The Impact of Human Capital on Saudi Economic Growth: Emphasis on Female Human Capital

Khalafalla Ahmed Mohamed Arabi
Professors of Econometric and Social Statistics
College of Business, King Khalid University, Saudi Arabia.

Faiz Awad Bin Zafrah
Assistant Professors of Human Resources
Dean College of Business, King Khalid University, Saudi Arabia.

ABSTRACT

This research stems its importance from the effective role of human capital in economic growth. The purpose of this research is to analyze the prospects of Saudi Arabia 2030 challenges and success by means of simultaneous model covering three important areas i.e. economic growth, human capital and knowledge based economy. We lay special emphasis on the impact of female participation rate on economic growth. The research period span is 1990 – 2017. We estimated the model by Three Stage Least Squares 3SLS. The results reveal a positive impact of female participation rate in either the short run or long run. Human capital, employment, and private sector growth have direct positive impact on economic growth. However, the population class 15 - 64, capital expenditure and dependency ratio of population 15 and above affect economic growth indirectly through human capital. It is worth noting that dependency ratio is the one and only variable that has a negative sign. Many challenges has been facing Saudi Arabia of which are unemployment mainly among youth and female, transformation of the economy into non-oil based economy, replacement of foreign workers for Saudis, and women empowerment which entail more efforts to put forth.

Key Words: economic growth, human capital, knowledge economy, vision 2030

INTRODUCTION AND PREVIOUS STUDIES

KSA launched vision 2030 based on three pillars i.e. KSA becomes the heart of Arab and Islamic worlds, global investment powerhouse, and global hub links Asia, Europe, and Africa. The vision encompasses three themes i.e. a vibrant society, a thriving economy and an ambitious nation. This paper addresses the role Saudi human capital in general and female human capital in particular that can play in fostering economic growth in Saudi Arabia in the context of vision.
2030. To this end, a simultaneous model investigates the prospect of success of vibrant economy theme. To our knowledge there is few attempts to present quantitative analysis of the impact of human capital in general and female participation in particular on economic growth in the context of vision 2030 as well as assessing only single equation models (Naseem and Dhruva 2017, Varshney & Deepanjana 2016, Al Ghamdi 2016, and Abd Elkhalek 2015). Taking into consideration the large amount of money spent on cultivating human capital, accordingly, we expect human capital to have significant impact on economic growth and knowledge based economy. The population class 15 – 64 influences human capital positively as a vital supplier, contrary to the expected negative impact of dependency ratio.

The Kingdom of Saudi Arabia (KSA) has been conscious about the role of human capital, which can play on economic growth. For the past decades, the government has been spending billions of Saudi Riyals on education and health. KSA has become one of the top countries spending on these two sectors. KSA demonstrates this importance by King Abdullah Scholarship Program (KASP), which intends to offer scholarships to 70,000 to match the local demand for labor force. One of the focal causes of unemployment is the bad fit between current educations outputs and job requirements (Alrasheedy 2017). Women’s empowerment is another area the government has been keen to address. Empowerment is the process to enable women elaborate and recreate what they can be, do, and accomplish (2018). Misunderstanding of Islamic teaching, culture and social tradition are the key obstacles face women participation in the labor force (EF 2014). One of the challenges facing KSA is how to reduce high rate of unemployment. Labor force participation rate of females (2018) was only 14% in 1990 and has been growing gradually to reach 22% in 2017.

Empirical research evidences that, there is a linkage between economic growth and human capital (HC). Thomas et al (2013) define human capital (HC) as the people, their performance and their potential in the organization. This definition is in line with the definition of Dess and Picken (1999) who put forward that HC encompasses ‘the individual’s capabilities, knowledge, skills and experience of the company’s employees and managers, through individual education. The World Bank (2017) emphasizes the role of time in enhancing HC. Closely related to HC is the Human Development Index (HDI), which is a statistic of life expectancy, education, and per capita income indicators. Knowledge, operation, building of production instrument, are characteristics of an ideal growth-and-development society. Landes (1998) adds to the definition the creation, adaptation and mastering of new technologies.

The contribution of human capital as a keystone of economic development has been an issue of interest among academicians for very long time. Naseem et.al (2017) estimated regression equation where the unemployment rate, urban rate, fertility rate, and higher education influence the female participation rate. They visualize that vision 2030 will pave the way for women empowerment to contribute in economic growth in Saudi Arabia.

Bokhari (2017) inspected the relationship between investment in human capital and economic growth in the KSA for the period 1970-2014 via Granger Causality approach, and error correction model. He has not observed any long run or short-run causality between expenditure on education and economic growth. Fixed capital formation was an effective aspect.

