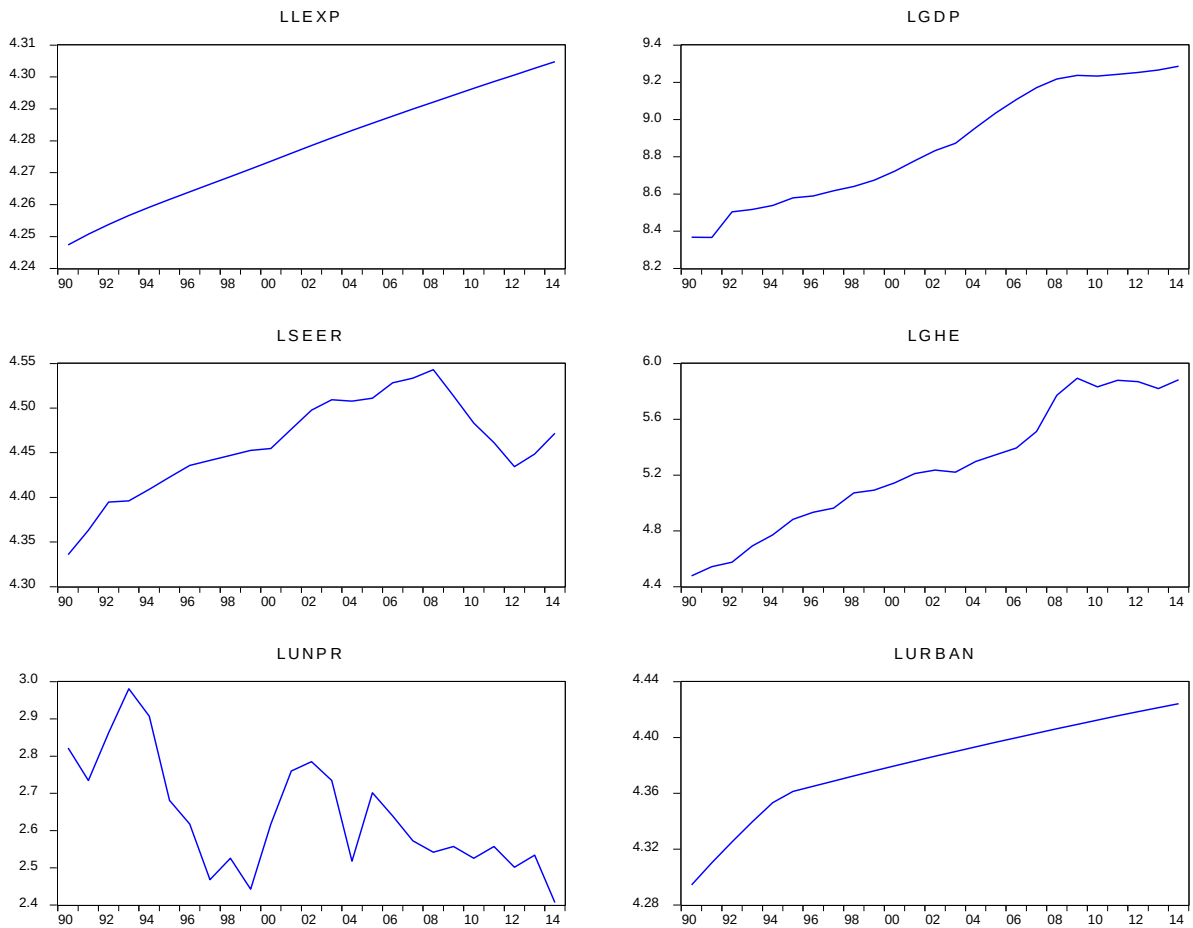

Figure 1: Time Series Plot for the variables (LLIFE), (LGDP), (LSEER), (LGHE). (LUNPR) (LURBAN)

