Water, Energy, Food and Environment Journal
An International Journal

http://dx.doi.org/10.18576/wefej/040102

Evaluating the Nonlinear Population-economic Growth Nexus in MENA Countries

Ismail BENGANA[1*], Bosede Ngozi ADELEYE[2], Abdelaziz BOUKHELKHAL[3], Victoria OKAFOR[45], ABDULAH HAMOUD Alnefaie[1], Eltahir Ibrahim Elnour Salim[1]

[1]Department of Quantitative methods, college of business, King Faisal University, Saudi Arabia.

[2]Department of Accounting, Finance and Economics, Lincoln International Business School, University of Lincoln, UK.

[3]Scientific and Technical Research Centre for Arid Areas (C.R.S.T.R.A), Touggourt, Algeria.

[4] Regional Centre of Expertise (RCE) Ogun, Nigeria.

[5]Centre for Economic Policy and Development Research (CEPDeR), Covenant University, Nigeria.

Received: 5 Aug. 2022, Revised: 18 Sep. 2022, Accepted: 21 Oct. 2022.
Published online: 1 Jan. 2023.

Abstract: The relation between population growth and economic growth is a complex one, and the historical quantitative evidence is ambiguous. This study contributes to the population-economic growth literature by interrogating whether the relationship is monotonic or if a turning point exists. Using panel data on a sample of 19 MENA countries from 1965 to 2018 and deploying the PSCE and FGLS techniques, the results reveal inter alia: (1) a U-shaped relation exists; (2) unemployment and financial development are negative predictors of economic growth; and (3) trade and inflation rate are positive predictors. Policy recommendations are discussed.

Keywords: Economic Growth; Population Growth; MENA; Nonlinear.

1 Introduction

At the initial stages of human story, as well as pre-history, the human population grew at a slow speed till 17th century (i.e. about 2% growth rate per year). But with advancement in science, agriculture and industry the population growth began to accelerate. It took humankind more than million years to reach the first billion around the year 1800. By 1900, a second billion was added and the 20th century added another 3.7 billion. The present world population is estimated at about 6.8 billion. According to Agarwal (2014), world population increase every four days by 1 million. The increase in population has become a source of concern due to the limited natural resources. The unequal distribution of wealth has contributed to the demarcation of North and South countries. The “South countries” are thought to be the main cause of the demographic explosion and classified as “consuming” countries. While the “North countries” are classified as developed and “producing” countries. History has shown that most of the countries of the south were colonized for with their wealth plundered. The influence of size and rate of growth population on the economic and developmental prospects of developing countries has continued to attract the attention of economists, demographers and social scientists in general. The perceptions about this influence have varied over time from extreme pessimism to optimism and all positions in between (Srininvasan, 1987).

The focus on the Middle East and North African (MENA) is germane. The total population of the MENA region has increased fivefold since the 1950s, from just under 110 million in 1950 to 569 million in 2017 (UNDESA, 2017). Despite generally declining rates of fertility, absolute population numbers are expected to further double to over 1

Correspondingauthore-mail: ibengana@kfu.edu.sa

billion inhabitants by 2100, according to medium variant projections. By the end of the century, therefore, there will be more people in the MENA region than in China, whose population is expected to continue to shrink to just over 1 billion and more than in Europe, the population of which is expected to recede by approximately 10 percent by 2100 (Mckee et al., 2017). The MENA countries are one of the world's most rapidly transforming regions politically, economically, demographically and environmentally, despite largely declining total fertility rates, the momentum of absolute population growth will mean that the region surpasses China in terms of total population by 2090. Land degradation, water scarcity and trends of urbanisation will also have significant impacts upon the future development of the MENA region (Mckee et al., 2017).

Figure 1 shows the scatterplot of average per capita income (vertical axis) which is the proxy for economic growth and average population growth (horizontal axis). From the scatterplot, MENA countries can be split into five groups using the size of income per capita and average population. The first group includes Egypt, Iran and Turkey which exhibit high population size with a low gross domestic product (GDP). The second group includes: Algeria, Morocco, Sudan and Iraq, characterized by the low per capita and average population. The third group includes all of Kuwait, Qatar and the UAE, as well as Bahrain characterized by high income and a small population. The fourth group includes: what is left of North Africa and the Middle East and is characterized by low income with an average population. Lastly, the fifth group includes Saudi Arabia, which is characterized by its average income and average population.

