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The impact of government expenditure on education on income inequality in the MENA region: Panel analysis on the period from 1990 to 2017.

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Abstract

This paper examines the impact of government education expenditure on income inequality in selected MENA countries from 1990 to 2017. The pooled OLS model utilized in the study showed a positive relationship between government education expenditure and income inequality, measured by the Gini index. The findings came at odds with most of the reviewed literature. The findings of the study and reviewed literature could indicate how complicated is the relationship between government education expenditure and income inequality, specifically in the MENA region and Turkey. It is observed that the MENA and Turkey are among the lowest income inequalities. Furthermore, the findings of this paper might be asserted by other researches that argued how other factors might have critical effects on income inequality.

Keywords: Education, Income inequality, Gini index, MENA, Turkey

JEL Classification: I24, H52, D63, C32, D31

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List of Abbreviations

CPI: Consumer price index.

EXP: Government expenditure on education, total (% of GDP).

GINI: GINI index.

HDI: Human Development Indicator.

IMF: International Monetary Fund.

LGINI : Lagged Gini variable.

MDGs: Millennium Development Goals.

MENA: Middle East and North Africa.

POPD: Population density (people per sq. km of land area).

PRIM: Primary school enrollment.

SDGs: Sustainable Development Goals.

SEC: Secondary school enrollment.

TERT: Tertiary school enrollment.

USA: United States of America.

WDI: World Development Indicators.

Chapter 1: Introduction

The issue of unequal distribution of income is a significant concern for various individuals in any given society, including economists and government representatives. Income inequality is defined as the degree to which income is distributed equitably among a population (IMF, 2020). Verme et al. (2014) have demonstrated that the factors influencing income inequality can be classified into two primary categories: the ability and the opportunity to derive income, where education is a key factor that affects both of these categories. Furthermore, Wan and Zhou (2004) have argued that income inequality can be attributed to variables that impact the ability of income generation within a household. This ability to generate income is asserted by human capital and production theories, and is shaped by factors such as health, education, employment, economic status, and the utilization of physical capital (Wan & Zhou, 2004).

Income inequality on the global level has been generally increasing across time, for instance, in the OECD region, there has been an increasing trend since the 1980s (Cingano, 2014). In the USA, the income inequality trend has been increasing since the 1980s as well as through the following four decades (Horowitz et al., 2020). South Asia has historically had moderate income inequality, however, it has been increasing since the early 1990s. In the 1980's, East Asia was the region with the lowest inequality but it has steadily been deteriorating through time (Ravallion, 2014). As for the Middle East and North Africa region [1]and Turkey [2], the findings of Alvarado et al. (2019)[3] show that the region is the most unequal, where they found great income concentrations in the top 1% and 10% income shares compared to other regions and countries, such as: Western Europe, USA, India, etc, and within the MENA and Turkey, there exhibited a huge income gap when comparing among the various income classes in the region. A widely held belief is that education may play a major role in reducing economic disparity (Carnoy, 1975). Human capital theories suggest that income inequality arises due to disparities in investment in human capital among various income groups. Typically, low-income groups invest

[1] According to the World Bank (2021a) the Middle East and North Africa region (MENA) consists of 21 countries which are: Algeria, Jordan, Qatar, Bahrain, Kuwait, Kingdom of Saudi Arabia (KSA), Djibouti, Lebanon, Syrian Arab Republic, Egypt, Arab Rep., Libya, Tunisia, Iran, Islamic Rep., Malta, United Arab Emirates, Iraq, Morocco,West Bank and Gaza, Israel, Oman, Yemen Republic.

[2] According to the World Bank (2021a), Turkey is in the region (Europe and Central Asia).

less in their human capital than high-income groups. Government interventions such as subsidizing investments in human capital, which is represented by government education expenditure, could help reduce income inequality among different income groups (McConnell et al., 1986; etc.).Thus, measuring the effect government education expenditure has on income inequality is essential to understand how policymakers might want to influence income distribution.

Although several studies had established a link between government expenditure on education and income inequality, the direction of this relationship was still subject to debate. The findings of the literature were inconclusive as the majority of the literature found that increasing government expenditures on education declined income inequality, however, some of these literature findings had increasing effects, and the minority found that there was no relationship between government expenditures and income inequality. These variations were due to several factors, including differences in the study region, methodologies, and limited availability of data. These qualitative factors were often considered error terms or limitations that needed to be addressed to obtain results that are more accurate.

The reason this paper focused on the MENA region is that analyzing government expenditure in the region is to gain insights into how governments could address this challenge and whether government education expenditures are effective in reducing income inequality or not. By examining this relationship in this region, this paper can offer insights into government education expenditures and how that macroeconomic variable contributes to income inequality. In order to identify potential solutions to this complex and pressing issue.

This paper have selected the period from 1990 to 2017 for this study due to data availability that would allow for a decent quantitative analysis. In December 2000, the United Nations established the Millennium Development Goals (MDGs), which aimed to reduce illiteracy, poverty, and discrimination. In 2015, the Sustainable Development Goals (SDGs) were established, consisting of 17 objectives aimed at reducing inequalities, improving education quality, enhancing living standards, and promoting economic growth through innovation. To analyze the relationship between government expenditures on education and income inequality, a pooled OLS regression model will be employed since the data extracted is panel data. This study aims to create a model that accurately captures the impact of government education expenditure

on income inequality in the MENA region. By utilizing this model, decision-makers can gain a better understanding of how government education expenditure can be used to influence income inequality. However, if the model shows that the relationship is not significant, it can be used to test the significance of other explanatory variables on income inequality.

This paper is structured as follows. Chapter 2 provides a literature review that delves into the theoretical framework of this study and then discusses both theoretical and empirical literature on the relationship between government expenditures and income inequality. Chapter 3 reviews the evolution of income inequality and government expenditure on education through time in the MENA region. Chapter 4 covers the empirical assessment of the impact of government education expenditure on income inequality. Finally, Chapter 5 presents the conclusion and policy recommendation.

Chapter 2: Literature Review

Income inequality is a real obstacle to reaching development and economic growth in any country, as increased income inequality levels negatively affect economic growth (Panizza, 2002) as Mo (2000) articulated "the effects of income inequality penetrate every aspect of an economy which significantly reduces efficiency and hence the rate of productivity growth". Therefore, studying income inequality should be through a quantifiable economic variable that capture the dimensions of income inequality. Reviewing the most recent and relevant literature, this study found that the GINI Index is the most appropriate tool to measure changes in income inequality, as it's the most known index to measure income inequality and the most available one. Sylwester, K. 2002; Behr, T., Christofides, et al. 2004; Köse, S., & Güven, A. 2007; Anderson, E., et al. 2017; Olupona, T. 2018; Seefeldt, B. 2018; Jianu, I. 2020).

According to Kaasa (2003) the factors affecting income inequality, are about 14 variables that explain the variability of 68.6% of the GINI index. These variables are; unemployment, inflation, government expenditure on education and health as a percentage of GDP, school enrolment (primary), growth of population, population density, etc.Vazquez et al. (2012) was studying the impact of expenditure policies on income distribution. The study defined some other bundle of variables that affect income inequality, which include; the extent of corruption, population

growth, age dependency, the level of globalization, GDP per capita growth, unemployment, education level, and the size of government, etc.

The studies that show the significance of government expenditures on education on income inequality were extensively abundant, but their results are inconclusive due to differences in the predictors used and the adopted measure of income inequality. Furthermore, the structure of government expenditure on education differ in each region.

This study reviewed the existing literature by grouping the findings of most of the studies that discussed the relationship between government expenditures on education on income inequality, in order to reflect the debate on the topic from several points of view. In the upcoming section, the theoretical framework underpins the relationship between government expenditure on education and income inequality. Subsequently, in section 2.2 and section 2.3, this paper focuses on the existing theoretical and empirical studies that explored this relationship. This section also discusses the direction and significance of the relationship between government expenditure on education and income inequality.

2.1 Theoretical Framework

The theoretical underpinning of this study is the human capital theory framed by Schultz (1963). According to Schultz (1963) if expanding human capital through education is growing more rapidly than physical capital, then it is expected that the overall income inequality may be alleviated, as income from physical capital property (physical capital property such as land or a factory) is assumed to be more unequally distributed than income from human capital. In addition, Schultz (1963, p. 65) stated: “changes in the investment in human capital are a basic factor reducing the inequality in the personal distribution of income”. Shultz referred to the situation where an individual's real income increases by investment in human capital through more acquisition of knowledge and skills that has economic value. For example, training that enhances human knowledge or services that support human education can be considered significant human capital investments.

One of the scholars that used the human capital theory that has been proposed by Schultz (1963) in predicting the relationship between education expansion and income inequality was Ram (1989) who stated that Schultz's argument does not always hold true in reality, and may not

provide a clear prediction of the impact of education on income inequality. Since the relationship between education and income is much more complex and depends on a variety of factors, including the distribution of educational opportunities, the structure of the labor market, and the broader economic and social context. Additionally, Ram (1989) claimed that despite theoretical and empirical uncertainties, education could still be a good balancing tool if educational policies reflect a reduction in schooling inequality, where education has the rare property of acting as both an equalizer and a growth accelerator.

Complementary to Shultz's human capital model (1963), McConnell et al. (1986) argued that government expenditure on education could decrease income inequality by reducing disparities in human capital investment, where individuals from high-income families face a low cost of borrowing funds for their education, thus having more chances to increase their schooling and earnings abilities. Whereas individuals from poor families face a high cost of borrowing for their human capital investment leading to them having lower levels of schooling and lower earning abilities. Therefore, the result is an earning inequality between the two income classes. McConnell et al. (1986) believed that the government might have to intervene by subsidizing education in order to make a balance between the two classes and avoid income inequality. Intuitively, such a view of the role of government education expenditure in generating more income equality is appealing (Sylwester, 2000).

