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Energy Utilization and Output Dynamics in the Middle East and North Africa Countries: Is the Export- and Globalization-Led Hypothesis Valid?

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1. Introduction

The Middle East and North Africa (MENA) region consists of several countries in a vast area of land spreading across the northern part of the continent of Africa up to the Middle East region in Asia. Over the years, trading activities have notably grown in this region, especially the trade of raw primary commodities such as crude petroleum as many of the countries in this region are vastly endowed with oil and gas reserves. As of 2019, countries in the Middle East region alone account for about 48.08% of the global proved crude oil reserves, and the MENA region altogether accounts for about 45.39% of total global crude oil export (BP 2020). This abundant raw commodity endowment partially explains the trend of the growing volume of trade that was witnessed in the region as production in oil and gas industry does not only stimulate larger exports but also helps in footing large import bills through abundant foreign reserves from oil revenues. As such, trade dynamics are expected to have created attendant effects on the general economic performance of the MENA countries over the years.

In the era that is characterized with the global drive for sustainable economic growth amidst the global goals vis-à-vis the Sustainable Development Goals (SDGs) of the United Nations Development Programme (UNDP, 2015), growth dimensions have consistently been amplified. While the account of export in trade especially for energy commodities might be significant for the case of the MENA countries, generally, other factors are potential sources of economic expansion. For instance, the early work of Kraft and Kraft (1978) has been largely complemented, thus reaffirming the aspects of energy development (Khalid et al. 2018, Alola et al. 2020, Doğan et al. 2021, Nwani 2021). In addition, the new global order of economic competition amidst the SDGs (SDG-1, SDG-8, and SDG-10) for economic prosperity and reduction of inequality, is recalibrating the economic aspects of trade globalization (Brown &

Lauder 1996, Joshua et al. 2020). With a broader economic intuition, the augmentation of the growth model (Solow 1956) has provided more relevant aspects of economic development.

While the global concern for a more sustainable environment continues to rise, a review of the export-led growth hypothesis (ELGH) vis-à-vis the growing energy demand and rapid urbanization would be beneficial for both the economic and environmental sustainability of the countries in this part of the world. Firstly, because of the roles that hydrocarbon-based activities play in the overall economic performance of the region, and secondly, to address the growing demands for environmental sustainability even in the era of trade globalization. Hence, this study focuses on empirically exploring the subject matter of the ELGH while considering the possible implications of energy dynamics for both the economic and environmental sustainability of selected MENA countries including Algeria, Egypt, Iran, Qatar, Saudi Arabia, Kuwait, Oman, and Morocco. The study addresses the salient issues of sustainable development from the perspectives of trade globalization and energy consumption amidst rapid urbanization in the region which has often been overlooked in the extant studies on the ELGH for the area. The novelty of the study is both from the variable augmentation (by employing export in trade and trade globalization) and model specification (the utilization of both cointegration and quantile regression).

The entire study has been structured into four sections. Section one (1) contains the introduction, section two (2) discusses the extant studies, section three (3) provides detailed information on the empirical methodology, data sources, and the discussions of results, while section four (4) concludes the study with policy recommendations.

2. Literature Review

The debate on economic growth catalyst has been a topical issue in the growth literature. This has led to lots of growth models like the classical growth model built on the Cob-Douglas production function (Douglas, 1976), Solow growth model (Solow, 1956), and more. Additional growth models have been recorded in the growth literature like the export-led growth hypothesis (ELGH); this hypothesis highlights the nexus between export and economic growth. The export-induced economic growth is well documented in development and international economic literature. The baseline assumption of neoclassical growth theory advances that export is integral and pertinent to economic productivity which by extension increases global market more competitive. However, the export and economic growth in inconclusive in the extant literature.

