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Effect of Health on Economic Development: Evidence Among OIC High-Income Economies

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ABSTRACT

Many studies have shown relationship between health and economic development. The findings show that the direction of causality can run from economic development to health or vice versa. This paper investigates causal relationship between health and economic development of high income economies of selected OIC countries. Since these countries have also high expenditure on health in comparison with other OIC countries, the findings would give some indications of the importance of having high spending on health for economic wellbeing of a country. Using Toda-Yamamoto Granger non-causality model on data spanning from 1970 to 2011, the results show mixed causal relationships. Specifically, some countries like Brunei and Qatar have health condition that causes economic development while Bahrain and United Arab Emirates experience the opposite causation. In the meantime, health and economic development have bidirectional causality in Kuwait and Oman while Saudi Arabia is the only country which does not show any causal direction between health and economic development. The findings give some evidence on the importance of health on economic wellbeing without disregarding the fact that economic development is also important for having good health condition.
JEL classification: H51, I15, O57

INTRODUCTION

Over the years, the health status in Organization of the Islamic Conference (OIC) countries has improved significantly. The average lifespan in the OIC member countries was 59 years in 1990 as compared to 68.5 years in 2011. In comparison, life expectancy in developed countries increased from 73 years in 1990 to 78 years in 2011. Despite some improvement in life expectancy at birth, OIC countries are still lagging behind the world average by 3.5 years (OIC Health Report, 2013). Moreover, expenditure on health is still low in many OIC countries. In 2011, OIC member countries spent US$279.5 billion on health which represented on average 4.7 percent of their GDP as compared to US$3706 billion or 8.7 percent in developed countries.

At the individual country level, Qatar, Brunei, Albania, Maldives, UAE, Syria, Bahrain, Libya, Tunisia, Kuwait have the highest life expectancy at birth in 2011. Qatar and Brunei have the highest life expectancy at birth of 78 years old. Meanwhile, the infant mortality rate in UAE (6 deaths per 1,000 live births), Qatar, Malaysia, Brunei, Oman, Saudi Arabia, Lebanon, Maldives, Kuwait and Bahrain are the lowest in 2011. Member countries with the highest per capita health expenditure are Qatar, UAE, Kuwait, Brunei, Saudi Arabia, Oman and Bahrain (OIC Health Report, 2013). These countries are also categorized as high-income economies by the World Bank.

From the statistics of OIC countries, it is observed that the countries with high per capita health expenditure experience high life expectancy at birth and low infant mortality rate. As these countries also experience high economic development, it seems that higher health condition have a causal linkage with economic development of a country. Knowing the existence of the relationship would not only benefit the countries themselves, but it would also give some insight to other developing OIC countries to improve their health system or their economic wellbeing.

Thus, this paper attempts to investigate causal link between health and economic development of selected high income OIC countries. Specifically, the study focuses on seven OIC countries with the highest per capita health expenditure. The countries are Bahrain, Brunei Darussalam, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates. The analysis uses time series data from 1970 to 2011.

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Aggregate data at the country level on health expectancy and GDP per capita are gathered from the Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC).

This paper contributes to the literature in two ways. Firstly, past studies on this issue mostly focus on panel or cross sectional data analysis. Thus, the findings on the importance of health are therefore general in nature, concentrating the status of the countries or regional location. This study on the other hand, looks at individual country level and examine whether the effect of health is similar. Secondly, empirical studies on the causal effect of health on economic growth in OIC countries are still lacking and the findings from the analysis would provide some recommendations to policy makers in those countries.

The remainder of this paper is organized as follows. Section 2 reviews related literature on the effects of health on economic development followed by section 3 that describes the data and empirical models used in the estimation. Section 4 discusses the results. Finally, section 5 concludes with some policy remarks.

LITERATURE REVIEW

Labor quality in the form of human capital is always measured by education level. As a result, many studies have identified education as the main factor that contributes significantly to economic growth. On the other hand, many studies have ignored health as an aspect of human capital that can potentially contribute to economic development. In United Kingdom, the Department of Social Security identified poor health as one of the major problems associated with low income. Furthermore, on average, people in poor countries are much less healthy than their counterparts in rich countries. Weil (2007) studied this phenomenon and tried to answer how much of the gap in income between rich and poor countries is accounted for by the differences in health. Weil (2007) quantitatively assessed the differences in health in explaining income differences between rich and poor countries and found that the effect of health on income is economically significant. Besides that, in many developing countries the benefits of better health on productivity have been proven in many studies such as in Basta et al. (1979), Spurr (1983), Bhargava (1997) and Strauss and Thomas (1998). Grimm (2011) studied 62 low and middle income countries over the period of 1985 to 2007 and found a substantial and relatively robust negative effect of health inequality on income levels and income growth after controlling for life expectancy, country and time fixed-effects as well as other factors shown to matter for growth.