Al Yousef (2017) discloses that the interest of Saudi government in investment in human capital - King Abdudallah Scholarship Programme (KASP) as an example - acknowledges its significance in future growth and development.
Chhetri (2017) examined the relation between human capital and economic growth in developing countries worldwide. The study concluded that the key factors of economic growth are GDP/capita, per capita income, birth rate, death rate, population growth rate, life expectancy at birth, working age population, education, literacy rate and investment in technology.

Varshney (2016) conceals an over-reliance on expatriate workforce, and oil. Consequently, the researcher found that there are serious efforts towards developing a knowledge-based economy and competent local workforce.

Edrees (2016) explores the causal-relationships between human capital, economic growth, and on the other hand between infrastructure and economic growth in Arab World countries. Results reveals that the causal-relationships between variables of interest are highly heterogeneous in Arab World.

Elimam et al (2014) established that there is a significant relationship between the variables labor work force participation, literacy rate of adult females and GDP rate within Saudi Arabia. Furthermore, (Ibrahim 2013) inspects the relationship between financial development and economic growth for Saudi Arabia for the period 1989-2008 using fully modified ordinary least squares approach. Results specify that the domestic bank credit to the private sector have significant and positive effect on economic growth in the long run, but insignificant and negative effect in the short run. Conversely, stock market index has positive yet insignificant effect in the long run and insignificant effect in the short run. Finally, the growth of industrial production has positive and significant influence on economic growth in whichever the short or long run.

Gallarotti and Al Filali (2013) scrutinizes the Kingdom’s search for a knowledge economy, and threw light on the anatomy of the strategy itself, as well as identify important prerequisites for and barriers to the strategy’s success. The case study of Saudi Arabia’s quest for a knowledge economy carries important repercussions and lessons for other nations, especially those with resource economies that are seeking effective economic plans of economic development and transition

Ageli (2013) investigates the Keynesian Relations and Education Expenditure in Saudi Arabia during the period (1970-2012) for real Oil GDP and Non-Oil GDP. Keynesian Relations investigated that fundamental economic growth its validity to the education growth. The results find that the Keynesian proposition can explain the growth of education in Saudi Arabia, which holds for both the Oil and Non-Oil income cases. The findings also indicate that the existence of strong causality for all of Keynesian Relations versions in the long run.

Chudárková, and Tomáš (2012) reflect through the relationship of human capital and economic growth in Austria positive long-run relationship exists between human capital and economic growth, i.e. national competitiveness. Population: population age structure plays a great role in economic growth over time I.e. concerns about the affects the labor supply, labor productivity and human capital accumulation.

Ali (2002) raises fundamental questions regarding the links between education systems, human capital formation, and economic development. One possible interpretation of this relationship, even though narrow aspect, would be to relate per worker output as an indicator of development performance, and to human capital appropriately measured. However, the
most worrying aspect is that it shows that, though not statistically significant, the relationship is negative.

Martin and Artadi (2002) analyzed the economic growth performance in the Arab world over the last forty years concluding that the low class of investment projects is the key determinant of growth. The excessive reliance on public investment, the low quality of financial institutions, the bad business environment (due to political and social instability and to excessive public intervention and overregulation) and the low quality of human capital are important determinants of systematically unproductive investment decisions and, thus, low economic growth.

Ghali (1997) builds on Barro’s (1990) endogenous growth model to disentangle the nature of the relationship between government expenditure and economic growth in Saudi Arabia by scrutinizing the inter-temporal interactions between the growth rate in per capita real GDP and the share of government spending in GDP. Results found no consistent evidence that government spending can increase Saudi per capita output growth.

To summarize, the above previous studies reflected the role of public expenditure on the GDP growth. Spending on capital, education, and health, has positive effect via an increasing productivity. Foreign workers dominate the private sector that its growth rate experiences equally positive and negative effects on GDP. The positive affects stem from the production side although foreign worker remittance cause leaks from GDP thus a negative impact. Additionally the dominance of foreign works limits the opportunities for national Saudis in particular youth and female. Female employment faces many obstacles including social and traditional perspectives. Some studies presented the effort to stimulate Saudi Arabi transforming into knowledge-based economy, challenges faced in terms of upgrading the standard of current education system outcome.

The structure of this paper is as follow: literature review in section two, theoretical background in the third section, methodology and data in the fourth section, empirical results in section five and finally the conclusion.

**RESEARCH METHODOLOGY**

Human capital and economic growth have a strong relationship. Consequently, human capital affects economic growth and can help to develop an economy through the knowledge and skills of people (Nikolas 2018).

