



## RESEARCH ARTICLE

# The Growth, Inequality, and Poverty Triangle: Empirical Evidence from Egypt

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| ARTICLE INFO                  | ABSTRACT   |
|-------------------------------|--|
| Received: May 17, 2024        | The study purpose is to explore the simultaneous relationships between the Growth, income inequality and Poverty (GIP) triangle in Egypt, and the interaction effect of growth and income inequality on Egypt's poverty level and the effect of both poverty on economic growth and income inequality on economic growth in Egypt. Using the three-stage least squares (3SLS) method to estimate the simultaneous equations on annual data between 1975 and 2019. The results show that economic growth affects poverty indirectly through the income inequality channel, as increasing economic growth leads to an increase in the misdistribution of income, which leads to a decrease in the poverty rate, and that poverty has a direct negative effect on economic growth. In contrast, inequality has a net negative effect on economic growth, as income inequality has a direct negative effect on economic growth, and income inequality has a positive indirect effect via the poverty channel. The current study also found a negative reciprocal relationship between poverty and income inequality in the Egyptian economy. |
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## INTRODUCTION

Egypt has embarked on implementing an economic openness policy to encourage Arab and foreign investment, by issuing Law No.43 of 1974, which grants foreign capital special treatment in the form of tax exemptions and exceptional powers in project management, in order to encourage its contribution to financing projects and raising growth rates. This was reinforced by adopting an economic reform program to raise the proficiency of the national economy, in order to address the deficit in both external accounts and the state's general budget, and to reallocate resources and raise the efficiency of their use (Hussein et al., 2024). The economic reform program consists of two main components: stabilization policies and structural reform and adjustment policies. Consequently, the average real GDP per capita increased from 10,251 Egyptian pounds in 1975 to 38,426 in 2019 (World Bank, 2024), with a yearly growth rate of 6.1% on average (Flayyih & Khiari, 2023). Accelerated economic growth alone won't eliminate poverty or raise living standards, but it might be necessary to distribute the benefits of growth equitably across all demographic groups, given the significant impact of rising income inequality on the SDGs. (Ravallion and Chen 2004). Moreover, inequality is projected to impede prospected growth through a variety of transmission channels (Abass et al., 2023; Flayyih et al., 2024). Specifically, it may rise the possibility of financial predicaments and rise deficits in the current account (Rajan, 2010; Acemoglu, 2011; Salman et al., 2023). Evidently, the interlinked relationship between growth, inequality and poverty, the so-called growth, inequality and poverty (GIP), is complex. The literature review lacks, to my knowledge, a study of the interrelationships between economic growth, inequality and poverty rate in Egypt. To achieve the study objective of investigating whether economic growth reduces poverty incidence and whether its interaction with income inequality improves or mitigates its impact on poverty, and whether declining poverty and increasing inequality contribute to accelerating economic growth in Egypt, 3SLS is used to

estimate the coefficients of the simultaneous equations. The subsequent sections of the paper are organized as follows: Section 2 discusses the literature review; Section 3 presents the trends of economic growth, inequality, and poverty in Egypt; Section 4 Model and Data specification; Section 5 Econometric analysis and Results; and Section 6 Conclusion and Recommendations.

## **2) LITERATURE REVIEW: THEORETICAL AND EMPIRICAL CONSIDERATIONS**

**2.1 Theoretical literature:** The discussion of the relationship between inequality, poverty, and economic growth has a lengthy history and dates back-to-back to Adam Smith's work *The Wealth of Nations*. Smith (1776) observed that wealth inequality could result in social instability and emphasized the responsibility of government to protect the property of the wealthy from being seized by the poor.

Karl Marx (1867) observed that capitalism led to a widening wealth gap, as owners of capital accumulated more wealth in the mid-19th century. He believed that increasing income inequality could lead to revolution, eventually replacing capitalism with a communist system. At the same time, workers experienced a decline in their economic status. The complex relationship between income distribution and economic growth has been a matter of interest to many economists, including the work of Simon Kuznets (1955). The Kuznets hypothesis proposes an inverted U-shaped curve as the relationship between economic growth and income inequality. The assumptions of incomplete labor markets and sectoral disparities are the basic theoretical reasons for the Kuznets curve with an inverted U shape, which has been observed for 50 years in many developed and developing countries. In simple terms, income distribution tends to deteriorate until countries reach a certain income threshold during the early phases of economic growth. As per capita income rises, inequality declines later in the development process. This is predicated on the traditional assumption that the wealthy have a greater marginal propensity to save than the deprived, and it is based on the trickle-down effect of growth, which results in a decrease in poverty and inequality as a consequence of growth (Acemoglu & Robinson, 2002). This was associated with the dualism of economies between the agriculture and industrialization sectors. Inequality within urban sectors and a rural-urban inequality gap may be associated with a rise in inequality during the primary stages of development. The expansion of urban industrialization and the growing increase in inequality is the consequence of the mismatch between the pay of workers and the profits of capital owners.

Stiglitz further explains Kuznets' idea by explaining the accumulation of returns to capital. These returns initially grow during the growth phases and are earned by the wealthy until the economy reaches a point where the marginal returns on physical capital may decline, while the marginal returns on human capital may increase. The distribution of income tends to show a greater degree of equity (Stiglitz, 1988). Several subsequent studies have shown a possible relationship between trade-induced growth and poverty, as trade-induced growth has the potential to reduce poverty because it typically leads to an increase in the income of the bottom 20 percent of the population in proportion to the average total income. Although the income of the bottom quintile of the population experienced similar proportional changes to the average growth performance, the liberalization process appears to have been rather moderate (Dollar and Kraay, 2002).

Several subsequent studies have shown that there is no link between economic growth and income inequality, contradicting the Kuznets hypothesis as inequality continues to increase with the increase in economic growth. These investigations show that the Kuznets curve doesn't exist and it was just random predictions about the income inequality movement in the developing countries (Piketty, 2006). Piketty argued that the dynamics of inequality are primarily influenced by the policies and institutions implemented by governments and societies as a whole which Kuznets ignored (Higgins & Williamson 2002) predicted that inequality continues to rise not to decrease after some peak point as Kuznets stated. Urban sector income exceeds rural sector income due to the transition of agriculture towards a market-oriented approach.

The primary evidence for variations in inequality resulting from economic growth is derived from lowering the poverty rate through the enhancement of national income. Over time, fresh perspectives on longstanding difficulties have arisen, prompting a reevaluation of the relationship

between income distribution and economic development within the framework of the trickle-down effect. The trickle-down effect's core concept is predicated on wealth accumulation. People typically consider the transmission of accumulated wealth from the wealthy to the poor beneficial. Certain economists argue that economic growth does not eliminate income disparity and may rather result in higher levels of poverty. (Norton, 2002; Bhanumurthy and Mitra, 2004) conducted research that supports the trickle-down impact, although they did not establish the validity of the trickle-up effect.

Bourguignon (2004) provides a comprehensive description of what he refers to as the poverty-inequality-growth triangle, asserting that these three variables have a mutual influence on each other. The author assumes that the distribution of income follows a log-normal pattern. He attributes changes in poverty levels to two distinct factors: the growth effect, which occurs when there is a proportional change in income levels without any accompanying change in relative incomes, and the distribution effect, which refers to a change in the distribution of relative income. the triangle is founded upon the assumption that in specific conditions, such as an inaccurate distribution of achieved result (growth effects), large economic growth could represent an inequality rise and therefore a poverty rise too

(Michálek & Výboštok, 2018).

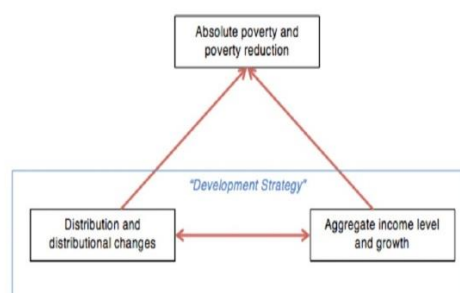
Bourguignon (2004) argues that seeking a direct connection in the relationship between economic growth, poverty, and inequality in a simple manner may lead to a misleading choice between two options. According to his perspective, the connections between distribution and growth are important in a development plan aimed at reducing poverty. Bourguignon thus concluded that achieving the immediate eradication of absolute poverty in all its manifestations is a significant objective for development. However, this necessitates the implementation of robust, country-specific strategies that combine economic growth and equitable distribution policies. He expands the notion of poverty reduction beyond the scope of the absolute approach by including both the rate of increase in the population's average income and the changes in income distribution at a specific moment of time (Odusola, 2019).

Bourguignon formulated the relationship between changes in poverty levels with economic growth and inequality using the following function:

$$\Delta \text{poverty} = F(\text{Growth, Distribution or changes in Distribution})$$

Both economic growth dynamics and wealth distribution have an important effect on poverty incidence. Nevertheless, the consequences of these occurrences will vary based on the beginning level of income and inequality. Furthermore, the impacts of both phenomena may vary significantly between countries (Bourguignon, 2004).