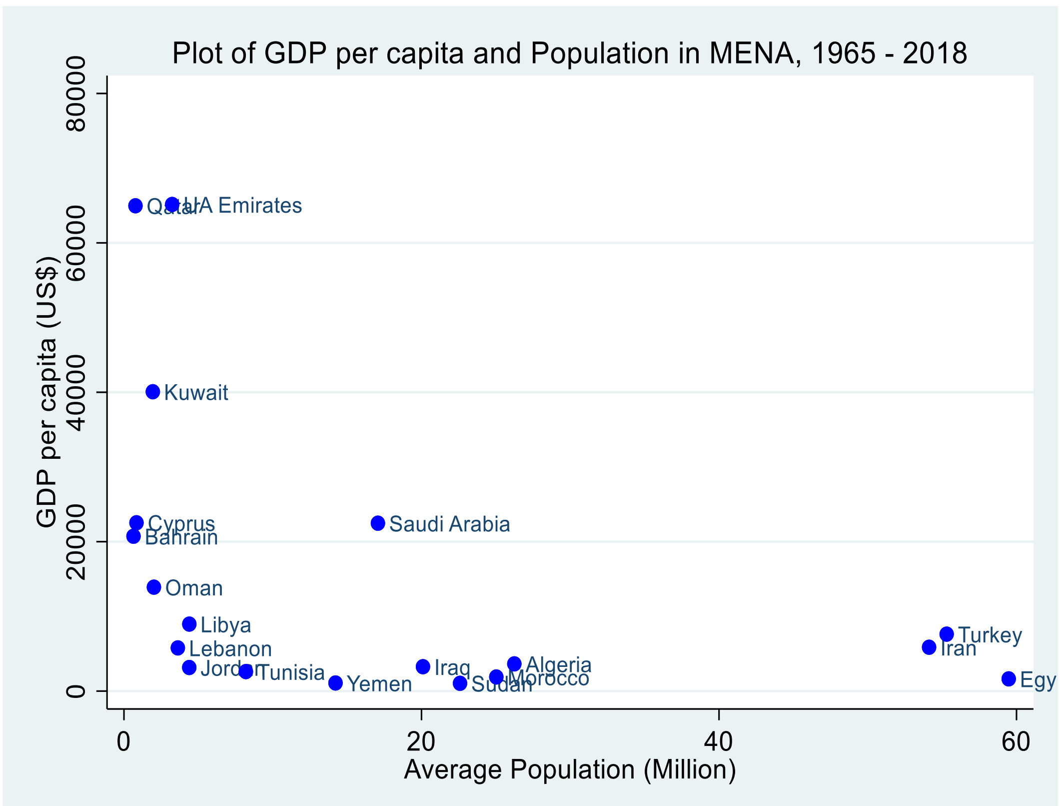

Fig. 1: Plot of GDP per capita and Population in MENA, 1965 – 2018.

Source: Authors' Computations from World Bank (2020) World Development Indicators.

Our study contributes to the literature in different ways. Firstly, MENA countries are an interesting case to test the different theories (schools) concerning population growth effects on economic growth. Secondly, to explain if the relationship between population and economic growth is monotonic or if a turning point exists (nonlinearity). Finally, methodologically this study is among the few studies which use techniques that control for cross-sectional dependence to investigate this nonlinear relationship. The rest of the paper is structured as follows: section 2 delivers the literature review. Section (3) presents the methodology, model and data. Section 4 discusses the results. Section 5 presents the conclusion along with policy directions.

2 Literature Review

The relationship between population and economic growth has been a strong debate among researchers since the publication of the book that entitled *"An Essay on the Principle of Population"* by Thomas Robert Malthus in 1798. According to Malthus and neo-Malthusians the population growth has a negative impact on economic growth. However, other researchers believe that population growth increases economic growth, while others argue that population change may not determine economic growth. Thus, the different points of view regarding the relationship between population and economic growth can be classified into three schools of thought; the pessimistic view that supports the negative effect; the optimistic view that adopts the positive effect and the neutralism view that assumes no effect of population on economic growth.

Regarding the first school which adopts the pessimistic view Malthus (1798), argued that population growth hinders the economic growth of the nations by decreasing their per capita output. He noted that population grows by a geometric rate making a big and a continuous pressure on food production and natural resources which follows an arithmetic pattern growth. Thus, more and more people will slow the economic development and diminish returns. To preserve the balance in a country, Malthus (1798), insisted the necessary of preventive checks (low fertility) and positive checks (high mortally caused by epidemic, war, etc.). The neo-Malthusian Solow (1956) thought population grows following an arithmetical pattern, and considered it as exogenous variable in his neoclassical growth model. Solow (1956), confirmed the negative impact of population growth on per capita output. According to him population growth increases labour force amount on one hand, and reduce physical capital stock per worker on the other hand, which slows economic growth. Mason (1988), examined the relationship between saving and economic growth considering demographic change. The study reveals evidence of strong and positive effect of domestic saving on the gross domestic investment. Hence, population growth decreases the rate of savings, which reduces potential investment, which in turn reduces per capita output. The negative effect was confirmed also by Kelley and Schmidt (1995). However, Kelley and Schmidt (2001) found that population growth as a result of fertility increase, may decline economic growth by reducing aggregate savings. Heady and Hodge (2009) argued that population growth has a negative impact on economic growth rates of low-income countries in contrast of high-income countries. This fact is confirmed by Dao (2012), who examined a sample of 43 developing countries. This study attempted to test the nonlinear effect of population growth on economic growth. The results of this study revealed that GDP per-capita, linearly, and negatively affected by population growth, with no significant impact of fertility rate.

Contrary to the first school of thought, the second school which is known as the optimistic view assumes that population growth boosts economic growth. A large population increases market size and competition; it also increases the labor supply (Degu, 2019). In other word, a null or a negative rate of population growth will cause recession. In such case economic activities like production, consumption, capital accumulation, and saving are expected to decrease. This is confirmed by Kuznets (1967) who proved that population growth increases productivity by rising the stock of knowledge. Kremer (1993) revealed that population growth contributes to improve technology as a result of learning and innovation which leads to increase labor productivity. According to Jones (2001) rising population has to be accompanied with an increase of productivity as a result of technological progress to promote economic growth. Moreover, Tamura (2006) revealed that the large level of human capital accumulation due to low fertility drives economic growth. Furthermore, many recent studies have contributed in the optimistic view using single cases or panel data, include Thuku et al., (2013), Eli et al., (2015), who investigated the population – economic growth nexus in Nigeria. Whereas, Bawazir et al., (2019) investigated ten Middle East countries using static linear panel data models. The results of this study indicate that economic growth is positively affected by population growth rate.

The third view on the population growth-economic growth nexus is known as the neutralism View. This school of thought argues that population rise is neutral on economic growth. In fact, the association between population growth and economic growth might be insignificant if other control variables are taken into account (such as demographic structure, the level of education, the technological level, the unemployment rate) as Bloom et al. (2003) concluded. The finding of Wesley (2017) revealed that the development country's level plays a critical role in determining the relationship between the two variables, since low population growth in high-income countries is likely to create social and economic problems, while high population growth in low-income countries may slow their development.