Table 1: Descriptive Coefficients Statistics

	LLIFE	**LGDP**	**LSEER**	**LGHE**	**LUNPR**	**LURBAN**
Mean	4.27	8.86	4.45	5.25	2.63	4.38
Std. Dev.	0.01	0.31	0.05	0.46	0.15	0.03
Skewness	-0.11	-0.001	-0.41	-0.001	0.56	-0.90
Kurtosis	1.82	1.52	2.60	1.85	2.42	3.12
Observations	25	25	25	25	25	25

Apart from non-normality checking whether the series is stationary or not is an important process while handling time series data. This is because non-stationary series might have bogus results. In agreement with Brooks (2014), it is better to use jointly stationary and unit root tests for stationary testing which is known as confirmatory data analysis. Thus, in this paper the ADF test by Dickey and Fuller (1981) with a null hypothesis of unit root while the KPSS test by Kwiatkowski et al. (1992)[2] was with a null hypothesis of stationary to be applied. Next, the cointegration test will b carried out to investigate whether all the series are cointegrated or not.

Cointegration test assist in determining whether long run association among the series do exists. In this paper, the Johansen cointegration test is to be carried out. This test is established on a two test statistics, the first one is Trace statistic and the second one is Maximum eigen statistic (Johansen, 1988; Johansen and Juselius, 1990). After that, both Vector Auto Regression (VAR) model and Vector Error Correction Model (VECM) shall be performed. However, VECM will be performed if cointegration among variables exists. In VAR model, each of the series is regressed on its own lag and the lags concerning other series. This system will allow each of the series to be affected by its own past and the past of other series that minimize the problem of simultaneity.

Moreover, modelling VAR using level series will have significant insights on the nature of relationships between all the series. In addition, the VAR also contains two procedures to evaluate the relationship. Firstly, the Granger causality test which capture the direction of causal relationships or the direction of impact linking life expectancy and the socio-economic factors. Secondly, variance decompositions offer a slightly different method, which measures the related magnitude of an impact in percentage. More precisely, it shows the percentage variance of life expectancy that might be ascribed to the effect of extension in socio-economic variables.

4 Results

As mentioned in the previous section, non-stationary group will have a specious and inconsistent estimation. Thus, the results in Table 2 indicate that all

[2] Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test.

the groups were non-stationary at data level as the null hypothesis was rejected in KPSS test and accepted in ADF test. However, both groups of series are stationary after the first difference as the null hypothesis is not rejected for the KPSS test and rejected for the ADF test, which means that all group series are stationary at the same first difference level.

Table 2: Results of Stationary test

Series	**ADF Statistic**		**KPSS Statistic**	
	Level	**1st Diff**	**Level**	**1st Diff**
LLIFE	-1.68	-2.48**	0.19**	0.12
LGDP	-3.21	-2.11**	0.71**	0.16
LSEER	-2.05	-2.43**	0.16**	0.37
LGHE	-1.09	-2.42**	0.71**	0.12
LUNPR	-2.46	-4.76**	0.43**	0.05
LURBAN	5.02	-3.52**	0.16**	0.47

Note: ***, **, * indicates significance levels at 1%, 5% and 10% subsequently.

For an accepted policy analysis, the association linking all the series in the long- run considered very crucial. Based on the Johansen test of cointegration in Table 3, the Trace statistic and the Maximum Eigen statistic suggest two different results. In the case of conflicting results, the Maximum Eigen statistic is preferred. Enders (1995) states that Maximum Eigen statistics value must be preferred when choosing the number of cointegrating equations as it has a precise alternative hypothesis than the Trace statistic. From Table 3, it can be concluded at least two cointegrating equations among the series. This asserts the presence of long-run association linking short-run dynamic and long-run balance of the model.

