

# Examination of the Effects of Population Age Distribution and Oil Rent on Inequality of Income: Dynamic Panel for Selected Oil-Exporters MENA Countries

*(Pemeriksaan Kesan Pengagihan Umur Penduduk dan Sewa Minyak Terhadap Ketidaksamaan Pendapatan: Panel Dinamik untuk Negara-Negara Pengeluar Minyak MENA Terpilih)*

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## ABSTRACT

*This paper analyzes the impacts of oil rents and population age structure on inequality in income for selected oil-exporters MENA countries. The research model is estimated using Generalized Method of Moments (GMM) for dynamic panel for the period 2006–2020. Results indicate that the distribution of income in these nations has been significantly affected by the oil rents. Additionally, a rise in the dependency ratio and the population over 65 and in the 0–14 age group both significantly and negatively affect the distribution of income. However, increasing the working-age population to total population ratio improves income distribution. Oil price fluctuations and related uncertainties changes economic structure of countries in MENA region over the past decade. Several of these countries have worked to diversify their economies and enhance welfare and income distribution in recent years. Along with reducing income inequality attempts, different policies taking into account of different variables have been suggested to decrease inequality in income. Therefore, identifying the extends and direction of changes in income distribution and its attributes is a major challenging issue facing policy makers. Policymakers should reduce income inequality by providing adequate childcare and family benefits to reduce dependency ratio, investing in education, increasing per capita income, properly managing and utilizing total natural resource rents % of GDP, design and implement free trade agreements, and plan to mitigate the effects of ageing.*

*Keywords: Income inequality; MENA countries; oil rent; population age structure; generalized method of moments (GMM).*

## ABSTRAK

*Kajian ini menganalisis kesan sewaan minyak dan struktur umur penduduk terhadap ketidakseimbangan pendapatan di negara-negara MENA yang dipilih. Model penyelidikan dianggarkan menggunakan panel dinamik dan Kaedah Detik Umum (GMM) sepanjang tempoh 2006–2020. Penemuan menunjukkan bahawa sewa minyak negara-negara ini mempunyai kesan negatif yang ketara terhadap pengagihan pendapatan; Seterusnya, peningkatan dalam nisbah tanggungan, serta penduduk berumur 0-14 dan ke atas 65 tahun, mempunyai kesan yang ketara dan negatif terhadap pengagihan pendapatan. Walau bagaimanapun, meningkatkan nisbah penduduk umur bekerja kepada*

*jumlah penduduk meningkatkan pengagihan pendapatan. Turun naik harga minyak dan ketidaktentuan berkaitan mengubah struktur ekonomi negara di rantau MENA sepanjang dekad yang lalu. Dalam beberapa tahun kebelakangan ini, beberapa negara ini telah berusaha untuk mempelbagaikan ekonomi mereka dan meningkatkan pengagihan pendapatan dan kebajikan. Bersama-sama dengan mengurangkan percubaan ketidaksamaan pendapatan, dasar yang berbeza dengan mengambil kira pembolehubah yang berbeza telah dicadangkan untuk mengurangkan ketidaksamaan pendapatan. Oleh itu, mengenal pasti lanjutan dan hala tuju perubahan dalam pengagihan pendapatan dan sifat-sifatnya merupakan isu mencabar utama yang dihadapi oleh pembuat dasar. Penggubal dasar harus mengurangkan ketidaksamaan pendapatan dengan menyediakan penjagaan anak dan faedah keluarga yang mencukupi untuk mengurangkan nisbah pergantungan, melabur dalam pendidikan, meningkatkan pendapatan per kapita, mengurus dan menggunakan jumlah sewa sumber asli % daripada KDNK dengan betul, mereka bentuk dan melaksanakan perjanjian perdagangan bebas, dan merancang untuk mengurangkan kesan penuaan.*

*Kata kunci: Ketaksamaan pendapatan; negara MENA; sewa minyak; struktur umur penduduk; kaedah umum detik (GMM).*

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## INTRODUCTION

Early development theories emphasized economic growth as a critical factor in achieving income equality. However, the experience of most developing economies, such as Africa and Latin America, demonstrated that despite their relative success in economic growth, the situation of poor nations had not improved significantly. This was thought to be due to increased inequality in these countries, as the wealthy obtained the greatest benefits from economic growth (Galbraith 1998). In recent decades, most economists have become concerned about the unequal distribution of income and, as a result, poverty (Fosu 2010, Yang 2018, Bucelli 2020 and Amponsah et al. 2023). As stated in the World Inequality Report (2018), the world's top 1%'s income has increased by 27% since 1980, while the income of the bottom 50% has increased by only 12% (Alvaredo 2018).