A part of studies has been conducted to examine the impact of demographic change on economic growth. For instance, Kelley and Schmidt (2005) proved that GDP per capita growth is positively affected by low birth and death rates, while the output per worker is negatively related to the ratio of youth dependency. According to Mierau and Turnovsky (2014) population growth as a result of low mortality rates stimulates the economic growth, while population growth resulting from high fertility rates slows it. This is related to the aggregate savings, since declines in mortality push people to save more for the future which stimulates growth, while increased fertility reduces saving amounts. These findings provide evidence of the age structure importance for economic development. High population growth rates mean that the average age of a population will be young and there will be high dependency rates Wesley (2017).

From this literature review, one can conclude that economic growth seems to be depended to the population growth. However, the nature of this dependence still inconclusive and even complicated. Many factors have to be taking in account when investigating the relationship between the two variables in the various countries and regions. For example, demographic age structure and demographic evolution appears to have significant impacts on economic performance. Besides, the socioeconomic circumstance that differs from one country to another has also their role. Few studies have been conducted for the Middle East and North Africa (MENA) region, which knows a rapid and increased population growth rate, high fertility and big youth dependency ratio, with weak economic performances. Table 1 summarizes some relevant literature on the impact of population on economic growth.

Table 1: Summary of the literature on the population-economic growth nexus.

Authors	Scope	Period	Methodology	Impact
Akintunde et al. (2013)	15 Sub-Saharan African	1975- 2005	Panel OLS and dynamic panel techniques	Negative
Bawazir et al. (2019)	10 Middle East countries	1996 - 2016	Static linear panel data models	Positive
Dao (2012)	43 developing economies	1990–2008	OLS estimation technique	Negative
Degu (2019)	Ethiopia	1981 - 2018	ARDL bounds cointegration test and Toda-Yamamoto Causality tests	Negative
Eli et al. (2015)	Nigeria	1980- 2010	OLS estimation technique	Positive
Hakeem et al. (2016)	Nigeria	1970 - 2014	OLS estimation technique	Negative
Kotani and Kotani (2012)	Indonesia	1993- 2005	OLS estimation technique	Negative
Thuku et al. (2013)	Kenya	1963- 2009	Vector Autoregression	Positive

Source: Authors' Compilations

3 Data, Model, and Empirical Approach

3.1 Variables Description and Expectations

The study scope covers 19 Middle East and North African countries from 1965 to 2018 using annual panel data on six variables. GDP per capita (PC) is the dependent variable measured in constant 2010 US$. The explanatory variables are total of population (POP), total unemployment (UNEM), domestic credit to private sector by banks (DCB), inflation (INFL) and trade openness (TR). Lastly, the square of population is included to address the study objectives. All the variables are sourced from World Bank (2020) World Development Indicators.

On *a priori* expectations, the relationship between population growth and economic growth is controversial. Low population growth in high-income countries is likely to create social and economic problems while high population growth in low-income countries may slow their development (Wesley & Peterson, 2017). Therefore, the sign of the coefficient is indeterminate. Rapid population growth makes it difficult for economies to create enough jobs leading to high unemployment rate which slows economic growth (Messner, 1983; Krahn, Hartnagel, & Gartrell, 1986; Adeleye & Jamal, 2020). A negative coefficient is expected. Finance is an essential growth input due to the ability to spur investment and productivity in the economy. A positive coefficient is expected (Orji et al., 2015; Adeleye et al. 2018; Adeleye et al. 2020). Since a continuous increase in the general price level will cause stunted growth if unchecked, therefore, inflation will have a negative impact on economic growth. (Mohseni & Jouzaryan, 2016). A negative coefficient is expected. Openness refers to the degree to which a domestic country permits to trade with other countries which increases capital formulation and expands markets through an increase in investment (Miller & Upadhay, 2000; Sulaiman et al. 2015; Adeleye et al. 2020) leading to economic growth. Hence, a positive coefficient is expected. Table 2 details the variables descriptions and *a priori* expectations.

Table 2: Variables Description and Expectations.

Variables	Description	Expectations
PC	GDP per capita (constant 2010 US$)	-
POP	Total of Population	-/+
UNEM	Unemployment, total (% of total labour force)	-
DCB	Domestic credit to private sector by banks (% of GDP)	+
INFL	Inflation, consumer prices (annual %)	_
TR	Trade (% of GDP)	-

Source: Authors' Computations

3.2 Model Specification and Empirical Approach

To address the main objective on whether the impact of population on economic growth is monotonic or nonlinear the explicit model is specified as:

$$\ln PC_{it} = \gamma_0 + \psi_1 \ln POP_{it} + \psi_2 \ln POPSQ_{it} ++ \psi_3 \ln Z_{it} + v_{it} \quad [1]$$

Where, the variables are as defined in Table 1; γ_0 is the intercept of the model; ψ_i are the parameters to be estimated; i=1…..N represents the number of cross-sections, t is the period; v_{it} is the general error term. To evaluate the *overall* impact of POP on PC, the first differential of equation [1] is derived as:

$$\frac{\partial \ln PC}{\partial \ln POP} = \psi_1 + \psi_2 2\ln POP \quad [2]$$

To address one of the core objectives of the study, Equation [1] assumes homogeneity for the parameters ψ_1, and ψ_2 which depends neither on a specific country nor on the time period. It is assumed that all countries take on the same shape of the functional relation of the pollutant-output paradox. More importantly, Equation [1] allows for testing the various forms of population-economic growth. That is, (i) $\psi_1 < 0,\ \psi_2 > 0$ reveals a U-shaped relationship; (ii) $\psi_1 > 0,\ \psi_2 < 0$ reveals an inverse U-shaped relationship. The population turning point of this curve is computed by $\hat{\tau} = \exp\left(0.5\, {\hat{\psi}_1}/{\hat{\psi}_2}\right)$; (iii) $\psi_1 > 0,\ \psi_2 > 0$ reveals a monotonically increasing linear relationship; (vi) $\psi_1 < 0$, $\psi_2 < 0$ reveals a monotonically decreasing linear relationship; and (vii) $\psi_1 = 0$, $\psi_2 = 0$ reveals a level relationship. In general, the turning point is when the first derivative of Equation [1] with respect to economic output is equated to zero. Therefore, to ensure that the estimated turning point is within the minimum and maximum values of population, the exponent of equation [2] is calculated.