As a conceptual framework, this paper used government expenditure on education as a reflection of subsidizing human capital investment and its effect on income inequality measured by the Gini coefficient. However, there exist other used measures of income inequality including the Theil index, Atkinson index, Palma ratio, and Percentile ratios. Each measure has its limitations and can provide different insights into income distribution. The choice of measure is determined by the research question and data availability.

Starting with the most commonly used Gini coefficient, it measures the ratio of high-income earners to low-income earners by calculating the gap between the Lorenz curve (a graphical representation of the distribution of income) and the line of perfect equality. However, it does not convey the complete picture of income inequality. For instance, in a developing nation, the Gini index may climb while the number of people living in absolute poverty drops. Analogously, the Palma ratio compares the percentage of income earned by the top 10% of earners to the rate

of income earned by the bottom 40%. Similarly, the Percentile ratio or the 90-10 ratio compares the incomes of those at the top and bottom of the income distribution. Another measure of income inequality is the Theil index, which accounts for inequality within and between income groups, precisely dividing the overall inequality into two components: one that measures inequality within the group and one that measures inequality between groups. The Atkinson index is another measure of income inequality, focusing on income distribution among the poor and adding the concept of social justice by averaging the percentage reductions in income required to make the distribution of income among the poor exactly equal (Mellor, 1990;Cowell, 2011; Atkinson, 2015; Trapeznikova, 2019).

2.2 Theoretical Literature Review

According to various human capital theoretical models that are developed during the last decades by Mincer (1958), Schultz (1963), Becker & Chiswick (1966), Romer (1986), McConnell et al.(1986), Lucas (1988), and Lee & Lee (2018), most income disparities are driven by differences in the quantity of human capital invested, which is represented in the disparities of the qualification levels among labor market employees. Assuming that employers frequently choose to recruit workers with higher qualifications which impacts labor demand and, as a result, income distribution. This increase in the demand for highly qualified workers leads to an increase in wages for these workers. Conversely, a fall in the demand for low-qualified workers leads to lower wages for these workers. As a result, income inequality emerges. However, in order to avoid income inequality peaks, Mincer (1958), Schultz (1963), Becker & Chiswick (1966), Romer (1986), McConnell et al. (1986), Lucas (1988), and Lee & Lee (2018) claimed that governments should subsidize human capital investment so that individuals or groups can easily maximize their welfare by investing a reasonable amount in human capital. Thus, the overall trend of investing in human capital causes wage disparities to narrow and increase the population of qualified workers as well. Subsequently, greater investment in human capital will thereby reduce human capital inequality and, as a result, reduce income disparity.

Furthermore, Glomm & Ravikumar (1992), Saint-Paul & Verdier (1993), and Zhang (1996) conceptual models argue that financing public education increases human capital accumulation in the economy thus alleviating income disparities. Notwithstanding, private education may yield higher per capita income but has no distributional effect, where private education systems tend to

devote more time to the accumulation of human capital than public education systems, which implies that students in private education systems may have more opportunities to develop the skills and knowledge that contribute to higher income potential. However, this benefit is not evenly distributed across the population. In other words, private education may benefit some people more than others, depending on whether they have access to and can afford private education or not. Which is not the case for the public education system as it provides equal opportunities for all individuals to develop their human capital regardless of their background or financial resources.

Conversely, Psacharopoulos (1985) and Carnoy (2011) assumed that the relationship between income inequality and educational investment was proportional, such that higher investment would lead to higher income inequality. Since educational investment at any level of education is heavily reliant on governmental spending policies and investment policies. Additionally, this relationship is part of a more complex relationship between education and economic growth, as well as between economic growth and income distribution. Assuming that the state makes uneven investments in distinct levels of education with the aim of attaining economic growth that aligns with greater income inequality. For instance, if the societal rate of return on investment in higher education is higher than the societal rate of return on investment in primary education, an optimal (for growth) investment strategy in education may result in greater income inequality in the short and medium term, keeping other factors constant.

Shifting to Knight & Sabot's (1983) and Thurow's (1975) & Miller's (1960) theoretical models, which proposed a complex and dynamic relationship between education and income inequality, due to various reasons like; the variability in the demand and supply of educated workers. Where in the long term, demand for highly educated workers is expected to decrease income disparity, but in the short run, both demand and supply shift, resulting in an unchangeable income position for such workers. As the demand for such workers kept pace with the increased supply (Miller, 1960).

There are two opposing effects on income distribution: first, the composition effect, which reflects the influence on income inequality by a change in the educational composition of the labor force. When educational inequality increases, the wage distribution initially widens with education expansion, as more people progressively earn higher incomes. However, income

inequality eventually falls as fewer uneducated people remain or are left without an education. In addition, when returns to education are higher for less educated individuals. Second is the compression effect of human capital accumulation, which reflect the narrowing of the wage distribution due to the increase in the supply of educated labor. Impling that when the supply of educated labour exceeds the demand for educated labour, as a result of educational expansion, the advantage of educated workers fades over time and wage disparities narrow (Knight and Sabot, 1983). Furthermore, if the distribution of job opportunities does not change and more people are educated, the newly educated workers will get jobs at the expense of those who do not receive additional schooling. As a result, income distribution approaches equality (Thurow, 1975).

Sylwester's (2002) and Artige & Cavenaile's (2023) models both assure a complex theoretical relationship between income inequality, public education, income, human capital, and economic growth. Whereas growth is determined by the level of public education spending and the form in which human capital is distributed. The effect of public education expenditure on income inequality may differ across countries due to differences in human capital investments and the method by which public education spending is funded. For instance, public education funded by progressive taxes may exacerbate rather than eliminate income inequality.

Furthermore, Kuzents (1955) formed hypotheses of an inverted U-curve stating that countries during their stages of development would experience a "U-shaped" pattern of income inequality, with a relative increase in income inequality followed by a drop as the countries experience economic growth and become more developed. While Kuznets's hypotheses (1955) were originally focused on the relationship between economic growth and income inequality, some scholars, including Schultz (1960), De Ferranti (2004), and López-Calva & Lustig (2010) have argued that education can play a key role in shaping the relationship between economic development and income inequality. Schultz (1960) argued that investments in education can help to accelerate the transition from the rising phase of the Kuznets curve to the falling phase, by increasing the productivity and earning potential of workers and reducing the skill premium that contributes to income inequality.

Moreover, De Ferranti (2004) and López-Calva & Lustig (2010) argued that with the turning point occurs at the middle-income stage of development. Countries in their low-income stage of

development would experience a rise in income disparity since governments in those emerging economies offer poor education services and lower support to education, limiting access to education among individuals in the labor market. Individuals who possess advanced degrees or specialized skills frequently receive higher incomes when compared to those with lower levels of education. As economies advance towards higher-income stages, governments typically allocate increased resources towards education and enhance their educational systems in order to mitigate income inequality. This approach enables all members of society to gain access to the requisite skills and knowledge necessary to fully participate in the economy, thereby enhancing their capacity to earn higher incomes.

2.3 Empirical Literature Review

In many nations and regions of the world according to several studies, there is strong evidence that government spending on education tends to reduce income disparity (Sylwester, K. 2000; Behr et al., 2004; Duman, 2008; Seefeldt, 2018; etc.). Nevertheless, the consensus is that the connection between government expenditure and income inequality is complicated, and many concerns have been raised towards the efficiency of government spending on education as a tool for redistributive policy (Stiglitz, J., 1973). In this section, this paper shows the empirical literature's findings according to the significance and the direction of the relationship.

Numerous studies, for example, have found a negative significant relationship between government education spending and income inequality (Sylwester, K. 2000; Behr et al., 2004; Duman, 2008; Seefeldt, 2018; Jianu, 2020; Anderson et al., 2017; Qazi et al., 2010; and others). However, some of those studies have explained that the negative significance may vary between investments in different levels of education from primary to tertiary or higher education whereas spending on higher education has the highest impact on reducing income inequality (Duman, 2008; Seefeldt, 2018; Panton-Ntshon, 2021; Qazi et al., 2010).

Sylwester, K. (2000) argued that if the attendance rate was low in the United States of America (USA) or American primary schools, the government expenditures on the education sector will have an insignificant effect on income inequality, moreover, it could even lead to higher income inequality. According to Duman, A. (2008), which focused on Turkish education impact on income inequality between 1963-2005, public spending should be concentrated on primary and

secondary schooling, as the public spending in primary and secondary in Turkish schools was well below the average of OECD countries, while public spending on tertiary education was relatively high. It could be argued that individuals will join higher education, while they do not finish their primary and secondary schooling. Therefore, to impact income inequality negatively in Türkiye government expenditures on education should be restructured. Accordingly, Duman, A. (2008) argued that the "Turkish government is not investing sufficiently into education". While in Pakistan, government spending on education influences income inequality only in the short run, however; the relationship seems insignificant in the long run Qazi, P. et al. (2010). De Gregorio & Lee, (2002) finds that government social spending contributes to an equal distribution of income. However, cross-country variation in income inequality remains unexplained due to a lack of data. Moreover, According to Keller, K. R. I. (2010) "expenditures per student in primary education highly significantly improve income distribution especially globally and for less developed". Implying the collective impact of decreasing income inequality would appear even more globally. Others clarified that according to their findings that public education expenditure can promote development within the nation by contributing to human capital thus reducing income inequality (Köse, 2007).

