African pathway to achieve inclusive growth: COMESA case study

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Abstract

Purpose – The relationship between economic growth performance and achieving inclusive growth, especially concerning poverty rate, is a subject of continuous argument in economic literature. Although some argue that this relationship is deterministic, i.e. achieving economic growth will definitely reduce poverty and enhance inclusive growth, others believe that the relationship between growth and poverty is conditional, depends mainly on the status of income distribution in this country, i.e. if the growth is combined with a significant improve in distribution then it will reduce poverty.

Design/methodology/approach – Africa is a clear example of the nexus between economic growth and poverty reduction. Although many African countries manage to achieve relatively high growth rates, hit two digits in some cases, during the last decades, poverty still widely spread in those countries. Of the 30 poorest countries in the world, 24 are African countries. And about 50% of African people still live under the poverty line. Common Market for Eastern and Southern Africa (COMESA), which could be considered as one of the fastest growing regions in Africa, is not an exception; although the region achieves relatively high growth rates, poverty and inequality are still among the region's main development challenges.

Findings – This paper found that the economic growth rate achieved in COMESA countries could not be considered as inclusive growth as it does not combine with adequate enhancement in inclusiveness indicators. And that the structural characteristics of those countries economy and its inelasticity are the main reasons behind this inefficiency.

Originality/value – In this context, this paper aims to evaluate the effectiveness of economic growth achieved in COMESA countries in achieving inclusive growth and to identify the main factors affecting this relationship by using two steps data envelopment analysis. Although this method is originally developed to evaluate the relative economic efficiencies, the main contribution of this paper is the adaptation of data envelopment analysis to evaluate the efficiency of economic growth achieved in COMESA countries in enhancing inclusive growth dimensions such as poverty rate, inequality, unemployment, education, health, and then to identify in its second step the main indicators that could be used to explain the variation in efficiency scores.

Keywords Data envelopment analysis, Africa, COMESA, Inclusive growth, Poverty

Paper type Research paper

1. Introduction

The Common Market for Eastern and Southern Africa (COMESA) is one of the Regional Economic Communities (RECs) in Africa consists of 19 countries, which include Egypt, Burundi, Zimbabwe Comoros, Congo D.R., Zambia, Djibouti, Seychelles, Eritrea, Swaziland,

Ethiopia, Kenya, Libya, Madagascar, Mauritius, Malawi, Rwanda, Uganda and Sudan. It was formed in 1994 to enhance intra-regional trade among its members.

COMESA was established in the mid-1960s, when Eastern and Southern African Countries initiated a process to create an Eastern and Southern African economic community. In 1981, the preferential trade area for eastern and southern Africa establishing treaty was signed, entering into force in 1982. COMESA establishment treaty was signed in 1993 in Kampala, Uganda. It turned into a free trade area in 2000. In 2009, COMESA Customs union was launched in Harare, Zimbabwe.

Although a significance number of COMESA countries manage to achieve relatively high economic growth rate, poverty and inequality are still among the main challenges facing those countries.

This paper tries to evaluate the inclusiveness of economic growth achieved in COMESA countries, to identify whether this growth is combined with adequate improvement in inclusiveness indicators as poverty reduction, less inequality, more job opportunities, etc. in this context, the paper is divided into four sections. Section 1 presents the introduction and the definition of inclusive growth, whereas Section 2 presents the literature review of inclusive growth. Section 3 presents the evaluation of the efficiency of COMESA growth rates using two steps data envelopment analysis (DEA). Finally, the conclusion and policy implications of the study are presented in Section 4.

2. Inclusive growth definition and literature review

Inclusive growth is the economic growth that generate significant sustainable improvement in welfare, and whose fruits are distributed fairly among individuals and groups. In other words, inclusive growth is the growth with low and declining inequality, economic and political participation of the poor in the growth process and benefit-sharing from that process. It is the growth that creates economic opportunities and ensuring equal access to these opportunities by all groups of society; Equity in the provision of public services particularly education, health and employment opportunities.

Inclusive growth became a central concern in development literature. However, it still has multiple different definitions. The United Nations Development Program (UNDP) defines inclusive growth as: the growth with low and declining inequality; economic and political participation of the poor in the growth process; and the benefit-sharing from that process (Ali and Son, 2007).