Before engaging the econometric analyses, it becomes imperative to subject the data to some pre-estimation checks such as (1) cross-sectional dependence, (2) stationarity and (3) cointegration tests. Failure to control for cross-sectional dependence (CSD) can result in biased estimates due to high dependence across countries (Pesaran, 2004, 2015). The CSD test is suited for both balanced and unbalanced data. The null hypothesis is either strict cross-sectional independence (Pesaran, 2004) or weak cross-sectional dependence (Pesaran, 2015). In the event that cross-sectional dependence is evident in the data, the study applies the *t*-test for unit roots in heterogeneous panels with cross-section dependence, proposed by Pesaran (2003). The null hypothesis which assumes that all series are non-stationary removes dependence across the panels and the regressions are augmented with the cross-section averages of lagged levels and first-differences of the individual series using the augmented Dickey-Fuller approach (CADF). Correspondingly, the second-generation Westerlund (2005) cointegration test suited for heterogeneous and cross-sectionally dependent panels is applied. The null hypothesis of no cointegration can be rejected if the variables are cointegrated in all the panels or some of the panels. Finally, in the event of cross-sectional dependence in the data and cointegration among the variables, the Prais-Winsten regression model with panel-corrected standard errors (PCSE) which also controls for heteroscedasticity and serial correlation is used to estimate equation [1]. For robustness checks and to observe the consistency of the results, we deploy the bootstrapping ordinary least squares (BOLS) and the feasible generalized least squares (FGLS) techniques. The bootstrap technique is a nonparametric approach that allows for resampling of the data in memory with replacement (Mooney & Duval, 1993).

4 Results and Discussions

4.1 Summary Statistics and Correlation Analysis

The statistical properties of the variables are displayed in the upper panel of Table 3. Restricting discussions to the main variables of the study, the sample average for PC is US$12,601.42 and the standard deviation of 16875.46 reveals that the countries are widely dispersed from the sample average. That is, there are clear differences in the level of per capita income per country. To highlight the heterogeneity of the income levels, Appendix Table A1 shows that, on average, the top three countries with the highest per capita income are: The United Arab Emirates (US$65,143.67), Qatar (US$64,962.44) and Kuwait (US$40,071.00) while bottom three countries with the lowest per capita income are: Egypt (US$ 1,638.28), Yemen (US$1,084.77), and Sudan (US$1,042.13). The standard deviation of 2740055 for POP also indicates a wide dispersion from the sample average of 34,528,332. From Appendix Table A1, the top three countries with the highest population, on average, are Egypt (59,473,844), Turkey (55,302,767) and Iran (54,121,933) while the bottom three countries with the lowest population are Cyprus (843,405.4), Qatar 773,243.60) and Bahrain (641,655.8). Deductively, high-populated countries show low per capita income relative to low-populated countries.

Table 3: Summary Statistics and Correlation Analysis

Variable	PC	POP	UNEM	DCB	INFL	TR
Mean	12601.42	34528332	9.699685	51.12784	10.89823	67.7764
Std. Dev.	16875.46	27400755	5.68101	45.38295	16.98589	31.29322
Maximum	69679.09	98423595	31.84	255.1936	105.215	148.9129
Minimum	730.423	753334	0.11	3.904611	-4.86328	14.14485
			Correlation Analysis			
lnPC	1.000					
lnPOP	-0.560***	1.000				
lnUNEM	-0.621***	0.531***	1.000			
lnDCB	0.312***	-0.212***	-0.156***	1.000		
INFL	-0.200***	0.219***	0.140**	-0.403***	1.000	
lnTR	0.509***	-0.532***	-0.349***	0.501***	-0.597***	1.000

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively; ln = natural logarithm; PC = per capita GDP; POP = population; UNEM = unemployment rate; DCB = domestic credit provided by banks; INFL = inflation rate; TR = trade openness
Source: Authors' Computations

From the lower panel of Table 3, all the explanatory variables show significant associations at the 1% level with per capita GDP, the proxy for economic growth. While both domestic credit and trade are positively associated, population, unemployment and inflation rate reveals a negative relationship. There is no evidence of multicollinearity as no correlation coefficient exceeds the threshold of 0.80.

4.2 CSD, Unit Root and Cointegration Tests

De Hoyos and Sarafidis (2006) observed that some panel data exhibit traits of cross-sectional dependence (CSD) which can render the results of analysis invalid. CSD is not an unusual occurrence in panel data because shock from one country can be transmitted to another through globalisation and international trade (Olaoye, Orisadare, Okorie, & Abanikanda, 2020). It is therefore necessary for the cross-sectional dependence be accountable for and if present among the variables of consideration, should be corrected. Hence, the result of the CSD test is detailed in the uppermost part of Table 4 where it can be observed that CSD is present among the variables following the array of techniques (Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM and Pesaran CD) employed for the test.

Table 4: CSD, Panel Unit Root and Cointegration Tests.