The lowest and highest inequalities in income distribution are found in Europe and the Middle East, respectively. In the Middle East, 10% of the population owns 64% of the region's wealth. In South Africa, Brazil, the United States, and Europe, the inequality is 62%, 55%, 47%, and 38%, respectively. In the Middle East, the share of income of the top 1% is 27%, while 50% of its poor receive only 9% of the region's income, compared to 18% in Europe. Along with economic and political developments, MENA countries have experienced significant demographic changes over the past decades. Hydrocarbon exploitation, fertility and labour growth rates are among the major causes of these changes.

The MENA countries have seen remarkable economic growth because of revenues from hydrocarbon exploitation. As their governments dominate in the area of oil and gas distribution, opportunities for the private sector to engage in are limited (McKee et al. 2017). Another key factor for these demographic changes is declining fertility. In the early twenty-first century, high fertility rates in MENA countries produced rapid population growth, from about 110 million in 1950 it more than quadrupled to 464 million today (UN 2020). Aside from rapid population growth, the MENA region faces numerous economic challenges, including the world's highest labour force growth rates and youth unemployment (2.7% average annual growth and around 25%, respectively). Figure 1 shows population trends for selected MENA countries from 1950–2100. As depicted, the population growth rate increases rapidly at first, then declines. The population is ageing due to lower fertility and longer life expectancies.

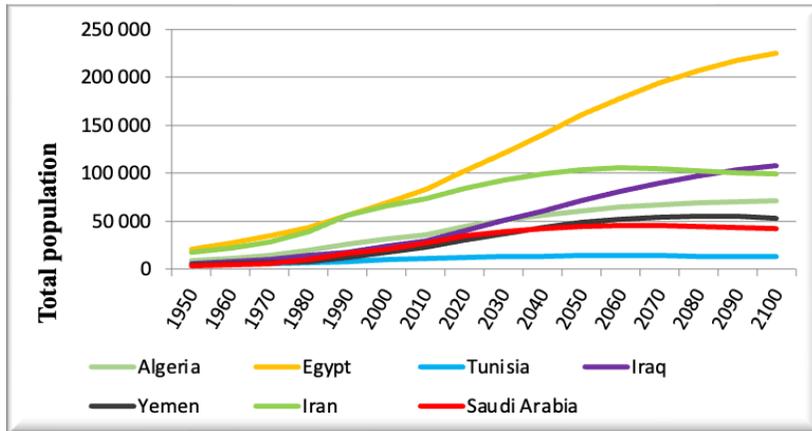


FIGURE 1. Total Population of Selected MENA Countries from 1950–2100 (Thousands)  
 Source: (UN 2020)

As the population ages, so do their social needs and participation in economic affairs (Loichinger et al. 2016). Governments must develop a policy for attending to community needs and priorities in light of the present changes in the age structure of the population in MENA nations (Loichinger et al. 2016). An examination of the population age structure provides valuable information on demographic change in the MENA countries (Figure 2). In order to accomplish development through large government spending and frequently populism social decisions, governments in several MENA nations have started implementing development programmes (Cammett et al. 2015). The government's efforts to enlarge social welfare rules during the past fifty years have raised life expectancy and lowered rates of maternal and new-born death, which has led to a sharp increase in population. Since the middle of the 1960s, "population transfer" has occurred in several of the region's countries (Gillis et al. 1992). Higher levels of education, as well as family planning and urbanization, have all contributed to this population shift, which has resulted in lower fertility rates.