On the other hand, a number of studies argued that government education expenditures have a positive impact on income inequality (Bishop et al., 1992; Verdugo et al., 2011). Bishop (1992) disregarded income inequality measures and focused on the Lorenz curve itself. Bishop et al.'s most critical finding was that, if all other factors are held constant, higher educational expenditure in a particular state is associated with states that have income inequality higher than the average of the rest of the states. Additionally, the study found that the coefficient for the education expenditure is the largest for middle and upper-middle-income groups backing his results returns by Alchain's hypotheses (1968), which pointed to the distribution of costs and benefits of education expenditure. As more rich people benefit from education expenditure than poor people, a positive shift in income inequality appears where more impoverished families are under-represented in higher education. More generally, the benefits of education are primarily captured by those who receive it, as their incomes are higher than they would otherwise be without redistribution. In the sub-Saharan region, Panton-Ntshona (2021) found that government expenditure on the education sector would lead to higher income inequality due to inefficiencies of government spending on education. As the government spending on education is not allocated

"to the educational levels of the highest proportions of the population". Panton-Ntshona (2021) was referring to primary and secondary levels of schooling where more people are enrolled in those levels and improvement in those levels would allow more people to qualify for higher education. Furthermore, Olupona, T. (2018) using panel data across 145 countries, finds that the relationship is positive in low and high-income countries, as his findings are partially consistent with Kuznets (1955).

A third strand of empirical studies argued that government education expenditures have no or insignificant effect on reducing income inequality (Braun, 1998). Braun (1998) used five measures of income inequality (the Gini coefficient, the Theil index, the coefficient of variation, the Atkinson measure, and the Nelson index) and analyzed the effects of 19 socioeconomic variables (per capita education expenditure, median school years completed, standard deviation of years of school completed, per capita health expenditure, per capita welfare expenditure...etc.) on the five indices of the income inequality. Braun (1998) justified his presuppositions by claiming that the choice of income inequality measure depended on the type of phenomenon being observed, due to the clear disparities between the measurements of income inequality. Similarly, Ram (1989) argued that the relationship was insignificant in a group of developing countries, and he could not suggest any policy actions, due to a lack of theoretical and empirical evidence. However, it is important to note that the number of studies that found a significant relationship between government education expenditures and income inequality outweighs the studies that found an insignificant relationship. Nonetheless, the former did not settle on a specific directional relationship.

Few studies found a U-shaped curve (Olupona, 2018; Shahabadi et al., 2018; Artige & Cavenaile 2023, etc.). The studies not only confirmed Kuznets' hypothesis of an inverted U-shaped curve between income inequality and economic growth, but they also presented a different U-shaped curve between education levels and income inequality. A study utilized panel data analysis to determine sources of inequality within selected MENA countries[4] for the 1980–1997 period found that among factors that affect income inequality measured by Theil Index, education index measured by adult literacy and enrollment rate, and urbanization measured by urban

[4] Selected MENA countries here were: Algeria, the Arab Republic of Egypt, the Islamic Republic of Iran, Jordan, Morocco, and Turkey

population share, were statistically insignificant. While factors like GDP per capita and female labor force participation have inequality increasing effects, although openness (trade % of GDP), as well as manufacturing value-added share (%of GDP), have an inequality-decreasing effect (Acar & Dogruel, 2012). The study attempted to support Kuzent's (1955) hypotheses of U shape inequality, which predicts that inequality will rise during a county's transition from an agricultural to industrialized economy as a results of migration from rural to urban areas and then fall as a result of improvement in educational opportunities and social policies that become available to people of different income levels. For instance, Shahabadi et al. (2018) concluded that income inequality is inversely associated with government spending on primary and secondary education, while income inequality is proportionally associated with government expenditure on higher education. Those results were built on three grounds. Firstly, both primary and secondary education levels participate heavily in the country's process of development by enhancing the position of low-income individuals in the market. Secondly, individuals in higher education have higher remuneration and experience, which increases the income gap between different classes of individuals. Thirdly, the structure of higher education itself operates in such a manner that only those with a high income may benefit from it, where the cost of higher education is partially borne by the government, thus increasing the income gap.

To sum up, previously this paper reviewed the literature by focusing on the findings of the relationship between government spending on education on income equality, to group the aligned ideas and reflect them appropriately. The reviewed studies supported Braun (1998)'s conclusion that the differences in findings are mainly due to dissimilarities in the predictors used and the choice of income inequality measure. Moreover, each country or region has differing aspects, therefore, the scheme of government spending on the education structure and the determinants of income inequality should be taken into consideration. The impact of government expenditure on education on income inequality has been studied extensively, however; there are different theoretical or empirical trends to follow, which means the relationship appears inconclusive given the variations of the findings between different regions and even within the same region depending on. Thus, this topic needs to be studied in the MENA region that had not been applied before formally in the period 1990 to 2017; to reach findings that are more conclusive and better policy recommendations.

Chapter 3: Government Education Expenditure and Income Inequality in Selected MENA Countries from 1990-2017

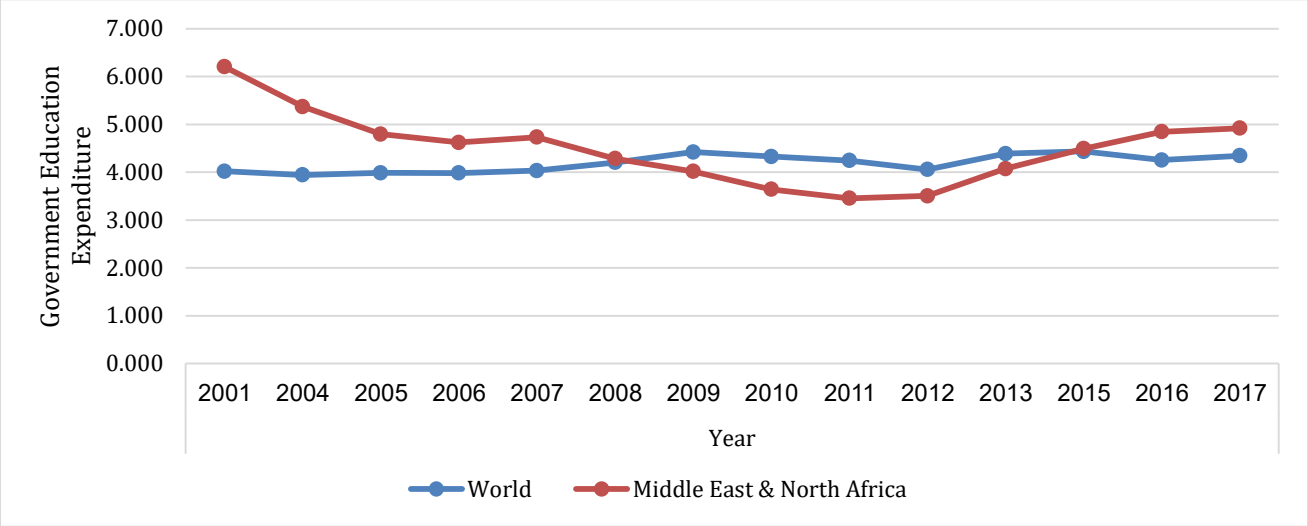
This chapter aims at describing the condition of income inequality and government education expenditure in selected MENA countries during the period 1990 to 2017. Section 3.1 focuses on government education expenditure by analyzing its average in the MENA versus the rest of the world's average as a benchmark. Section 3.2 starts by classifying the selected MENA countries by their respective Gini values. Additionally, the trend of the average Gini values was observed for the selected MENA countries versus North America as a benchmark.

3.1 Government Education Expenditure

The figure below shows that the average government education expenditure on all educational levels as a percentage of GDP in the selected MENA [5]countries has been decreasing from 2001 to 2006, indicating lower spending and support for education, although it is still higher than the rest of the world's average government education expenditure. At 4.6% of GDP in 2006 and grew to 4.7% of GDP in 2007 compared to 4.0% of GDP for the rest of the world's average. From 2007 to 2011, support for education deteriorated in selected MENA countries, reaching around 3.5% of GDP, while for the rest of the world it was fluctuating, increasing from 2007 to 2009 and then decreasing from 2009 to 2012, reaching 4.1% of GDP, higher than that of the selected MENA countries during the same period. However, after the Arab Spring in 2011, the average spending on education began to rise; in 2015, the selected MENA countries had a higher average education expenditure than the rest of the world's average education expenditure, reflecting a higher priority for education, commitment to human capital development, and the MDGs during that period.

[5] Not all MENA nations are included in the analysis, only: The Arab Republic of Egypt, The Syrian Arab Republic, The Islamic Republic of Iran, Yemen, Tunisia, The West Bank and Gaza Strip, Iraq, Algeria, Jordan, Morocco, Malta, Djibouti, Lebanon, and Israel, as well as Turkey although its regarded in different geographical area according to the World Bank. Other MENA countries, including Bahrain, Kuwait, Kingdom of Saudi Arabia (KSA), Oman, Qatar, and Libya were excluded from the analysis and the panel model due to missing data

Figure 1: Evolution of government education expenditure in selected MENA countries from 2001 to 2017, with the rest of the world as a benchmark.



Source: Authors' compilation based on World Bank (2021c).

From 2015 to 2017, average education expenditure was also increasing, indicating a huge increase in government education investment in the selected MENA countries, especially after the start of the SDGs. However, for the rest of the world, it was fluctuating until 2016, with a slight increase in the average education expenditure in the selected MENA countries until 2017.