Cross-Section Dependence Tests

Tests	lnPC	lnPOP	lnUNEM	lnDCB	lnTR	INFL
Breusch-Pagan LM	2427.283***	8782.927***	213.484***	1991.603***	925.334***	783.066***
Pesaran scaled LM	122.006***	465.679***	15.111***	112.513***	44.151***	36.019***
Bias-corrected scaled LM	121.827***	465.501***	14.996***	112.352***	43.982***	35.849***
Pesaran CD	19.88***	93.684***	-0.48217	28.111***	16.405***	18.532***

Panel Unit Root Tests

Tests	lnPC	lnPOP	lnUNEM	D(lnUNEM)	lnDCB	D(lnDCB)	lnTR	INFL
Levin, Lin & Chu t*	-3.541***	-6.953***	-2.254**	-4.753***	-0.18185	-9.020***	-2.775***	-1.736**
Im, Pesaran and Shin W-stat	-2.753***	-1.094	-1.011	-5.896***	1.83025	-11.943***	-3.646***	-5.158***
ADF - Fisher Chi-square	89.339***	59.865**	28.148	84.756***	17.2098	232.379***	67.336***	95.389***
PP - Fisher Chi-square	73.583***	178.095***	23.625	122.508***	25.609	415.015***	83.113***	124.178***
Decision	*I*(0)	*I*(0)	*NS*	*I*(1)	*NS*	*I*(1)	*I*(0)	*I*(0)
Cross-sections	19	19	11	11	17	17	18	18

Westerlund Panel Cointegration Test

Without cross-sectional means	-3.381***
With cross-sectional means	-3.891***

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively; ln = natural logarithm; PC = per capita GDP; POP = population; UNEM = unemployment rate; DCB = domestic credit provided by banks; INFL = inflation rate; TR = trade openness; ADF = Augmented Dickey-Fuller; PP = Phillip-Perron; NS = Nonstationary.

To further perform the empirical analysis in this study, the Panel Unit root test which controls for CSD is employed as a result of the verification of CSD among the variables. The results of the unit root test as seen in Table 4 show that the variables are integrated of different order. PC, POP, TR and inflation are integrated at level whereas, differenced UNEM, In DCB are integrated of order one. Since this study focuses on countries that are spatially close, it is important that the Cross-Sectional Dependence (CSD) test is to avoid having a bias result.

Furthermore, the panel cointegration test results is also displayed in middle-part of Table 4 using the Westerlund (2007) cointegration test. This cointegration technique was proposed by Westerlund (2007) as a technique that had more advantage than panel cointegration tests based on the absence of common factor restriction in the technique. This technique therefore, takes into consideration errors such as cross-sectional dependence to give unbiased efficient results (Tugcu, 2018). It can be seen that the null hypothesis of no cointegration among the variables is rejected at the 1% level.

4.3 Main PCSE Results

Having established cross-sectional dependence in the data, the panel corrected standard errors (PCSE) technique is the most appropriate as it corrects for heteroscedasticity, autocorrelation and cross-sectional dependence. The technique is robust in obtaining efficient estimates (Hecht, 2008; Moundigbaye, Rea, & Reed, 2018; Sundjo & Aziseh, 2018). Following the work of Nathaniel, Adeleye, and Adedoyin (2021), that used the PCSE estimation technique, it can be seen that PCSE results are based on three forms of autocorrelation namely; no autocorrelation, common autocorrelation and panel-specific autocorrelation. The results which are displayed in Table 5 are consistent across the 3 specifications for lnPOP, lnPOPSQ, lnUNEM and lnDCB.

Table 5: Main PCSE Results (Dep. Var. lnPC).

Variables	No Autocorrelation	*AR*(1) Process	Panel *AR*(1) Process
	[1]	[2]	[3]
lnPOP	-4.3394***	-5.7592***	-7.1536***
	(-10.64)	(-9.93)	(-9.17)
lnPOPSQ	0.1233***	0.1692***	0.2103***
	(9.32)	(9.54)	(9.00)
lnUNEM	-0.4939***	-0.3180***	-0.2201***
	(-15.72)	(-10.75)	(-6.93)
lnDCB	-0.2407***	-0.0934***	-0.0426***
	(-3.88)	(-4.38)	(-2.73)
lnTR	0.1668*	-0.0517	-0.0093
	(1.73)	(-0.96)	(-0.24)
INFL	0.0130***	-0.0011	-0.0005
	(2.97)	(-1.13)	(-0.78)
Constant	-71.2097**	0.0000	0.0000
	(-2.06)	(.)	(.)
No. of Obs.	273	273	273
Year Dummies	Yes	Yes	Yes
Countries	11	11	11
R-Squared	0.792	0.987	0.996
Wald Statistic	24979.64***	572563.57***	618691.23***

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively; ln = natural logarithm; PC = per capita GDP; POP = population; UNEM = unemployment rate; DCB = domestic credit provided by banks; INFL = inflation rate; TR = trade openness
Source: Authors' Computations

Population shows a nonlinear U-shaped relation to economic growth across all model specifications. The results indicate that as population grows, per capita income falls up to a population threshold after which per capita income rises. This outcome is an important contribution to the literature because it shows population growth may initially exert negative outcomes on economic growth (Messner, 1983; Krahn, Hartnagel, & Gartrell, 1986; Wesley & Peterson, 2017) after which it becomes a significant positive contributor to growth (Rahman et al. 2020). This outcome supports Sebikabu, Ruvuna, and Ruzima (2020) who find population growth encouraged the development of the economy of Rwanda. This is not unexpected as population brings about increased demand which in turn enhances the productive capacity of an economy thereby leading to growth. From Equation [2], the population-economic growth turning point is 17.592 in natural logarithm. Taking the respective exponent, the population threshold at which economic growth starts to rise is 43,662,492. This figure lies within maximum values of the population of the sampled countries. In actual fact, three countries have average population figures that is slightly above the threshold. They are Egypt (59,473,884), Turkey (55,302,767) and Iran (54,121,933). Figure 2 shows the population-economic growth turning point for the model [1] which is based on the assumption of no autocorrelation.

