The role of Human Capital and Total Factor Productivity in Promoting Economic Growth: a Comparative International Study

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Abstract:

The aim of this study is to test the existence of a positive relationship between the human capital and economic growth in a group of countries. The study has employed ARDL method on data for the period 1950-2014. The results show that there is a long-term relationship between human capital and economic growth in South Korea, South Africa, the United States, France and Germany, while there was no significant correlation in Japan, Saudi Arabia and Egypt. As for the effect of the total factor productivity, it was found that their effect is significant in all countries except Egypt. The study suggests the continued accumulation of human capital and that the output of education be directly involved in the production process.

Keywords: Human Capital, Economic Growth, Total Factor Productivity, Knowledge Economy.

(JEL) Classification : O47, J24

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I. Introduction:

The prevailing economic theory lacks a clear vision of what it is, the nature, determinants, limits, and possibilities of a knowledge economy. Some research centers and study institutes, specifically the World Bank, have developed some applications and databases that allow for the measurement of the degree to which an economy is integrated into a knowledge economy or to determine the proportion of a knowledge economy in an economy. Most of these applications have been developed in accordance with the World Bank Group's vision for the knowledge economy, a simplified application vision. The knowledge economy refers to four main dimensions:

- Institutions and Governance.
- Education and Human Capital Education and Human Capital
- Creativity and invention Innovation
- Information and Communication Technology Information and Communication Technology.

This paper attempts to invest one of these dimensions, education and human capital, as one of the dimensions of the knowledge economy, in economic growth. This relationship will be monitored in several countries, each of which belongs to an economic sector that believes that human capital and total productivity of production factors have had a qualitative contribution to its attainment of enhanced economic growth. The data will be based on data from Japan, Germany, South Korea, South Africa, Egypt, Saudi Arabia, and the United States of America. This group of countries reflects the differences in income levels and the developmental group to which each belongs. While the United States, Japan, Germany and France belong to the group of developed countries, South Korea and South Africa belong to the group of emerging countries. As for Egypt, it is a clear example of the group of low-income developing countries, while Saudi Arabia represents the group of countries with rent economies, i.e., whose growth depends on natural resources and not on productive activities.

Many studies have examined the relationship between human capital and economic growth. Much of these researches has been divided between the exogenous economic growth theory and the Lucas model. One of the most prominent of the importance of human capital in economic growth according to this theory Lucas Jr (1988). A section of the studies adopted the theory of endogenous economic growth, which theory and applications considered that human capital was one of the fundamental determinants of economic growth. Barro (1991) highlighted the practical result. De la Fuente and Doménech (2006) found a positive correlation between production and human capital, using data at the level or in the first difference.

Depending on the results of the studies, whether theoretical or applied, we can determine the hypothesis of the research as follows:

- The first basic hypothesis that the researcher should test, is that countries that have achieved enhanced growth have relied on human capital accumulation through decades, which has increased the productivity of individuals and the overall productivity of the elements of production and thus improved the conditions of production of growth.
- The second hypothesis is that the elasticity of the rate of economic growth for both human capital and total factor productivity is greater than one, to reflect the increasing returns of both eliminates

This paper will use the appropriate econometrics methods for testing its hypotheses. The characteristics of the time series used in some of them for the period 1950-2014 will be identified and their level of stability will be determined, and the model of the study will be estimated using the autoregressive distributed lags method for the nature of the variables and the need to obtain the short and long-term capabilities.

The second part will be given, addition to introduction to the theoretical framework and previous studies. In the third section, the study model and data will be identified. In the fourth section, the model will be evaluated and diagnosed. Finally, in its fifth Section, we will discuss the findings.

1. Theoretical framework and previous studies

The economic development literature concerned human capital and the total factor productivity (or technical progress as in Solow) as important keys to economic growth. Economists of economic growth, especially proponents of modern growth theory such as the recent winner of the Nobel Prize in Economic Sciences Romer (1986), Mankiw, Romer, and Weil (1992), Barro and Sala-i-Martin (2004), Gyimah-Brempong and Wilson (2004), Hanushek and Woessmann (2008), Hartwig (2010) and Qadri and Waheed (2014). The growth of human capital and its increased intensity in the economy improve the productivity of workers and increase the total factor productivity. Schultz (1961) and Becker (2009) defined human capital as a set of knowledge, skills and abilities embodied in the individual and acquired over time through training, work experience, medical care and travel.