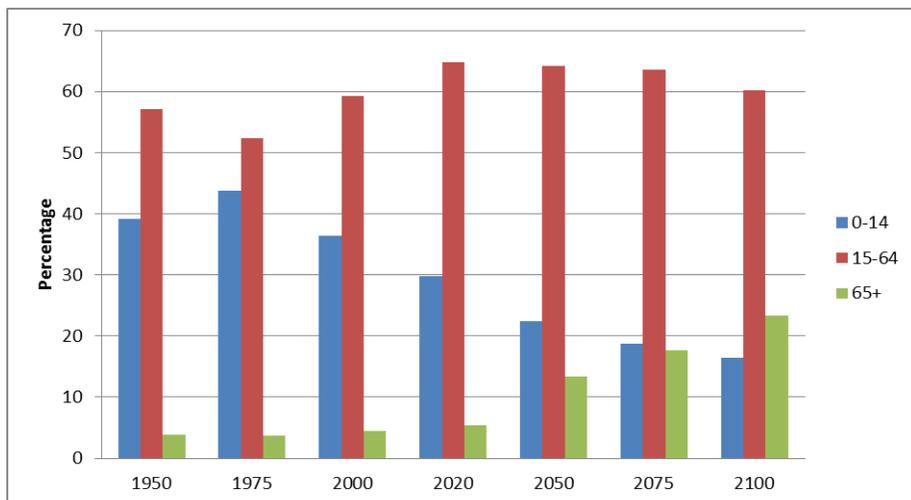


FIGURE 2. Age structure transition, MENA countries, 1950–2100  
 Source: (UN 2020)

The age structure shifts significantly as people age from young to old due to the fall in fertility (pyramid to cylindrical form). The MENA region is ageing, despite rapid population growth, because,

in addition to declining fertility rates, advances in health care and significant access to new medical technologies have increased life expectancy in MENA countries (ESCWA 2017). Due to a growth in both the elderly and youth populations, there is an urgent need in MENA countries to rely on the employed population. TABLE 1 depicts total dependency ratio of selected MENA countries from 1950–2100. It should be noted that the migration of working-age people from the MENA region has increased such dependency (Saxena 2013).

Several factors influenced income inequality, including industrialization, technological advancement, and educational system development, age structure, and population ageing (Kuznets 1955, Forbes 2000, Madsen 2018 and Thang 2021). However, population growth stimulates the consumer market and encourages economic institutions and manufacturing industries to invest (Macunovich 2012). One key demographic measure is the proportion of young people in the country compared to the overall population. When people enter their last decades, they use their assets and savings to make a living and invest less in economic activities and productive affairs, while ageing reduces the active labour force (Uddin et al. 2016). Due to these linkages, income inequality is one of the most serious negative consequences of ageing (Deaton & Paxson 1994).

A lack of capital formation in poor and emerging nations is considered by many experts to be one of the main drivers of poverty and inequality in income, urging them to implement necessary economic restructuring reforms (Lewis 2013). While large revenues from natural resources such as oil should increase societal wealth and reduce poverty, the experiences of many oil-producing countries do not support this. Indeed, population ageing has occurred in developed countries first since the mid-twentieth century, and then in developing countries in recent years. This phenomenon has occurred because of two factors: ongoing fertility decline and increased life expectancy. Compared to developed countries, concerns about population ageing and its effects on the economy and society are less prevalent in emerging nations (H. Zhong 2011).

TABLE 1. Total dependency ratio of selected MENA countries from 1950–2100<sup>1</sup>

Country	1950	1970	1990	2000	2020	2050	2070	2100
Egypt	71.8	85.1	83.0	71.7	64.6	56.9	53.9	60.9
Libya	78.4	97.1	81.4	60.3	47.7	54.1	58.3	72.3
Tunisia	80.3	96.0	72.7	56.9	49.6	61.1	65.5	79.7
Bahrain	82.4	89.8	53.5	48.4	26.5	35.4	52.5	67.3
Iran	71.1	90.2	95.5	62.2	45.6	60.9	67.9	79.3
Iraq	67.3	94.6	98.5	86.6	69.9	55.6	53.4	57.2
Jordan	102.3	97.1	95.9	74.4	58.2	49.7	55.9	71.8
Kuwait	65.0	84.3	56.8	42.8	32.4	59.0	46.9	56.0
Oman	83.0	97.9	90.6	65.4	33.3	40.2	58.4	74.5
Qatar	84.2	61.5	42.0	37.9	18.1	33.1	51.8	55.2
Saudi Arabia	83.0	91.1	81.2	70.3	39.3	50.5	58.0	72.3
The Syrian Arab Republic	76.4	105.8	100.4	79.7	55.4	52.9	57.0	73.2
United Arab Emirates	84.1	56.8	47.6	37.2	19.2	45.2	41.6	53.7
Yemen	86.0	93.5	117.9	107.1	71.7	46.3	45.4	55.3