World Bank defines inclusive growth as the growth that is rapidly paced, broad-based across all sectors and inclusive for a large part of labour force. In this way, the definition includes both macro and micro determinants of economic growth. This implies that inclusive growth means the growth strategy that involves the equity and equality of opportunities and social protection. And thus, while short run inclusiveness is based income redistribution, in the long run, it bases on enhancing labour productivity. So according to World Bank approach, inclusive growth is a labour absorbing growth and depends on increasing productivity labour force. The Asian Development Bank adds to this definition of inclusiveness the aspects of gender, ethnicity and race equality (Ngepah, 2017).

In the same context, Organization of Economic Cooperation and Development defines inclusive growth a multi-dimensional concept goes beyond gross domestic product (GDP) growth to include welfare and other dimensions of people well-being that allow them to productively participate in the economy and society. It also includes the policy instruments (fiscal and monetary) needed to achieve this inclusiveness (Ngepah, 2017).

While the African Development Bank (AFDB) defines inclusive growth as:

[...] economic growth that results in a wider access to sustainable socio-economic opportunities for a broader number of people, regions or countries, while protecting the vulnerable, all being done in an environment of fairness, equal justice, and political plurality (AFDB, 2012).

Accordingly, the AFDB strategy to achieve inclusive growth based on four pillars: economic, social, spatial and political inclusions (Ngepah, 2017).

In this context, inclusive growth is a very wide expression that includes not only poverty reduction and income inequality but also a wide range of indicators. Those indicators could be classified into two groups: the access indicators, which measures the access or opportunities to be able to participate in the growth such as health, education, governmental efficiency, infrastructure endowment.; and the distribution indicators such as poverty and inequality reduction, unemployment reduction, gender equality enhancement.,

Although the term “inclusive” can be traced back to the beginning of 2000s, it was first introduced to highlight the contents of pro-poor growth, as that one enables the poor to actively participate in it and benefit from the growth process. Inclusive growth includes both poverty and inequality reduction. However, the idea of inclusiveness, or mainly the triangle relationship between poverty, inequality and economic growth, is discussed earlier than the concept of inclusive growth itself.

But for better understanding of this concept, inclusive growth should be defined in the line with the development of economic thought mainly concerning the relationship between economic growth on one side and poverty reduction and income inequality on the other side. While the economic thinking in the earlier years post Second World War was concentrated on how to achieve high rates of economic growth, and that how this economic growth will improve the standard of living of all population and reduce poverty rate. This understanding changed, as these promises were not achieved. And problem as poverty, inequality started to be seen as major challenges facing countries even those which achieve promising growth rates.

The relationship between economic growth, poverty reduction and income inequality can be tracked down to the earlier literature of neoclassic. According to the neoclassical model, the economic growth is a comprehensive procedure in which the growth of a certain sector pushing other economic sectors to grow through forward and backward links, but the first attempt to study this relationship was what is known as “Kuznets hypothesis”.

According to this hypothesis, economic growth could be related to income inequality and thus poverty reduction in a U-shape relationship in which income inequality is increasing in the early stages of growth since savings is concentrated in high income groups, then income inequality started to be improved as growth rate increases later on. This shape of relationship could be explained by two factors: saving concentration in high income groups and then transforming into new capital investments that lead to more growth; and the economic structural transformation accompanied with the growth rates, the traditional economy turned into more modernized industrialized sector where labour move from the less productive sector (agriculture) to more productive sector (industry), leading to an improvement in their standard of living (Kanbour, 2000).

There is also Lewis 1954 Model. According to this model, under the assumption that the economy is consists of only two sectors, namely, a traditional agricultural sector and an industrial sector. The relationship between economic growth and income inequality go through two stages. The first stage characterized with high income inequality, as wages remain unchanged while profits accelerate. While inequality decreases in the second stage, as wages increases because of the reduction of labour supply in the traditional sector. However, this stage will not last forever because of the technological changes that change the income distribution again causing an increase in the profits even with the higher wages,

so growth rate increases again and improvements in poverty rates and inequality will be achieved again (Kanbour, 2000).

On the other hand, many literatures believe that the main factor, which determines the nature of the relationship between economic growth and poverty reduction, is the structure of this growth. The effect any sector growth depends on its contribution in the economy as whole and its labour share, and labour elasticity to move from the lagged sector to the growing one and thus enhance income equality and reduce poverty (Suryahadi *et al.*, 2009).