Table 3: Johansen Cointegration Test

Cointegrating Vector (LLIFE, LGDP, LSEER, LGHE, LUNPR, LURBAN)

"Null" Hypothesis	**"Trace" Statistics**	**"Maximum Eigen" Statistics**
r=0	242.41**	144.02**
r=1	98.39**	44.26**
r=2	54.13**	24.90
r=3	29.22	20.07
r=4	9.15	7.27
r=5	1.88	1.88

Notes: ***, **, * point out to the significance levels at 1%, 5% and 10% correspondingly.

Since all the series were stationary at the same level and are cointegrated, the analysis proceeds with VAR model. Table 4 categorize the VAR estimation; rather Table 5 display different specification tests on the residuals. As seen in Table 4, the one period past of the life expectancy (LLIFE), the GDP, the

secondary school enrolment (LSEER) and the urban population (LURBAN) affect current level of life expectancy. From the specification tests in Table 5, it can be concluded that the model is well specified because all the tests are nonsignificant.

Table.4: VAR Estimation

Variable	Coefficient	t-statistic	Others statistics
Constant	-0.08	-3.89**	R^2=0.99
LLIFE(-1)	1.042	167.33**	F-stat.= 334483**
LGDP(-1)	-0.001	-5.40**	
LSEER(-1)	0.001	4.53**	
LGHE(-1)	0.0002	1.77	
LUNPR(-1)	0.00002	0.263	
LURBAN(-1)	-0.02	-13.90**	

Table 5: Specification Tests Results

Hypothesis Testing	H_0	Statistics of the test
VAR RSC LM Test	No serial correlation	34.11
VAR	Residuals are homoskedastic	264.81
VAR RNT	Residuals are multivariate normal	7.04

Note: ***, **, * denotes level of significance are at 1%, 5% and 10% levels. RSC: Residual Serial Correlation LM Test. (RHT): Residual Heteroskedasticity Test (RNT): Residual Normality Test.

Next, the investigation continues by executing pair wise of Granger causality to test the causality association linking life expectancy and five socio-economic factors. Results in Table 6 disclose that null hypothesis of per capita GDP (LGDP), secondary school enrolment (LSEER), government expenditure on health (LGHE) and urban population (LURBAN) do not Granger causes the life expectancy (LLIFE) were denied at 5% and 1%. However, unemployment (LUNPR) appeared not to Granger cause LLIFE while LLIFE also not to Granger cause LUNPR. In addition, the test uncovered bi-directional causality between LGDP and LSEER.

Table 6: Pair-Wise Granger Causality Results

Causality Direction	Chi-Square Estimate	Remarks
LGDP→LLIFE	29.21**	Reject
LLIFE→LGDP	11.51**	Reject
LSEER→LLIFE	20.56**	Reject
LLIFE→LSEER	9.20**	Reject
LGHE→LLIFE	3.151*	Reject
LLIFE→LGHE	1.99	Do not reject
LUNPR→LLIFE	0.07	Do not reject
LLIFE→LUNPR	0.373	Do not reject
LURBAN→LLIFE	193.31**	Reject
LLIFE→LURBAN	0.27	Do not reject

Remarks: ***, **, * means significance level at 1%, 5% and 10% appropriately.

The principal decomposition of variance is to gauge the percentages of shocks or changes in a variable that are based on its own shocks, versus shocks on other variables. In this paper, only life expectancy (LLIFE) variance decomposition is presented, as it is the focus of this research. The finding denotes that apart from the share of 46% of shock from itself, the change in life expectancy spurs from per capita GDP (LGDP) with 21% and unemployment (LUNPR) with 19%. This is followed by a small change in of 6%, 5% and 2% of government expenditure on health (LGHE), secondary school enrolment (LSEER) and urban population (LURBAN) respectively.