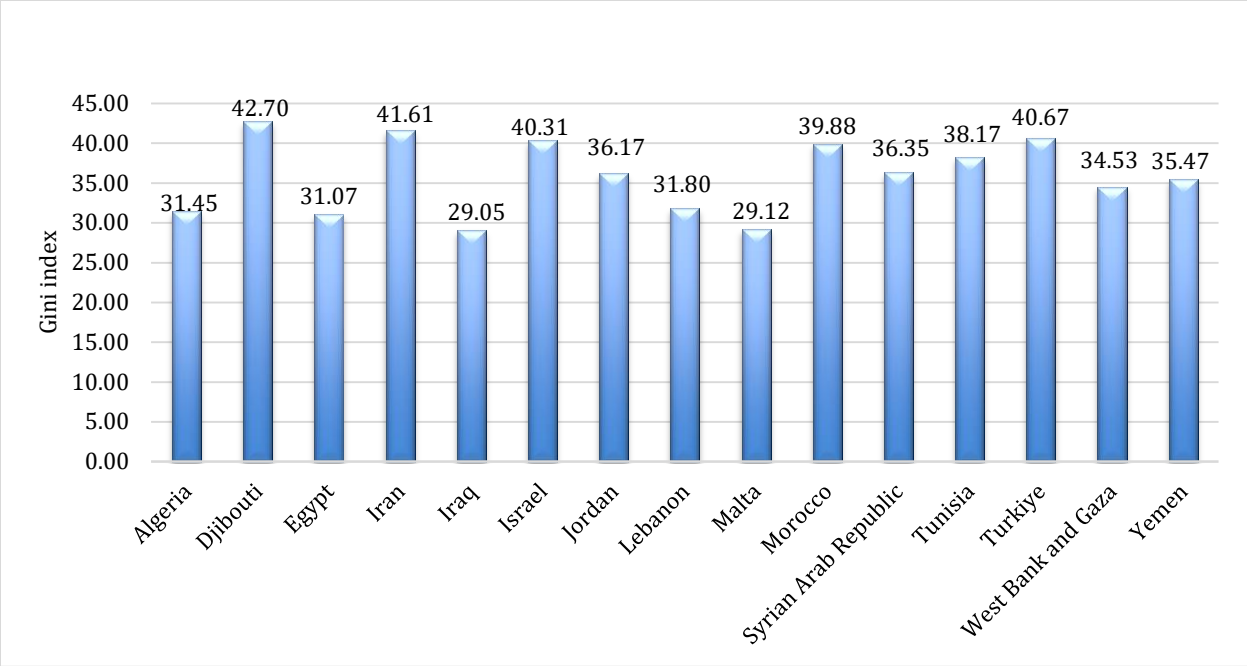
To sum up this point, the over-all trend of government education expenditure in the selected MENA countries was declining until 2011, which marked a turning point for the MENA region. While for the rest of the world, government education expenditure had slight fluctuations relative to these of the MENA during the period, with an overall stable trend.

3.2 Income Inequality

Figure 2 shows that the Gini coefficient varies across the selected MENA countries. According to the Gini classification of Bhorat et al. (2017)[6], the Islamic Republic of Iran, Djibouti, and Turkey are considered countries with low-income inequality as their average Gini index scores ranged from 40 to 44.9 over the period (1990–2017). While the Egyptian Arab Republic, the Syrian Arab Republic, Yemen, Tunisia, the West Bank and Gaza Strip, Iraq, Algeria, Jordan, Morocco, Malta, Djibouti, Lebanon, and Israel all have an average Gini index scores below 39.9, which is classified as very low-income inequality compared to the rest of the world.

[6] Gini > 60 is classified as very high inequality, Gini between 53 and 59.9 is classified as high inequality, Gini between 45 and 52.9 is classified as medium inequality, Gini between 40 and 44.9 is classified as low inequality, Gini < 39.9 is classified as a very low inequality (Bhorat et al. 2017)

Figure 2: Condition of income inequality in selected MENA countries



Source: Authors' compilation based on World Bank (2021b).

The table below represents the classifications of the selected MENA countries with respect to income inequality and its trend throughout the selected period. The table below shows that the Gini index's trend in the 1990s for Algeria, the Islamic Rep of Iran, Morocco and Turkey was falling indicating improvement in income distribution in these countries. However, during the 2000s' income distribution started to deteriorate for Morocco and turkey as the Gini index was rising. On the other hand, Algeria and the Islamic Rep of Iran managed to reduce income inequality even further.

Table 1: Inequality classification and trend during the 1990s and 2000s in the selected MENA countries

Country	Average Gini Index 1990-2017	Gini Classification	Gini Trend (1990s)	Gini Trend (2000s)
Algeria	31.45	very low inequality	Falling	Falling
Djibouti	42.70	low inequality	N/A	N/A
Egypt, Arab Rep.	31.07	very low inequality	Rising	Falling

Iran, Islamic Rep.	41.61	low inequality	Falling	Falling
Iraq	29.05	very low inequality	N/A	N/A
West Bank and Gaza	34.5	very low inequality	N/A	N/A
Jordan	33.7	very low inequality	No change	No change
Lebanon	36.17	very low inequality	N/A	N/A
Malta	29.12	very low inequality	N/A	N/A
Morocco	39.88	very low inequality	Falling	Rising
Syrian Arab Republic	36.35	very low inequality	N/A	N/A
Tunisia	38.17	very low inequality	Falling	Falling
Israel	40.31	low inequality	Rising	No change
Yemen, Rep.	35.47	very low inequality	N/A	N/A
Turkey	40.67	low inequality	Falling	Rising

Source: Authors' compilation based on Bhorat et al. (2017) and UNDP (2016)[7].

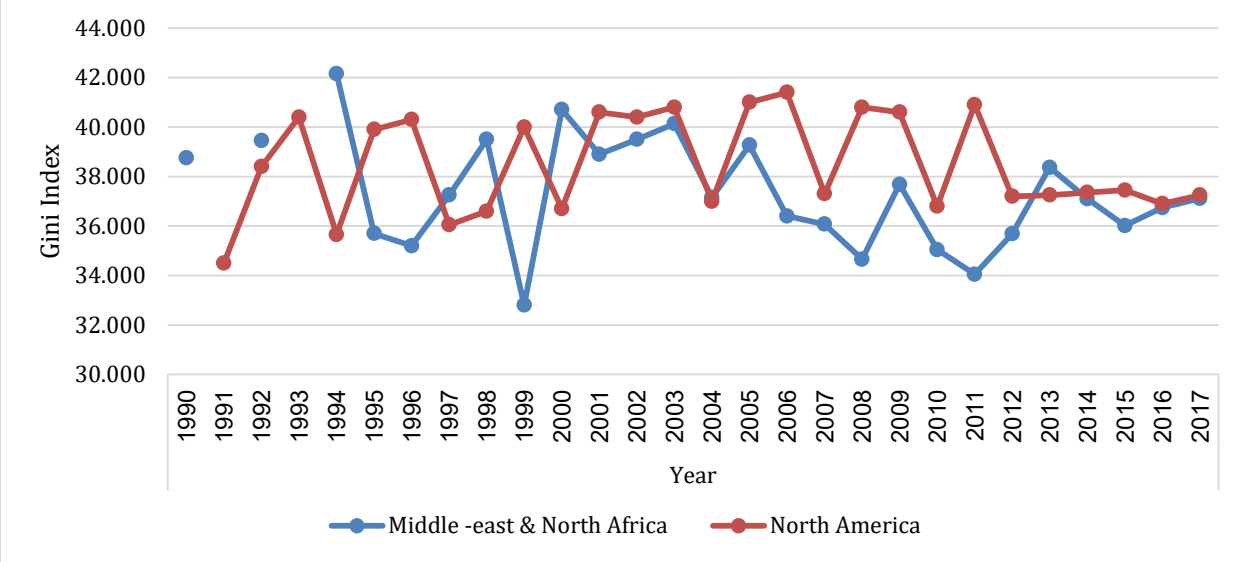
As for Egypt, Arab Republic and Israel income inequality was worsening throughout the 1990s as the Gini index values was rising. However, in the 2000's, income distribution in Egypt improved with decreasing Gini index values, while Israel plateaued reflecting no fluctuations during that period. Likewise, Jordan had a stable income inequality during 1990's and 2000s.To sum up this part, the average Gini coefficient values are low and very low in the selected MENA countries over the period 1990 to 2017.

As seen in figure 3 the overall trend in MENA has been fluctuating over the period but slightly decreased at the end of the period. The Gini index averaged at 39 in the 90s, reaching an all-time high of 42 in the mid-'90s and lowest in the late 90's with a value of 33. However, a slight deterioration in income distribution, averaging around 37 is observed at the end of the selected timeframe. On the other hand, North America's overall trend has been fluctuating with a slight increase at the end of the period. Gini index averaged around 35 in 90's and reached an all low at the beginning of the 90's with a value of 35 and reached an all high of 41 in the mid 2000's.

[7] Inequality Trend by UNDP (2016) using data from Solt (2009).

Similarly, by 2017 North America's Gini index averaged around the same of that of the MENA at 37, which could indicate a slight improvement in income distribution in North America.

Figure 3: Evolution of income inequality in selected MENA countries from 1990 to 2017, with North America[8] as a benchmark.