Source: (UN 2020)

The link between income inequality and the aged varies between industrialised and developing nations due to notable differences in their social and economic systems. Adding natural resources revenues makes this situation more complex. Since MENA countries are the world's top producers of crude oil, analysing the link between oil rents and income inequality is a critical issue that merits further research. Using a dynamic panel model, this study examines the effects of population age distribution and oil rents on income inequality in selected MENA countries between 2006 and 2020. This study specifically addressed the following issues:

1. Do changes in population age structures increase income inequality?
2. What effect do oil rents have on income inequality?

The remainder of the paper is structured as follows: A survey of the literature is presented in Section 2 from both a theoretical and empirical perspective. Section 3 discusses the methodology and presents the developed econometric model. Results and discussion are presented in Section 4, and conclusions and policy implications are presented in Section 5.

## LITERATURE REVIEW

Income inequality has been increasing globally throughout the previous few decades. Many components, as identified in economic literature, can influence income inequality. Despite a large body of research on income distribution and its influencing factors, no comprehensive theory has yet been developed. It is impossible to study all the factors influencing income distribution due to a lack of data. According to the economic literature, a variety of factors influence income inequality. Different studies show that trade liberalization, inflation, unemployment, urbanization, tourism, taxation, government fiscal policy, financial development, and rent from the sale of natural raw materials are the major factors that can affect income inequality. Education income, employment structure, population growth, and population composition are the most effective population factors for income inequality.<sup>2</sup>

Early research on factors influencing income distribution concentrated on the effects of economic growth, most notably the Kuznets inverted-U hypothesis. Empirical studies in the 1970s and early 1980s confirmed Kuznets's theory (Kravis 1960; Kuznets 1963; Stewart 1978; Winegarden 1979 and Mdingi & Ho 2021). However, empirical studies conducted after the 1990s revealed a weak relationship between income inequality and development, and many recent studies have rejected the relationship (Chen et al. 2018; Ravallion et al. 2004; Rehme 2007; Saith 1983). Piketty (2014) concluded that a rise in income inequality seen in recent decades is a direct result of slowing economic growth. The majority of researchers in this field have focused on one or more limiting factors; however, some studies have tested multiple factors (Biewen & Juhasz 2012). Therefore, analyzing the impacts of different factors on income equality differs as economic structure changes; For instance, from developed to developing with dependency on natural resource revenues.

Most empirical studies in above topic have been carried out in advanced economies. Hwang et al. (2021) investigate the relationship between population ageing and income inequality in South Korea with RIF regression methodology. The results show that ageing decreases income. Using an overlapping generation model, Storesletten et al. (2004) examined the connection between inequality in income and population ageing in the US. According to the study's findings, population ageing worsens income distribution. Increases in the economy's dependence ratio have been shown by Razin et al. (2002) to decrease trades and worsen income inequality.

Gruber and Wise (2001) studied this relationship in OECD countries and concluded that the elderly had a small share of society's income. Barrett et al. (2000) in Australia and Bishop et al. (1997) in the US demonstrated that ageing was partially accountable for income inequality.

The effect of population ageing on inequality in income has not been extensively studied in developing nations. According to the finding of Wang et al. (2017), the elderly had a small share of the income, and their wages were lower than those of younger citizens. Zhang and Xiang (2014) suggested that about 10% of income inequality in China is related to population ageing. Population ageing brought on by China's one-child policy has been shown by H. Zhong (2011) to be a significant contributor to income inequality in the country's recent history. The change of literature to the natural resource dependent economies is more complicated and variable.