The model possibly be illustrated as a triangle with poverty at the top. Depending on the measurement method, there are several ways to express poverty. The bottom left corner denotes inequality, or its distribution, which is associated with differences in population income. An aggregate level of population income and the economic growth rate (usually GDP growth) express growth in the bottom right corner. The arrows leading to poverty represent these phenomena and their impact on poverty. According to the model, inequalities and growth influence each other while simultaneously affecting poverty. As shown in figure 1



**Figure 1: Growth, Inequality, Poverty triangle**

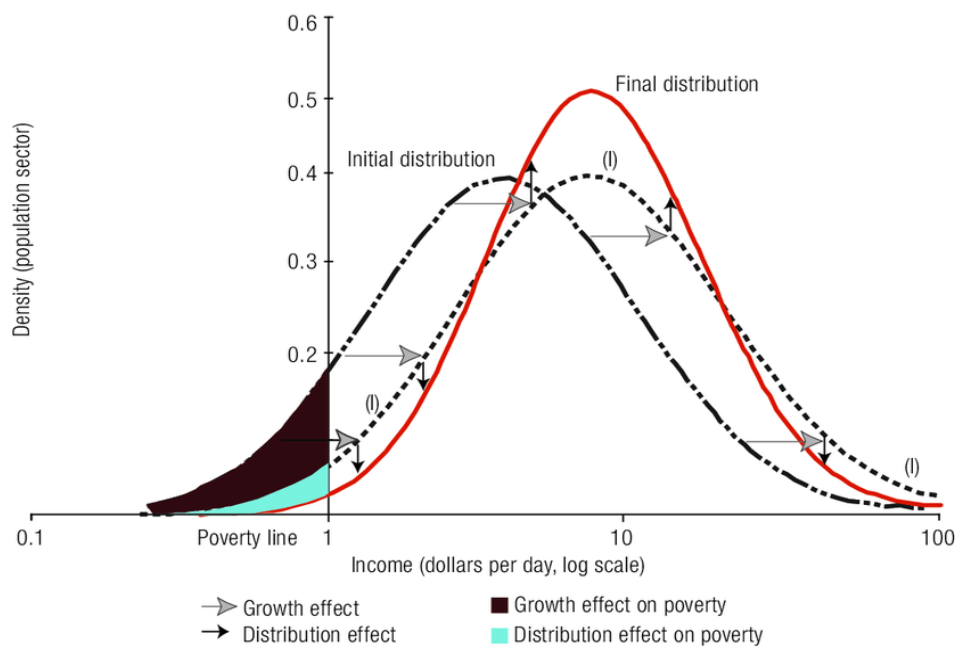
**Source: Bourguignon, 2004**

Bourguignon analyzes changes in income distribution by identifying two distinct effects: the growth effect, which occurs when overall economic growth leads to relative changes in incomes without altering the distribution of relative incomes, and the distribution effect, which occurs with an alteration in the distribution of relative income.

The accounting approaches used in this analysis detangle the relationship between poverty, mean income, and distribution. This is achieved by breaking down the rate of change of a poverty indicator between two periods into its growth and inequality components. The former component is derived by quantifying the effects of observable economic growth on poverty, while keeping the income distribution constant. The latter refers to the poverty shift resulting from the observed changes in inequality, without altering the average income (Lombardo, 2008).

Therefore, the modification results in a shift in the income distribution density towards the right as shown in figure (2). By considering  $z$  as the poverty threshold, it becomes evident that there is a decrease in the population of impoverished individuals. The decrease in the proportion of individuals living in poverty is solely attributed to the impact of economic progress.

The movement of curve (I) towards the final distribution occurs due to a consistent average income and a shift in the relative allocation of income, which is known as the distribution effect. Therefore, the poverty level decreases due to a reduction in income inequality, even while the average income of the population remains unchanged. Put simply, when income concentration decreases, the number of individuals with incomes below the poverty line also decreases (Araujo & Campêlo, 2017)



**Figure (2) Decomposition of poverty changes due to economic growth and income distribution**

**Source: Bourguignon, 2004**

## 2.2 Empirical literature:

Due to the theoretical debates in explaining the interrelationships between poverty, income inequality and economic growth, the empirical evidence regarding the link between these variables is also subject to considerable scrutiny. This is as a result of the diverse economic, political and social frameworks that exist in several countries throughout the world, and the different methods of estimating this relationship. The empirical studies are presented as follows:

A study of (Heshmati, 2004) examine the causal relationship between inequality, growth and poverty using fixed effects model on cross sectional data from 146 developed and developing countries from (1950-1998) he found a global U shape between inequality and growth confirming

the Kuznets relation between economic growth and inequality but couldn't determine the effect of economic growth on poverty levels on developing countries. He suggested that economic growth may benefit the poor but without redistribution policies the income inequality will be worsen. He criticize the literature on neglecting the simultaneous causal relationship between key variables like openness and trade on the poverty, growth, inequality relation

A study in Egypt by (Bourguignon, 2005) investigate the poverty, growth, inequality relationship using time series and cross sectional data in the period from (1990-2005), decomposition method to examine whether the change in poverty attribute to economic growth or income inequality or both ,he calculated poverty's elasticity to both growth and inequality he found that the distribution of income can influences the extent to which growth can effectively reduce poverty, the income inequality can diminish the growth effect on poverty reduction When inequality is low, growth has a substantial impact on reducing poverty. Similarly, when the level of development is high, growth also has a substantial effect on poverty reduction, regardless of the level of inequality. Nevertheless, there exists an interrelated link between growth and distribution.

In a study of the Egypt economy (Kheir-El-Din and El-Laithy, 2006) investigate the period of growth from (1990 – 2005). Using time series data is to determine whether the growth period has significantly reduced poverty or if it has resulted in a worsening of income distribution, potentially offsetting growth's impact on poverty. The analysis is conducted at three different levels: macroeconomic, sectoral, and household. They found that only experiencing growth is not enough to effectively reduce poverty; targeted strategies are necessary, they found regional variations between urban and rural areas in the level of income inequality and this affect the growth effect in reducing poverty effectively in rural areas.

Studies such as (Bhorat and Van der Westhuizen, 2008) examined the correlation between economic growth, poverty, and inequality in South Africa from (1995-2005) the research used a distribution-neutral measure, estimates of poverty inequality elasticity, and the marginal proportional rate of substitution. They found that the effect of income inequality has been to dampen growth, especially pro-poor growth. They suggested higher growth rates are consequently needed to pay off for the rising inequality.

A study of (Araujo & Campêlo, 2017) they assess the Bourguignon (2003) hypothesis using the generalized method of moments (GMM) methodology in estimating panel data for Brazilian states & Latin America in the period from 1995 to 2009 to examine the influence of economic growth and income inequality on changes in poverty in Brazil, they calculate poverty elasticity's in relation to income and inequality. They found the impact of economic growth on reducing poverty is less significant when the beginning level of development is low. Similar results are observed when the initial level of inequality is high. Hence, areas characterized by a low level of beginning development, high level of starting inequality, or both, offer less conducive circumstances for poverty reduction through income growth. so inequality reduce the effectiveness of growth to alleviate poverty.

A study in the Middle East and North Africa region (MENA) by (Ncube, et al., 2014) examine the influence of economic growth and income inequality on changes in poverty using pooled OLS to estimate a cross-sectional time series data, in the period (1985–2009) he found that income inequality negatively impacts economic growth and increases poverty. Rising inequality will hinder dynamic economic growth they explain key determinants of economic growth encompass the preceding growth rate, exchange rate, government consumption expenditure, inflation, and elementary education. The domestic investment rate, urbanization, infrastructure development, and mineral rent are all key drivers of economic growth.

In a study of the South Africa economy (Ramudzuli, 2019) study examined the relationship between income inequality, economic growth, and poverty. The panel mean group model, error correction model, and common corrected effects model were used. Results showed a negative relationship between GDP growth and poverty, while income inequality and economic growth had a positive relationship.

A study of (Olabisi et al., 2020) analyzed the relationship between Nigeria's economic growth, inequality, and poverty during 1980 and 2018. Results showed income inequality had a positive but insignificant effect on economic growth, while absolute poverty had a negative but insignificant relationship. Population growth rate also positively impacted economic growth. Gross capital formation showed a positive but insignificant relationship but a negative long-term effect. The study recommends government programs to address poverty and income inequality, development of infrastructure, and corruption prevention.

Studies such as (Breunig and Majeed, 2020) evaluated the Growth, Inequality, poverty triangle using the Two-Step Instrumental Variables, Generalized Method of Moments (2SIV-GMM) to estimate panel data from 35 Sub-Saharan Africa countries in the period (1990-2018), They concluded that income disparity harms poverty and inclusive growth, & that inclusive growth can reduce poverty, but its influence on income disparity relies on inclusiveness. Inclusive growth offsets the adverse effect of income inequality on poverty they found that inclusive growth is essential for reducing poverty and income inequality in Sub-Saharan Africa.

A study of (Wan et al., 2021) examines the growth, inequality, poverty triangle in Asia and its sub-regions using fixed effect model to estimate unbalanced panel data from 87 economies in the period from (1960-2010) decomposing the poverty reduction to growth effect and inequality effect they found a poverty reduction due to the increase in growth but this effect is offset by inequality in many economies. They found that using fiscal instruments to achieve redistribution policy is insufficient they recommend using minimum wage and social protection

A study in 158 countries by (Marrero and Servén, 2022) analyzed the inequality-growth and poverty growth links Using pooled-OLS and within-group estimates (WG) to estimate a panel in the period (1960 -2010) they found that the correlation between growth and poverty is steadily negative the relationship between growth and inequality is uncertain, with both positive and negative correlations.