Cobb-Douglas model relates economic growth and factors of production as follows:

\[ Y = AL^{\beta_1}K^{\beta_2} \]

Where Y shows the GDP used as proxy variable of economic development, the letter A represents the technological progress, K denoted to capital stock and L denotes labor force. However, equation (1) will be the base for a simultaneous model below. There is strong relationship between education, health and economic growth. The knowledge people gain through education helps develop an economy and leads to economic growth. Workers with more education tend to have higher earnings, which then increases economic growth through additional spending. Health has direct impact on the economic growth as a healthier people can work strong and longer, healthier student can learn superior. Therefore, better health in a country will raise its level of income (Chhetri 2017).
Investment in machine, computer and building of new capital leads to the accumulation of human capital as Solow model perceives. Investing more capital per capita, results in more produced per capita due to the technology input increase more productivity (Kesici and Kan 2015). Augmented Cobb-Douglas production model postulates that production is a function of factors of production i.e. labor, capital, technology and inputs. They claims that the use of new technologies paves the way for production of new cheaper goods and for capital accumulation and, for that matter, for an enhanced international competitiveness of individual countries, as well as to an enhanced quality for scientific research institutions, while, on the other hand, contributing to cultural and political development of societies. It is not possible for technology to be unbiased or neutral to the social and economic conditions (Stewart 1978).

The World Bank has described the knowledge economy as a way to achieve economic growth without actually burning fuels or making anything tangible, then constructed the Knowledge Economy Index (KEI) as a means to measure a country’s economic performance relative to other countries, about its ability to move, create and use information. The application of knowledge — as manifested in entrepreneurship and innovation, research and development, and software and product design — is one of the key sources of growth in the global economy. Consequently, the proposed model contains three-equation simultaneous model provides investigation of the success prospects of vision 2030. Variables appear after @ are instruments used to estimate the model simultaneously by three stages least squares, which is suitable estimation tool for this types of models according to the rank condition.

**Equation One**
Per capita GDP is a function of human capital HC, employment rate EMP, and private sector growth rate PSGR.

\[ Q_t = C_1 HC_t + C_2 EMP_t + C_3 PSGR_t @ HC EMP PSGR \]  

(1)

**Equation 2**
Higher registration at high education institutes as a proxy of knowledge based economy (HEDU) is a function of human capital as trainee seeking upgrading (HC), and female participation rate. A higher participation of females in computer science, engineering and technology-oriented jobs would spur innovation and economic advances in all countries. However, knowledge economy is composed of innovation, information & communication technology, education and economic incentive and institutional regime. Substitution of human capital by advanced technological tools decreases men and women employment (Abd Elkhalek 2015).

\[ HEDU_t = C_4 * HC_t + C_5 * FP_t @ HC_t FP_t \]  

(2)

**Equation 3**
Human capital (HC) is a function of capital (development) expenditure on machine, computer and building of new capital (DV) the reasoning is that availability of computer and information apparatus will enhance the capability of human resources. An important factor that leads to the accumulation human capital is the total number of population in working age 15 – 65.

\[ HC_t = C_6 POP1564_t + C_7 DV_t + C_8 DPN_t @ POP1564 DV DPN \]  

(3)

Since all equations (annex 3) are overidentified, the appropriate estimation method is the Three Stages Least Squares or Full Information Maximum Likelihood.
The research covers the period 1990 – 2017. Data has been collected from internal and external sources as indicated in the table below.

| Variable                     | Symbol | Description     | Source            |
|------------------------------|--------|-----------------|-------------------|
| Real Domestic Product        | Y      | Million Saudi Riyals | GAUS’             |
| Gross Domestic Product       | GDP    | Million Saudi Riyals | GAUS’             |
| Total Population             | POP    | Million Persons  | GAUS’             |
| Per capita GDP               | Q      | Y/POP           | Constructed       |
| Capital Stock                | K      | Million Saudi Riyals | GAUS’             |
| Spending on Education        | EDX    | Million Saudi Riyals | GAUS’             |
| Spending on Health           | HX     | Million Saudi Riyals | GAUS’             |
| Private Sector Growth Rate   | PSGR   | Rate            | World Bank        |
| Human Development Index      | HDI    | Index           | United Nations    |
| Human Capital Index          | HCI    | Index           | Constructed       |
| Employment Rate              | EMP    | Rate            | World Bank        |
| Population 15 – 64           | POP1564| Million Persons  | World Bank        |
| Female Participation Rate    | FP     | Percentage      | World Bank        |

* General Authority for Statistics

**EMPIRICAL RESULTS AND DISCUSSION**

| Table (2) Descriptive Statistics |
|----------------------------------|
| Skew.                            |
| DJ                              |
| Kurtosis                        |
| JB                              |
| Prob.                           |
| CV                              |

Dependency ratio is the only variable skewed to the left. All variable are not normally distributed. The coefficient of variation (CV) discloses that capital expenditure followed by human capital have the most variation while employment rate is least one followed by the population at the 15 -64.