The positive effect of health (in the form of reductions in mortality) on economic growth has earlier been found by Sorkin (1977). In addition, Sorkin found that increases in the health status of the population of developed nations will have little impact on economic growth, but the impact could be different for developing countries. Subsequently, by using life expectancy as a measurement for health at individual level, many studies have found positive effect of health on economic growth such as in Barro and Lee (1994), Barro and Sala-I-Martin (1995), Barro (1996), Sachs and Warner (1997), Bloom and Malaney (1998), Bloom and Sachs (1998), Bloom and Williamson (1998), Bloom et al. (1999), Hamoudi and Sachs (1999), Bloom, Canning and Malaney (2000), and Gallup and Sachs (2000). Most of the studies used the ordinary least squares (OLS) and seemingly unrelated regression (SUR) methods. In 2004, Bloom, Canning and Sevilla measured total factor productivity (TFP) by including human capital that consisted of three components which are average years of schooling, averages work experience of the work force and health. They found that a one-year improvement in a population's life expectancy contributes to a 4% increase in output and thus concluded that health (in the form of life expectancy) effects in growth regressions is a real labour productivity effect after controlling for experience of the workforce.

The link between individual income and health has also been seen clearly in Marmot (2010). The study showed that in the UK, people living in the poorest neighborhoods will, on average, die seven years earlier than people living in the richest neighborhoods. Furthermore, data from the Office for National Statistics (2007) showed that for the period 2002 to 2005, men and women in professional occupations had higher life expectancy as compared to people in unskilled manual occupations. In a systematic review of 98 studies in the field of health inequality, Lynch et al. (2004) concluded that 'it is widely accepted that at the individual level, higher incomes – and other markers of socioeconomic circumstances – are associated with better health'.

While many studies have looked at the relationship between health and income at individual level using cross sectional data, there are limited number of studies looking at this relationship at macro level using time series data. Furthermore, policy formulation especially in reducing poverty in less developed OIC countries can be strengthened by utilizing the findings from this study. Thus this study is conducted to test the relationship between health and economic development using time series data in high income OIC countries.

METHOD

In this study, the income classification of the OIC member states follows the World Bank categorization which is based on income groups of 214 countries. A country is classified as a low-income economy with GNI per capita of US$1,025 or less; lower-middle-income economies with GNI per capita from US$1,026 to US$4,035; upper-middle-income economies with GNI per capita from US$4,036 to US$12,475; and high-income economies with GNI per capita more than US$12,476. Among the 57 OIC member states only seven countries are categorized as high-income economies. They are Bahrain, Brunei Darussalam, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates.

Life expectancy is used to indicate health status (H) while GDP per capita (GDP) represents economic development of the OIC countries. The data cover the period of 1970 to 2011. It is expected that the health status of OIC countries in the high income economy category contributes to the country's' economic development.

In order to investigate whether health status leads to economic development or vice versa, this study employs Toda-Yamamoto (1995) approach of Granger non-causality. Consider the following VAR model of a country .

$$\begin{bmatrix} GDP_t \\ H_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(1)} & \alpha_{12}^{(1)} \\ \alpha_{21}^{(1)} & \alpha_{22}^{(1)} \end{bmatrix} \begin{bmatrix} GDP_{t-1} \\ H_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} \alpha_{11}^{(k+d)} & \alpha_{12}^{(k+d)} \\ \alpha_{21}^{(k+d)} & \alpha_{22}^{(k+d)} \end{bmatrix} \begin{bmatrix} GDP_{t-(k+d)} \\ H_{t-(k+d)} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

where *k* is the optimum number of lag in the VAR model while *d* is the maximum order of integration in the system. *k* is initially selected by Schwarz Criterion (SC) but finally determined by the multivariate Lagrange multiplier (LM) test for VAR residual serial correlation. *d* is basically determined from the results of Augmented Dickey Fuller (ADF) and Kwiatkowski, Phillips, Schimdt and Shin (KPSS) tests. Phillips Perron tests are also employed if the two prior tests provide mixed results.