In the classical theory of economic growth, labor productivity is an external factor that depends on the ratio between labor force and physical capital, as well as other factors (technical progress), but the beneficial effect of education on potential growth of productivity is not considered. The new theory of economic growth in the 1980s comes to correct this deficiency in the classical theory that emphasizes the importance of education and innovation (human capital components) in long-term economic growth. By contrast, market value theory shows that studies have highlighted the impact of intangible assets such as R & D, patents and intellectual capital on the market value of firms as well as on their development, ultimately leading to overall national economic growth.

Romer (1990), the author of the Theory of Endogenous Economic Growth, build his model about the determinants of long-term economic growth on the following assumptions:

- Technical progress is an endogenous factor, which results from the production of knowledge through scientific research and development for profit.
- The interpretation of the multiplier growth that has occurred in developed countries can be explained by the role played by the knowledge component available to them.
- The output function has different composition to be as follows:

$$Y = K^{a} \times (AL_{Y})^{1-a} \qquad (1)$$

Where A is the balance of ideas rather than technical progress. Although the function is subject to the same conditions as the constrained of Cobb–Douglas production function (i.e. yield stability), when A is considered as a production factor, it is transformed into a function of increasing yield. Capital in the Romar model accumulates in the same way as the Solow model and based on Keynes' approach to the consumption -saving relationship.

This theoretical argument means that the total factories productivity which includes the cognitive progress resulting from scientific research and the applications of knowledge acquired and embodied

in technologies that are better productive than their predecessors and structural management improvements and decision-making systems, is the fundamental determinant of long-term economic growth. There is no doubt that this theory includes a fundamental role of the human capital through which knowledge is transferred and accumulated over time (generations), which is bound to create enhanced growth.

Statically, it is difficult to measure the details of human capital, especially the measurement of the outputs of education and training, and it remains that the other two components canaddress education (quantitatively) and health. The applied studies used different statistical formulas, especially when measuring human capital as well as education. Some studies of human capital expressed the size of expenditure on education, while many other studies focused on the fact that the number of graduates of secondary education is the figure of human capital, Barro(1991).

From a theoretical point of view of the relationship between human capital and economic growth, Bloom, Canning, and Sevilla (2004) discussed this relationship by saying that good health and good education certainly support labor productivity in the economy and thus improve the conditions for producing economic growth. Ogundari; Ito; and Okoruwa (2016) noted that better education and better employment are much like creating new technology.

The importance of education comes as education in a knowledge-based economy plays a critical role in providing the highly skilled human capital needed to create jobs, economic growth and prosperity for the individual and society (Pegkas and Tsamadias, 2014). In the theory of exogenous growth, especially Lucas, Lucas Jr (1988) is considered Education as one of the determent of production alongside labor and capital. The Funke and Strulik (2000) study emphasized the different effects of human capital on economic growth according to the country's development phase. In their view, the Ozawa-Lucas model may explain development mechanisms if the accumulated knowledge productivity is high. However, according to the Grossman and Helpman (1995) model, growth can be explained by considering technological growth as an internal variable that involves considerable expenditure on scientific research and development. Physical capital contributes significantly to the growth of per capita income in the early stages of development while the accumulation of knowledge through continuing education and training moves the economy to higher stages of development.

In recent empirical studies, the expression of human capital has been common as outcomes of education, as in Aka and Dumont (2008). Benos and Zotou (2014) surveyed 27 studies on the impact of human capital on economic growth, all of which considered that education was the gateway to this human capital.

2. Study model and data

Based on the of modern growth theory or endogenous economic growth theory, the rate of growth of GDP is dependent to group of determinants. While this paper attempts to measure the effect of human capital on economic growth, the first independent variable in the model will be the growth rate of the human capital index expressed in the index of years of schooling adjusted by the expected annual return from education, gHC, and the growth rate of capital stock per worker gKW and the growth of total factor productivity, GTFP. the effect of foreign trade as the rate of exports of capital goods to GDP will be expressed. Thus, the growth function in the context of this paper can be written as follows:

$$gY_{i,t} = a + \beta_1 gHC_{i,t} + \beta_2 gKW_{i,t} + \beta_3 gTFP_{i,t} + \beta_4 EXP_{i,t} + \epsilon_{i,t} \quad (2)$$

Where β_n and a is the parameters of the model and ε the error term. *i* is the country concerned.

It should be noted in the growth function that the most important factors affecting economic growth are the total factor productivity and the qualitative aspect of labor and capital. It is safe to say that economic growth depends on subjective-cognitive factors. The increase in the quality of employment expressed in the growth of human capital is the most important elements of knowledge that is reliable in the production of growth, and then the per capita share of physical capital means increasing the technological intensity in the economy, which is pure cognitive production. Finally, the reflects the ability of the society to deal with technology or the ability of society through its institutions and labor force to localize the technologies used in the national production system.