Figure (1) below depicts clearly the low level of female participation rate compared to the employment rate which is due to many social, religious, and economic factors..
The diagnostic tests reveal that the model variables are nonstationary, four of them has one order of integration I(1) and the others are of order two I(2). The first category comprises per capita income (Q); employment rate (EMP); private sector growth rate (PSGR); and capital expenditure (DV). The second category contains dependency ratio (DPN), human capital (HC), Enrollment into higher education (HEDU), and the total number of population in the class 15 – 64.

Trace test indicates six cointegrating equations at the 0.05 level among DPN EMP FP HC HEDU PSGR Q that is there exists a long run relationship among these variables assuring the evading of spurious regression i.e. getting real estimates.

Estimation of a simultaneous model composed of three equations, i.e. per capita GDP, knowledge economy (enrollment to higher education), and human capital gives the following results:

\[
Q = 0.226*HC + 301.05*EMP + 1316.96*PSGR
\]

\[
t = (13.96) \quad (5.38) \quad (4.80)
\]

R Squared = 0.93

Per capita GDP as a proxy of growth rate relates positively - as expected- to human capital, employment rate, and private sector growth rate. The t distribution indicates that estimated coefficient are highly significant different from zero. The coefficient of determination is 0.93 meaning that these three variable interpret ninety three percent of per capita variation.

\[
HEDU = 0.000125*FP + 0.7032*HC
\]

\[
t = (17.08) \quad (11.67)
\]

R Squared = 0.95

The rate of higher education proxy's knowledge economy relates positively - as expected- to female participation rate and human capital. The t distribution point out that estimated coefficient are highly significant different from zero. The coefficient of determination is 0.95.
indicating that explanatory variables interpret 95 per cent of the total variation of the dependent variable.

\[
HC = 9103.846 + 0.1402*DV - 5830.302*DPN + 0.798*AR(1) \\
t = (9.50) (2.45) (-7.92) (7.33) \\
R^2 = 0.98
\]

The sum of government expenditure on education and health proxy's human capital relates positively - as expected- to capital expenditure and negatively to dependency ratio of the population class 15 – 64. Autoregression of order one i.e. AR(1) tackles the serial correlation problem. The coefficient of determination is 0.98 specifying that capital expenditure and dependency ratio interpret 98 per cent of the total variation of the human capital. Finally, historical simulation indicates that the estimated model does not suffer from structural stability.

There is clear evidence that human capital in general and female participation rate in particular support the success of vision 2030. Our main emphasis is on role of female in backup the success of vision 2030. Female participation rate includes the employed female as well as the unemployed female. Social norms and believes, misunderstanding of religious teachings affect female unemployment and leads to restraints on women's labor force participation. In addition to fewer employment opportunities than men, lower wages and benefits, and less economic independence (Abd Elkhalek 2015). Economic empowerment and self-reliance of women is main goal of the National Transformation Program 2020. Employment gives women greater decision-making within a household, and is linked to lower fertility rates, decreasing infant mortality rates, higher life expectancy rates and increased investment in children's educational attainment, especially for girls”. Another aspect is administrative creativity is strongly affected by psychological empowerment for academic female leaders 2016. Female
participation rate demonstrations steady upward trend since 1991 (14.2%) until 2017 (22.3%)

King Abdullah Scholarship Program offers 70,000 opportunities for study in more than 25 countries directed by the Ministry of education. The most favorable countries are Canada and United States and several European countries, People’s Republic of China and the Republic of India and the Kingdom of Malaysia and the Republic of Singapore and the Republic of South Korea and Japan and Australia. The opportunities are for the following disciplines: Medicine-Medical Sciences (nursing, radiology, health sciences, medical laboratories, applied medical technology) pharmacy-engineering-computer-basic sciences (mathematics, physics, chemistry)-accounting, e-commerce law-insurance-finance-marketing. In 2005, the late King Abd Allah scholarship programme to care for Saudi nationals to study abroad. As part of the King Abdul Allah for scholarships, students received four months of training in English before you start programs. As payment of the program fees and flights and medical insurance and pocket money. Over a decade, King Abdul Allah programme funded scholarship 90% of all Saudi students in undergraduate and graduate degree programs abroad. Although King Abdul Allah support for scholarships to thousands of students since its inception, the falling oil prices forced the Government to reduce the scope of the program, both students and universities in English speaking countries they are in financial distress. Adjusted financial position after a short period of time and get back to business (EF 21/9/2018).