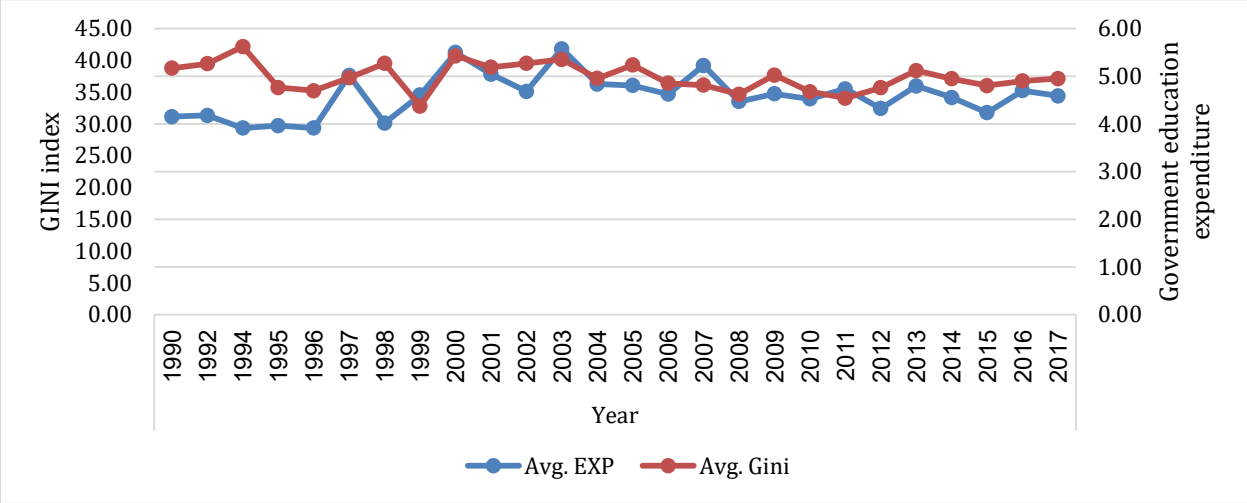


Source: Authors' compilation based on World Bank (2021b).

To sum up, the average Gini coefficient in MENA has been fluctuating throughout the period 1990 to 2017, with a slightly deterioration, while in North America the average Gini coefficient started at a better income distribution position with a slight deterioration.

[8] North America was chosen to be a benchmark due to data availability; North America includes the USA and Canada, but excludes Bermuda due to missing data. The World Bank includes the USA, Canada, and Bermuda in its classification of the region (North America).

Figure 4: Trends of Income inequality and government education expenditure in selected MENA countries from 1990-2017.



Source: Authors' compilation based on World Bank (2021b) and World Bank (2021c).

The figure shows that the overall trend of government education expenditure and Gini index in selected MENA countries has been slightly positively correlated. Further, the figure shows that during 90s government education expenditure and Gini index trend for the selected MENA countries was in a stable trend. Both variables were moving in the same direction that if government expenditure increases income inequality increases. However, during 20s, government education expenditure was fluctuating compared to Gini that was stable reflecting that increase or decrease in education expenditure did not affect income inequality at that time. At the end of the period both were at consistent trend indicating a positive relationship between government education expenditure and income inequality.

This paper demonstrated the evolution of government education expenditure and income inequality throughout the selected MENA countries. Considering that the literature review (chapter 2) did not settle on a relationship between those variables, further assessment is advised when approaching this relationship. Additionally, the literature focusing on the impact of government education expenditure as a determinant of income inequality in the MENA region have been quite rare. The magnitude of this relationship and direction prompts further empirical research in order to lay the foundation for policies.

CHAPTER 4: Model Specification, Results and Limitations

This chapter discusses the model specification, which aims at fitting a Pooled OLS model that satisfies all the required assumptions. The chapter starts by providing the foundations of the choice of model. Section 1 and 2 lays the conceptual framework of the variables. Section 3 focuses on the verification of the OLS assumptions of the model employed. Finally, the chapter ends with a detailed discussion of the model results and pinpoints its limitations. All analyses in this chapter are conducted through R software.

The panel data covers 15 selected MENA countries[9] across 27 years. The utilization of panel data models allows for the integration of sectional and time-series data, thereby making it possible to identify and measure the effects that may not be discernible in either type of data (Ullah et al,2018). This method has the benefit of yielding unbiased and consistent estimations, as it takes into account potential sources of heterogeneity associated with units or groups. In contrast, other econometrics approaches on sectional and time-series data do not consider this unobserved heterogeneity, presenting a risk for bias in results through estimation based on such methods. Panel data models prove useful in controlling for this unobserved heterogeneity as well as allowing for greater visibility into otherwise difficult-to-detect effects (Ullah et al.,2018).In other words, panel models control differences in the observational units (ie. countries), thus reducing possible confounding effects.

4.1 Gini Index and Government Education Expenditure

The Gini index calculates how far away from precisely equal distribution the income is distributed among people or households within an economy. As a percentage of the largest area under the line, the Gini index calculates the distance between the Lorenz curve[10] and a hypothetical line of absolute equality. Since perfect equality is represented by a Gini index of 0, perfect inequality is implied by a Gini index of 100 (World Bank, 2021b).

[9] Not all MENA nations are included in the analysis, only: The Arab Republic of Egypt, The Syrian Arab Republic, The Islamic Republic of Iran, Yemen, Tunisia, The West Bank and Gaza Strip, Iraq, Algeria, Jordan, Morocco, Malta, Djibouti, Lebanon, and Israel, as well as Turkey although its regarded in different geographical area according to the World Bank. Other MENA countries, including Bahrain, Kuwait, Saudi Arabia, Oman, Qatar, and Libya were excluded from the analysis and the panel model due to missing data.

[10] The Lorenz curve shows the cumulative percentages of total income received versus the cumulative number of beneficiaries.

Government education expenditure represents the total government expenditure on education as a percentage of the GDP. The variable is computed by dividing total government education expenditure at all education levels by the GDP, and multiplying by 100. It emphasizes government policy priority relative to education and alternative investment choices. The higher the government spending on education, the grander the government's priority for education relative to other investment choices. In addition, it indicates the government's commitment to human capital development (World Bank, 2021c).

4.2 Control Variables

To avoid specification bias in the estimates of the impact of government education spending on income inequality, the relevant economic determinants of income inequality must be considered, which have been consistently found in previous literature on income inequality (see Anderson et al., 2017; Panton-Ntshona, 2021; Köse, 2007; Minh Ho, 2020; Ifa & Guetat, 2018; Bulíř, 2001; Vazquez et al., 2012; Kaasa, 2003; De Gregorio & Lee, 2002; Kaasa, 2005). These control variables include population structure, inflation, and degree of education explained in further detail in the following paragraphs.

Firstly, individuals' educational level play a significant role in income disparity. Previous literature on income inequality divides the effect of education level on income inequality into two groups: those who find that a more unequal distribution of education leads to more income inequality (the so-called "composition" effect) and those who find that a higher average education level leads to less income inequality (the "compression" effect)[11]. Furthermore, primary and secondary education are expected to potentially reduce income disparities, while tertiary education is expected to increase income inequality as it is associated with remuneration and experience (Shahabadi et al., 2018; Kaasa, 2005; Knight & Sabot, 1983).

Secondly, income inequality also depends on the population structure of the country. To represent this dimension, previous literature on income inequality has usually used a demographic variable called: population density. According to Kaasa (2003) and Kaasa (2005), there are contradicting beliefs concerning the impact of population density on income inequality. On the one hand, higher population density is expected to be likely to result in lower income inequality, mainly because higher population density implies a better potential for advanced social organization and a lesser opportunity for land concentration, both of which are related to lower income inequality. On the other hand, as population density grows, so does income inequality, as income inequality is often higher in urban areas than in rural areas.

Thirdly, inflation is expected to widen the income gap between people. Bulíř, (2001) argued that workers whose income streams are protected from changes in price levels (insiders)[12]would earn

[11]for more elaboration refer to section 2.2
[12] "insiders" are those who accept inflation-adjusted wage contracts (Bulíř, 2001)

more than the unprotected group of workers (outsiders)[13]. Assuming that government policies such as taxing the rich and transfers to the poor are insufficient in preventing outsiders from sliding into poverty and close the income distribution gap caused by inflation (Bulíř, 2001).

Table 2: The determinants of income inequality and their hypothesized sign

Variable	Proxy	Source	Hypothesized sign
Educational level	School enrollment, primary (% gross)	WDI	Negative
	School enrollment, secondary (% gross)	WDI	Negative
	School enrollment, tertiary (% gross)	WDI	Positive
Population density	Population density (people per sq. km of land area)	WDI	Positive/negative
Inflation	Consumer price index (2010=100)	WDI	Positive

Source: Compiled by the authors.

The following model is proposed as a preliminary fitting of the relationship:

$$GINI_{it} = \alpha + \beta_1 EXP_{it} + \beta_2 PRIM_{it} + \beta_3 SEC_{it} + \beta_4 TERT_{it} + \beta_5 PopD_{it} + \beta_6 CPI_{it} + \varepsilon_{it}$$

Firstly, the dependent variable $GINI_{it}$ refers to the Gini coefficient. Secondly, the explanatory variable of interest denoted as EXP_{it} represents government education expenditures as (% of GDP). Thirdly, the control variables are school enrollment, primary (% gross); school enrollment, secondary (% gross); school enrollment, tertiary (%gross); population density; and consumer price index, denoted as $PRIM_{it}$, SEC_{it}, $TERT_{it}$, $PopD_{it}$, and CPI_{it}, respectively. Gross enrollment ratios is the proportion of all enrolment, regardless of age, to the population in the age bracket that is considered to formally correspond to the education level displayed. Population density is the population divided by land area in square kilometers. Moreover, the consumer price index measures shifts in the average consumer's cost of acquiring a basket of goods and services, which may be set or modified on a regular basis, such as annually. Lastly, subscripts of 'X_{it}' refer to country i =1, 2, 3…15 and year t=1990, 1991, 1992….2017 respectively. ε_{it} captures unobserved influences that can vary based on the country or period.