The flourishing literature on ELGH varies based on the sample period, data, and econometrics procedure used. Empirically in Bangladesh, Love and Chandra (2005) explored the validity of the ELGH over the period 1972–2000. The study showed a uni-directional causality running from economic growth to export. Thus, it failed to give credence to the ELGH in Bangladesh over the sample period. More recently, Marwan et al. (2013) did not find support for a causality connection between exports and economic growth for Sudan's economy. Similarly, Gokmenoglu et al. (2015) explored the case of Costa Rica using Johansen co-integration and Granger Causality test as estimation techniques to investigate the long-run relationship and causality between exports and economic growth for Costa Rica. Their empirical results fail to find support for ELGH. Instead, the study found a economic growth-export relationship as reported by the Granger causality analysis over annual frequency period from 1980–2013. The study of Quaicoe et al. (2017) using Vector error correction model (VECM) join the strands of literature that fail to find validity for the ELGH for the Ghanaian experience. On the other hand, there exist studies that find support for the validity of the ELGH. Balassa (1978) investigated the nexus between economic growth and exports for eleven selected developing economies. The study findings submit that exports drive economic growth thereby affirming the validity of the ELGH for the sampled blocs. Tyler (1981) examined ELGH for fifty-five countries. The study found a positive relationship between export and economic growth over the sampled period. More studies have found validation for the ELGH (see Wacziarg (2000), Mamun & Nath (2005), Herrerias & Orts (2010)).

There is a flourishing study on the nexus between impact of export diversification, energy consumption on economic growth for different regions, and different techniques to explore the effect of other macroeconomic indicators on economic growth. For instance, Herzer and Nowak-Lehmann (2006) investigated the impact of export diversification in a production function framework for an annual frequency period from 1962–2001 in Chile. The study shows that export is pertinent to the economic growth of the Chilean economy. More studies in the energy literature have augmented the production function with foreign trade volume to explore the effect of foreign trade on economic growth. Examples of such studies are Shahbaz et al. (2013) using autoregressive distributed lag methodology investigated the long run and causality relationship between financial development, foreign trade, and capita in China's economy over 1971–2011. The study demonstrated a long-run relationship between the outlined variables. While the long-run regression shows a positive correlation between foreign trade and energy consumption on economic growth, in the case of China. Another study for Australia conducted by Rahman and Mamun (2016) investigated the long-run and causality relationship between energy use and international trade on GDP growth. The study submits that there exists a long-run bound between the outlined variables. On the other hand, the causality analysis reveals a feedback casualty relationship between trade and economic growth. In a panel of fifteen countries, Usman et al.

(2020) examined the impacts of financial development, disaggregated energy consumption (renewable and non-renewable energy usage), and trade openness on economic growth. The study found that both renewable energy utilization and trade openness significantly influence GDP growth. The outcome of Le (2020) for forty-six Emerging Market and Developing Economies shows that financial development energy use and trade openness positively and significantly affect the GDP growth while the study also validates the energy induces growth hypothesis where energy is a key indicator for GDP growth over investigated period. The study of Zafar et al. (2019) is in line with Le (2020) however for the case of Asia-Pacific Economic Cooperation (APEC) countries.

Given the trajectory of literature highlighted, looking from another perspective, studies of the nexus between export and economic growth while accounting for trade and financial development on economic growth is well established in the literature. However, an investigation into ELGH while addressing the role of urbanization, trade, globalization, and primary energy consumption on economic growth for selected Middle East and North Africa (MENA) countries is limited. To this end, the present study distinct from the previous literature on the following fronts: (i) This study incorporates primary energy consumption, globalization, urbanization, and trade openness in the ELGH framework for selected Middle East and North Africa (MENA) countries which have received less documentation in the extant literature. The variables highlighted in this study align with the United Nations Sustainable Development Goals (SDGs) target to be achieved by 2030 which has received fewer entries in the literature. Thus, this study seeks to fill this void. (ii) The scope of this study is timely for selected Middle East and North Africa (MENA) countries, which will serve as policy documented for other emerging economies. (iii) This study provides a battery of econometrics contribution by the adoption of quantile regression that accounts for different tails of the data in conjunction with Augmented Mean Group (AMG), Common Correlated Effects Mean Group (CCEMG), and Dumitrescu and Hurlin for direction of causality analysis among the outlined variables. Our study circumvents cross-sectional dependency analysis by utilizing second-generational estimators, thus providing robust coefficients for ample policy construction.