There is also the theory of trickle-down effect that dominated development literatures in 1950s and 1960s. According to this theory, countries in their attempts to achieve development have to adopt growth models that transfer growth fruits from the high-income groups to lower income groups by increasing investment expenditure of these groups that benefit directly from the growth. Correspondingly, the relationship between growth and poverty is not a direct relationship, but if it does not exist, the growth will lead to higher income inequality and widen the income gap (Bhagwati, 1988).

With the increasing international concerns about poverty issue, the theories of pro-poor growth appear. This concept refers to this type of growth which enhances poor people standard of living and which benefits poor people more than higher income groups; in other words, it is the growth that is accompanied with better income distribution. In other words, pro-poor growth focusses on the improvement of the income of the poor relative to that of rich, rather than the absolute improvement of poor income (Ranieri and Almeida Ramos, 2013).

Recently, there is a common understanding that the sustainable development could not be achieved by economic growth alone and, thus, even high growth rate will not reduce poverty unless it is accompanied with enhancement in income inequality. According to this, more comprehensive concept of growth started to be used in literatures, which is inclusive growth. Inclusive growth scope is not limited to poverty reduction and income inequality but goes further to cover other dimensions of inequality and discrimination economically, politically and socially, as mentioned previously in this paper. This growth model is used today as the targeted growth model to achieve sustainable development (Lundstorm, 2009).

Empirically, in the absence of a commonly agreed definition for inclusive growth and so clear or direct indicators for measuring it, there is a lack of empirical studies that identifies its status or determinants or explaining the variations in countries performance in achieving inclusive growth. The empirical studies of inclusive growth usually concentrate on the relationship between economic growth on one hand and poverty reduction and income distribution on the other hand. As in the study of Andree(2017) which investigates the relationship between economic growth and income inequality in 46 sub-Saharan African countries between 2005 and 2015, to measure to what extent economic growth could be considered inclusive and how could political and societal factors explain the variation in inclusive growth. The paper found that social programmes directed to lower income groups is the main factor that helps in achieving inclusive growth.

While Aslam(2016) uses vector error correction model to analyse the long run and short run effects of education, health, trade openness, inflation, GDP per capita and institutional indicators on inclusive growth in less and middle developed Asian countries. The paper concluded that those countries could achieve inclusive growth on the long run but not for the short run. And thus, the main factors that determine the ability of countries to achieve long-run inclusive growth are as follows: education, initial GDP growth, institutional quality.

There is also the study of Jalles (2019) that investigates the determinants of inclusive growth episodes between 1980 and 2013 for 78 countries using logit and multinomial probit estimations that show that human capital accumulation, redistribution policies, productivity

improvements, labour force participation, trade openness and institutional quality are the main determinants of the inclusive growth.

In [Anyanwu\(2013\)](#), the study examined factors affecting poverty rates in African countries and thus inclusive growth using regression analysis of data of 43 African countries for the time period from 1980 to 2011. The study shows that higher level of income inequality, primary education, mineral rents, inflation and high population growth rates increase the poverty rate in African countries and thus inclusive growth. While real GDP per capita, net official development assistance and secondary education increase poverty and hinder inclusive growth.

On the other hand, talking about DEA, there are relatively few studies that aim to evaluate inclusiveness or sustainability of economic growth. One of these studies is the study of [Burja\(2018\)](#), in which the authors uses DEA for investigating the efficiency levels of sustainable development in newly members of European Union (EU) by using economic growth as an input, and Global Competitiveness index, Human Development Index and Environmental Performance index as outputs. The paper concludes that Romania did not achieve enough efficiency in achieving sustainable development using its economic, social and environmental resources. And thus, reducing gaps between Romania's economy and other EU countries could lead to better harmonization of economic, social and environmental components of sustainable development.

There is also the study of [Halkos\(2015\)](#), in which two-staged DEA is adopted by using a panel of 20 developed countries for time period 1990–2011 to measure the sustainability of those economies. By first calculate the production efficiency using capital stock and total labour force as inputs and GDP as output, and then in the second stage, eco-efficiency is calculated using GDP as input and different gas emissions as outputs. The result shows that there is large variation between case studies in the environmental dimension of sustainability and less in the overall performance, and that the high production efficiency does not imply an eco-efficiency in all cases.