To test whether health does not Granger cause wealth, parameter restriction of the following will be tested using modified Wald (MWALD) test.

$$H_0 = \alpha_{12}^{(1)} = \ldots = \alpha_{12}^{(k)} = 0$$

In integrated and cointegrated system, Toda and Yamamoto (1995) prove that the Wald test for linear restrictions on the parameters of a VAR(k) has an asymptotic χ^2 distribution when a VAR(k + d) is estimated. Rejection of the null implies that health does Granger cause wealth. Similarly to test whether wealth Granger cause health, the following null will be tested.

$$H_0 = \alpha_{21}^{(1)} = \ldots = \alpha_{21}^{(k)} = 0$$

In this study, when both variables have the same order of integration, e.g. I(1), a Johansen cointegration test is conducted to investigate whether there exist a long run relationship among the variables. Nevertheless, the results do not affect the causality tests, but rather provide a possible cross-check on the validity of the test's results.

FINDINGS AND DISCUSSION

Table 1 provides summary of initial key results. It shows the results of unit root tests of the time series, the maximum number of integration in the system and the result of cointegration for model which variables have the same order of integration (i.e model for Qatar). The full results can be seen in **Table 3**, **Table 4** and **Table 5** in the appendix.

As shown, each GDP variables for each country is I(1). The finding is straightforward as the ADF and KPSS reveal almost similar results. Nevertheless, some health variables are I(0) while others are I(1) and I(2). Most of the time, ADF and KPSS tests are not sufficiently informative. Consequently, PP is employed to help us make the decision.

From the results, the maximum number of integration in the system (*d*) for each country can be determined and it is shown in the third column of **Table 1**. Johansen cointegration test is also done to test the long run relationship between health and GDP for Qatar since both time series in the country are integrated in the same order, i.e. I(1).

Once *d* is determined, unrestricted VAR is modeled for each country. The number of lags used in each model is $k + d$. For testing Granger non-causality, only *k* lags are taken into account. Except for Oman, each estimated VAR model is stable (stationary) with regards to its roots which have modulus less than one and lie inside a unit circle. These figures are not presented to preserve space.

Table 2 shows the results of Toda-Yamamota's Granger non-causality test. As indicated, health condition does Granger cause economic development in Brunei and Qatar. The opposite causal direction is, however, evident in Bahrain and United Arab Emirates. In the meantime, Kuwait and Oman witness bidirectional causality between the variables while Saudi Arabia does not show any causal direction. Cointegration and Granger non causality results for Qatar, as expected coincide with each other. In other words, having one cointegrating equation in the model is proved by the one causal relationship that exists.

CONCLUSION

Studies have shown that health has become one of the important factors for economic development of a country. Nevertheless, having better economic development could also lead to better health condition. Knowing which cause the other is crucial for policy implication especially if higher proportion of income has been contributed to improve health condition.

This paper examines causal relationship between health and economic development of selected high income economies of OIC. Since the selected countries have also high expenditure on health in comparison with other OIC countries, the study could give some indications of the importance of having high spending on health on economic wellbeing of a country.

Employing Toda-Yamamoto Granger non-causality model on data spanning from 1970 to 2011, the results show mixed causal directions. In particular, Brunei and Qatar have health condition that causes higher economic development while Bahrain and United Arab Emirates experience the opposite. For the meantime, Kuwait and Oman observe bidirectional causality in the variables while Saudi Arabia shows no causal direction between health and economic development. The results imply that spending high on health could not always stimulate better economic wellbeing even though better health condition can be achieved. Likewise, better economic development could also lead to better health condition. Future research can thus look into factors that cause why a particular causal linkage exists in some countries but not the others and vice versa.

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APPENDIX

TABLE 1: Summary of Key Results

Order of integration of time series				**Maximum order of Integration *(d)* in the system**	**Cointegration**
GDP_{BAH}	I(1)	H_{BAH}	I(0)	1	-
GDP_{BRU}	I(1)	H_{BRU}	I(2)	2	-
GDP_{KUW}	I(1)	H_{KUW}	I(0)	1	-
GDP_{OMA}	I(1)	H_{OMA}	I(2)	2	-
GDP_{QAT}	I(1)	H_{QAT}	I(1)	1	Yes: 1 equation
GDP_{SAU}	I(1)	H_{SAU}	I(0)	1	-
GDP_{UAE}	I(1)	H_{UAE}	I(0)	1	-