3. Data and Methodology

The data set consists of a panel of observations on all variables of interest for the included countries in the study from 1990 spanning to 2018. The main explanation and justification for the sample range and the number of countries included in the study is based on data availability. The level of availability of reliable data points is still very low in many of the MENA countries as majority of these countries are still developing. Besides, the developmental process that could pave way for reliable and continuous data collection in some countries in the region are often characterized by various setbacks including political instability, corruption, various humanitarian challenges, conflicts, and displacements of the people among other issues. As such, the study is limited to eight selected countries including, Algeria, Egypt, Iran, Qatar, Saudi Arabia, Kuwait, Oman, and Morocco. Data points were sourced from the World Bank Development Indicator WDI (2020), the Globalization Index of the KOF Swiss Economic Institute (Gygli et al. 2019), and British Petroleum Statistical Review of World Energy (BP 2020). Equation (1) was set up to explore the nexus between globalization in trade, energy consumption, and the economic performance of the selected countries:

$$LnY_{it} = \alpha + \beta_1 LnREXP_{it} + \beta_2 LnTiG_{it} + \beta_3 LnECN_{it} + \beta_4 LnUrB_{it} + \mu_{it} \quad (1)$$

From equation (1), the variable *LnY* represents the real gross domestic product (GDP) per capita (current $) for country *i* in time *t* while the variable *LnREXP* denotes the real export of goods and services. The ratio of the sum of import and export of a country measured as a percentage of the country's GDP has been used in extant studies to proxy for trade openness and in some cases, it is simultaneously used to measure the impacts of globalization (Bal et al. 2016, Joshua et al. 2020; Khatir et al. 2022; Yussif et al. 2022). However, rather than using this variable to capture the effect of globalization in trade, the KOF index for trade globalization ($LnTiG$) was adopted for the study. The index provides a broader approach to measuring globalization in trade by accounting for not just the export components of trade as commonly used in the ELGH, or the traditional trade openness variable alone, but the index also accounts for other crucial factors that impact international trade dynamics such as trade regulations, taxes, tariffs, and agreements. As such, the $LnTiG$ variable provides necessary control for important trade impacting factors within the context of trade globalization. The KOF index has been applied in empirical studies in many economies, especially for the OECD countries and the BRICS economies (Lee et al. 2017, Haseeb et al. 2019, Ilham et al. 2021; Saint Akadiri et al. 2020; Gyamfi et al. 2023). The variable $LnECN$ denotes primary energy consumption per capita (Gigajoule per capita) and it was used to capture the impact of energy consumption in each country as seen in several studies (Onifade, 2023; Haouas et al. 2023; Onifade et al. 2023), while μ_{it} is the error term for the model given estimations from the observations from each country. Also, we incorporated the variable $LnUrB$ (urban population measures as percentage of total population) into the model to capture the possible effects of urbanization among the countries as this variable has been strongly debated and associated with energy dynamics in contemporary studies (Shahbaz et al. 2019, Hassan et al. 2019, Onifade et al. 2021, Shahbaz et al. 2021). Lastly, the model was defined in terms of per capita because the countries under investigations vary in different regards when considering their population size, the size of individual country's labor force, and the GDP size among other issues (Yavari and Mohseni 2012, Luo 2020).

3.1 Summary Statistics and Correlation Analysis

The correlation analysis amongst the four variables was performed and the obtained correlation coefficients are provided in Table 1.

<Insert Table 1>

The simple correlation results from Table 1 shows that there is a weak correlation between per capital income and the trade components while both energy consumption and urbanization have strong correlation with income level. Given that there is substantial level of economic proximity among the countries in the panel study considering that economic activities are predominantly driven by oil and gas sector in the region, it is highly imperative to account for possible cross-section dependency among variables of interest. This would help in providing a better insight into the choice of appropriate unit-root and cointegration tests accordingly. Besides, the significance of the CD test has been emphasized in the literature (De Hoyos & Sarafidis 2006, Eberhardt & Bond 2009, Dong et al. 2018). Hence, the results of three cross-sectional dependency tests were reported for the study. The outputs of Pesaran (2015) LM Test, Pesaran (2007) CD Test, and the estimate from Breusch and Pagan (1980) LM Test, have been reported in Table 2.