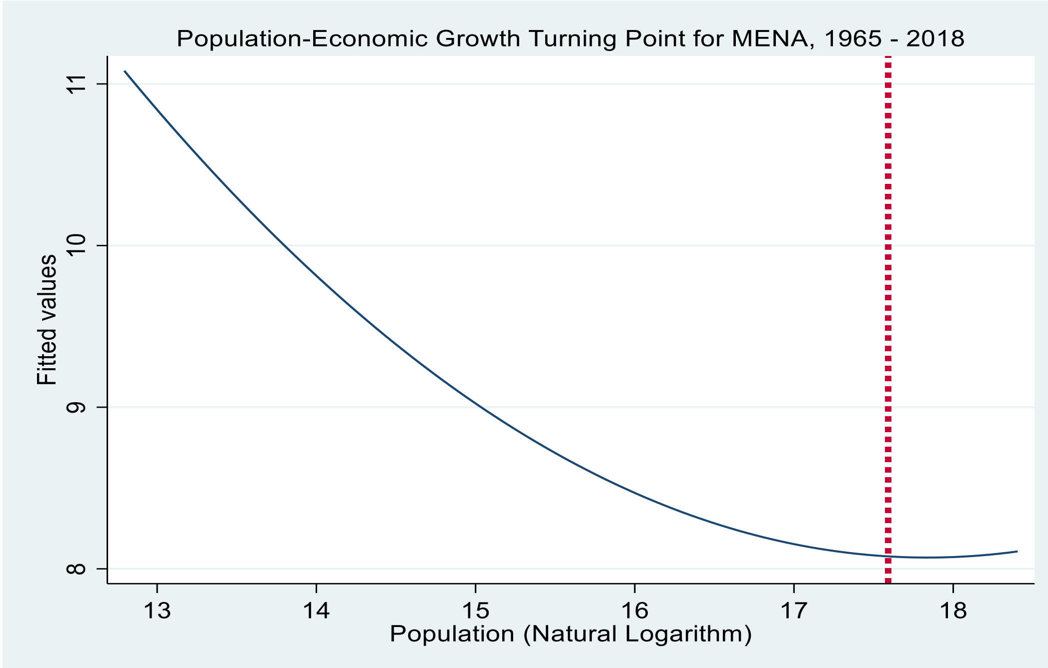

Fig. 2: Population-Economic Growth Turning Point at 17.592 for MENA, 1965 – 2018.
Source: Authors' Computations.

Other results reveal that a percentage change in unemployment leads to a decline in economic growth by 0.49, 0.32 and 0.22 per cent, on average, *ceteris paribus*. This finding further illuminates the different outcomes on the unemployment-output relation as goes to show that this relation varies due to different economic climates. It majorly contradicts Okun's law (1962) which argues that if the unemployment rate falls to 1%, then the output will be increased by 3% but aligns with Mitchell and Pearce (2010) and Irfan et al. (2010) who show that output and unemployment move in opposite direction. Sadiku et al. (2015) found no significant impact of unemployment on economic growth.

Also, a percentage change in financial intermediation results in 0.24, 0.09 and 0.04 percentage decrease in economic growth, on average, *ceteris paribus*. This outcome is not consistent with *a priori* expectations as finance is adjudged to be an important growth stimulator (Hye & Wizarat, 2013; Orji et al. 2015). In retrospect, the results align with the conjectures of McKinnon (1973) and Shaw (1973) who illustrated the dangers of a repressive financial system on the economies of developing countries and argues that financial repression is inimical to economic growth. The negative-finance outcome further aligns with Adeniyi et. (2015), Inekwe et al. (2019), and Odugbesan et al. (2020).

From the model with no autocorrelation, trade has a significant positive impact on economic growth. The outcome shows that a percentage change in trade leads to 0.17 percentage increase in economic growth, on average, *ceteris paribus*. This finding shows that trade plays a key role in influencing growth in MENA countries and consistent other related studies (Menyah, Nazlioglu, & Wolde-Rufael, 2014; Sakyi, 2011; Nathaniel et al. 2020). Inflation shows to have a significant growth impact which contradicts Mohseni & Jouzaryan (2016). The results of the technique robustness checks with the feasible generalised least squares (FGLS) approach shown in Table 6 validate those of Table 5. Therefore, analogous interpretation holds.

Table 6: Robustness FGLS Results (Dep. Var. lnPC).

Variables	No Autocorrelation	*AR*(1) Process	Panel *AR*(1) Process
	[1]	[2]	[3]
lnPOP	-6.9338***	-4.1175***	-5.4869***
	(-12.49)	(-6.79)	(-11.19)
lnPOPSQ	0.2017***	0.1145***	0.1593***
	(11.77)	(5.99)	(10.45)
lnUNEM	-0.4186***	-0.1594***	-0.1051***
	(-12.79)	(-7.14)	(-5.59)

lnDCB	-0.2415***	-0.0106	0.0133
	(-4.75)	(-0.46)	(0.75)
lnTR	0.1279	-0.0759	-0.0604*
	(1.58)	(-1.59)	(-1.69)
INFL	0.0145***	-0.0003	-0.0001
	(5.71)	(-0.33)	(-0.19)
Constant	315.2372	67.4382*	38.5122
	(0.78)	(1.73)	(1.24)
No. of Obs.	273	273	273
Year Dummies	Yes	Yes	Yes
Countries	11	11	11
Wald Stat.	1928.27***	1359.86***	803.07***