TABLE 2: Results of Toda-Yamamoto Granger Non-Causality Tests

Null Hypothesis	k	Chi-sq	Probability	Causal Nexus
H_{BAH} does not Granger cause GDP_{BAH}	4	2.89	0.58	Economic Development causes Health
GDP_{BAH} does not Granger causes H_{BAH}	4	11.34**	0.02	
H_{BRU} does not Granger cause GDP_{BRU}	2	6.85**	0.03	Health causes Economic Development
GDP_{BRU} does not Granger cause H_{BRU}	2	0.82	0.67	
H_{KUW} does not Granger cause GDP_{KUW}	3	9.82**	0.02	Bidirectional causality
GDP_{KUW} does not Granger cause H_{KUW}	3	7.73*	0.05	
H_{OMA} does not Granger cause GDP_{OMA}	6	12.23*	0.06	Bidirectional causality
GDP_{OMA} does not Granger cause H_{OMA}	6	36.80***	0.00	
H_{QAT} does not Granger cause GDP_{QAT}	2	12.76***	0.00	Health causes Economic Development
GDP_{QAT} does not Granger cause H_{QAT}	2	0.42	0.81	
H_{SAU} does not Granger cause GDP_{SAU}	6	6.14	0.41	No causality
GDP_{SAU} does not Granger cause H_{SAU}	6	5.57	0.47	
H_{UAE} does not Granger cause GDP_{UAE}	2	0.46	0.80	Economic Development causes Health
GDP_{UAE} does not Granger cause H_{UAE}	2	5.22*	0.07	
Note: *** significant at 1% level; ** significant at 5% level; * significant at 10% level				

TABLE 3: Results of Unit root tests: GDP

Augmented Dickey Fuller						
H_0: The variable has a unit root						
Time Series	Level Form		First Difference		2nd Difference	
	constant	constant & trend	constant	constant & trend	constant	constant & trend
GDP_{BAH}	-1.86 (1)	-1.83 (1)	-5.36 (0)***	-5.37 (0)***	-7.00 (2)***	-6.90 (2)***
GDP_{BRU}	-0.82 (2)	-3.92 (5)**	-4.16 (1)***	-4.18 (1)**	-5.80 (3)***	-5.69 (3)***
GDP_{KUW}	-1.29 (0)	-1.96 (0)	-5.87 (0)***	-5.79 (0)***	-7.36 (1)***	-7.25 (1)***
GDP_{OMA}	-1.54 (0)	-2.08 (1)	-5.69 (0)***	-5.86 (0)***	-9.75 (0)***	-6.88 (5)***
GDP_{QAT}	-1.69 (2)	-0.48 (0)	-2.35 (1)	-5.11 (0)	-11.88 (0)***	-11.75 (1)***
GDP_{SAU}	-1.72 (1)	-2.32 (1)	-3.53 (0)**	-3.40 (0)*	-9.78 (0)***	-9.87 (0)***
GDP_{UAE}	-0.80 (1)	-2.06 (1)	-4.92 (0)***	-4.86 (0)***	-8.62 (0)***	-8.51 (0)***
KPSS						
H_0: The variable is stationary						
Time Series	Level Form		First Difference		2nd Difference	
	constant	constant & trend	constant	constant & trend	constant	constant & trend
GDP_{BAH}	0.11	0.11	0.12	0.11	0.33	0.25***
GDP_{BRU}	0.55**	0.09	0.18	0.12*	0.03	0.02
GDP_{KUW}	0.61**	0.12*	0.11	0.11	0.24	0.16*
GDP_{OMA}	0.74**	0.16**	0.20	0.06	0.13	0.12*
GDP_{QAT}	0.22	0.19*	0.36*	0.10	0.08	0.06
GDP_{SAU}	0.43*	0.11	0.15	0.14*	0.23	0.11

GDP_{UAE}	0.70**	0.14*	0.10	0.11	0.22	0.25***

Phillips-Perron						
H_0: The variable has a unit root						
Time Series	Level Form		First Difference		2nd Difference	
	constant	constant & trend	constant	constant & trend	constant	constant & trend
GDP_{BAH}	-1.85	-1.82	-5.34***	-5.36***	-26.84***	-27.36***
GDP_{BRU}	-0.92	-2.58	-4.96***	-4.96***	-13.94***	-15.06***
GDP_{KUW}	-1.33	-2.07	-5.86***	-5.76***	-30.14***	-34.45***
GDP_{OMA}	-1.55	-1.73	-5.69***	-5.86***	-20.97***	-20.23***
GDP_{QAT}	-1.33	-0.83	-4.86***	-5.30***	-14.20***	-14.06***
GDP_{SAU}	-1.66	-2.64	-3.38**	-3.40*	-10.22***	-11.47***
GDP_{UAE}	-0.68	-1.83	-4.93***	-4.87***	-23.19***	-26.27***