In a study of the Indonesia economy (Hadi et al., 2024) explore the interconnections between economic growth, income disparity, and poverty alleviation using panel data in the period from (2015-2022) they found a positive correlation between economic growth and poverty alleviation. However, the relationship between economic growth and income inequality remains uncertain.

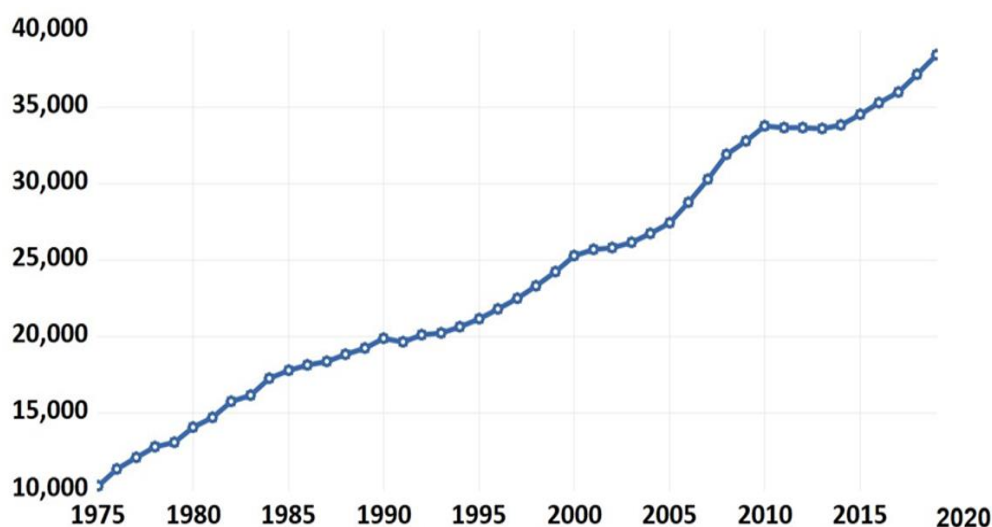
The literature review reveals extensive investigation from various viewpoints into the issue of poverty, inequality, and economic growth, The literature review showed consensus on the effect of growth in reducing poverty but no strong evidence that growth can shrink inequality also the relation between growth and inequality is ambiguous, few researchers pay attention to both direction of causality between variables and the feedback effect between variables especially in Egypt

Therefore, this study aims to examine the interrelationships between poverty, inequality and economic growth using simultaneous equations in Egypt, to address the interrelationships and interdependence between variables and focus on the bidirectional relationships between variables, using the three-stage least squares estimation method, a technique that has not been used previously in studying the growth-inequality-poverty triangle to the best of our knowledge.

Most research in Egypt has focused on the impact of growth and equality on poverty alleviation by calculating the elasticity of poverty indicators to growth and income inequality and neglecting the indirect relationship between growth, inequality and poverty in the Egyptian economy during the period (1975-2019).

### **3) Trends of Economic Growth, Poverty, Income inequality in Egypt**

**3.1) Trends of Economic Growth in Egypt:** The real GDP per capita followed a general upward trend during the period (1975-2019), rising from EGP 10,252 in 1975 to EGP 38,426 in 2019 (World Bank, 2024), which may be due to the increase in investment in both physical and human capital. The graph shows the trend of the real GDP per capita, as shown in Figure (3):



**Figure (3): Economic Growth Rate of Real GDP per capita in Local currency in Egypt (1975-2019)**

**Source:** authors' computation.

The period from 1975 to 1990 witnessed continuous economic growth, with per capita GDP rising from about 10,252 EGP to about 19,883 EGP (World Bank, 2024), probably due to the stabilization policies of the late 1970s and 1980s. The government also launched an open-door policy (infatih), which gave the private sector a greater role (Dobronogov and Iqbal, 2007). National income also increased due to the unexpectedly large increase in Suez Canal revenues of and oil exports (Handoussa, 2002), revenues of tourism, and workers' remittances from abroad during this period.

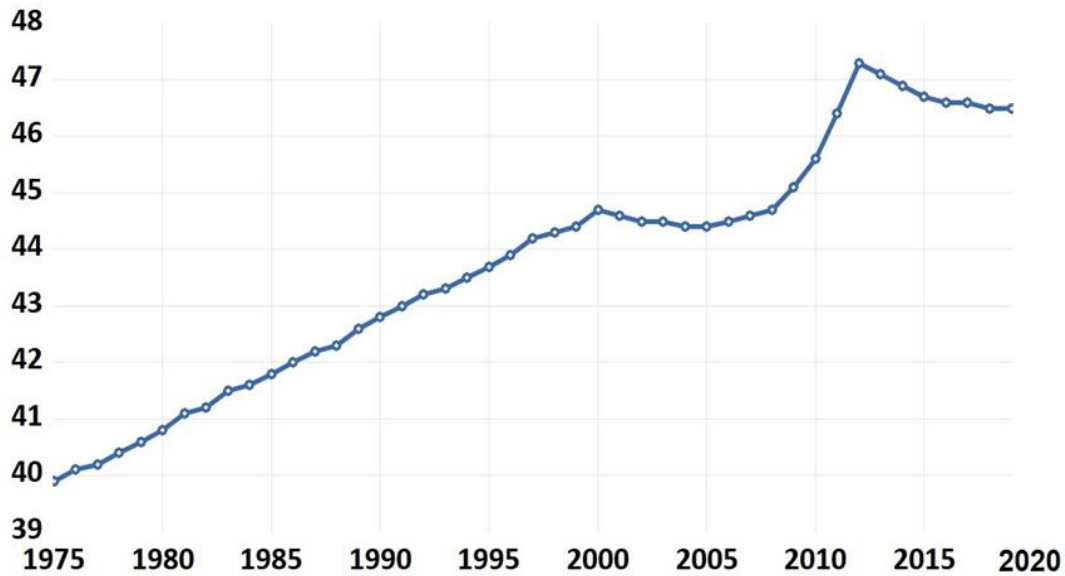
Following the economic reform that began in 1990, Egypt experienced a period of rapid economic growth, with per capita GDP nearly doubling to around 27,430 EGP in 2005 (World Bank, 2024). During this period, Egypt began a gradual process of managing inflation, eliminating the government's extensive control over the economy, and facilitating increased competition in the markets. Consequently, the private sector became an important economic participant in terms of production and employment (El-Laithy et al., 2003), in addition to liberalizing trade and the exchange rate, taking policies and measures to attract foreign direct investment, and privatizing nearly a third of the assets of all state-owned enterprises (Khattab, 1999).

The period from 2005 to 2010 was characterized by a slowdown in economic growth, as the average real income in Egyptian pounds rose from 27,430 Egyptian pounds to about 33,654 EGP (World Bank, 2024), as Egypt was affected by the global financial crisis during this period, then the Egyptian revolution in 2011 and the resulting political unrest, which led to a decline in the economic growth rate compared to the previous period, which caused a decrease in the per capita share of the gross domestic product from 33,777 Egyptian pounds in 2010 to 33,614 Egyptian pounds in 2014. However, it gradually increased to reach about 38,426 Egyptian pounds in 2019 EGP (World Bank, 2024).

**3.2) Trends of Income inequality in Egypt:** The graph in Figure (4) depicts the path of the Gini index in Egypt from 1975 to 2019. It allows us to illustrate how inequality has changed in a given situation over time, it offers valuable insights into the distribution of income within a country (Farris, 2010).

The Gini coefficient tends to rise during the period (1975-2019), as the Gini coefficient in Egypt increased from 39.9 in 1975 to 46.5 in 2019 (Solt,2024), which indicates an increase in income inequality during the study period, and it was noted that the Gini coefficient reached 47.3 in 2012, but it later decreased to 46.5 in 2019 (Solt,2024). The implementation of initiatives targeting comprehensive economic growth, along with increased social spending, may have played a role in the slight decrease in inequality. Egypt will rank among the most equal developing countries in

the world. Although the Gini coefficient in Egypt has fluctuated significantly in recent years, it generally decreased during the period 2012-2019 (Abdel Ghaffar, 2021).



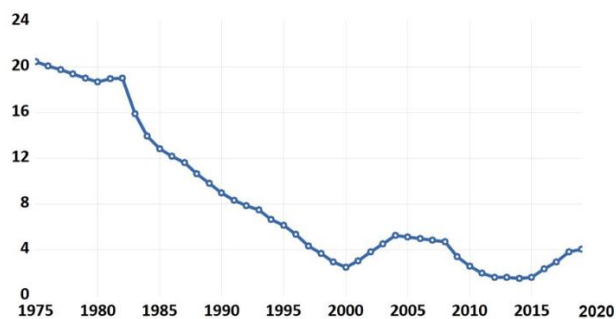
**Figure (4): Inequality Trend in Egypt Using GINI Index (1975-2019)**

Source: authors' computation.