In terms of correlational researches, early studies suggest a positive connection between inequality in income and ageing (Lindert 2015; Wahiba & El Weriemmi 2014; Repetto 1978). The data used in the research that follow was collected from countries like the US (Lam & Levison 1992), Japan (Ohtake & Saito 1998), New Zealand (Hyslop & Maré 2005), the United Kingdom (Deaton & Paxson 1994), and OECD member countries (Wang 2015), and emerging countries like China (Wang et al. 2017). Few studies have examined how ageing influences income inequality despite the fact that many have examined how ageing affects other economic factors. The impact of ageing populations on

inequality (caused by low birth rates and long-life expectancies) may be explained theoretically in a number of ways.

An overlapping generation equilibrium model (OLG) was employed by Bussolo et al. (2015) to demonstrate how a rise in life expectancy and a decline in fertility raised the wage-to-capital-return ratio. Accelerated population ageing increases the proportion of capital to labour, and capital to production consequently. Therefore, the proportion of wages to capital return ( $\frac{w}{r}$ ) increases (Bussolo et al. 2015). Krueger and Ludwig (2007) predicted a 1% decline in interest rates and a 4% increase in wage rates in OECD countries from 2005-2050 in their study of the ageing effects. Therefore, a shift in ( $\frac{w}{r}$ ) may cause the income to be redistributed from the old to the young. Consequently, this change in the ratio of wages to interest rates can reduce income inequality. Ageing can also indirectly affect inequality through economic growth. On the other hand, growth may make inequality worse since wealthy people are more inclined to invest in savings and human capital.

Conversely, growth can provide the underprivileged greater opportunities, which would lower inequality (Miyazawa 2006). Using the Friedman permanent income hypothesis and the Modigliani life cycle theory (Friedman 1957; Modigliani 1966), Deaton and Paxson (1994) and Chen et al. (2018) demonstrated that income inequality has increased with age in Taipei, China, the UK, and the US. They concluded that weaker population growth and a higher population average age increase inequality through this channel. Vandembroucke and Zhu (2017) observed that population ageing can have different effects on a society's income and consumption depending on its source. They argued that population ageing caused by increased life expectancy would result in negative economic wealth for the elderly. Therefore, per capita consumption will decrease, and inequality will increase. Piketty's work drew the attention of researchers to the impact of population on inequality (Piketty 2014). He argued that the decline in population growth, caused by lower fertility rates, raises capital accumulation and, as a result, inequality (Piketty 2014; Solow 1956). Regression's direction and degree of association between variables alter when natural resources are included.

Some researchers show natural resources revenues reduce inequality (Fum & Hodler 2010; Ross et al. 2012; Van der Ploeg 2011; Sebri & Dachraoui 2021; Awoa et al. 2024). According to Goderis and Malone (2011), natural resources may directly affect inequality of income in a country that receives money from the trade of natural resources, especially minerals and oil.

But there isn't a significant effect in the long-run. Furthermore, uncertainty about the prices of export goods raises long-run income inequality, which may be due to poor countries' limited ability to manage their country's natural resources. According to empirical evidence, countries with natural raw materials have not grown faster than countries without natural resources. Poorer countries with income from the sale of natural raw materials have not always been able to avoid poverty. Some researchers agree that when the Dutch disease, poor infrastructure, and rent-seeking behaviour strike a country with sufficient natural resources, the country not only loses the needed growth to increase equality but is also plagued by the resource curse (Buccellato & Mickiewicz 2009; Sachs & Warner 2001).

## METHOD AND DATA

Using dynamic panel models, this study examines the relationship between income inequality and the age structure of the population and oil rents in the selected MENA countries from 2006 to 2020. The theoretical bases are reviewed to identify the most important variables influencing income distribution in the MENA region. Furthermore, based on previous literature by Gustafsson and Johansson (1999) and C. Wang et al. (2017), Eq.1 is expanded specifically for this paper.

$$LGINI_{it} = \alpha_1 + \beta_1 LGINI_{it-1} + \beta_2 LPop_{it} + \beta_3 LHuman_{it} + \beta_4 LGDP_{it} + \beta_5 (LGDP_{it})^2 + \beta_6 LTrade_{it} + \beta_7 Rent_{it} + \varepsilon_{it} \quad \text{Eq. (1)}$$

The natural logarithm is denoted by the letter L in Eq. 1. The Gini coefficient is often applied to compare the distribution of incomes of countries and on a global scale. The variable Gini coefficient lag is used to investigate the dynamics of the inequality process. Table 2 depicts the model variables.