[13] "outsiders," are those who accept nominal contracts (Bulíř, 2001)

4.3 Verifying OLS Assumptions

The normality assumption being one of the most difficult assumptions to validate in economic data posed a serious challenge. Unfortunately, no universal transformation sufficed in validating the normality in the analysis conducted in this chapter. Thus, each variable had to be transformed separately, while taking into consideration the prospective interpretation of those variables.

Table 3: Transformed Variables

Variable	Type	*Lambda (if-applicable)*
$GINI_{it}$	Square-root	-
EXP_{it}	Log base 10	-
$PRIM_{it}$	Box-cox	1.999958
SEC_{it}	Box-cox	1.756894
$TERT_{it}$	Square-root	-
$PopD_{it}$	Box-cox	0.02170782
CPI_{it}	Square-root	-

The interpretation of a box cox transformed variable is simply X^ lambda.

Each transformation is done based on the prior probability distribution of the variable, for instance, a log base 10 normalizes positively skewed variables, ln normalizes most skewed variable in general. The Box-Cox transformation is a power transformation used to normalize data and stabilize variance (Weisberg, 2014). It is often used when the data is skewed or heteroscedastic and cannot be normalized using the aforementioned transformations. Taking the square root of a variable is a non-linear method designed to transform the relationship into a linear relationship while simultaneously reducing heteroscedasticity (Manikandan, 2010). It is important to note that while the tests show that the normality assumption has been violated, however the normal QQ-plot of the model appears to follow a normal distribution. Normal QQ-plot is a graphical tool that compares the quintiles of the residuals distribution versus what the theoretical normal quantiles. Thus, visually, it could be observed whether the assumption of

normality of residuals is satisfied. Refer to Figure 1 in the appendix for normal QQ-plot of the model.

Moreover, homoscedasticity is essential for yielding best linear unbiased estimators, commonly referred to as BLUE. Heteroscedasticity in a population or sample can cause skewed results and lead to incorrect conclusions. The Breusch-Pagan Test is a procedure used to determine whether heteroscedasticity may be present in a linear regression model. This test is based on the Lagrange multiplier concept and assesses whether or not the variance of the residuals is related to the values of the independent variables (Maddala & Lahiri, 1992). If so, it implies that heteroscedasticity exists (Maddala & Lahiri, 1992). As seen in Table 4 below-, the P-value of the test is greater than the specified alpha at 0.05, which indicates that homoscedasticity is present.

$$H_0: \text{Var}\ (\varepsilon_{it}) = \sigma 2$$

$$H_1: \text{Var}\ (\varepsilon_{it}) \neq \sigma 2$$

Table 4 : Studentized Breusch-Pagan test

Statistic	Degrees of freedom	P-value
8.6813	5	0.1225

**P-value is more than specified alpha (0.05), thus there is no enough evidence to reject the null hypothesis Homoscedasticity is present*

Similarly, autocorrelation, also known as serial correlation, occurs when the errors or residuals in a time series or regression model are correlated with each other over time. This violates the assumption of independence of errors, which is a key assumption of many statistical tests and models. Autocorrelation can lead to unbiased estimates of coefficients, incorrect standard errors, and invalid hypothesis tests (Maddala & Lahiri, 1992).The Durbin-Watson statistic is an effective tool for identifying auto-correlation at lag one from residuals in a regression analysis. Durbin (1950) derived the test statistic for least squares regression residuals and developed statistical tests to detect first-order autoregression in the error.

$$H_{0:}\ Cov\ (E_i,E_j) = 0, \text{For i} \neq \text{j}$$

$$H_{1:}\ Cov\ (E_i,E_j) \neq 0, \text{For i} \neq \text{j}$$

Table 5: Durbin-Watson test (before taking the lag of Gini)

Statistic	Lag	P-value
1.385402	1	0*

**P-value is less than specified alpha (0.05), thus there is enough evidence to reject the null hypothesis Autocorrelation is present*

There is enough evidence to reject the null hypothesis and conclude that the errors are correlated. A common solution to fix serially correlated residuals is to take the lag of the dependent variable. The following table represents the Durbin-Watson test after the lagging the Gini variable.

Table 6: Durbin-Watson test (After taking the lag of Gini)

Statistic	Lag	P-value
2.115296	1	0.252*

**P-value is more than specified alpha (0.05), thus there is no evidence to reject the null hypothesis. Autocorrelation is not present*

Thus, a panel model with an autoregressive term is proposed as follows:

$$GINI_{it} = \alpha + \beta_1 EXP_{it} + \beta_2 PRIM_{it} + \beta_3 SEC_{it} + \beta_4 TERT_{it} + \beta_5 PopD_{it} + \beta_6 CPI_{it} + Gini_{t-1} + \varepsilon_{it}$$

Where the $Gini_{t-1}$ refers to the lagged term of the Gini coefficient.

Lastly, multicolinearity has an adverse effect on the precision of regression coefficient estimates, making it difficult to detect how independent variables influence the dependent variable. Therefore, this inflates the standard errors associated with certain or all coefficients in a regression model (Maddala & Lahiri, 1992). Variance inflation factor (VIF) is a statistic computed to determine which regressor is the main cause of multicolinearity in the model. A relatively high VIF is a good sign to drop that variable. As shown in the table below all variables have relatively similar VIF values, indicating that multicolinearity is not an issue.

Table 7: VIF Results

Variable	Value
EXP_{it}	1.256
$PRIM_{it}$	1.839
SEC_{it}	3.180
$TERT_{it}$	2.467
$PopD_{it}$	1.182
CPI_{it}	1.418

4.4 Robustness

Standard procedure to testing the robustness of the results is to add or omit one of the control variables from the specification and observe whether the coefficient of the variable of interest changes significantly. Moreover, if the coefficients are robust, the model is interpreted as having a good structural validity (Lu & White, 2014). As shown in Table 8 and Table 9 the only significant change in the coefficient of government education expenditure is when secondary education enrollment is omitted from the model. However, none of the other control variables significantly changed the coefficient of government education expenditure. Nevertheless, the inclusion of these variables are solely based on the specification criteria mentioned in the control variables section.

As observed in the table below, model 2, which has secondary education enrollment omitted from, displayed the most significant change on the coefficient of government education expenditure. This implies that the secondary education enrollment variable acts as a confounder, which is a variable that affects the dependent and independent variables in a way that produces distorted associations between two variables (Skelly et al., 2012). Thus, the model needs to be adjusted for secondary education enrollment by adding the secondary education enrollment as a control variable. Model 3 to 5 displays the effect of omitting population density, tertiary school enrollment, and consumer price index from the model. It can be observed that those variables have no significant effect on government education expenditure, as seen by changes in its coefficient. Therefore, population density, tertiary school enrollment, and consumer price index are only included in the model to enhance its predictive capability. The inclusion of those variables enhanced the predictive capability of the model as reflected by the R-squared and adjusted R-squared. The final model possess the highest R2 of all the models with a value of 0.515, this implies that the model explains 51.5% of the variation of the Gini index. The value of the R-squared and adjusted R-squared of Model 1 is acceptable and reliable compared to most of

the literature; as the study of Kaasa (2003) tried to figure out all the determinants of the Gini index, reached a model that explained 68. 6% of the GINI using about 14 socioeconomic variables.

Table 8 : Alternative specification

	Dependent variable:		
	GINI		
	(1)	(2)	(3)
Government expenditure on education, total (% of GDP)	0.368***	0.422***	0.321***
	(0.078)	(0.081)	(0.082)
School enrollment, primary (% gross)	-0.003	-0.037**	0.010
	(0.015)	(0.015)	(0.015)
School enrollment, secondary (% gross)	-0.149***		-0.053***
	(0.021)		(0.017)
School enrollment, tertiary (%gross)	0.095***	0.042***	
	(0.012)	(0.010)	
Population density (people per sq. km of land area)	-0.028**	-0.032**	-0.009
	(0.013)	(0.014)	(0.014)
Consumer price index (2010 = 100)	-0.021***	-0.022***	-0.005
	(0.005)	(0.006)	(0.005)
GINI Index (Lagged)	0.500***	0.573***	0.570***
	(0.033)	(0.033)	(0.034)
Constant	2.510***	2.294***	2.447***

	(0.200)	(0.207)	(0.211)
Observations	405	405	405
R^2	0.515	0.466	0.458
Adjusted R^2	0.508	0.460	0.452
Residual Std. Error	0.277 (df = 397)	0.290 (df = 398)	0.292 (df = 398)
F Statistic	78.863** (df = 7; 397)	75.892 (df = 6; 398)	73.498 (df = 6; 398)
Note:		{*}p<0.1; {**}p<0.05; {***}p<0.01	

Table 9: Alternative specification(cont'd)

	Dependent variable:		
	GINI		
	(1)	(4)	(5)
Government expenditure on education, total (% of GDP)	0.368***	0.385***	0.348***
	(0.078)	(0.078)	(0.079)
School enrollment, primary (% gross)	-0.003	-0.003	-0.002
	(0.015)	(0.015)	(0.015)
School enrollment, secondary (% gross)	-0.149***	-0.152***	-0.151***
	(0.021)	(0.021)	(0.021)
School enrollment, tertiary (%gross)	0.095***	0.090***	0.077***
	(0.012)	(0.012)	(0.011)
Population density (people per sq. km of land area)	-0.028**		-0.023*
	(0.013)		(0.013)

Consumer price index (2010 = 100)	-0.021***	-0.020***	
	(0.005)	(0.005)	
GINI Index (Lagged)	0.500***	0.509***	0.514***
	(0.033)	(0.033)	(0.034)
Constant	2.510***	2.454***	2.344***
	(0.200)	(0.199)	(0.198)
Observations	405	405	405
R^2	0.515	0.511	0.501
Adjusted R^2	0.508	0.505	0.495
Residual Std. Error	0.277 (df = 397)	0.278 (df = 398)	0.281 (df = 398)
F Statistic	78.863 (df = 7; 397)	90.687 (df = 6; 398)	87.117 (df = 6; 398)
Note:		{*}p<0.1; {**}p<0.05; {***}p<0.01	