**3.3) Trends of Poverty in Egypt:** A wide range of theories have been used to determine consistent and fair measures of poverty, including: the population index, the poverty gap index, and the poverty gap squared index, also known as the poverty severity index..... The World Bank suggests that the proportion of Egypt’s population living on less than \$1.90 a day is based on the cost of basic needs (CBN) approach to determining the country’s poverty rate, This means the absolute minimum income required to obtain basic necessities such as food, clothing, and shelter, This threshold is predominantly important for developing countries, as it provides a consistent measure of extreme poverty.

The poverty rate in Egypt has been on a downward trend during the period (1975-2019), rising from 20.5% in 1975 to 1.4% in 2019 (ourworldindata, 2024), which indicates a general improvement in reducing extreme poverty rates, and perhaps reflects the efforts made by the state to implement economic reforms that focused on the social dimension of development, although there have been some challenges in recent years to reduce poverty rates by providing cash and in-kind transfers to the poor, as shown in Figure (5).

**Figure (5): poverty rate in Egypt (1975-2019)**



Source: authors' computation.

There was decline in the poverty rate between 1975 and 1985, falling from about 20.4% in 1975 to 18.9% in 1981, then rising slightly to 19.01% in 1982 and then gradually declining to about



12.8% in 1985(ourworldindata, 2024). The downward trend in poverty is probably due to the development programs implemented during this period aimed at improving living conditions.

The poverty rate declined steadily in the period after 1985, eventually reaching 2.5% by 2000 (ourworldindata, 2024), probably due to the expansion of social safety nets and the implementation of specialized programs aimed at poverty reduction. Increased social spending on health care, education, and infrastructure also reduced poverty and increased living standards. The poverty rate then increased to about 5.1% in 2005. This was due to several interrelated factors, such as facing significant inflationary pressures, with the inflation rate in 2005 reaching about 8.8% (ourworldindata, 2024). Inflation reduced the purchasing power of the people, causing more people to fall below the poverty line, and reduced foreign investment, limiting the country's ability to create jobs.

Between 2005 and 2014, the poverty rate continued to decline again, reaching its lowest level of about 1.53% in 2014 (ourworldindata, 2024). During this period, there was a recovery in economic reforms, significant investments in infrastructure, and improvements in social policy aimed at alleviating poverty. The economic expansion during this period contributed to further poverty reduction, reflecting the success of the state's efforts to achieve social justice in parallel with economic reforms. Between 2014 and 2019, the poverty rate gradually increased again, reaching about 4.1% in 2019 (ourworldindata, 2024), possibly due to high inflation rates, reductions in energy and food subsidies, and demographic factors such as continued population growth and an increase in family size, which put pressure on resources and labor markets.

The implementation of policies aimed at promoting inclusive economic growth is crucial for addressing extreme poverty and reducing inequality. These policies should specifically target the poor and recognize the multidimensional nature of poverty (Todaro, Smith, 2012).

#### **4) EMPIRICAL MODEL SPECIFICATION, DATA AND ESTIMATION TECHNIQUES**

This section discusses the techniques used for estimating the relationship between poverty, growth and inequality and the data used. It involves constructing a model that consider the dynamics of economic growth, inequality, and poverty. The equations specified in this section aim to investigate the interrelationships between these variables using econometric methods;

**4.1) Empirical Model Specification (model construction):** The dynamics of economic growth are entirely determined by changes in poverty and income inequality, as shown in the literature review. In this context, it is reasonable to think regarding the interactions between poverty and income inequality, which are the two primary drivers of growth. Additionally, it is important to consider the simultaneous relationships between poverty, income inequality, and growth.

Poverty and income disparity can exert an influence on growth. Higher inequality implies that a greater number of people experience limitations on their ability to obtain credit in an imperfect capital market. Consequently, they are unable to make profitable investments. (Galor, Zeira 1993; Fishman, Simhon, 2002) second, Poverty and inequality lead to higher fertility, and lower investment in the human capital of impoverished individuals (De La Croix, Doepke, 2003). Third, Rising poverty and inequality can lead to a reduction in domestic demand, which limits economic growth. Fourth, rising inequality leads to a greater need for wealth redistribution, which in turn decreases the motivation for investment. (Alesina, Rodrik 1994; Person, Tabellini, 1994) Fifth, increasing poverty and inequality meaning the presence of an unstable social and political atmosphere for economic activities (Benhabib, Rustichini, 1996). Finally, growing inequality negatively affects crime and health. (Li et al., 2019; Yao et al., 2019) (Kuznets, 1955; Lewis, 1955) suggested that growth creates benefit opportunities that is not shared by everyone often equally, leading eventually to increased inequality.

Of course, poverty and income inequality are not determined solely by economic growth. Various variables can contribute to economic growth, poverty, and income inequality. Trade can facilitate economic expansion and alter income disparities. Similarly, we widely acknowledge that technical advancement serves as the primary catalyst for both income inequality and economic

growth. All these factors indicate the potential presence of endogeneity among growth, inequality, and poverty. A way to deal with the endogeneity problem is to use an instrumental variables (IV) & to use simultaneous equations model

In this paper we adopt system Simultaneous equation (SSE) to model inequality, poverty, and economic growth, physical and human capital following (Deininger, Squire, 1998; Wan et al., 2006). Our preference for using SSE because of the presence of many endogenous variables and the difficulties in finding good IV tools, especially for the inequality variable. We depend on modifying (Wan, et al. 2021; Marrero & Servén, 2022) model in constructing our model

The overall relationship of this model is explained using simultaneous equations which is defined as:

$$\ln RGDP_{C_t} = \beta_0 + \beta_1 \ln RGDP_{C_{t-1}} + \beta_2 \ln Gini_t + \beta_3 \ln Poverty_t + \beta_4 \ln K_t + \beta_5 \ln HC_t + \beta_6 \ln TFP_t + \beta_7 \ln TO_t + \beta_8 \ln FD_t + \varepsilon_t \quad (1)$$

$$\ln Gini_t = \gamma_0 + \gamma_1 \ln Gini_{t-1} + \gamma_2 \ln RGDP_{C_t} + \gamma_3 \ln Poverty_t + \gamma_4 \ln FDI_t + \gamma_5 \ln HC_t + \gamma_6 \ln TO_t + \varepsilon_t \quad (2)$$

$$\ln Poverty_t = \lambda_0 + \lambda_1 \ln Poverty_{t-1} + \lambda_2 \ln RGDP_{C_t} + \lambda_3 \ln Gini_t + \lambda_4 \ln INF_t + \lambda_5 \ln EX_t + \lambda_6 \ln RIR_t + \lambda_7 \ln Cons_t + \varepsilon_t \quad (3)$$

$$\ln K_t = \rho_0 + \rho_1 \ln Gini_t + \rho_2 \ln HC_t + \rho_3 \ln TFP_t + \rho_4 \ln FD_t + \varepsilon_t \quad (4)$$

$$\ln HC_t = \gamma_0 + \gamma_1 \ln HC_{t-1} + \gamma_2 \ln RGDP_{C_t} + \gamma_3 \ln Gini_t + \gamma_4 \ln TFP_t + \gamma_5 \ln Edu_t + \varepsilon_t \quad (5)$$

Using Equation (1) to describe economic growth, inequality is included as committed in neoclassical growth models, following (Deininger, Squire, 1998; Forbes, 2000; Wan et al., 2021; Kanval et., 2024) poverty is also included following (Ravallion, 2012; Marrero & Servén, 2022).

Neoclassical growth theory requires the inclusion of physical and human capital stock variables, together with total factor productivity (TFP), as the controlling variables for economic growth. Although the role of trade in eliminating poverty and inequality is controversial, its positive impact on GDP has been found in numerous studies, including (Barro, 2001). Numerous studies also affirm the significance of financial depth in enhancing the economic growth process.

Using Equation (2) to describe inequality, economic growth is included following (Desbordes & Verardi, 2012; Blanco, Ram, 2019; Jovanovic, 2018). poverty are included following (Marrero & Servén, 2022) Given that skilled workers are less likely to experience unemployment, it is expected that human capital will be related to a reduction in inequality inversely (Gregorio & Lee, 2002), and there are also ambiguous views in the literature about the role of FDI in reducing income inequality in developing countries (Couto & Center, 2018) Finally, there has been increasing interest in the role of trade in increasing inequality.

Using Equation (3) to describe poverty, economic growth and inequality are included to complete the explanation of the interconnection between the variables (Niyimbanira, 2017). This study examines the factors that influence poverty, including the inflation rate, interest rate, exchange rate, and per capita consumption. These variables have a substantial influence on defining the poverty line.

Considering that the accumulation of physical and human capital stocks are common factors that can contribute to economic growth, poverty, and inequality, it is reasonable to conclude that the physical capital and human capital variable in the mentioned models may be endogenous. This necessitates controlling the dynamics of their accumulation. In the current framework, equations (4) and (5) will be used to describe them.

Using Equation (4) to describe physical capital; Inequality, human capital, and TFP, Financial depth are determinants of the accumulation of physical capital stock. Inequality has an impact on the political and social atmosphere in which investors make decisions. (Li et. al, 2019) revealed that increasing income inequality leads to additional crime opportunities, which in turn dampens

investment. Conversely, human capital plays a crucial role in attracting investment, particularly foreign direct investment (FDI).