There is also the study of [Santana\(2014\)](#) which evaluates the efficiency of BRICS countries in transforming productive resources and technological innovation into sustainable development using DEA method. The inputs used were gross fixed capital accumulation, employed population and R&D expenditure, whereas the outputs were GDP, CO2 emission and life expectancy. The analysis showed that Brazil had the highest economic and social efficiencies, whereas China has the lowest environmental efficiency.

3. Evaluate the efficiency of achieving inclusive growth in Common Market for Eastern and Southern Africa countries

3.1 Method and data description

Although DEA is mainly developed to measure the efficiency of non-profit organizations as educational and health public entities, it is also used to measure the efficiency of complex entities with diverse inputs and outputs where the traditional methods of measuring efficiency could not be applied.

DEA is defined as a “data-oriented” approach for evaluating the performance of a set of peer entities called decision-making units (DMUs), which convert multiple inputs into multiple outputs ([Copper, 2011, Handbook on Data Envelopment Analysis](#)). DEA was introduced for the first time in 1978 by Charness, William Cooper and Rhodes who developed its basic model known by their name as CCR model ([Copper, 2007](#)), assuming that DMUs works under constant returns to scale.

DEA can be interpreted with either input-oriented or output-oriented approaches. The output-oriented approach focusses on how high maximal output can be achieved with the same amount of resources. The output-oriented approach is appropriate one for inclusive

growth efficiency because the principle of cost minimization is not applied according to the market condition (Copper, 2007).

The original CCR model for n DMU _{j} where $j = 1, \dots, n$, that produce Y_{rj} where $(r = 1, \dots, s)$ using X_{ij} where $(i = 1, 2, \dots, m)$ takes the following formula (Copper, 2011):

$$\text{Max } \theta = \sum_{r=1}^s U_r Y_{r0}$$

Subject to:

$$\sum_{r=1}^s U_r Y_{rj} - \sum_{i=1}^m V_i X_{ij} \leq 0, \quad j = 1, 2, \dots, n$$

$$\sum_{i=1}^m V_i X_{i0} = 1$$

$$*U_r, V_i \geq 0, \quad r = 1, 2, \dots, s \text{ and } i = 1, 2, \dots, m$$

In this paper, output orientation approach to build CCR model is used, with four outputs and one input to evaluate the pathway to achieve inclusive growth in COMESA countries.

In choosing the inputs and outputs, the AFDB approach of inclusive growth is adopted; thus, inclusive growth indicators are not only limited to inequality and poverty dimensions but also to other economic and social dimensions. The input used in this analysis is the real GDP per capita growth rate. The outputs used in this analysis that represented inclusive growth are as follows:

- Poverty rate: percentage of population under national poverty line.
- Youth unemployment rate: the share of labour force of 15–24 years of age without work but available for seeking employment.
- Inequality adjusted human development index: it is human development indicator adjusted for inequalities in the three basic dimensions of human development.

The data used in this paper is obtained from the African Statistical Yearbook 2019 Report, and from World Bank online data base and UNDP online data Bank. Table 2 shows the data for the selected output/inputs indicators:

- There is a noticeable variation in the economic performance of the COMESA countries as could be noticed from the variation in real GDP growth rates. This rate varies from 1.4% in Burundi to 8.6% in Rwanda. But in general, most countries of the region have achieved a relatively high growth rates, actually 10 out of 16 countries included in this analysis have a growth rate higher than 4%, and only 2 countries have a low growth rate below 2%.
- The average real growth rate in this region is 4.8% which could be considered relatively high, especially when it compares with African average growth rate 4% or emerging market and developing countries average growth rate 3.9% or even world growth rate 3% [1].
- Poverty is still a severe problem in the majority of COMESA countries, where poverty rate exceeded 50% in 7 countries in this sample and even higher than 70%

in two countries: Madagascar and Zimbabwe. On the other hand, only three countries have a poverty rate below 25%, namely, Egypt, Uganda and Mauritius, as shown in Figure 1.

- In general, this region has a moderate human development level as measured by human developed index. The lowest country is Burundi 0.417, while the highest is Seychelles 0.797. But the image changes when moving to inequality adjusted human development index (IHDI), almost all COMESA countries loses a significance part of its HDI level reflecting the existence of inequality problem in all dimensions of HDI. Except Mauritius, all COMESA countries included in this analysis have inequality adjusted human development index (IHDI) below 0.450, as shown in Figure 2 (Table 1).