4.5 Findings and Discussion

After the assumptions have been verified, the following model is proposed:

$$\sqrt{GINI_{it}} = 2.51 + 0.37EXP_{it} - 0.00PRIM_{it} - 0.15SEC_{it} + 0.09TERT_{it} - 0.03PopD_{it} - 0.02CPI_{it} + 0.50Gini_{t-1} + \varepsilon_{it}$$

Observing the outcomes of the pooled AR (1) regression model, the coefficients for each of these variables represent the estimated effect of that variable on the square root of the Gini coefficient, holding all other variables constant. The coefficient for government expenditures on education suggests that countries within the MENA region with higher education expenditure as a percentage of GDP tend to have higher levels of income inequality, all else equal. Therefore, this indicates that on average, a 1% increase in government education expenditure is associated with an increase in income inequality by 0.0016 multiplied by the square root of the current value of income inequality, ceteris paribus. For instance, suppose the current value of the Gini index of country X in the MENA region is 30, holding all other factors constant a 1% increase in government education expenditures would increase the Gini index by 0.008%. Although government education expenditures have been widely viewed as a promising strategy for reducing income inequality (Shahabadi, 2018), its impact on inequality appears to be positively significant in the case of the MENA region. This aligns with Bishop et al. (1992) and Verdugo et al. (–2011), both papers corroborated this relationship. Moving to the primary education enrollment the relationship seems insignificant, reflecting the effect of primary school enrollment on income inequality in the MENA region is complex and may depend on a range of factors, including the quality and accessibility of education, the distribution of educational opportunities

across different regions and social groups, and the broader economic and political context (Shahabadi, 2018). However, secondary education enrollments have a negative significance on income inequality. In addition, secondary education can help to promote greater social and economic mobility by providing students with the qualifications needed to access higher levels of education and training (Iqbal & Kiendrebeogo, 2015). Moreover, 1% increase in the secondary enrollment rate is associated with a decline in income inequality by 0.036%, Ceteris paribus. While tertiary enrollment increase income inequality as it has a significant effect on income inequality, tertiary education in the MENA region may be limited by various factors, such as inadequate funding, poor infrastructure, and other barriers to access. A 1% increase in the tertiary enrollment rate would increase, on average, income inequality by 0.3%, ceteris paribus. A possible explanation would be that in many countries in the region, tertiary education may be restricted to a small elite and the quality of education may be poor (Shahabadi, 2018). However, this claim exists outside the scope of this research and should be investigated further. Moreover, political instability and conflicts in the region may further limit access to education (Delgado et al., 2013). The lagged Gini variable displayed a positive significant effect on the Gini coefficient. This indicates that the Gini index might be witnessing an increasing trend if all other variables are held constant. The inflation finding opposes the hypothesis, as any increase the inflation causes a decrease in income inequality, which violates Bulíř (2001) assumption that found an increase in inflation will increase income inequality. However, this inconsistency requires further exploration in the MENA region to determine a plausible explanation. So holding all other factors constant, an increase in CPI by 1% lead to a decrease in income inequality by 0.002. Moreover, any increase in population density will have a declining impact on income inequality, due to the better potential for advanced social organization and lesser opportunity for land concentration, both of which were related to lower income inequality (Kaasa, 2003 and Kaasa, 2005). However, most of the literature findings were inconclusive some found a positive relationship between population density and income inequality, and others found the opposite (Kaasa, 2003 and Kaasa, 2005). Therefore, further investigation is necessary for the MENA region to establish a credible explanation for this inconsistency. An increase in the population density by 1% lead to a decrease in income inequality by 0.09. The results of this model will serve as the foundation for conclusions and policy recommendations.

Table 10: Results pooled AR (1) regression model

	Dependent variable:
	GINI
Government expenditure on education, total (% of GDP)	0.368***
	(0.078)
School enrollment, primary (% gross)	-0.003
	(0.015)
School enrollment, secondary (% gross)	-0.149***
	(0.021)
School enrollment, tertiary (%gross)	0.095^***
	(0.012)
Population density (people per sq. km of land area)	-0.028**
	(0.013)
Consumer price index (2010 = 100)	-0.021***
	(0.005)
GINI Index (Lagged)	0.500***
	(0.033)
Constant	2.510***
	(0.200)
Observations	405
R^2	0.515
Adjusted R^2	0.508
Residual Std. Error	0.277 (df = 397)
F Statistic	78.863*** (df = 7; 397)
Note:	{*}p<0.1; {**}p<0.05; {***}p<0.01

4.6 Limitations of the Model

I. This study uses panel data analysis for a range of countries, it is possible that the positive association between income inequality and government spending on education exists only for the selected MENA countries. Specifically, the Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) were left out of the analysis due to absence of data and structural differences (Acar & Dogruel, 2012). In other words, the findings of this study can only be generalized to middle and low income MENA countries.

II. To avoid imputation and overfitting, multiple variables that would act as controls were omitted from the model. However, the paper used the most common variables in the literature focusing on the determinants of income inequality, refer to literature survey in the appendix.

III. The model ignored the differences in educational quality, equity of educational opportunities, efficiency of education distribution, and institutional factors. All of the aforementioned factors have a theoretical link to income inequality. Furthermore, most of those factors are not easily or readily quantifiable and can only be approached theoretically (Ram, 1989).

Chapter 5: Policy Recommendations and Conclusion

The model analysis indicated a significant positive relationship between income inequality and government expenditure in the MENA region from 1990-2017. This implies that increasing government spending in the education sector could result in higher levels of income inequality in the region. These findings contradict Schultz's theory (1963), which suggests that investing more in human capital will lead to lower income inequality. Contrary to Schultz's theory, Ram (1989) argued that education's impact on income inequality is complex and is influenced by various factors, including the distribution of educational opportunities, labor market structure, and broader economic and social contexts. Furthermore, the findings of this paper oppose the majority of the empirical literature, which backs the claim that government spending on education alleviates income inequality. However, this paper's findings aligned with some literature that supports the conclusion that government spending on education worsens income inequality (Bishop et al., 1992; Verdugo et al., 2011; Panton-Ntshona, S. 2021). Despite, the existence of extensive literature[14], the impact of government spending on education in relation to income inequality is still inconclusive in general and in the MENA region specifically. It is important to acknowledge that a definitive conclusion has not been reached.

[14] Refer to Table 1 in the appendix for the literature survey.

Improving income inequality through education relies not only on understanding the direction and magnitude of the relationship between government expenditures on education and income inequality but also relies on other critical factors such as the efficiency of government spending on the education sector, the equitable distribution of educational opportunities, and quality of education, etc. (See Duman, A. 2008; Panton-Ntshona, S. 2021). Moreover, this paper tried to reflect the quality of education and the distribution of education on the used control variables, which are the enrollment rates in different stages of education, and using population density to figure out the geographical distribution of the population, but it still a not sufficient reflection for such factors. So, without taking into consideration the effect of these factors in the MENA region, any policy recommendations or actions may be misleading. Therefore, it is crucial to study the determinants of income inequality in the MENA region to identify detrimental factors that can reduce income inequality and recommend adequate policies. Therefore, future research should focus on addressing these important gaps to develop efficient policy recommendations, and policymakers need to consider these factors carefully.

Moving to the other controlled variables, the relationship between primary education enrollment and income inequality seems insignificant, suggesting that the effect of primary school enrollment on income inequality in the MENA region is multifaceted and contingent on various factors such as the quality and availability of education, the allocation of educational resources among different regions and social groups, and the wider economic and political circumstances (Shahabadi, 2018). The secondary education findings support increasing the investment in this level of education as when secondary enrollments increased the income inequality gap decreased. As secondary education can facilitate increased social and economic mobility by equipping students with the necessary credentials to pursue higher levels of education and training (Iqbal and Kiendrebeogo,2015). However, tertiary education enrolment promotes higher income inequality which is aligned with the findings of the literature (Knight & Sabot, 1983). Inflation has a declining impact on income inequality, which violates the hypothesis, so this violation needs further research and exploration to come out with sufficient justification. Population density has a declining impact on income inequality, Because of the improved potential for sophisticated social organization and reduced opportunity for land concentration, which were both linked to lower income inequality (Kaasa, 2003 and Kaasa,2005).

To conclude, there is a positive impact on income inequality when governments increase educational expenditures in the MENA region, and this may due to the inefficiency of the distribution of education or even inefficiencies in government expenditures on education (Duman, A. 2008; Panton-Ntshona, S. 2021). As the efficiency of government spending on education was not the aim of this research, further research on this topic is necessary before major policies are implemented.

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Appendix

Table1. The impact of government education expenditure on income inequality: A survey of the literature

Study	Country or countries examined	Period estimated	Variable of interest	Dependent variable	Control /dummy variables	Methodology used	Main findings
Seefeldt (2018)	United of states	1987-2015	Government Education Expenditures (total)	GINI index	Real income per capita-high school attainment-college attainment-unemployment rate-manufacturing employment shares-farm employment shares	OLS-cross sectional data	Significant negative
Jianu (2020)	The member states of the European Union	2002-2015	Government expenditures on the (education, health)	GINI index	Unemployment rates-wages to GDP	Estimated generalized least squares method using panel data	Significant negative
Behr et al. (2004)	The fifty United States and the District of Columbia	1970-1995	Government expenditures on the education	GINI index	Age dispersion-social dispersion-educational dispersion-occupational dispersion	Time series analysis	Significant negative
Chu (2000)	Taiwan	1966-1995	Educational Expansion(public& private)	GINI index	Schooling dispersion-non-labor income	Time series analysis	Significant negative

Source: Compiled by the authors.