Table 7: Variance decompositions estimate (in percentages)

Period	LLIFE	LGDP	LSEER	LGHE	LUNPR	LURBAN
1	100.00	0.00	0.00	0.00	0.00	0.00
2	86.56	6.38	3.95	0.42	1.12	1.53
3	75.32	11.61	5.92	0.82	4.13	2.17
4	67.29	15.33	6.52	1.26	7.20	2.37
5	61.48	17.96	6.47	1.82	9.84	2.41
6	57.10	19.73	6.15	2.52	12.10	2.38
7	53.64	20.78	5.76	3.35	14.10	2.33
8	50.82	21.24	5.39	4.26	15.97	2.29
9	48.49	21.23	5.08	5.16	17.75	2.25
10	46.57	20.91	4.85	5.97	19.45	2.22

Finally, it is clear from the results in Table 8 that in the long-run the past one period of unemployment (LUNPR) and secondary school enrolment (LSEER) contribute in determining the life expectancy in Jordan.

Table 8. The VECM results

Variable	Coefficient	t-statistic	Others statistics
Constant	-0.001	-2.65**	R^2=0.99
LLIFE(-1)	1.49	7.90**	F-stat.= 245**
LGDP(-1)	-0.0003	-1.49	
LSEER(-1)	0.001	2.48**	
LGHE(-1)	-0.000005	-0.05	
LUNPR(-1)	0.0001	2.34**	
LURBAN(-1)	-0.001	-0.37	
ECM1	-0.036	-4.23**	
ECM2	0.0005	2.84**	

Notes: ***, **, * presents significance at 1%, 5% and 10% levels subsequently.

5 Discussion with Policy Recommendations

The study specified a vector autoregression (VAR) framework and five variables was utilized as predictors to check their influence to decide on life expectancy in Jordan over the period (1990-2014). To carry this analysis, we have

used annual data about variables in the study from the World Bank. The main idea of variance decomposition is to estimate the ratio of shock or changes in a variable that are based on its own shocks, versus shocks on other variables showed that GDP per capita have a positive effect on LE. Some of these results support results from previous studies as in Blazquez-Fernández et al, (2017); Alam,(2016); Sede (2015); Jia,(2009) and (Bayati, 2013). Actually, high levels of income implies more access to consume high goods and services (of quality), for superior housing, and medical care services that eventually affect health status. In a second importance, unemployment have a positive influence on LE. Results on unemployment asserted those of previous researches mentioned in Bayati (2013); Blazquez-Fernández et al. (2017); Sedee (2015) and Jia (2009). Politically speaking, the current research convey the fact that Jordan governments must create and pursue a vigorously employment opportunities, for having encouraging settings for a steady state macroeconomics. The justifications for this is high unemployment rates means high magnitude of unemployed that would eventually raise dependency ratio, expand distribution of income and influence affordability of unemployed to access medical care in a negative way. More certainly, the arguments is that policy makers have to work out on arrangements that emphasize commercial banks to broaden their target groups of clients to include new young entrepreneurship projects(at cheaper costs), and create investment environments for the purpose of breeding job opportunities, which will eventually enhance domestic production.

There is no assertion that increasing government expenditures on health, secondary school enrolment and urban population respectively may influence positively life expectancy of Jordanians. Nevertheless, in this study we propose that life expectancy can be enhanced if government health capital expenditures quality developed, i.e., expenditures on medical equipment and service deliverables. Usually people in urban regions have more connection to medical care services and heath knowledge. In the end, empirical output from VECM results propose that in the long-run the past one period of unemployment (LUNPR) and secondary school enrolment (LSEER) contribute in determining the life expectancy in Jordan. In general, people with high-income standards and of education have higher levels of sensitivity and awareness toward their health; therefore, they are more aware on ways to develop the quantity and quality of their health. Therefore, education quality can be used as an economic device to enhance health indicators through offering new curricula and syllabuses among education sector and that require s that the Jordan should enhance secondary education spending.

The essential conclusion of this study is the assumption that stabilization policies of an economy such as in increasing output, boosting economic activities and shrinking high levels of unemployment , all contributes as a major players in any country's populations health status. This imposes defiance for the enhancement of health population and in forwarding the attention into human development in coherence with Millennium Development Goals (MDGs).

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