Total factor productivity (TFP) is also expected to be related to the stock of physical capital because higher productivity means higher returns on investment, financial depth is also considered the main determinant in financing physical capital.

Finally, Using Equation (5) to describe human capital: Economic growth, inequality, TFP, and public spending on education as a share of output are included as factors explaining the accumulation of human capital stock. Inequality can impact human capital through various channels. For instance, individuals with low socioeconomic status frequently allocate fewer resources towards their children's educational pursuits, particularly in situations where they have limitations in accessing finance. (Galor, Zeira 1993; Fishman, Simhon 2002; De La Croix, Doepke, 2003) Also, high growth rates, may provide financial resources to increase expenditure on public programs such as tutoring and health.

It should be noted that the dependent variables with one lag period were included in all study equations as exogenous variable (except equation 4) to mitigate potential heterogeneity, following (Marrero & Serven ,2022).The logarithmic form was also used to obtain the long-term elasticity of variables, while minimizing volatility in data.

It is also important to note that even if poverty or inequality do not have a direct influence on growth - as assumed in equation (1), they can still affect growth indirectly through equations (2) (3).this is due to the linkage between inequality and poverty, not due to our own assumption, it is just a general consequence of defining poverty as the proportion of the population whose income falls below the poverty line. Given the poverty line and the average total income of the population, increasing inequality (more precisely the spread of misdistribution of income while maintaining the average) should lead to an increase in the number of individuals below the poverty line, and thus raise the poverty rate, and vice versa. Hence, poverty and inequality are generally positively related and it follows that increased inequality will indirectly reduce growth through increased poverty rates. By the same logic, increasing poverty rates could have a negative effect on economic growth through the inequality channel.

#### 4.2 Data

To discover the links between growth, inequality and poverty, annual time series data for Egypt during the period (1975-2019) with a total of 45 observations will be used to estimate the simultaneous equations. This period was chosen according to the availability of data. A wide range of variables were relied upon for endogenous variables from many international databases. As mentioned in recent empirical literature on growth, inequality and poverty.

Growth is measured as real GDP per capita in local currency this indicator is available on World Bank data base, world development indicators (WDI).Inequality is measured by the Gini coefficient it measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality. Poverty is measured by the poverty line of \$1.9 per day. Poverty headcount ratio at\$1.90 a day is the percentage of the population living on less than \$1.90 a day. The human capital index will also be used, which is calculated through the average years of schooling, the return on education, The capital stock index is calculated at constant national prices for the year 2017. The human capital index and capital stock index are available at Global Status Report (Renewable Energy Policy Network for the 21st Century).

As for the exogenous variables; The indicators of net foreign direct investment inflows were used as a proportion of output, trade openness as a proportion of output, financial depth expressed as (domestic lending to the private sector)as a percentage of output, and the inflation rate based on consumer prices index we calculate it as the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified

intervals, such as yearly, the official exchange rate refers to the exchange rate set by national authorities or to the rate determined in the legally authorized exchange market. It is estimated as an annual average based on monthly averages (local currency units relative to the U.S. dollar), and the real interest rate. education expenditure as a percentage of output, and finally consumption per capita. The inflation rate, exchange rate, real interest data are available on World Bank data base, world development indicators (WDI). Finally Table 1 in the study appendix presents a brief description of the variables used in the paper and source of data in details, table (1) and (2) shows the statistical description and the correlation matrix between variables.

**Table 1: Descriptive statistics for variables, 1975 - 2019**

|   | Unit            | Obs. | Mean  | Median | Std. Dev. | Min    | Max   | Normality test |
|---|-----------------|------|-------|--------|-----------|--------|-------|----------------|
| <b>Endogenous Variable:</b>                       |                 |      |       |        |           |        |       |                |
| <i>RGDP per capita</i>                            | (Constant LCU)  | 45   | 23879 | 22531  | 7979      | 10252  | 38426 | [2.626]        |
| <i>Gini index</i>                                 | (0 – 100)       | 45   | 43.71 | 44.2   | 2.14      | 39.90  | 47.30 | [1.949]        |
| <i>Poverty (1.90\$ per day)</i>                   | (% of Popul.)   | 45   | 8.233 | 5.271  | 6.30      | 1.526  | 20.46 | [6.194]**      |
| <i>Capital stock (k)</i>                          | (Constant 2017) | 45   | 727.9 | 570.0  | 554.      | 64.32  | 1837. | [4.338]        |
| <i>Human Capital (hc)</i>                         | n/a             | 45   | 1.899 | 1.879  | 0.46      | 1.226  | 2.677 | [2.728]        |
| <b>Exogenous Variables:</b>                       |                 |      |       |        |           |        |       |                |
| <i>Welfare-relevant TFP (tfp)</i>                 | (2017=1)        | 45   | 1.152 | 1.060  | 0.24      | 0.908  | 1.772 | [7.041]**      |
| <i>Trade openness (TO)</i>                        | (% of GDP)      | 45   | 50.45 | 50.13  | 10.9      | 30.25  | 74.46 | [1.793]        |
| <i>Financial depth (FD)</i>                       | (% of GDP)      | 45   | 32.26 | 27.90  | 11.9      | 13.94  | 54.93 | [4.523]        |
| <i>FDI, net inflows (fdi)</i>                     | (% of GDP)      | 45   | 2.374 | 1.708  | 2.09      | -0.205 | 9.349 | [40.26]***     |
| <i>Inflation, consumer prices (inf, annual %)</i> | (annual %)      | 45   | 11.84 | 11.08  | 6.04      | 2.269  | 29.51 | [2.705]        |
| <i>Official exchange rate (exc)</i>               | (LCU per US\$)  | 45   | 4.329 | 3.392  | 4.31      | 0.391  | 17.78 | [44.48]***     |
| <i>Real interest rate (rir)</i>                   | (%)             | 44   | 2.906 | 2.113  | 5.35      | -9.312 | 17.58 | [0.556]        |
| <i>Education expenditure (edu)</i>                | (% of GDP)      | 45   | 4.386 | 4.599  | 0.62      | 2.610  | 5.608 | [4.956]*       |
| <i>Consumption per capita (cons)</i>              | (Current LCU)   | 45   | 23706 | 22309  | 6301      | 15456  | 35338 | [4.025]        |

**Note:** - \*\*\* indicate significance at 1%.

For endogenous variables; we note that the per capita share of real output took a general upward trend during the period, as it rose from 10,252 pounds in 1975 to 38,426 pounds in 2019. This means that the average income of Egyptians has increased by 374.8% over 45 years, with an annual average equivalent to 8.3. The upward trend in per capita output is accompanied by a general upward trend in poor distribution of income and the quantity of human capital, in contrast to a general downward trend in poverty during this period, which indicates that the increase in the level of income is a result of the increase in the stock of human and physical capital and the decline in rates of income, Poverty.

The Gini coefficient in Egypt increased from 39.9 in 1975 to 47.3 in 2012, although it subsequently decreased to 46.5 in 2019. On the other hand, the percentage of the population living below the poverty line decreased by \$1.9 per day from 20.4696 in 1975 to 1.53 in 2014, although it increased relatively after that to 4.1% in 2019, This indicates that there is an inverse correlation between poverty and income inequality in Egypt, in other words. Income leads to a decrease in poverty and vice versa, and this will be confirmed in the correlation matrix, and at the level of exogenous variables we find a general downward trend in total factor productivity (TFP) which is normal corresponding to the general upward trend in physical and human capital as evident by the average decline in the level of trade openness, financial development, attracting foreign investments and real interest rate in Egypt with increase in inflation rate.