TABLE 2. Description of model variable/parameter

Variable/Parameter	Description
Gini	index of inequality
Gini(-1)	Gini coefficient lag
$\beta_0$	intercept
GDP	GDP per capita
Pop	population age structure
GDP <sup>2</sup>	GDP per capita squared
Human	high school enrolment rate
Rent	oil rent
Trade	economic globalization index <sup>3</sup>
$\mu$	error term
t	time
i	country

Source: Estimation model of current study

A sample of 13 countries in the MENA region was selected for this study according to the existence of data.<sup>4</sup> Data on the Gini coefficient was gathered from Version 8.1 of Solt's Standardized World Income Inequality Database (SWIID) (Solt 2020). The World Development Indicators (WDI) website provided the data for the other variables.<sup>5</sup> Because of the dynamic nature of the model and the ability to take the endogeneity of the explanatory variables into account, we estimate coefficients using the generalized method of moments (GMM) approach (Arellano & Bond 1991; Baltagi 2001; Blundell & Bond 1998). It should be noted that the panel GMM results will be valid if the basic assumptions are confirmed. The two second-order statistics Arellano-Bond, and Sargan are commonly used for this purpose. The second-order Arellano-Bond statistic examines the absence of serial correlations in error terms, while the Sargan statistic examines the model instruments' validity.

## RESULTS AND DISCUSSION

To avoid nonsense regression, it is necessary to test the stationary of the used variables before estimating the model. Table 3 displays the findings from the LLC<sup>6</sup> and IPS<sup>7</sup> unit root tests. According to the findings, all variables are stationary.

Table 3. Results of LLC and IPS's unit root tests

Variables	IPS		LLC	
	Statistics	Decision	Statistics	Decision
LGini	-30.5***	I(0)	-42.7***	I(0)
LPop(0 – 14)	-21.01***	I(0)	-40.4***	I(0)
LPop(15 – 64)	-30.21***	I(0)	-44.2***	I(0)
LPop(65+)	-9.01***	I(0)	-15.9***	I(0)
LPopA <sup>8</sup>	-27.7***	I(0)	-50.9***	I(0)
LPopB <sup>9</sup>	-17.1***	I(0)	-17.4***	I(0)
LHuman	-3.37***	I(0)	-7.65***	I(0)
LGDP	-7.94***	I(0)	-3.34***	I(0)
LGDP <sup>2</sup>	-5.60***	I(0)	-8.43***	I(0)
LTrade	-26.62***	I(0)	-15.18*	I(0)

<b>Rent</b>	-3.37**	I(0)	-7.12***	I(0)
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Note: Significance at the 10%, 5%, and 1% levels is indicated by \*, \*\*, and \*\*\*, respectively.  
Source: Estimation model of current study

Two models A and B are estimated based on the population's age structure. Model A includes LPop(0 – 14), LPop(15 – 64) and LPop(65+) while model B includes LPopA and LPopB. Table 4 summarizes the results from GMM estimator. According to Sargan's test, the instruments used in both models A and B are reliable with P-values of 0.24 and 0.37, respectively. To ensure no serial correlation in residuals, the Arellano-Bond statistics were used. As the test's zero hypotheses, the lack of second-order serial correlation is verified with P-values of the Arellano-Bond test models A and B at 0.32 and 0.41, respectively. According to the results, the LGini (-1) has positive significant coefficients in both models. As a result, it increases income inequality, which is influenced by economic and non-economic variables and persists over time. The positive significant coefficients of LPop(0 – 14) and LPop(65+) in the model [A] indicate that a higher share of the population under 18 and over 65 causes more unequal income distribution. In other words, increasing the population size of LPop(65+) and LPop(0 – 14) by 1% increased income inequality by 0.035 and 0.052 respectively. The estimated LPop(14 – 64) coefficient was negative and significant. As a result, the greater the working-age population, the lower the income inequality. In contrast, with a 1% increase in the LPop(14 – 64), income inequality fell by 0.04.