For data, the study was based on the Pen World Table (PWT9) in its ninth version. This database contains a set of variables starting for some countries from 1950 and ending, according to the latest version, in 2014. It also contains variables not included in other databases (I mean World Bank, IMF, and national statistics), particularly the and the human capital index.

The study defined the GDP growth variable (gY) as the basis of the first log of the natural logarithm of GDP at constant prices weighted by the Purchasing power parity (PPP) .The study also showed the rate of growth of human capital in the first difference of the natural logarithm of the human capital index gHc (the years of schooling weighted by the expected return of education). The following definition has been adopted for the indicator of the growth rate of the worker's share of physical capital stock:

$$gKW = \Delta\log(\frac{K}{emp}) \quad (3)$$

Where K is capital stock and *emp* the number of persons in Labor force.

The following document contains a breakdown of the human capital concept contained in the PWT9 database and the methodology used for each State in the rule to estimate the number of years of schooling. Where I preferred between 4 methodologies. Note that Barro-lee accounts were based on most countries.

For the index of trade openness, the index of the share of manufactured exports to GDP was used. The charts below show the evolution of the indicators of economic growth and human capital. Table 1 shows statistical characteristics (mean, standard deviation and observations) for all study variables. For the behavior of each economic growth rate, defined by real GDP growth, we show the average annual growth rates during the study period 1950-2014 (from 1971 for KSA); show the different levels of human capital growth and different economic growth rates corresponding to each. Figure 1 shows the differences between countries in relation to these growth rates.

II. Methods and Materials:

The study used the ARDL method to estimate the proposed model for each country. This is driven by the difference in the time series stability grades and because this method provides a set of results on the short and long term as well as the error correction parameter.

According to this method, the time series entering the model must be either stable at the level or the first difference or a combination of them, and certainly not in the second difference. A series of

the following diagnostic tests should be performed to ensure that there is a long-term joint integration relationship using the F for bound test and the t-test to detect the model to correct short-term errors to return to the long-term equilibrium.

As for the general shape of the ARDL model, which shows the relationship between the dependent variable Y and the variable X, it takes the following form:

$$\Delta y_t = \mu - \rho y_{t-1} + \theta x_{t-1} + \sum_{j=1}^{\rho-1} a_j \Delta y_{(t-j)} + \sum_{j=0}^{q-1} \pi_j \Delta x_{t-j} + \varepsilon_t \quad (4)$$

Representing the potential of variables at the level and slowing down the long-term information from which the long-term co-integration function is derived. The ρ is the error correction parameter whose significance is tested using the tabular values of Pesaran et al. (2001) and H0 Null Hypothesis There is no cointegration relationship. It should also be noted that it is important that the signal of this parameter or estimate is negative so that we can say that there is a possibility of overcoming the short-term errors to return to equilibrium. The long-term parameter of the co-integration function of X is calculated according to the equation:

$$\beta = -\frac{\theta}{\rho} \quad (5)$$

A cointegration relationship is tested using the Wald test where the null hypothesis is tested:

$$\mu = \rho = \theta = 0 \quad (6)$$

π_j estimations also refer to short-term estimations. P and q also indicate the number of adaptations estimated based on one of the criteria, such as the AIC standard or the SIC quartz standard for either the dependent variable or the independent variable.

The refusal to impose nihilism based on Pesaran et al. (2001) at the given level of significance means that there is a long-term equilibrium relationship moving from the independent variable X to the Y variable.

III. Results and discussion:

1. Unit root tests:

Before beginning to estimate the model of the study, the stability grade of the time series used in the model must be recognized. For this purpose, the researcher used the PP-PP test. Table 2 shows the results of the time series stability test for variables and for each country separately, where the results show the stability grade of each series. We note from these results that there is a difference in the rank of series stability, as some settled at the level and others settled in the first difference.