Table1. (Continued).

Study	Country or countries examined	Period estimated	Variable of interest	Dependent variable	Control /dummy variables	Methodology used	Main findings
Duman (2008)	Turkey	1994-2005				Qualitative analysis	Could have a negative impact, depending on the pattern of government spending
Fields (1980)	Developing countries	1975	Years of schooling (Education)	Per capita income	Labor market experiance-hours of working per week	Multiple regression model OLS	Significant negative
Turčínková & Stávková (2012)	Czech Republic	2005-2009				Qualitative analysis	
Braun (1988)	Developed states	1980	Educational expenditures per capita	GINI index	Mean family income-per capita health Expenditures-mean years of school-labor force employed-the labor force in manufacturing-per capita income from property- population per mile square land	Multiple regression model OLS	Insignificant

Source: Compiled by the authors.

Table1. (Continued).

Study	Country or countries examined	Period estimated	Variable of interest	Dependent variable	Control /dummy variables	Methodology used	Main findings
Bishop et al. (1992)	United of states		Educational expenditures per capita	GINI index	Health Expenditures per capita-mean years of school-employment rate-property income-population per mile square	Logit analysis of ordered state lorenz curves	Significant positive
Verdugo (2011)	United of states	1950-2009	Education attainments (primary, secondary, tertiary)	GINI index		Qualitative analysis	Significant positive
Anderson et al. (2017)	low- and middle-income countries		Government spending on (education, health, military...etc)	GINI index	Indices for trade-tax-inflation-governance-education and population	Meta-regression analysis-weighted ols	Significant negative
Panton-Ntshona (2021)	Sub-Saharan Africa(18 sub-Saharan countries)	1995-2015	The education index includes (Government expenditure on education, Literacy rate, Educational attainment. etc)	GINI index	Economic growth-Poverty- Inflation-unemployment-Government spending	Generalised method of moments	Significant positive

Source: Compiled by the authors.

Table1. (Continued).

Study	Country or countries examined	Period estimated	Variable of interest	Dependent variable	Control /dummy variables	Methodology used	Main findings
Qazi et al. (2010)	Pakistan	1973-2012	Government Education Expenditures (total)	GINI index	Real GDP-unemployed labor force-total real investment-enrollment of students in higher education	Time series analysis	Significant negative
Köse (2007)	Turkey		Government Education Expenditures (total)	GINI index	Enrolment in secondary-inflation index-government spending on social security	Ordinary least squares	Significant negative
Ram (1989)	Less-Developed Countries		Total Education Expenditures (total)	GINI index	school enrolments	Qualitative analysis of cross-sectional data-multiple regression model	Insignificant
Minh Ho et al. (2020)	Vietnam	2010-2016	Government Education Expenditures (total)	GINI index	Regional GDP-Inflation-Social security-agricultural contribution-Rural population	generalized method of moments	Significant positive
Shahabad et al. (2018)	Selected Islamic Countries	1990–2014	Education enrollment in primary, secondary, and tertiary	GINI index	GDP	panel data model	Significant/ Support Kuznets curve

Source: Compiled by the authors.

Table1. (Continued).

Study	Country or countries examined	Period estimated	Variable of interest	Dependent variable	Control /dummy variables	Methodology used	Main findings
Ifa & Guetat (2018)	Tunisia and Morocco	1980-2015	Government Education Expenditures (total)	GINI index	Inflation-GDP per capita	Auto-regressive distributive lags (ARDL)	Significant positive in Morocco and Significant negative in Tunasia
Dollar & Kraay (2002)	92 countries		Economic growth	Per capita income	Exports % GDP - imports% GDP-government consumtion-inflation-secondery education-social spending % of total public spending-primary education-secondry education	Pooled OLS-generalized method of moments (GMM)	Insignificant due to lack of data
Gregorio & Lee (2002)	Broad range of countries	1960-1990	Education attainments (primary, secondary, tertiary)	GINI index	GDP-social expinditures	Cross Country data-Panel regressions	Significant/ Support Kuznets curve
Coady & Dizioli (2017)	world wide	1980-2010	Education attainments (primary, secondary, tertiary)	GINI index	GDP-inflation-Credit Growth	Dynamic panel estimation	Significant negative

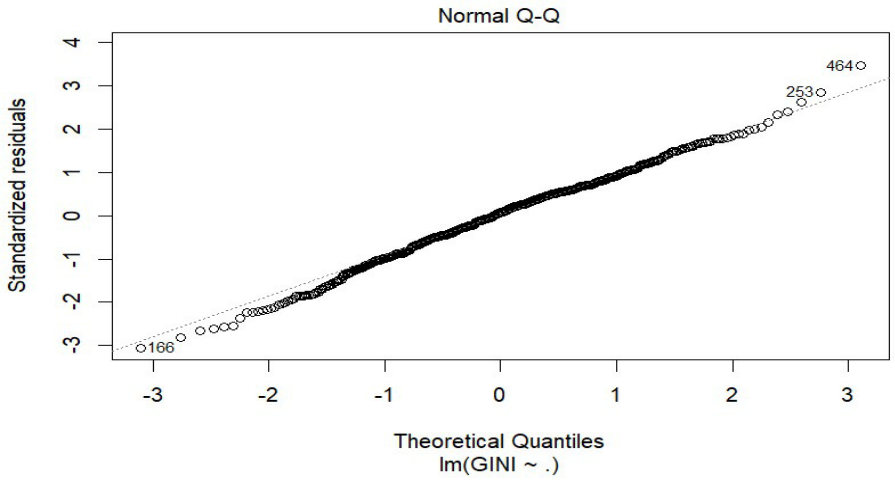
Source: Compiled by the authors.

Table1. (Continued).

Study	Country or countries examined	Period estimated	Variable of interest	Dependent variable	Control /dummy variables	Methodology used	Main findings
Keller (2010)	world wide	1970-2000	Investment in education (primary, secondry, terttiary)	GINI index	Inflation-GDP growth-government expinditures	Panel data model	Significant negative
Honkkila (1999)	50 countries	1980-1990	Education attainments (primary, secondary, tertiary)	GINI index	GDP-agricultural sector in the labour force		Significant negative
Sylwester (2002)			Public education expansion	GINI index		Qualitative analysis	Significant negative
Abdullah et al. (2015)	World wide		Education enrollment and attainment in primary, secondary, and tertiary	GINI index		Meta regression analysis	non-robust and inconclusive findings
Olupona (2018)	145 country	1996-2016	Education enrollments (primary, secondary, tertiary)	GINI index		panel data model	Significant/ Support Kuznets curve

Source: Compiled by the authors.

Figure 1



Source: R output of the estimated model.

Figure 2

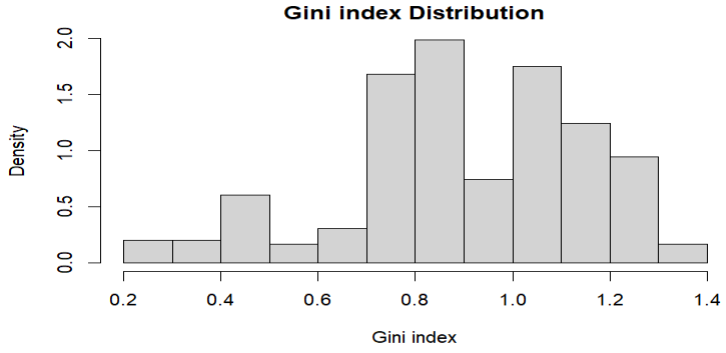


Table 2: Correlation matrix

	GINI	*EXP*	*PRIM*	*SEC*	*TERT*	*PopD*	*CPI*
GINI	1						
EXP	0.311166415	1					
AGE	0.130348487	0.26388551					
PRIM	-0.156300191	-0.341546328	1				
SEC	-0.334914296	-0.401583571	0.6563849	1			
TERT	0.036386878	-0.219654113	0.416294796	0.696047515	1		
PopD	-0.291761398	-0.26489398	0.110775941	0.327315458	0.250998506	1	
CPI	-0.094843029	-0.07642533	0.217386907	0.33394551	0.538546572	0.119100421	1

Note: GINI= GINI index; EXP=Government expenditure on education, total (% of GDP); PRIM= School enrollment, primary (% gross); SEC= School enrollment, secondary (% gross); TERT= School enrollment, tertiary (% gross), PopD= Population density (people per sq. km of land area); CPI= Consumer price index (2010 =100).

Table 3: Descriptive Statistics

Variable	Mean	Std.Dev	Min	Q1	Median	Q3	Max
GINI	37.02	4.75	27.6	33.7	37.5	41.3	45.1
EXP	4.81	2	0	3.37	4.48	5.99	14.2
PRIM	96.97	17.31	30.95	93.25	101.5	106.76	128.46
SEC	75.24	23.26	9.8	59.47	81.57	91.56	116.46
TERT	27.31	16.77	0	14.65	23.54	36.63	72.96
PopD	179.32	300.83	2.41	36.76	69.48	129.04	1867.74
CPI	79.99	41.02	0.03	59.67	79.55	102.21	333.67

Note: GINI= GINI index; EXP=Government expenditure on education, total (% of GDP); PRIM= School enrollment, primary (% gross); SEC= School enrollment, secondary (% gross); TERT= School enrollment, tertiary (% gross), PopD= Population density (people per sq. km of land area); CPI= Consumer price index (2010 =100).