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively; ln = natural logarithm; PC = per capita GDP; POP = population; UNEM = unemployment rate; DCB = domestic credit provided by banks; INFL = inflation rate; TR = trade openness
Source: Authors' Computations

5 Conclusion and Policy Recommendations

This study contributes to the population-economic growth literature by interrogating whether the relationship is monotonic or if a turning point exists. Using panel data on a sample of 19 MENA countries from 1965 to 2018 and deploying the PSCE and FGLS techniques, the results reveal *inter alia*: (1) a U-shaped relation exists; (2) turning point is at 43.6million population; (3) unemployment and financial development are negative predictors of economic growth; and (4) trade and inflation rate are positive predictors. Policy recommendations are not far-fetched. Having shown that population growth initially exerts a negative impact on economic growth before inverting its course after a turning goes to elucidate the significance of population. We there suggest that governments of MENA should provide enabling environments that will make its population contribute positively at the onset towards economic growth. Also, measures that will stimulate employment like informal skills acquisition for the people should be encouraged. This will enable individuals set up businesses of their own and aid in the development of the informal sector. Similarly, monetary regulators must promote financial liberalization that will allow the move of funds from the surplus to the deficit users which ultimately encourages lending, stimulates investment and output growth. In addition, more trade liberation which engenders globalization should be encouraged with relaxed tariffs to aid international product competition. Lastly, inflation must be controlled such that it does not have adverse consequences on the economy.

References

[1] Adeleye, N., and Jamal, A. (2020). “Dynamic Analysis of Violent Crime and Income Inequality in Africa”, International Journal of Economics, Commerce and Management, VIII(2) February 2020.

[2] Adeleye, N., Osabuohien, E., Bowale, E., Matthew, O., and Oduntan, E. (2018) “Financial reforms and credit growth in Nigeria: Empirical insights from ARDL and ECM techniques”, International Review of Applied Economics, 32(6), 807-820, DOI:10.1080/02692171.2017.1375466 http://dx.doi.org/10.1080/02692171.2017.1375466.

[3] Adeleye, B. N., Adedoyin, F., and Nathaniel S., (2020). “The Criticality of ICT-Trade Nexus on Economic and Inclusive Growth”. Information Technology for Development DOI: 10.1080/02681102.2020.1840323.

[4] Adeniyi, O., Oyinlola, A., Omisakin, O., & Egwaikhide, F. O. (2015). Financial development and economic growth in Nigeria: Evidence from threshold modelling. Economic Analysis and Policy, 47, 11–21.

[5] Agarwal, S. (2014). Impact of India’s Population Growth on Economic Development, Economics.

[6] Akintunde, T. S., Olomola, P. A., Oladeji, S. I. (2013). Population dynamics and economic growth. Journal of Economics and Sustainable Development, 4(13):148-157.

[7] Bawazir, A.A.A., Aslam, M., Osman, A.F.B. (2020). Demographic change and economic growth: empirical evidence from the Middle East. Economic Change and Restructuring 53:429–450.

[8] Bloom, D.E., Canning, D., Sevilla, J., 2003. The Demographic Dividend: A New Perspective on the Economic Consequences

of Population Change. RAND, Santa Monica, CA, MR-1274.

[9] Dao, M.Q. (2012). Population and economic growth in developing countries. International Journal of Academic Research in Business and Social Sciences, 2(1):6-17.

[10] Degu, AA (2019). The nexus between population and economic growth in Ethiopia: an empirical inquiry. 12(3): 43-50.

[11] Eli, H.T., Mohammed, I.D., Amade, P. (2015). Impact of Population Growth on Economic Growth in Nigeria (1980-2010). IOSR Journal of Humanities and Social Science (IOSR-JHSS) Volume 20 (4): 115-123.

[12] Hakeem, O.A., Chisom, E., Ikenna, M.N (2016) Population dynamics and economic growth in Nigeria. Journal of Economics and Sustainable Development. Vol.7, No.15.

[13] Heady, D. D., Hodge, A. (2009). The effect of population growth on economic growth: A meta-regression analysis of the macroeconomic literature. Population and Development Review, 35: 221-248.

[14] Hye, Qazi Muhammad Adnan, and Shahida Wizarat. 2013. "Impact of Financial Liberalization on Economic Growth: A Case Study of Pakistan." Asian Economic and Financial Review 3 (2): 270–282.

[15] Inekwe, J. N., Jin, Y., & Valenzuela, M. R. (2019). Financial conditions and economic growth. International Review of Economics & Finance, 61, 128–140.

[16] Irfan L. et al. (2010). "Test of Okun's Law in some Asian Countries: Cointegration Approach", European Journal of Scientific Research, 40 (1), 73-80.

[17] Jones, C.I., (2001). Was an industrial revolution inevitable? Economic growth over the very long run. Advances in Macroeconomics1.

[18] Karki, S., Banjara, S., & Dumre, A. (2020). A review on impact of inflation on economic growth in Nepal. Archives of Agriculture and Environmental Science, 5(4), 576-582. https://doi.org/10.26832/24566632.2020.0504022.

[19] Kelley AC, Schmidt RM (1995) Aggregate population and economic growth correlations: the role of the components of demographic change. Demography 32:543–555.

[20] Kelley, A. C., Schmidt, R. M. (2001). Economic and demographic change: A synthesis of models, findings and perspectives. In N. Birdsall, A. C. Kelley, & S. W. Sinding (Eds.), Population matters: Demographic change, economic growth, and poverty in the developing world (pp. 67-105). New York, NY: Oxford University Press.

[21] Kelley, AC., Schmidt, R.M (2005) Evolution of recent economic-demographic modeling: a synthesis. J Popul Econ 18:275–300.