**Table (2): Correlation matrix between variables, 1975 - 2019**

|                   | (1)  | (2)                 | (3)                 | (4)                 | (5)                 | (6)                 | (7)                 | (8)                 | (9)                 | (10)               | (11)                | (12)                | (13)  |                     |
|-------------------|------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|---------------------|---------------------|-------|---------------------|
| <i>ln rgdpc</i>   | (1)  | 1                   |                     |                     |                     |                     |                     |                     |                     |                    |                     |                     |       |                     |
| <i>ln gini</i>    | (2)  | 0.976 <sup>a</sup>  | 1                   |                     |                     |                     |                     |                     |                     |                    |                     |                     |       |                     |
| <i>ln poverty</i> | (3)  | -0.913 <sup>a</sup> | -0.964 <sup>a</sup> | 1                   |                     |                     |                     |                     |                     |                    |                     |                     |       |                     |
| <i>ln k</i>       | (4)  | 0.995 <sup>a</sup>  | 0.981 <sup>a</sup>  | -0.928 <sup>a</sup> | 1                   |                     |                     |                     |                     |                    |                     |                     |       |                     |
| <i>ln hc</i>      | (5)  | 0.988 <sup>a</sup>  | 0.985 <sup>a</sup>  | -0.929 <sup>a</sup> | 0.992 <sup>a</sup>  | 1                   |                     |                     |                     |                    |                     |                     |       |                     |
| <i>ln tffp</i>    | (6)  | -0.947 <sup>a</sup> | -0.938 <sup>a</sup> | 0.912 <sup>a</sup>  | -0.969 <sup>a</sup> | -0.942 <sup>a</sup> | 1                   |                     |                     |                    |                     |                     |       |                     |
| <i>ln to</i>      | (7)  | -0.377 <sup>b</sup> | -0.471 <sup>a</sup> | 0.549 <sup>a</sup>  | -0.376 <sup>b</sup> | -0.402 <sup>a</sup> | 0.296 <sup>b</sup>  | 1                   |                     |                    |                     |                     |       |                     |
| <i>ln fd</i>      | (8)  | 0.554 <sup>a</sup>  | 0.505 <sup>a</sup>  | -0.221 <sup>a</sup> | 0.593 <sup>a</sup>  | 0.529 <sup>a</sup>  | -0.705 <sup>a</sup> | -0.227              | 1                   |                    |                     |                     |       |                     |
| <i>ln fdi</i>     | (9)  | 0.196               | 0.053               | 0.062               | 0.159               | 0.139               | -0.113              | 0.356 <sup>b</sup>  | 0.108               | 1                  |                     |                     |       |                     |
| <i>ln inf.</i>    | (10) | -0.189              | -0.255 <sup>c</sup> | 0.403 <sup>a</sup>  | -0.242              | -0.216              | 0.356 <sup>b</sup>  | 0.284 <sup>c</sup>  | -0.619 <sup>a</sup> | 0.256 <sup>c</sup> | 1                   |                     |       |                     |
| <i>ln exc.</i>    | (11) | 0.939 <sup>a</sup>  | 0.942 <sup>a</sup>  | -0.872 <sup>a</sup> | 0.957 <sup>a</sup>  | 0.963 <sup>a</sup>  | -0.924 <sup>a</sup> | -0.286 <sup>c</sup> | 0.524 <sup>a</sup>  | 0.109              | -0.258 <sup>a</sup> | 1                   |       |                     |
| <i>ln riv</i>     | (12) | 0.177               | 0.175               | -0.225              | 0.214               | 0.176               | -0.272 <sup>c</sup> | -0.249              | 0.454 <sup>a</sup>  | -0.162             | -0.331 <sup>b</sup> | 0.182               | 1     |                     |
| <i>ln cons.</i>   | (13) | 0.963 <sup>a</sup>  | 0.967 <sup>a</sup>  | -0.915 <sup>a</sup> | 0.955 <sup>a</sup>  | 0.980 <sup>a</sup>  | -0.874 <sup>a</sup> | -0.431 <sup>a</sup> | 0.417 <sup>a</sup>  | 0.121              | -0.171              | 0.927 <sup>a</sup>  | 0.107 | 1                   |
| <i>ln edu.</i>    | (14) | -0.684 <sup>a</sup> | -0.655 <sup>a</sup> | 0.525 <sup>a</sup>  | -0.648 <sup>a</sup> | -0.694 <sup>a</sup> | 0.510 <sup>a</sup>  | 0.081               | 0.051               | -0.238             | -0.191              | -0.672 <sup>a</sup> | 0.149 | -0.742 <sup>a</sup> |

**Note:** - a, b, c indicate significance at 1%, 5% and 10% respectively.

From Table (2) the data clearly demonstrates a robust, statistically significant inverse correlation at 1% between poverty and income inequality in Egypt, with a correlation coefficient of 96.4%. This implies that an increase in income inequality in Egypt inevitably leads to a decrease in the poverty rate, and vice versa. This correlation runs counter to the general finding of a positive correlation between the two variables, which was previously explained in the previous section. We also find very strong positive correlations between per capita income and the stock of physical capital, which is equivalent to (99.5%), the human capital quantity(98.8%), and inequality (97.6%), compared to a strong inverse correlation with poverty (-91.3%).

Given that the general upward trend in per capita output in Egypt is accompanied by a general upward trend in income inequality, and a general downward trend in poverty. Therefore, the link between the poverty rate and growth is logical and consistent with the economic literature, and from here we discover something interesting income inequality in Egypt, which leads to higher income and a decrease in poverty rates.

#### 4.3) EMPIRICAL METHODOLOGY

We can study a system of two equations using the usual rank and order conditions, and it becomes clear that the two equations over identify each other. In general, we can use several methods to estimate a system of simultaneous equations, but we will adopt the three-stage least squares (3SLS) method to estimate the current simultaneous model. This method considers the entire statistical modeling of the other equations in the model when estimating each equation, hence its name. Of course, the complete information method outperforms the two-stage least squares (SLS) method, also known as the missing information method, as it does not consider the mathematical form of the remaining equations in the model when estimating each equation. It is also known that 3SLS is more efficient than 2SLS because it allows for correlations between unobserved errors across the different equations and constraints between the coefficients of the different equations, thereby improving the efficiency of estimation by taking into account the calculation of these correlations across the equations. (Wooldridge, 2002), and given that 3SLS has the same assumptions as the OLS method and therefore all variables in the model need to be stationary.

Accordingly, unit root tests were conducted and the results (see Tables CB in the appendix) were conducted. The results indicate that half of the variables are stationary at the level, i.e. (0)1, and the other half are stationary at the first difference, i.e. (1)1. After (Gujarati & Porter (2004, p. 820) the variables differ when estimating the system of simultaneous equations

## 5) ECONOMETRIC ANALYSIS AND RESULTS

**5.1) Econometric analysis:** The following table (3) shows the results of the standard analysis of the present study model, which aims to explore the links between growth, inequality and poverty. From equation (1), it is clear that there is a direct negative impact of poverty and income inequality on Per capita real output in Egypt, Increasing the logarithm of the Gini coefficient by one degree will lead to a decrease in the logarithm of real output per capita by 1.561 pounds on average, while increase in the population living below the line of Poverty of \$1.9 per day by 1% will lead to a decrease in the logarithm of real output per capita by 0.053 pounds on average. In the opposite direction, equation (2) shows a positive impact on real output per capita and negative for poverty on the Gini coefficient by 0.005 degrees on average , While equation (3) shows a negative effect of the Gini coefficient on the poverty rate in Egypt, while income had no effect on the poverty rate.

**Table (3): Gini index, Poverty and Economic growth in Egypt: Empirical results:**

| Variable                         | Equation (1)              | Equation (2)          | Equation (3)           | Equation (4)            | Equation (5)            |
|----------------------------------|---------------------------|-----------------------|------------------------|-------------------------|-------------------------|
|                                  | <i>ln RGDP per capita</i> | <i>ln Gini index</i>  | <i>ln Poverty</i>      | <i>ln Capital stock</i> | <i>ln Human Capital</i> |
| <i>ln RGDP per capita (-1)</i>   | 0.6307<br>[ 8.571]***     |                       |                        |                         |                         |
| <i>ln Gini index (-1)</i>        |                           | 0.6211<br>[ 9.668]*** |                        |                         |                         |
| <i>ln Poverty (-1)</i>           |                           |                       | 0.5615<br>[ 4.931]***  |                         |                         |
| <i>ln Human Capital (-1)</i>     |                           |                       |                        |                         | 0.8781<br>[ 41.34]***   |
| <i>ln RGDP per capita</i>        |                           | 0.0204<br>[ 2.308]**  | -0.1148<br>[-0.383]    |                         | 0.0874<br>[ 7.527]***   |
| <i>ln Gini index</i>             | -1.5605<br>[-3.332]***    |                       | -11.037<br>[-3.242]*** | 0.8336<br>[ 3.738]***   | 0.0050<br>[ 4.063]***   |
| <i>ln Poverty</i>                | -0.0531<br>[-4.186]***    | -0.0051<br>[-2.587]** |                        |                         |                         |
| <i>ln Capital stock</i>          | 0.2722<br>[ 4.564]***     |                       |                        |                         |                         |
| <i>ln Human Capital</i>          | -0.0487<br>[-0.462]       | 0.0260<br>[ 1.567]    |                        | 2.8212<br>[12.95]***    |                         |
| <i>ln TFP</i>                    | 0.4969<br>[ 6.871]***     |                       |                        | -1.1993<br>[-5.695]***  | -0.0031<br>[-0.278]     |
| <i>ln Trade openness</i>         | 0.0434<br>[ 2.944]***     | -0.0009<br>[-0.404]   |                        |                         |                         |
| <i>ln financial depth</i>        | 0.0062<br>[ 0.466]        |                       |                        | 0.0699<br>[ 1.605]      |                         |
| <i>ln FDI, net inflows</i>       |                           | 0.0029<br>[ 3.040]*** |                        |                         |                         |
| <i>ln Inflation</i>              |                           |                       | 0.0967<br>[ 2.697]***  |                         |                         |
| <i>ln Official exchange rate</i> |                           |                       | 0.2034<br>[ 4.259]***  |                         |                         |
| <i>ln Real interest rate</i>     |                           |                       | -0.0305<br>[-0.999]    |                         |                         |
| <i>ln Consumption per capita</i> |                           |                       | 0.2009<br>[ 0.685]     |                         |                         |
| <i>ln Education expenditure</i>  |                           |                       |                        |                         | 0.0140<br>[ 2.095]**    |
| <i>Constant</i>                  | 5.9174<br>[ 3.498]***     | 1.2284<br>[ 4.768]*** | 41.245<br>[ 3.669]***  | 8.1466<br>[ 1.929]*     | -0.7874<br>[-2.671]***  |

**Note:** - \*\*\*, \*\* indicate significance at 1% and 5% respectively.

## 5.2) RESULTS

We are currently investigating numerous remarkable findings regarding the fundamental interconnections between variables, which can be explained in what follows:

**5.2.1)** The relationship between poverty and inequality; According to equations (2) and (3), there is a reciprocal/simultaneous relationship between inequality and poverty, and this reciprocal relationship is inverse, meaning that higher rates of income inequality lead to lower rates of poverty and vice versa. Inequality has a direct negative impact on poverty, only by a percentage of 11.037, as shown in equation (3).