Note:

- Number in parenthesis is the optimum number of lags determined by SC.
- *** significant at 1% level; ** significant at 5% level; * significant at 10% level
- For ADF and PP, the critical values are from MacKinnon (1996), while for KPSS the critical values are from Kwiatkowski-Phillips-Schmidt-Shin (1992).

TABLE 4: Results of Unit root tests: Health

Augmented Dickey Fuller						
H_0: The variable has a unit root						
Time Series	Level Form		First Difference		2nd Difference	
	constant	constant & trend	constant	constant & trend	constant	constant & trend
H_{BAH}	2.79 (1)	-1.51 (1)	-1.38 (3)	-6.79 (0)***	-3.21 (2)**	-2.46 (2)
H_{BRU}	-3.27 (5)**	-1.00 (5)	-1.29 (0)	-3.19 (4)	-5.64 (0)***	-5.65 (0)***
H_{KUW}	-1.95 (4)	-2.08 (2)	-1.03 (3)	3.59 (1)	-0.32 (2)	-1.58 (2)
H_{OMA}	-1.67 (7)	-5.20 (5)***	-2.37 (6)	-1.14 (6)	-3.38 (2)**	0.13 (5)
H_{QAT}	-1.34 (3)	-1.95 (3)	-3.00 (7)**	-4.14 (2)**	-4.91(5)***	-2.89 (5)
H_{SAU}	-2.59 (5)	-3.93 (6)**	-2.05 (4)	-0.74 (5)	-1.66 (3)	-2.20 (5)
H_{UAE}	-3.47 (2)**	-1.10 (1)	-7.01 (1)***	-7.99 (1)***	-4.87 (4)***	-3.36 (4)*
KPSS						
H_0: The variable is stationary						
Time Series	Level Form		First Difference		2nd Difference	
	constant	constant & trend	constant	constant & trend	constant	constant & trend
H_{BAH}	0.76***	0.74**	0.21**	0.66**	0.20**	0.21**
H_{BRU}	0.80***	0.13**	0.10***	0.78	0.21	0.09
H_{KUW}	0.77***	0.68**	0.21**	0.71**	0.21**	0.19*
H_{OMA}	0.72**	0.20**	0.11**	0.73	0.21	0.16**
H_{QAT}	0.79***	0.56**	0.19**	0.70**	0.21**	0.15**
H_{SAU}	0.75***	0.40**	0.19**	0.72**	0.21**	0.15**
H_{UAE}	0.79***	0.62**	0.20**	0.71**	0.21**	0.19**
Phillips-Perron						
Time Series	Level Form		First Difference		2nd Difference	
	constant	constant & trend	constant	constant & trend	constant	constant & trend
H_{BAH}	-14.88***	-14.70***	-11.16***	-6.39***	-2.44	-4.17**
H_{BRU}	-13.54***	-0.21	-1.18	-2.22	-5.85***	-5.87***
H_{KUW}	-16.04***	-5.48***	-3.28**	3.54	-4.26***	-7.98***

H_{OMA}	-5.40***	-0.36	-1.11	-1.04	-1.27	-1.39
H_{QAT}	-11.79***	-19.16***	-6.03***	-2.37	-3.95***	-6.42***
H_{SAU}	-14.53***	-4.33***	-1.71	-0.02	-2.42	-3.45*
H_{UAE}	-12.39***	-24.61***	-19.62***	-13.60***	-3.03**	-3.21*

Note:

- Number in parenthesis is the optimum number of lags determined by SC.
- *** significant at 1% level; ** significant at 5% level; * significant at 10% level
- For ADF and PP, the critical values are from MacKinnon (1996), while for KPSS the critical values are from Kwiatkowski-Phillips-Schmidt-Shin (1992).

TABLE 5: Results of Cointegration for Qatar

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.3511	17.5810	15.4947	0.0239
At most 1	0.0297	1.1443	3.8415	0.2848

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.3511	16.4368	14.2646	0.0223
At most 1	0.0297	1.1443	3.8415	0.2848

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values