<Insert Table 2>

From the results in Table 2, given the statistical significance of the various test statistics, we reject the null hypothesis of no cross-sectional dependence and therefore conclude that there is cross-sectional dependence in the panel study. As a result, the study adopted panel unit root tests that can conveniently accommodate the challenges of presence of CD in the panel observations.

3.2 Panel Unit Root Test

The need to conduct a unit root test while analyzing economic relationships with time series data has been highlighted in the empirical literature (Katsiampa 2017, Onifade et al. 2020a, Taiwo et al. 2020). Having confirmed cross-section dependency in Table 2, applying the traditional panel unit root tests like the Fisher Augmented Dickey-Fuller (Dickey & Fuller, 1979), Philips & Perron (1988), and Im et al. (2003) could create spurious results as regarding the actual unit-root properties of variables and ultimately lead to a flaw in the corresponding cointegration relationship among the variables in the panel study. Hence, the Pesaran (2007) panel IPS and CIPS tests that can accommodate unit root test in the presence of cross-sectional dependency were applied for the unit root analysis. The tests were carried out on all the variables at the level and the first difference, using the model that allows for individual intercepts and trend and the results are provided in Table 3.

<Insert Table 3>

The unit root test results show that all variables are non-stationary at the level. However, all variables were stationary at the first difference and therefore integrated order of one I(1). This result justifies the adoption of the co-integration techniques for the study in line with empirical studies (Adedoyin et al. 2020, Shahbaz et al. 2018a, Shahbaz et al. 2018b).

3.3 Panel Cointegration Test

When variables are non-stationary in the level and stationary in the first difference, we can apply the Johansen co-integration test to ascertain the long-run relationship between the variables (Shrestha and Bhatta 2018, Çoban et al., 2020; Hakan, et al. 2022). However, caution must be exercised in choice of approach since not all panel cointegration techniques can conveniently accommodate the presence of cross-sectional dependency. Hence, the study utilizes Westerlund (2007) technique for examining the cointegration relationship among the variables. Given panel variables *Y* and *X* following the expression in Equation 2, the Westerlund (2007) cointegration technique is based on the error correction mechanism (ECM).

$$\Delta Y_{it} = \pi_i d_i + \theta_i (Y_{it-1} + \gamma_i^* X_{it-1}) + \sum_{j=1}^{m} \theta_{ij} \Delta Y_{it-j} + \sum_{j=0}^{m} \delta_{ij} \Delta X_{it-j} + \varepsilon_{it} \qquad (2)$$

Where, $\pi_i^* = (\pi_{1i}, \pi_{2i})^*$, denotes the vector of parameters in the model. The $d_t = (1-t)^*$, denotes the deterministic mechanisms, while θ_i represents the error correction parameter. The technique produces four major statistics based on the least square estimation and corresponding significance of the adjustment term θ_i of the ECM model in Eq. 2 to identify the existence of cointegration. The Westerlund (2007) cointegration technique produces both group statistics (Gτ and Gα) and the panel statistics (Pτ and Pα) as shown in Equation 3 and 4, respectively.

$$G\tau = \frac{1}{N}\sum_{i=1}^{N} \frac{\hat{}\propto i}{SE(\hat{}\propto i)} \qquad G\alpha = \frac{1}{N}\sum_{i=1}^{N} \frac{T\hat{}\propto i}{\hat{}\propto i(1)} \qquad (3)$$

From equation 3, $\hat{} \propto i$ is represented by $SE(\hat{} \propto i)$ as the standard error while the semiparametric kernel approach of $\propto i(1)$ follows $\hat{} \propto i(1)$.

$$P\tau = \frac{\hat{}\propto i}{SE(\propto i)} \qquad P\alpha = T\alpha\hat{} \qquad (4)$$

From Equation 4, the panel mean estimations show that the entire panel is co-integrated. Following contemporary studies (Alola et al. 2020, Shahbaz et al. 2018a;b; Onifade & Alola, 2022), we reported the estimates for the Westerlund (2007) cointegration technique as shown in Table 4.