On the other hand, poverty affects inequality both directly and indirectly. According to Equation (2), we find that poverty directly negatively affects inequality by 0.0051, while it indirectly positively affects it through the growth channel. According to Equation (1), a decrease in the poverty rate leads to a 0.0531 increase in income growth. Equation (2): A higher growth rate leads to a 0.0204 degree increase in inequality. Thus, poverty has a positive indirect effect on inequality through the growth channel of  $(0.0531 * 0.0204 = 0.0011)$  degrees on average. Thus, we explore that poverty has a net negative effect on inequality of  $(-0.0051 + 0.0011 = -0.004)$  degrees on average.

This result may seem at first glance illogical, despite its complete agreement with the correlation matrix, as the correlation coefficient between poverty and inequality was equal to (-96.46%). But this result is consistent with the structure of the Egyptian economy due to the significant decline in Egypt's stock of physical and human capital and its technological level, which is a mutual feature of most developing countries. It employs the strategy of attracting foreign and local investments by granting customs and tax exemptions and reductions and many other financial benefits, while preventing them from applying progressive taxes on incomes, as the most developing countries. Such policies make the distribution of income get worse in any country, but developing countries are forced to do so because they do not have any other advantages that they can offer to attract investments and thus accelerate the accumulation of capital stock. Egypt utilizes this to accelerate the process of economic growth and increase individuals' incomes by increasing the level of income inequality.

The state utilize the benefits of economic growth to fund education, health, and social protection programs, thereby stimulating many families to be above the poverty line, particularly the study's use low poverty line of 1.9 dollars per day, which is easily attainable. The study concludes that an increase in income inequality could potentially lead to a decrease in poverty levels in Egypt.

**5.2.2)** the relationship between inequality and growth, we notice from equations (1) and (2) that there is a reciprocal or simultaneous relationship between inequality and growth. Accelerating Egypt's economic growth leads to a more unequal distribution of income, as previously discussed. However, this increase in inequality also exerts pressure on the growth process, causing it to decline. Consequently, the structure of the growth process achieves a balance between growth and income distribution, resulting in stable changes in both growth and inequality levels over an extended period. What we observe in the Egyptian economic growth process is that there are no significant fluctuations, only a steady increase in growth rates. Inequality also has a direct negative effect on income growth by 1.5605 pounds, as shown in equation (1). However, it indirectly affects people through the poverty channel. According to equation (3), increasing inequality leads to a decrease in the poverty rate by 11.037. According to equation (1), a decrease in the poverty rate results in an increase in the income level by 0.0531 pounds. As a result, inequality has a positive indirect effect on growth of  $11.037 * 0.0531 = 0.5862$  pounds on average.

**5.2.3)** The relationship between poverty and growth: In equations (1) and (3), we discover that there is no direct relationship between the two variables, but we find There is only a one-way relationship between poverty and growth, meaning that lower poverty rates lead to higher economic growth, but this growth does not translate into a direct impact on poverty in the future. However, growth indirectly affects poverty via the inequality channel. According to equation (2), high growth leads to an increase in income inequality by (0.0204 degrees on average), whereas

in equation (3), an increase in inequality leads to a decrease in the poverty rate by (11.037) on average. Therefore, on average, growth has an indirect impact on poverty through income inequality of  $(0.0204 * 11.037 = 0.2252)$ .

Thus, we conclude that the structure and dynamics of the Egyptian economic growth process are deficient and weak. The Egyptian economy lacks the competitiveness to attract investments and accelerate economic growth, unless it receives encouragement. We reject inequality in income distribution by offering reductions or even exemptions from taxes and customs. Egypt aims to boost its investment appeal by implementing progressive taxes. Equation (2) confirms the positive effect of foreign direct investment flows on inequality in Egypt, while equations (4) and (5) confirm the positive effect of inequality on the accumulation of physical and human

## 6) CONCLUSION AND RECOMMENDATIONS

### 6.1) Conclusion:

6.1.1) there is a direct/simultaneous relationship between inequality and poverty, and this relationship is inverse, meaning that higher income inequality leads to lower poverty rates and vice versa. On the other hand, poverty affects inequality indirectly. We find that poverty directly affects inequality negatively, while indirectly it affects it positively through the growth channel. Poverty has a net negative effect on inequality.

6.1.2) there is a reciprocal relationship between inequality and growth. Accelerating economic growth in Egypt leads to more misdistribution of income, as inequality has a negative impact on growth/income directly. On the other hand, it has a positive impact indirectly through the poverty channel, as increasing misdistribution of income leads to a decrease in the poverty rate, and a decrease in the poverty rate leads to an increase in the income level, and thus inequality has a positive indirect impact on growth. Inequality has a net negative impact on economic growth.

6.1.3) there is a direct, one-way relationship from poverty to growth. That is, a reduction in poverty leads to higher economic growth rates, but this growth does not translate into a direct impact on poverty in the future. Rather, growth affects poverty indirectly through the inequality channel, where higher growth leads to higher income inequality among the poor, while higher income inequality leads to lower poverty.

**6.2) Recommendations:** Based on the findings, the study recommends that if the goal of development is to reduce poverty, growth strategies must be accompanied by policies to address the persistent inequalities that keep people in poverty from generation to generation. Distribution is able to bridge the gap between the poor and the rich in the country. The focus should be on programs that target improving living conditions - to drive growth, raise average incomes, create jobs, fully integrate women and youth into economies, address environmental and climate challenges and invest in human capital development through education which would reduce poverty levels by improving the skills and incomes of the poor in Egypt.

Supportive policies play a critical role in tackling poverty and inequality in the development process, encompassing the following four fundamental components:

**6.2.1) Fixing price distortions in factors of production:** In order to ensure that market prices accurately provide indications and incentives for producers and suppliers, a policy seeks to correct price distortions, such as undervaluation of capital or overvaluation of skilled wages. This process leads to increased productivity, employment, and reduced poverty. It may also be advantageous to encourage indigenous technological research and labor-intensive production methods.

**6.2.2) Implementing significant structural changes in the distribution of assets, power, and access to education and employment opportunities,** structural changes involving social, institutional, cultural, and political aspects whether immediate through public-sector interventions or gradual, through redistribution from growth can significantly improve the living conditions of rural and urban poor in developing countries



**6.2.3) Alter the income distribution among higher income brackets:** A policy or set of policies that are intended to alter the size distribution of income at the upper levels by enforcing legislated progressive taxation on incomes and wealth, and at the lower levels by expanding the provision of publicly provided consumption goods and services, including workfare programs, and direct transfer payments. The overall result is the establishment of a social "safety net" for individuals who may be overlooked during the development process.

**6.2.4) Enhance the welfare of poor individuals and their communities** by implementing programs that foster the development of skills, knowledge, and social connections. Governmental or non-governmental groups can implement these policies with the assistance of local and international support.

This research adds to the body of knowledge that has empirically evaluated the poverty-growth-inequality triangle in Egypt and reveals that in order to reduce poverty in Egypt, both economic growth and income distribution policies must be targeted.