3.2 Results and discussion

Figure 3 shows the efficiency score calculated for input-oriented model with constant returns to scale, using the DEA online software available at: www.deaos.com. The model is applied on 15 COMESA countries owing to the availability of data (Figure 3).

From the previous figure:

Figure 1.
Growth and poverty
rates in COMESA
countries

Source: By the author using data from table 2

Figure 2.
GDP growth rate,
HDI and IHDI in
COMESA

Source: By the author using data from table 2

Country	Input GDP growth rate ^a	Poverty rate ^b	IHDI ^c	Outputs Youth unemployment ^b	HDI ^c
Burundi	1.4	64.6	0.278	1.5	0.417
Comoros	3.3	44.8	0.275	3.7	0.503
Congo, Dem	5.8	63.6	0.319	4.3	0.457
Egypt	5.3	25.2	0.493	7.8	0.696
Eswatini	1.8	63	0.414	22.5	0.588
Ethiopia	6.8	29.6	0.331	19.1	0.463
Kenya	6.3	45.9	0.434	9.3	0.59
Malawi	4	50.7	0.332	5.4	0.477
Mauritius	3.8	11	0.683	6.9	0.79
Rwanda	8.6	44.9	0.367	16	0.524
Seychelles	7.9	39.3	0.7	3.5	0.797
Sudan	4.1	46.5	0.328	12.9	0.502
Uganda	5.3	19.5	0.37	2.1	0.516
Zambia	3.7	60.5	0.388	7.15	0.588
Zimbabwe	3.5	72.3	0.408	4.9	0.535

Table 1.
Inputs and output
variables of DEA

Notes: ^aAFDB, EAC and AUC: African Statistical Yearbook 2019 (Addis Ababa, EAC, 2019). ^bWorld Bank open data, at: www.data.worldbank.org ^cUNDP online data, at: www.hdr.undp.org/en/data

Efficiency score	GCI	CPI	Agr
100%	40.3	17	41
24%	36.1	19	20.8
26%	54.5	35	11.7
100%	46.4	38	8.9
20%	44.4	34	36.3
21%	54.1	27	38
34%	43.7	32	30.2
23%	64.3	51	3.5
14%	52.8	56	33.2
11%	59.6	66	2.3
23%	48.9	26	26.9
38%	46.5	35	4.3
47%	44.2	22	9.3

Table 2.
Tobit model data

- Only two countries achieve a 100% efficiency score meaning that only two countries have a growth rate that really equivalent to the inclusive growth indicators of the country, those countries are: Kingdom of Eswatini and Burundi. While other COMESA countries included in this analysis actually achieve a low efficiency score which is even below 50% (except Comoros 56%).
- Giving the fact that the efficiency score is only high in the two countries that actually have the minimum economic growth rate, one can conclude that the efficiency of COMESA countries in transforming economic growth into an inclusive growth is very low.
- This result implies that even many COMESA countries achieving relatively good growth rates. This growth rate could not be considered as inclusive growth rate,

Figure 3.
Efficiency scores for
selected COMESA
countries

since it does not translate into adequate poverty reduction, more employment or even enhanced inequality levels.

To analyse the main factors explaining the variation of efficiency score in COMESA region, several indicators is used mainly to express both economic and institutional factor that may affect the achievement of inclusive growth. In this paper, global competitiveness indicator is used to reflect the overall economic performance of the countries, while corruption perception index is used to reflect the main institutional factor that hinders development and inclusiveness in Africa. The last factor added to the model is the industrial value added as a percentage of GDP that reflects the economic structure of the country. This could be done through adopting Tow Limit Censored Regression Analysis (Tobit Regression) as follow:

$$\text{Efficiency}_i = \beta_0 + \beta_1 \text{GCI}_i + \beta_2 \text{Corruption}_i + \beta_3 \text{Ind}_i$$

Where the variables used in this model are identified in the following table (Tables 3 and 4):
Variables summary statistics [2]:

. summarize efficiency GCI CPI Ind					
variable	obs	Mean	Std. Dev.	Min	Max
efficiency	13	0.37	0.2955221	0.11	1
GCI	13	48.90769	7.876385	36.1	64.3
CPI	13	35.23077	14.63531	17	66
Ind	13	12.72308	7.106822	6.4	32