The effect of the very young and elderly population dependency ratio on income inequality was investigated in the model [B]. According to the findings in Table 4, income inequality increases as the dependency ratio of both the very young and the elderly population increases.

TABLE 4. The model estimation results

Variables	Model [A]	Model [B]
Intercept	35.7453*** (9.4965)	44.1727*** (10.5961)
LGini (-1)	0.7321*** (0.0130)	0.7940*** (0.0174)
LPop(0 – 14)	0.0351*** (0.0118)	-
LPop(15 – 64)	-0.0408*** (0.007)	-
LPop(65+)	0.0520*** (0.0121)	-
LPopA	-	0.0422*** (0.0016)
LPopB	-	0.0280*** (0.0215)
LHuman	-0.0009 (0.0008)	-0.0011* (0.0008)
LGDP	-5.969*** (1.9516)	-6.8457*** (2.1214)
LGDP <sup>2</sup>	0.2270*** (0.0984)	0.2964*** (0.1061)
LTrade	-0.0033*** (0.0009)	-0.0025*** (0.0008)
Rent	0.0084** (0.0028)	0.0043* (0.0028)
Sargan Statistic	35.1793	29.3448
Wald Test	5660.04***	3142.47***
Second-order Arellano-Bond Test	-1.2994	-1.4578
Number of Observations	120	120
Number of Instruments	63	62

Note: Standard deviations are indicated in parentheses.

Note: Significance at the 10%, 5%, and 1% levels is indicated by \*, \*\*, and \*\*\*, respectively.

Source: Estimation results

Estimation results show that increasing the dependency ratio of the very young (LPopA) and the elderly (LPopB) by 1% increases income inequality by 0.042 and 0.028, respectively. In other words, an increase in the ratio of the very young and elderly (unemployed population) to the working-age population (15-64) raises the dependency ratio and, as a result, increases income inequality. The decline in the employed population affects the labour market and, according to the life-cycle theory, consumption and, as a result, savings, and investment. The high dependency ratio suggests that the employed population rate is not keeping pace with the very young and elderly population growth. Because the very young and elderly population are consumers who contribute to production, investment, and economic activities, this imbalance disrupts economic and social processes. As a result, a higher dependency ratio increases income inequality. These findings are in line with Lam and Levison (1992), Deaton and Paxson (1994), Ohtake and Saito (1998), F. Wang (2015), and J. Zhong (2017).

In addition to diminishing labour supply, the transition to older ages in a population affects productivity, the share of production inputs, consumption and savings patterns, income distribution, as well as economic growth and its sustainability. Higher inequalities, both in income factor distribution (distribution among production factors) and in combination with retirement conditions impact economic growth.

Studies show that the effect of inequality on an aging population is affected by the type and quality of the support system, pension laws and the source of income received by the elderly household. When the only source of household income is wages, in the absence of an effective support system, it is obvious that exiting the labour market will lead to a decline in income and growth in inequality.

In these retirement conditions, the probability of the family joining the poor group increases. On the other hand, when wages and salaries are supplemented by other incomes, such as from interest, rents, and profits, leaving the labour market will not impact household incomes as much. In other words, an economy where a large section of society has excess income over consumption, and incomes can also be derived from savings at retirement, a larger aging population does not necessarily result in greater inequality in income distribution.

In both models, the estimated human capital coefficient is significant and negative. In other words, increasing the length of education leads to higher workforce productivity and more creative production methods, which boosts economic growth and improves income distribution. These results are in line with Li and Zou (1998), Breen and García-Peñalosa (2005), Barro (2000), Gunatilaka and Chotikapanich (2006), and Gregorio and Lee (2002). As a result, increasing human capital in MENA countries reduces inequality of income.