2. Estimating the model:

Table 3 shows the results of the model estimation using the ARDL method. From the diagnostically side, the Error Correction Term (ECT) was negative and significant P-value is less than 0.01. It is means that there is a cointegration relationship between gy and the explanatory variables, and the errors in the short run can be corrected to return to the long-term equilibrium. All the estimated models reflect a significant relationship at the level using the F-Bound Test, where it can be observed that the value of this statistic is greater than the critical values at 0.01 except for the

model for Egypt, which was significant at 0.05. The results with respect to variance analysis show that the errors in all models are normally-distributed using the Jarque-Bera (JB) Test and that these error terms are not serially correlated using the LM test. Finally, the diagnostic results show that all estimated models are not suffered from Heteroskedasticity problem using the Breusch-Pagan-Godfrey Test except the Saudi Arabia model. Overall, the estimated models are good and significant. On the other hand, the stability of the estimated model parameters was tested using the QSUM of Squares test. The results are presented in Fig. 2, where it is shown that all test curves across countries are located between critical value lines, indicating that all parameters are stable in the long run.

The results shows a difference in the impact of human capital on economic growth. In Japan, Saudi Arabia and Egypt, there was no statistically significant impact on economic growth. While the results shows that there is a significant effect of human capital on economic growth in the USA, South Korea and South Africa. For both, France and Germany, p-value was low (at 10%). As for the TFP effect (which includes inputs of scientific research, development, innovation, administrative development and decision-making systems), it has a direct and significant impact at significance level of less than 1% in all compared countries.

The results also shows that the growth by 1% of human capital in the United States led to GDP growth of approximately 1.9% and the growth in South Korea's human capital by 1% led to a growth of GDP of approximately 2.8%. In South Africa, growth in human capital led to growth in GDP about 1.5%. If we accept the results of both France and Germany at higher significant level (i.e. 0.10), the growth of human capital by 1% led to growth in GDP about 1.4% and 1.8% respectively. On the other hand, the results indicate the validity of the Romer (1990) hypothesis in the USA, France, South Korea and Germany, meaning that the elasticity of TFP is greater than one. While the results for Japan, South Africa and Saudi Arabia point to a diminishing yield returns phase with regard to the relationship of TFP and economic growth. Where the elasticity coefficient was 0.89, 0.83 and 0.786 in Japan, South Africa and Saudi Arabia, respectively. It should be noted that the coefficient of elasticity of the TFP in Egypt was zero, which is a significant value at the level of significance less than 1%.

It is clear that South Korea has relied mainly on its economic growth on human capital. The industrial progress and the great development progress in this country, which have been based on an educational system that has achieved good achievements over the past decades. The same is true for South Africa. While the educational system in the United States and the mobilization of human capital from other countries and availing an open opportunity for this human capital to cashing its serious contribution in the production system form an important economic factor. In Japan, human capital accumulation has been quiet over the past decades because Japan originally had an ancient educational system dating back to the Japanese Renaissance era, which began in 1854 (Meiji Restoration), which provided it with an accumulation of human capital on which it depends after World War II, which left behind huge destruction in Japan. On the other hand, the very low population growth rate reflected the decline in the average human capital growth rate which averaged 0.88% per annum. In parallel with achieving economic growth rates averaging 12% per annum, the growth rate of human capital was negligible.

In Saudi Arabia, while good GDP growth rates of 3.3% annually, human capital grew by only 1.3%. It is worth mentioning that the economic growth in Saudi Arabia is mainly due to the revenues

of oil exports and, to some extent, industrial exports, as reflected in the estimated model shown in Table 3. The model also shows that the TFP, which means improvements in management and technological art used in the production process (whether in the physical or service production sector), had a significant impact on economic growth. This result means that the localization of technology and dependence on expatriate labor, which worked on technologies imported from abroad, contributed to growth by 0.79%. As this result means and given the facts not shown in the model, the outputs of the educational system in the Kingdom did not contribute to the production of growth.

IV- Conclusion:

This paper aims to test the hypothesis of the positive relationship between human capital and economic growth in Saudi Arabia compared to some developed and developing countries. In highlighting the importance of research, the result shows that human capital is one of the most important levers of transition to a knowledge –based economy. As it is responsible for increasing productivity both for the labor force and for the rest of the factors of production.

The study used the ARDL method and data for the period 1950-2014 from the PWT 9 database. Before estimating models for individual countries, the statistical characteristics of the time series included in the model were identified. The descriptive results shows that there was a difference in the rates of growth of human capital between countries in addition to the different rates of growth in GDP. The results of the assessment also showed that the impact of human capital on economic growth was not sufficiently significant except in the United States, while it was strong in emerging economies such as South Korea and South Africa. In Saudi Arabia, the results shows no effect of human capital changes in economic growth. The study attempted to analyze this result by saying that the economic growth in the Kingdom depends more on oil export revenues and on improvements in total factors productivity. The results also indicate the important role played by scientific research and development in economic growth in all countries, especially the developed ones (where the elasticity coefficient was greater than 1) except Egypt, where the elasticity coefficient was zero.