Saudi Arabia has achieved substantial progress in improving access to all levels of education (Abdennour & Alwagdani 2017). The ratio of spending on education to GDP has been oscillating during the period 1985 – 2015. Started with 5.33 percent then displayed downward trend until 1996 at that time started an upward trend for three years again has been declining to reach the minimum in 2008 with 4.5 percent, subsequently has been increasing steadily to reach 8.63 percent in 2015.

Saudi Arabia has been facing shortage of skilled and unskilled nationals, at the same time there is growing rate of unemployment particularly among youth and females, Varshney (2016) confirmed these facts. However, unemployment as an indicator of social and economic problem may inspire the risk of political unrest. The highest levels of unemployment are among in youth populations. The government took some steps to Saudization that will attempt to reduce unemployment. Alrasheedy (2017) presents that most of the previous studies placed much of the blame for high rate of unemployment on the education system for not equipping the native citizens with the required skills to meet the labor needs of employers. The skills that most Saudis acquire in the public school systems do not align with those required by the current labor market. Lastly, they claimed that the market suffers from the lack of training in technical and vocational skills. Wage differential, and gender cultural role are the main cause of unemployment (IMF 2013). Nevertheless, remains the problem of wages and job commitment.

Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation (WHO 2018). Health spending as a percent of GDP exhibited downward during the period 1991(2.08%) -1995 (1.53), at that juncture the ratio has been increasing steadily during the period 1995 (1.53%) – 2001(3.24) to decline afterward to the minimum in 2008 (1.89%)
at that point started mounting again to reach the peak in 2015 (4.12%). As part of its privatization program, the Health Ministry will establish a holding company and five regional companies to operate 15 hospitals and 100 primary healthcare centers by the end of 2018. The move aims at improving the quality of healthcare and productivity of workers. The ministry intends to privatize 290 hospitals and 2,300 primary health centers by 2030 (Ministry of Health 2015).

The private sector play significant role in economic development in Saudi Arabi despite the dominance of foreign workers. The creating jobs for Saudis is crucial goal by the Crown Prince that mean replacing of foreign workers with Saudis taking into consideration the challenges that is an increase in the wage bills, adaptation to shift work, and commitment to the job. Foreign workers affects positively the Saudi economy by expanding production, even with the fact that their remittance outside the country has a negative impact on economic growth in both the short and the long run.

Human capital index measures countries' ability to maximize and leverage their human capital endowment. The index assesses learning and Employment outcomes across five distinct age groups on scale from zero (worst) to 100 (best) and assesses 130 economies.

| Table (1) Human Capital Index of Saudi Arabi |
|---------------------------------------------|
| Rank 2015 | Score 2015 | Rank 2016 | Score 2016 |
| Overall Score | 85th | 61.8 | 87th | 63.69 |
| Under 15 age group | 66th | 82.38 | 86th | 78.24 |
| 15 – 24 age group | 70th | 66.10 | 68th | 66.77 |
| 25 – 54 age group | 97th | 53.69 | 89th | 57.49 |
| 55 – 64 age group | 107th | 53.69 | 91th | 61.23 |
| 65 and over age group | 115th | 33.34 | 95th | 44.95 |

The government efforts on knowledge economy boil down the Saudi’s KEI to 4.6 in year 2000 occupying the seventy-sixth rank, improved to 5.96 in 2012 to get better rank i.e. 50th.

CONCLUSION

This research was concerned with impact of human capital on economic growth, taking the expenditure on education and health as a proxy. Per capita income usually represents economic growth; therefore, we take it as a proxy. The main goal is to assess the prospects of vision 2030 success based on the historical data for the period 1990 – 2017. Results illustrate that the human capital has direct and significant influence on growth by means of two per cent. However, the indirect effect tracks through capital expenditure. In addition, human capital and female participation rate support together the success of vision 2030. To decrease workers' remittances, Saudi Arabia must find appropriate new channels to convince foreign workers to consume and invest their money in the country. The participation rate of female labor force that is the percent of the female population ages 15 and older who are economically active, an increase is necessary to ensure more contribution of productive families. It recommended that the government should focus on the development of talented women and pool their energy to contribute in economic growth. Authorities should struck a balance between social life and work without disrupting the family system. Saudization at firm, freelance program and part-time job enable women to engage in the labor market. In addition to eliminate gender discrimination in wages, the government has to narrow and ultimately bridge the gap between the required qualifications and skills of labor market and the outcome of the current education system.
ANNEX