In both models, the estimated coefficient of the **LGDP** is significant and negative. As a result, as per capita output rises, the Gini coefficient falls, lowering income inequality. The coefficient of the **LGDP**<sup>2</sup> is significant and positive in both models. Results are in line with Saith (1983), Ravallion et al. (2004), and Chen et al. (2018). As a result, this research does not support Kuznets' inverted-U hypothesis. The estimated coefficients of the degree of openness (ratio of total trade to GDP) in both models are negative and significant. To be more specific, economies in the MENA region that are more open to trade lower inequality of income. Therefore, it is possible to conclude that increasing trade barriers lead to increased inequality. These findings are consistent with Chakrabarti (2000), Silva (2007), Babones and Zhang (2008), Xu et al. (2008), and Georgantopoulos and Tsamis (2011). In both models, the estimated coefficients of **Rent** are significant and positive. Consequently, the MENA countries' oil rents have increased income inequality. These results correspond to Sachs and Warner (2001), Buccellato and Mickiewicz (2009), and Vicente and Gomes (2018).

## CONCLUSION AND POLICY RECOMMENDATIONS

Population issues are crucial to a society's economic status, growth, and development. Numerous methods exist for its quantitative and qualitative characteristics to influence the economy directly or indirectly. Several economic indicators have been significantly impacted by changes in demographics during the past 50 years, especially in MENA countries, according to the data that are now available. Because of the dynamic nature of the model and the ability to take the endogeneity of the explanatory variables into account, this study used the generalized method of moments (GMM) method for estimating coefficients to investigate the effect of population age structure on inequality of income from 2006 to 2020.

The findings for MENA indicate that changes in its population age distribution have a negative impact on the distribution of income. An increase in the  $LPop(0 - 14)$  results in a greater emphasis on basic needs as the very young do not play a significant role in the economy, relying heavily on the economic contributions of others. Furthermore, an increase in the  $LPop(+65)$  reduces economic growth. An increase in the elderly population will almost certainly increase healthcare costs. It should be noted that in countries with weaker social security, the active population will face greater economic stress. Furthermore, increasing the proportion of those aged 14 to 65 in the overall population will improve income distribution. Increased use of the demographic window benefits the country's economic growth and development, and population growth transformation necessitates proper planning and appropriate macro-policies. The study's findings also show that oil rents in the MENA region increases inequality.

In terms of policy recommendations, four policies can be proposed: (i) supplying enough family subsidies and childcare programmes to raise the probability of working and the fertility rate, which will raise labour force participation over the long and short terms; (ii) granting older workers access to further education and training to motivate them to retain their employment and improve their capabilities and (iii) design, negotiate, and implement free trade agreement (FTA) between MENA countries to develop trade opportunities; and (iv) developing a fund for collecting oil resources revenues and cutting governments' budget dependence on these unstable revenues, can reduce income inequality in these countries.

## LIMITATIONS AND FUTURES RESEARCH

A key characteristic of MENA countries is their abundant natural resources, especially oil and gas, a position that differs significantly from other countries. Due to the lack of access to specific data for each country, a more complete investigation should include variables such as literacy rates, government expenditure (education and health), inflation and exchange rates. Accordingly, the importance of population age structure on income inequality makes it necessary for future studies to consider the above issues separately for each country.

## NOTES

1. Total Dependency Ratio is  $\frac{\text{Population}(0-14)+\text{Population}(65+)}{\text{Population}(15-64)} \times 100$
2. See, for example (Amiri et al. 2019; Babones & Zhang 2008; Barrett et al. 2000; Beckfield 2006; Cassette et al. 2012; Björklund & Jäntti 1997; Buccellato & Mickiewicz 2009; Chakrabarti 2000; Demir et al. 2012; Georgantopoulos & Tsamis 2011; Gustafsson & Johansson 1999; Hepenstrick & Tarasov 2015; Jarvis & Jenkins 1995; Meschi & Vivarelli 2007; Munir & Bukhari 2019; Silva 2007; Silva & Leichenko 2004; Vicente & Gomes 2018; Xu et al. 2008)
3. Total trade as a percentage of GDP.

4. Algeria, Egypt, Iraq, Iran, Jordan, Israel, Lebanon, Malta, Morocco, Saudi Arabia, Tunisia, Qatar, and Yemen
5. <https://databank.worldbank.org/>
6. Levin et al. (2002)
7. Im et al. (2003)
8. 
$$LPopA = \frac{Population(0-14)}{Population(15-65)} \times 100$$
9. 
$$LPopB = \frac{Population(65+)}{Population(15-65)} \times 100$$

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