The study recommends a greater focus on the integration of educational outputs in the production process, especially graduates of engineering and technological colleges, and the continued accumulation of human capital in preparation for the structural transformations that can be relied upon to transform the Saudi economy into a knowledge –based economy. The study also recommends expansion in the industrial sector, especially manufacturing, the largest employer of human capital, and the title of the transition from a Rental to an industrial economy and a post-industrial one.

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Appendix:

Table 1: Descriptive Statistics of the Variables

		GY	GK	GHC	GTFP	CSH_G
ksa	Mean	0.0498	0.0012	0.0120	-0.0071	0.1983
	Std. Dev.	0.1458	0.0469	0.0039	0.0922	0.0245
	Observations	44	44	44	44	44
usa	Mean	0.0310	0.0209	0.0057	0.0091	0.1172
	Std. Dev.	0.0224	0.0159	0.0035	0.0112	0.0137
	Observations	64	64	64	64	64
egpt	Mean	0.0691	0.0577	0.0132	0.0084	0.2823
	Std. Dev.	0.0542	0.0675	0.0082	0.0373	0.1490
	Observations	64	64	64	64	64
safr	Mean	0.0344	0.0310	0.0075	0.0031	0.1267
	Std. Dev.	0.0340	0.0393	0.0062	0.0230	0.0328
	Observations	64	64	64	64	64
frnc	Mean	0.0338	0.0386	0.0056	0.0182	0.1687
	Std. Dev.	0.0257	0.0366	0.0053	0.0199	0.0263
	Observations	64	64	64	64	64
grmn	Mean	0.0382	0.0375	0.0064	0.0184	0.1469
	Std. Dev.	0.0316	0.0285	0.0043	0.0194	0.0164
	Observations	64	64	64	64	64
kore	Mean	0.0712	0.0584	0.0111	0.0151	0.1338
	Std. Dev.	0.0533	0.0512	0.0139	0.0268	0.0250
	Observations	61	61	61	61	61
jpan	Mean	0.0477	0.0529	0.0068	0.0103	0.1716
	Std. Dev.	0.0425	0.0430	0.0028	0.0259	0.0455
	Observations	64	64	64	64	64

Table 2: Results of the unit root test using a PP test

	gY	gK	gHC	gTFP	Export
KSA	0	1	1	0	0
USA	0	0	1	0	1
EGYPT	0	0	1	0	1
South of Africa	0	1	1	0	1
FRANVE	0	0	1	0	1
GERMANY	0	0	1	0	1
KORIA	0	1	1	0	1
JAPAN	0	0	1	0	1

Table 3: Results of the study sample estimation

ARDL Long Run Form and Bounds Test
Dependent Variable: D(GY)

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	USA	Japan	FRANCE	GERMANY	KORIA	South of Africa	EGYPT	KSA
ECT	**-0.630**	**-0.722**	**-0.579**	**-0.644**	**-0.831**	**-1.075**	**-0.618**	**-1.927**
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GHC	**1.979**	**4.205**	**1.447**	**1.765**	**2.787**	**1.494**	**-0.530**	**-7.303**
	0.017	0.204	0.071	0.083	0.000	0.014	0.763	0.108
GK	**-0.315**	**0.219**	**0.184**	**0.146**	**0.075**	**-0.030**	**0.397**	**0.291**
	0.036	0.011	0.158	0.224	0.532	0.736	0.080	0.253
GTFP	**2.706**	**0.890**	**1.647**	**1.188**	**1.539**	**0.835**	**0.000**	**0.786**
	0.000	0.000	0.001	0.000	0.000	0.000	0.999	0.001
CSH_X	**-0.068**	**-0.031**	**0.175**	**-0.003**	**0.050**	**-0.035**	**-0.247**	**0.346**
	0.577	0.857	0.060	0.927	0.519	0.749	0.551	0.012
C	**0.002**	**0.021**	**-0.041**	**-0.007**	**0.050**	**0.038**	**0.079**	**0.014**
	0.848	0.618	0.122	0.632	0.000	0.012	0.099	0.862