Table 3.
Variables used in
Tobit regression

Variable	Definition	Data Source
Global Competitiveness index (GCI)	Index developed by World Economic Forum that include the macroeconomic and micro business aspects of country competitiveness, it includes many indicators that reflects the country macro and micro performance	Global Competitiveness Report 2019
Corruption	Corruption Perception Index is an indicator published annually by Transparency International since 1995 that measures the country perceived levels of public sector corruptio.	Corruption Perception index report 2019
IND	the share of industrial sector in country Gross domestic Product	African Statistical yearbook 2019

Country	Efficiency	GCI	Corruption	IND
Seychelles	0.110	59.6	66	7.4
Rwanda	0.140	52.8	56	6.4
Ethiopia	0.200	44.4	34	6.7
Kenya	0.210	54.1	27	8.8
Mauritius	0.230	64.3	51	13.4
Uganda	0.230	48.9	26	9.4
Congo, Dem	0.240	36.1	19	20.6
Egypt	0.260	54.5	35	16.7
Malawi	0.340	43.7	32	9.8
Zambia	0.380	46.5	35	8.7
Zimbabwe	0.470	44.2	22	12.3
Burundi	1.000	40.3	17	13.2
Eswatini (Swaziland)	1.000	46.4	38	32

Table 4.
Tobit model data

The Tobit Model estimated as follow:

Tobit regression					Number of obs	=	13
					LR chi2(3)	=	8.52
					Prob > chi2	=	0.0364
Log likelihood = -1.9376538					Pseudo R2	=	0.6874
efficiency	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]		
GCI	-0.0089656	0.0134828	-0.66	0.521	-0.0390071	0.0210758	
CPI	-0.0018144	0.0072902	-0.25	0.808	-0.018058	0.0144292	
Ind	0.0283826	0.0113458	2.50	0.031	0.0031025	0.0536626	
_cons	0.5312709	0.5444385	0.98	0.352	-0.6818136	1.744356	
/sigma	0.2363352	0.0529848			0.1182777	0.3543928	
obs. summary:							
0 left-censored observations							
11 uncensored observations							
2 right-censored observations at efficiency>=1							

As could be noticed from the previous analysis, the economic structure is the only significance indicators that affected the efficiency or could be used to explain the variation

of the efficiency score, as the economic structure of the economy is more industrialized the country could transform its growth into inclusive growth. And this could be explained as the economic transformation to more industrial economy implies an enhancement in the labour productivity than the traditional agricultural economy, and thus long run inclusive growth could be achieved as assumed by World Bank approach of inclusive growth.

4. Conclusion

Although DEA is commonly used in measuring and evaluating economic efficiencies, it could be used in evaluating the macro economic performance of countries, measuring environmental performance and reducing poverty.

This result of the analysis shows that even many COMESA countries are achieving relatively good growth rates. This growth rate could not be considered as inclusive growth rate, as it does not translate into adequate poverty reduction, more employment or even enhanced inequality levels.

However, the second stage of the analysis shows that the main indicator, which could explain the variation and efficiency level in COMESA countries, was the economic structure of these economies. As the share of industrial or modern economic sector increases in the country GDP, the ability of these countries to transform its growth into an inclusive growth increases. In this context, COMESA countries need to focus more not only on achieving high economic growth rates but also on how to structurally change its economy in the way that enhances the industrial sector. This could be only done by giving a priority to industrial sector by adopting a comprehensive economic strategy that targeting all factors affecting industry or barriers that may hinder its enhancement, as improving technical educations or providing more financial and nonfinancial incentives to attract more industrial investment both local and foreign.

Notes

1. Recently, Egypt managed to achieve a relatively high growth rate that reflects the economic reform policies adopted since 2013 by the country on both monetary and fiscal policies. For more details about these reforms, especially in the financial sector see: Mohieeldin et al., (2019), "On Financial Development and Economic Growth in Egypt", *Journal of Humanities and Applied Social Sciences*, Vol.1, No.2, pp. 70-86. At: <http://doi.org/10.1108/JHASS-08-2019-0027>
2. Since the sample size is relatively small. Shapiro-wilk test is used to ensure the normality of residual.

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