Annex (1): System: SYS01

Estimation Method: Three-Stage Least Squares

Date: 09/18/18  Time: 22:11

Sample: 1986-2015

Included observations: 31

Total system (unbalanced) observations 81

Iterate coefficients after one-step weighting matrix

Iterate coefficients after: 1 weight matrix, 9 total coefficient iterations

| Coefficient | Std. Error | t-Statistic | Prob. |
|-------------|------------|-------------|-------|
| C(1)        | 0.227299   | 0.016491    | 13.78318 | 0.0000 |
| C(2)        | 284.3457   | 55.51767    | 5.121715 | 0.0000 |
| C(3)        | 1433.002   | 276.3303    | 5.185831 | 0.0000 |
| C(5)        | 0.000125   | 7.34E-06    | 17.07908 | 0.0000 |
| C(6)        | 0.703268   | 0.06028     | 11.6666   | 0.0000 |
| C(8)        | 9103.856   | 957.9577    | 9.5034    | 0.0000 |
| C(9)        | 0.140172   | 0.057143    | 2.452994  | 0.0166 |
| C(10)       | -5830.3    | 736.3321    | -7.91803  | 0.0000 |
| C(11)       | 0.798175   | 0.108954    | 7.325831  | 0.0000 |

Determinant residual covariance 2.74E+16

Equation: \( Q = C(1) \times HC + C(2) \times (EMP) + C(3) \times PSGR \)

Instruments: HC EMP PSGR C

Observations: 25

R-squared 0.927253  Mean dependent var 51458.36
Adjusted R-squared 0.92064  S.D. dependent var 24485.02
S.E. of regression 6897.674  Sum squared resid 1.05E+09
Durbin-Watson stat 1.215613

Equation: \( HEDU = C(5) \times HC + C(6) \times FP \)

Instruments: HC FP C

Observations: 26

R-squared 0.954762  Mean dependent var 25.67007
Adjusted R-squared 0.952877  S.D. dependent var 12.98487
S.E. of regression 2.818727  Sum squared resid 190.6853
Durbin-Watson stat 0.467027

Equation: \( HC = C(8) \times POP1564 + C(9) \times DV + C(10) \times DPN + [AR(1) = C(11)] \)

Instruments: DV POP1564 DPN C HC(-1) POP1564(-1) DV(-1) DPN(-1)

Observations: 30

R-squared 0.984906  Mean dependent var 99235.7
Adjusted R-squared 0.983165  S.D. dependent var 86714.71
S.E. of regression 11251.29  Sum squared resid 3.29E+09
Durbin-Watson stat 1.561921
### Annex (2) Vector Error Correction Estimates Growth rate and Female Participation

Date: 09/19/18  Time: 16:21  
Sample (adjusted): 1992 2016  
Included observations: 25 after adjustments  
Standard errors in () & t-statistics in [ ]

| Cointegrating Eq: | CointEq1 |
|-------------------|----------|
| **YGR(-1)**       | 1        |
| **FP(-1)**        | 3.015587 |
|                   | -1.2655  |
|                   | [2.38292]|
| **70**            | -0.93544 |
|                   | -0.3533  |
|                   | [-2.64771]|
| **C**             | -23.0752 |

**Error Correction:**  
| D(YGR)           | D(FP) |
|------------------|-------|
| **CointEq1**     |       |
| -0.98697         | -0.02986 |
| -0.15369         | -0.0218 |
| [-6.42191]       | [-1.36961] |
| **D(YGR(-1))**   |       |
| -0.01439         | 0.012337 |
| -0.13279         | -0.01884 |
| [-0.10833]       | [0.65487] |
| **D(FP(-1))**    |       |
| 3.753405         | 0.419049 |
| -1.54374         | -0.219 |
| [2.43137]        | [1.91346] |
| **C**            |       |
| -1.72776         | 0.191745 |
| -0.83483         | -0.11843 |
| [-2.06959]       | [1.61903] |

**R-squared**  
| 0.691059         | 0.178212 |

**Adj. R-squared**  
| 0.646925         | 0.060813 |

**Sum sq. resids**  
| 235.2329         | 4.734145 |

**S.E. equation**  
| 3.346874         | 0.4748 |

**F-statistic**  
| 15.65808         | 1.518008 |

**Log likelihood**  
| -63.4947         | -14.6725 |

**Akaike AIC**  
| 5.399577         | 1.493802 |

**Schwarz SC**  
| 5.594597         | 1.688823 |

**Mean dependent**  
| -0.5308          | 0.3192 |

**S.D. dependent**  
| 5.632562         | 0.489931 |

**Determinant resid covariance (dof adj.)**  
| 2.468736 |

**Determinant resid covariance**  
| 1.74194 |

**Log likelihood**  
| -77.8844 |

**Akaike information criterion**  
| 7.110754 |

**Schwarz criterion**  
| 7.647059 |

**Number of coefficients**  
| 11 |
Annex (3) Identification Test

The order condition is a sufficient condition for the identification deals with the excluded variables (endogenous and pre-determined K) from target equation. If the number of excluded variables equals to the number of endogenous variable minus one (G-1) the equation is exactly identified; if less than (G-1) the equation is underidentified; if greater than (G-1) the equation is overidentified.