F-Bounds Test				Null Hypothesis: No levels relationship				
F-statistic	75.518	6.596	7.886	5.270	21.945	17.787	4.590	4.905
k	4	4	4	4	4	4	4	4
Actual Sample Size	61	60	62	63	57	62	62	40
J-B test (Prob.)	0.4032 (0.817)	0.205 (0.903)	2.915 (0.233)	0.048 (0.976)	2.598 (0.273)	1.293 (0.524)	1.174 (0.556)	0.996 (0.60)
F- LM test (Prob.)	0.061 (0.8053)	0.005 (0.945)	0.177 (0.676)	0.281 (0.598)	0.065 (0.800)	1.258 (0.267)	0.612 (0.437)	0.801 (0.3805)
Breusch-Pagan-Godfrey Test	1.788 (0.0874)	1.362 (0.215)	0.721 (0.701)	0.862 (0.554)	0.400 (0.967)	0.726 (0.683)	2.738 (0.008)	3.257 (0.000)

Figure 1: Growth rates of human capital and economic growth of some economies

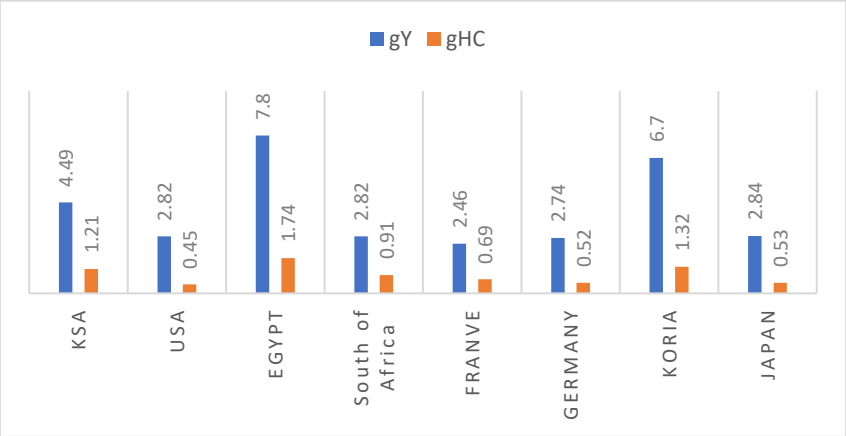
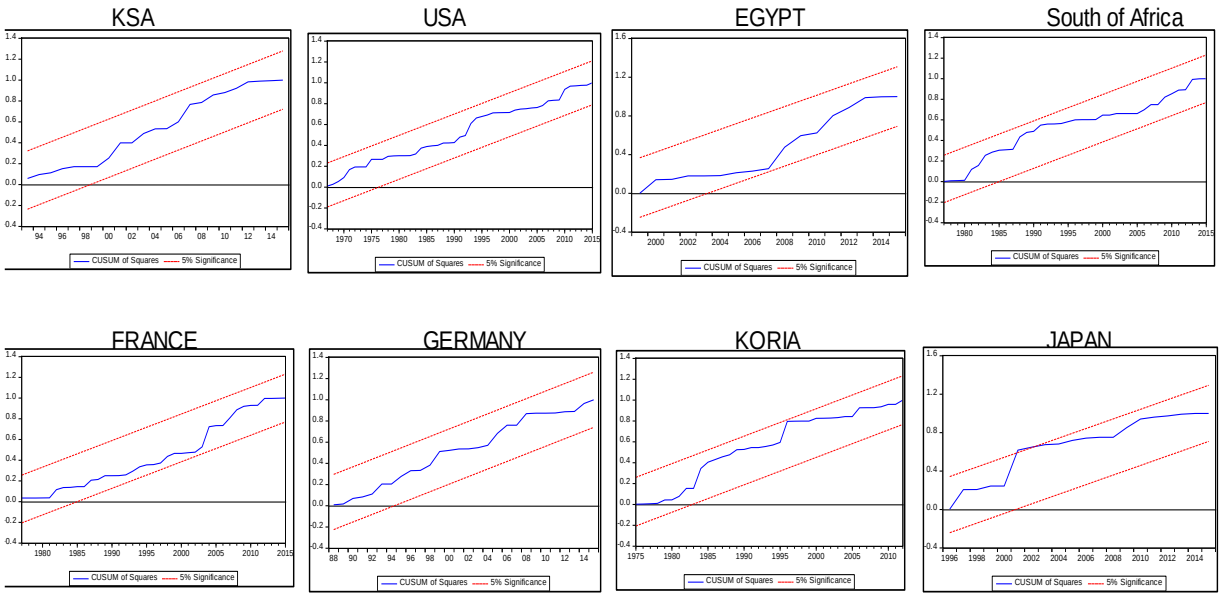


Figure 2: Results of the long-term stability test of model parameters using QUSUM of Squares Test



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