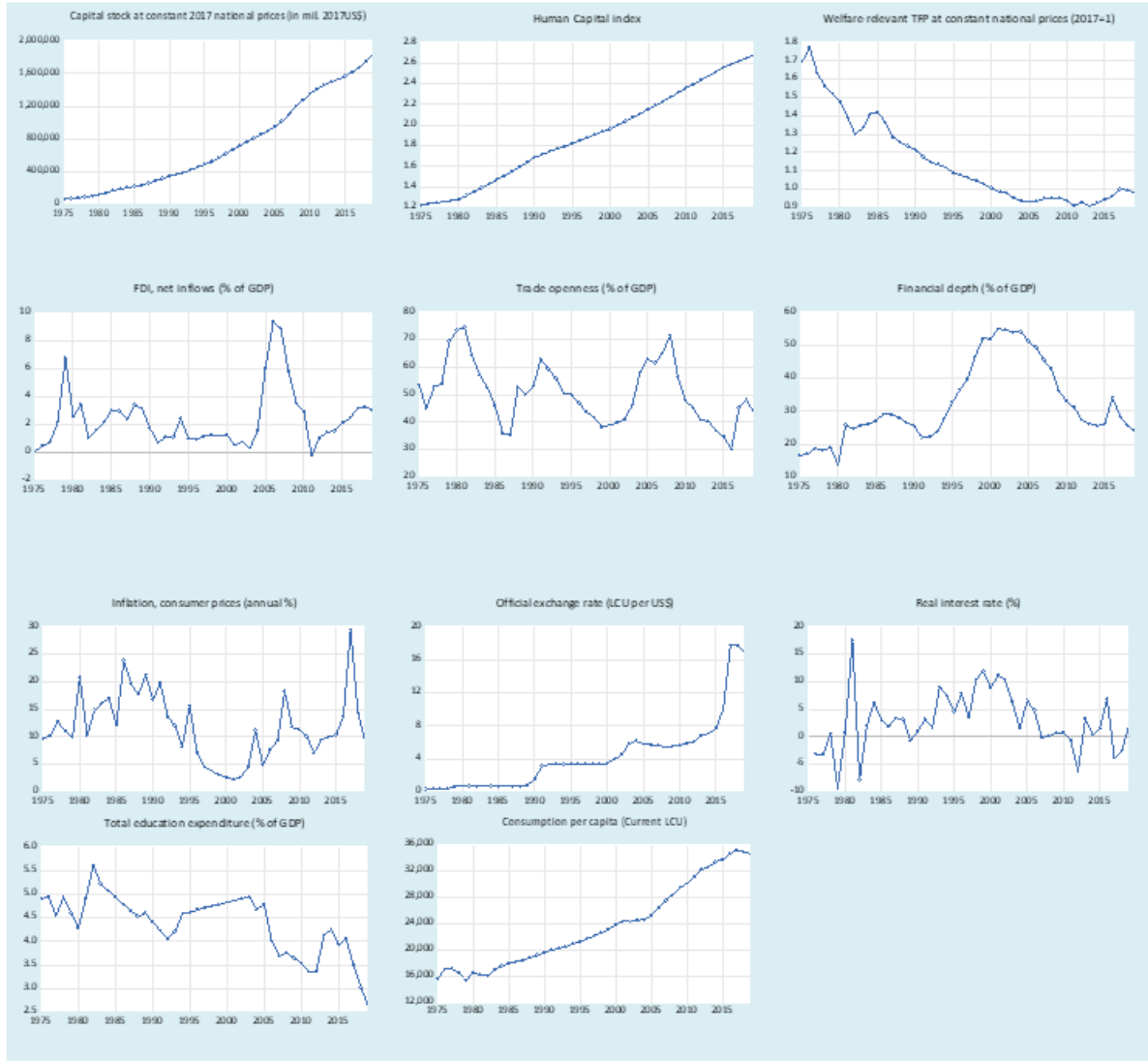
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**APPENDIX:**



**Figure (A): Variables trend during the period, 1975 – 2019**

**Table (A): Unit root test results using Augmented Dickey-Fuller (ADF)**

| Variables                        | Level, $I(0)$         |                      |                    | First difference, $I(1)$ |                       |                     |
|----------------------------------|-----------------------|----------------------|--------------------|--------------------------|-----------------------|---------------------|
|                                  | Intercept             | Intercept & trend    | None               | Intercept                | Intercept & trend     | None                |
| <i>ln</i> RGDP per capita        | -1.5732<br>(0.487)    | -2.7886<br>(0.209)   | 2.5657<br>(0.997)  | -4.8385<br>0.000***      |                       |                     |
| <i>ln</i> Gini index             | -1.3715<br>(0.587)    | -2.8874<br>(0.177)   | 1.9121<br>(0.985)  | -3.5068<br>(0.013)**     |                       |                     |
| <i>ln</i> Poverty                | -1.9551<br>(0.305)    | -3.7920<br>(0.027)** |                    |                          |                       |                     |
| <i>ln</i> Capital stock          | -2.4818<br>(0.127)    | -1.8860<br>(0.644)   | 1.2482<br>(0.944)  | -1.9997<br>(0.286)       | -2.7567<br>(0.221)    | -1.6355<br>(0.096)* |
| <i>ln</i> Human Capital          | -2.0297<br>(0.274)    | -2.4245<br>(0.362)   | 0.0506<br>(0.694)  | -2.0299<br>(0.273)       | -7.4929<br>(0.000)*** |                     |
| <i>ln</i> TFP                    | -3.5896<br>(0.010)**  |                      |                    |                          |                       |                     |
| <i>ln</i> FDI                    | -3.3432<br>(0.019)**  |                      |                    |                          |                       |                     |
| <i>ln</i> Trade openness         | -3.3301<br>(0.019)**  |                      |                    |                          |                       |                     |
| <i>ln</i> Inflation              | -2.4235<br>(0.141)    | -2.4794<br>(0.336)   | -0.6039<br>(0.450) | -8.4679<br>(0.000)***    |                       |                     |
| <i>ln</i> Real interest rate     | -5.8464<br>(0.000)*** |                      |                    |                          |                       |                     |
| <i>ln</i> Education expenditure  | 0.0792<br>(0.961)     | -1.9840<br>(0.593)   | -1.2593<br>(0.188) | -5.0497<br>(0.000)***    |                       |                     |
| <i>ln</i> Consumption per capita | 0.6856<br>(0.991)     | -3.9606<br>(0.018)** |                    |                          |                       |                     |
| <b>Critical Values</b>           | <b>ADF</b>            |                      |                    | <b>PP</b>                |                       |                     |
| 1%                               | -3.7696               | -4.4407              | -2.6743            | -3.7529                  | -4.4163               | -2.6694             |
| 5%                               | -3.0049               | -3.6329              | -1.9572            | -2.9981                  | -3.6220               | -1.9564             |
| 10%                              | -2.6422               | -3.2547              | -1.6082            | -2.6388                  | -3.2486               | -1.6085             |

Note: - \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% respectively.

**Table (C): Unit root with Breakpoint test results:**

Break Type: *Innovational outlier*

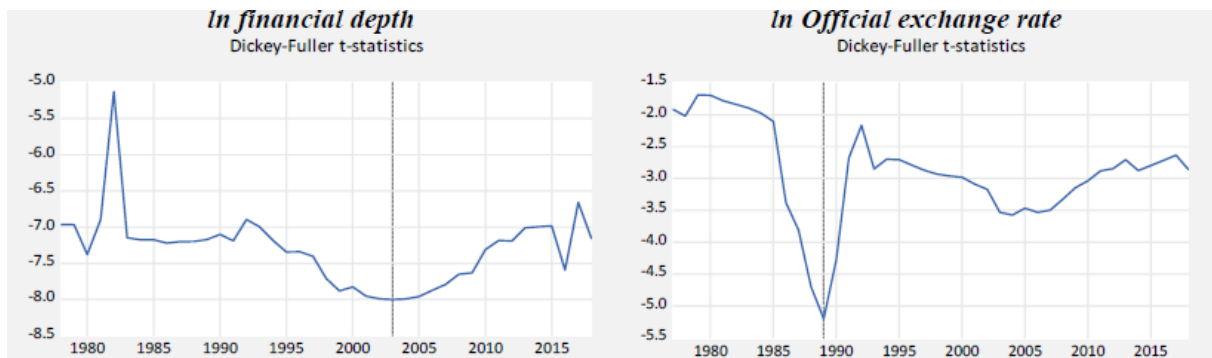
| Variables                        | Level, $I(0)$      |                      | First difference, $I(1)$ |                   | Year of Break |
|----------------------------------|--------------------|----------------------|--------------------------|-------------------|---------------|
|                                  | Intercept          | Intercept & trend    | Intercept                | Intercept & trend |               |
| <i>ln</i> financial depth        | -2.7375<br>(0.816) | -2.4504<br>(0.986)   | -8.0001<br>(0.000)***    |                   | 2003          |
| <i>ln</i> Official exchange rate | -2.8878<br>(0.745) | -5.1986<br>(0.018)** |                          |                   | 1989          |
| <b>Critical Values</b>           | <b>Level</b>       |                      | <b>First difference</b>  |                   |               |
| %1                               | -4.95              | -5.72                | -4.95                    | -5.72             |               |
| %5                               | -4.44              | -5.18                | -4.44                    | -5.18             |               |
| %10                              | -4.19              | -4.89                | -4.19                    | -4.89             |               |

Note: - \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% respectively.

**Table (B): Unit root with Breakpoint test result**

| Variables                        | <i>Level, I(0)</i>  |                      | <i>First difference, I(1)</i>  |                   | Year of Break |
|----------------------------------|---------------------|----------------------|--------------------------------|-------------------|---------------|
|                                  | Intercept           | Intercept & trend    | Intercept                      | Intercept & trend |               |
| <i>ln financial depth</i>        | -2.7375<br>(0.816)  | -2.4504<br>(0.986)   | -8.0001<br>(0.000)***          |                   | 2003          |
| <i>ln Official exchange rate</i> | -2.8878<br>(0.745)  | -5.1986<br>(0.018)** |                                |                   | 1989          |
| <b>Critical Values</b>           | <b><i>Level</i></b> |                      | <b><i>First difference</i></b> |                   |               |
| %1                               | -4.95               | -5.72                | -4.95                          | -5.72             |               |
| %5                               | -4.44               | -5.18                | -4.44                          | -5.18             |               |
| %10                              | -4.19               | -4.89                | -4.19                          | -4.89             |               |

**Note:** \*\*\*, \*\*, \* designate significance at 1%, 5% and 10% respectively.



**Figure (B): Unit root with Breakpoint test graph**