**Equation 1:** K = 9; M = 4; K – M = 9 – 4 = 5; G-1 = 3 – 1 = 2; K – M > G – 1
Equation is overidentified

**Equation 2:** K = 9; M = 4; K – M = 9 – 2 = 6; G-1 = 3 – 1 = 2; K – M > G – 1
Equation is overidentified

**Equation 3:** K = 9; M = 4; K – M = 9 – 2 = 7; G-1 = 3 – 1 = 2; K – M > G – 1
Equation is overidentified.

**Rank Test**

The rank condition works as follows: delete target equation then collect columns contain zeros K and number of equation G; if K < G-1 the equation is underidentified; if K = G-1 it exactly identified; if K > G – 1 it is overidentified.

| Rank Test |
|-----------|
| Q | HC | EMP | PSGR | HEDU | FP | POP1564 | DV | DP |
| Q | X | X | EMP | PSGR | HEDU | FP | POP1564 | DV | DP |
| HC | 0 | X | X | 0 | 0 | 0 | 0 | X | X |
| HEDU | 0 | 0 | 0 | 0 | X | x | 0 | 0 | 0 |

Annex (4) Cointegration Test

Date: 09/19/18 Time: 20:30
Sample (adjusted): 1993 2015
Included observations: 23 after adjustments
Trend assumption: Linear deterministic trend
Series: DPN EMP FP HC HEDU PSGR Q
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized | Trace | 0.05 |
|--------------|-------|------|
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None *       | 0.999587 | 347.0002 | 125.6154 | 0.0000 |
| At most 1 *  | 0.913474 | 167.7553 | 95.75366 | 0.0000 |
| At most 2 *  | 0.804186 | 111.4673 | 69.81889 | 0.0000 |
| At most 3 *  | 0.716455 | 73.96365 | 47.85613 | 0.0000 |
| At most 4 *  | 0.656548 | 44.97483 | 29.79707 | 0.0005 |
| At most 5 *  | 0.56398 | 20.39453 | 15.49471 | 0.0084 |
| At most 6    | 0.055077 | 1.302982 | 3.841466 | 0.2537 |

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
References
Abdennour, Faouzi, Alwagdani, Othman (2017) Education and Inclusive Growth in Saudi Arabia International Journal of Economics, Commerce and Management Vol. V, Issue 4, http://ijecm.co.uk/wp-content/uploads/2017/04/5421.pdf

Abd Elkhalek, Abeer Mohamed Ali (2015) Impact of knowledge economy on participation of Women in Labor Market. https://www.aast.edu/pheed/staffadminview/pdf_retreive.php?url=37685_77

Al Ghamdi, Azala M. (2016) Empowerment of Academic Women Leaders at Saudi Universities and Their Administrative Creativity Unpublished PhD Western Michigan https://scholarworks.wmich.edu/cgi/viewcontent.cgi?article=3474&context=dissertations

Alrasheedy, Abudelah (2017) The Cost of Unemployment in Saudi Arabia Working Paper WP/17/5 Saudi Arabian Monetary Authority http://www.sama.gov.sa/en-US/EconomicResearch/WorkingPapers/THE%20COST%20OF%20UNEMPLOYMENT%20IN%20SAUDI%20ARABIA.pdf

Abd Elkhalek, Abeer Mohamed Ali (2015) Impact of knowledge economy on participation of Women in Labor Market. https://www.aast.edu/pheed/staffadminview/pdf_retreive.php?url=37685_77

Ageli, Mohammed Moosa (2013) Does Education Expenditure Promote Economic Growth in Saudi Arabia? An Econometric Analysis https://mpra.ub.uni-muenchen.de/46673/

Ali Abd Gader Ali (200) Building Human Capital for Economic Development in the Arab Countries MPRA Paper No. 46673 http://mpra.ub.uni-muenchen.de/46673/

AL Yousef, Maha Hamad Abdulaziz (2016) The Kingdom of Saudi Arabia and the Challenges of Globalization, Human Capital Investment and Economic Reform: A Critical Evaluation of the King Abdullah Scholarship Programme unpublished PhD University of East Anglia England https://ueaeprints.uea.ac.uk/61698/1/Final_version_(Maha_Al_Yousef).pdf

Barro, Robert J. 1990. Government spending in a simple model of endogenous growth. Journal of Political Economy 98(S5): 103-125. https://dash.harvard.edu/handle/1/3451296