[22] Kotani S., Kotani, K. (2012). The effect of net-migration on population-growth relationship in Indonesia. Asian Journal of Empirical Research, 2(2):62-72.

[23] Krahn, H., Hartnagel, T. F., and Gartrell, J. W. (1986). Income Inequality and Homicide Rates: Cross-National Data and Criminological Theories. Criminology, 24(2), 269-294.

[24] Kremer, M., 1993. Population growth and technological change: One million B.C. to 1990. Quarterly Journal of Economics 108 (3): 681–716.

[25] Kuznets, S., 1967. Population and economic growth. Proceedings of the American Philosophical Society 111: 170–193.

[26] Malthus, T.R. (1798). An Essay on the Principle of Population, J. Johnson, London, pp 1–126.

[27] Mason A (1988), Savings, Economic Growth and Demographic Change, Population and Development Review 14, No. 1: 113-144.

[28] Mckee, M. et al. (2017). Demographic and economic material factors in the MENA Region. Working Papers, MENARA.

[29] McKinnon, R. I. 1973. Money and Capital in Economic Development. Washington, DC: Brookings Institution.

[30] Menyah, K., & Wolde-Rufael, Y. (2010). Energy consumption, pollutant emissions and economic growth in South Africa. Energy Economics, 32 (6), 1374–1382.

[31] Messner, S. F. (1983). Regional Differences in the Economic Correlates of the Urban Homicide Rate. Criminology, 21(4), 477-488.

[32] Mierau, J. O., Turnovsky, S. J. (2014). Demography, growth and inequality. Economic Theory, 55: 29-68.

[33] Miller, S.M.; Upadhyay, M.P. (2000) The effects of openness, trade orientation, and human capital on total factor productivity. Journal of Development Economics, 63, 399–423.

[34] Mohseni, M. and Jouzaryan, F. (2016). Examining the Effects of Inflation and Unemployment on Economic Growth in Iran (1996-2012). Procedia Economics and Finance 36, 381 – 389. doi: 10.1016/S2212-5671(16)30050-8.

[35] Nathaniel, S., Barua, S., Hussain, H., and Adeleye, N. (2020). "The Determinants and Interrelationship of Carbon Emissions and Economic Growth in African Economies: Fresh Insights from Static and Dynamic Models", Journal of Public Affairs, e2141, https://doi.org/10.1002/pa.2141.

[36] Odugbesan, J. A., Ike, G., Olowu, G., and Adeleye, B. N. (2020). "Investigating the causality between financial inclusion, financial development and sustainable development in Sub-Saharan Africa economies: The mediating role of foreign direct investment". Journal of Public Affairs DOI: 10.1002/PA.2569.

[37] Okun, A. M. (1962). Potential GNP: Its measurement and significance. American Statistical Association, Proceedings of the Business and Economics Section, 98-103.

[38] Orji, Anthony, Ekene Aguegboh, and Onyinye I. Anthony-Orji. 2015. "Real Sector Output and Financial Liberalisation in Nigeria." Journal of Infrastructure Development 7 (2): 136–150.

[39] Sadiku, M., Ibraimi, A., Sadiku, L. (2015). Econometric Estimation of the Relationship between Unemployment Rate and Economic Growth of FYR of Macedonia. Procedia Economics and Finance 19, 69 – 81 doi: 10.1016/S2212-5671(15)00009-X.

[40] Sakyi, D. (2011). Trade openness, foreign aid and economic growth in post-liberalisation Ghana: An application of ARDL bounds test. Journal of Economics and International Finance, 3(3), 146–156.

[41] Shaw, E. S. 1973. Financial Deepening in Economic Development. New York, NY: Oxford University Press.

[42] Sulaiman, C.; Bala, U.; Tijani, B.A.; Waziri, S.I.; Maji, I.K. (2015). Human capital, technology, and economic growth: Evidence from Nigeria. SAGE Open. 5, 2158244015615166.

[43] Solow, RM. (1956). A Contribution to the Theory of Economic Growth. The Quarterly Journal of Economics 70:65–94.

[44] Srininvasan, T. N. (1987). Population Growth and Economic Development, Yale University.

[45] Tamura, R., 2006. Human capital and economic development. Journal of Development Economics 79 (1): 26–72.

[46] Thuku, G. K., Gachanja, P. M., & Obere, A. (2013). The impact of population change on Economic growth in Kenya. International journal of Economics and management sciences, 2(6):43-60

[47] Wesley, E. and Peterson, F. (2017). The Role of Population in Economic Growth. SAGE Open. 1-15. DOI: 10.1177/2158244017736094.

Appendix:

Table A1 List of Countries and Average Values

S/No	Country	GDP per capita	Population
1	UA Emirates	65,143.67	3,240,830.5
2	Qatar	64,962.44	773,243.6
3	Kuwait	40,071.00	1,940,269.2
4	Cyprus	22,532.47	843,405.4
5	Saudi Arabia	22,474.88	17,072,912.0
6	Bahrain	20,730.99	641,655.8
7	Oman	13,914.91	2,013,168.2
8	Libya	8,971.01	4,393,883.8
9	Turkey	7,622.32	55,302,767.0
10	Iran	5,869.01	54,121,933.0
11	Lebanon	5,779.61	3,622,195.9
12	Algeria	3,641.97	26,242,887.0
13	Iraq	3,266.70	20,101,562.0
14	Jordan	3,158.09	4,388,660.8
15	Tunisia	2,611.16	8,196,987.0
16	Morocco	1,889.16	25,030,415.0
17	Egypt	1,638.28	59,473,844.0
18	Yemen	1,084.77	14,221,115.0

19	Sudan	1,042.13	22,591,351.0

Source: Authors' Calculations