Bokhari Abla A. H. (2017) Human Capital Investment and Economic Growth in Saudi Arabia: Error Correction Model International Journal of Economics and Financial Issues, 2017, 7(4), 104-112 http://www.econjournals.com

Chhetri, Surya Bahadur Khatri (2017) The Relationship between Human Capital and Economic Growth in Developing Countries A Study and Analysis on Developing Countries http://www.diva-portal.org/smash/get/diva2:1177718/FULLTEXT02.pdf

Chudárková, Silvie, Verner, Tomáš (2012) Relationship between human capital and economic growth: The case of Austria Proceedings of 30th International Conference Mathematical Methods in Economics http://mme2012.ofp.slu.cz/proceedings/pdf/059_Chudarkova.pdf

Dess, G.D. and Picken, J.C. (1999) Beyond Productivity: How leading companies achieve superior performance by leveraging their human capital. New York: American Management Association https://www.amazon.com/Beyond-Productivity-Companies-Performance-Leveraging/dp/0814404359

Edrees A (2016) Human Capital, Infrastructure and Economic Growth in Arab World: A Panel Granger Causality Analysis Business and Economics Journal http://dx.doi.org/10.4172/2151-6219.1000201

Elimam, Haga. Abdullah, Lobna. Al-Banawi, Nisreen and Bokhari, Abla (2014) The Contribution of the Saudi Woman in Economic Development International Journal of Business and Economic Development (IJBED) Vol. 2 Number 3 https://www.researchgate.net/publication/293486775_The_contribution_of_the_Saudi_woman_in-economic_development

EF (21/9/2018) https://www.ef.com/sa/scholarship/kas/

Gallarotti, Giulio M. and AlFilali, Isam Yahia, "Smart Development: Saudi Arabia's Quest for a Knowledge Economy" (2013). Division II Faculty Publications. Paper 153. http://wesscholar.wesleyan.edu/div2facpubs/153

Ghali, Khalifa H. (1997) Government Spending and Economic Growth in Saudi Arabia Journal of Economic Development Volume 22, Number 2, December 1997 http://www.jed.or.kr/full-text/22-2/Ghali.PDF
Ibrahim, Abbas Mohamed (2013) Financial Development and Economic Growth in Saudi Arabian Economy. Applied Econometrics and International Development Vol. 13-1. http://www.usc.es/economet/journals1/aeid/aeid13111.pdf

Kesici, Hülya and kan, Çal (2015) Technological Change and Economic Growth, World Conference on Technology, Innovation and Entrepreneurship, Procedia - Social and Behavioral Sciences 195 649 – 654. https://acels-cdn.com/S1877042815036538/1-s2.0-S1877042815036538-main.pdf?_tid=1a0b7f67-45f6-4ee6-a050-402d257175

Landes, D. (1998), The Wealth and Poverty of Nations: Why Some Are So Rich and Some Are So Poor? Abacus, London. https://tsu.ge/Landes%20-%20The%20Wealth%20and%20Poverty%20of%2

Ministry of Health Saudi Gazette report (21/9/2018) http://saudigazette.com.sa/article/524113/SAUDI-ARABIA/5-firms-to-run-15-hospitals-100-health-centers-by-end-of-2018

Naseem, Sana and Dhruva, Kamini (2017) Issues, Challenges of Saudi Female Labor Force, and the Role of Vision 2030: A Working Paper International Journal of Economics and Financial Issues, 2017, 7(4), PP. 23 -27. http: www.econjournals.com.

International Monetary Fund. (2013, July). Saudi Arabia: 2013 Article IV consultation. Washington DC: Author. https://www.imf.org/external/pubs/ft/scr/2013/cr13229.pdf

Stewart, F., (1978). Technology and Underdevelopment, the MacMillan Press, London. https://www.palgrave.com/us/book/9781349066025

Thomas, H. Smith, R. R. and Diez, F. (2013) Human capital and global business strategy. New York: Cambridge University Press. http://assets.cambridge.org/97811070/33153/frontmatter/9781107033153_frontmatter.pdf

Varshney, Deepanjana (2016) Exploring Recent Saudi Human Capital Development Initiatives: An Evaluation Human Resource Management Research 2016, 6(1): 1-5. https://www.researchgate.net/publication/296195348_Exploring_Recent_Saudi_Human_Capital_Development_Initiatives_An_Evaluation

World Bank (2017) Measuring Knowledge in the World Economies. Knowledge Assessment Methodology and Knowledge Economy Index web.worldbank.org/archive/website01030/WEB/IMAGES/KAM_V4.PDF

World Health Organization, WHO (121/9/2017) Saudi Arabia - Health expenditure https://www.indexmundi.com/facts/saudi-arabia/health-expenditure