<Insert Table 4>

From Table 4, the Westerlund (2007) panel cointegration techniques report a combination of four test statistics. According to the results, both group statistics (Gτ and Gα) and the panel statistics (Pτ and Pα) have P-values that are less than 5% to reject the null hypothesis that there is no co-integration relationship among the variables. Hence, the confirmation of a long-run relationship between the variables.

3.4. Panel Regressions Approach

Having established the long-run relationship between the variables, we proceed to panel regression estimations. The Common Correlated Effects Mean Group (CCEMG) estimator, the Augmented Mean Group (AMG), and the Quantile regression (QR) techniques were adopted for the study as these techniques are among the second-generation regression approaches that have been noted to be capable of producing robust estimate for models with cross-sectional dependence (Mensi et al. 2014, Halliru et al. 2020, Moreno-Izquierdo et al. 2020). The CCEMG panel estimator of Kapetanios et al. (2011) based on the original approach of Pesaran (2006) was applied with regards to Equation 5 while the AMG estimator of Eberhardt and Bond (2009) and Eberhardt and Teal (2010) follows the Equation 6.

$$Y_{it} = \alpha_i + \beta_i X_{it} + \gamma_i {Y^*}_{it} + \delta_i {X^*}_{it} + \theta_i UCF_t + \mu_{it} \quad (5)$$

$$\Delta Y_{it} = \alpha_i + \beta_i \Delta X_{it} + \sum_{t=1}^{T} \pi_t D_t + \varphi_i UCF_t + \mu_{it} \quad (6$$

From Equation 5, the Y^* and X^* denote the average values of the panel variables Y and X while the *UCF* variable denotes the unobserved common effects. Subsequently, from Equation 6, given that Δ and D are the difference operator and a dummy component, respectively, the corresponding AMG operator given N number of countries follows the expression in Equation 7.

$$\text{AMG} = \frac{1}{N}\sum_{i=1}^{N}\varphi_i \qquad (7)$$

The country-specific estimates of coefficients are denoted by φ_i in Equation 7. Having taken into cognizance the outputs from the initial tests, in addition to the CCEMG and the AMG, the quantile regression (QR) as developed by Koenker and Bassett (1978) was also applied to examine the impacts of the explanatory variables in the initial base model of the study following the expression in Equation 8.

$$QLnY_{it}(\tau/\chi_{it}) = \phi_i^{(\tau)} + \phi_1^{(\tau)}LnOPN_{it} + \phi_2^{(\tau)}LnTiG_{it} + \phi_3^{(\tau)}LnLab_{it} + \phi_4^{(\tau)}LnEXR_{it} + \phi_5^{(\tau)}LnECN_{it} + \mu_{it} \quad (8)$$

From equation 8, the β represents the slope parameter for each regressor at given quantile (τ) while $QLnY_{it}(\tau/\chi_{it})$ represent the τ^{th} conditional quantile of the given dependent variable. χ_{it} captures the vector of the regressors for the quantile (τ) with respect to individual country *i* in the panel study at a given time *t* while μ_{it} represents the disruption term of the given vector. The estimated slope parameters ϕ_1 and ϕ_2 are espexted to come out positive and significant for the affirmation of the trade-led growth hypothesis. The estimations from the QR were used as sensitivity test to complement the findings from the CCEMG and the AMG approaches for the purpose of enhanced empirical analysis since the QR approach has a unique strength of accounting for heterogeneity and other important issues like variations in distribution of data observations for obtained coefficient estimates (Angrist et al. 2006, Alsayed et al. 2020). The results of the combined estimation techniques were presented in Table 5.

<Insert Table 5>

Table 5. QR and CCEMG estimates

Techniques	***CCEMG***	***AMG***	***Quantile Regression (QR)***									
Dependent (var): LnY			τ = 0.05	τ = 0.10	τ = 0.20	τ = 0.30	τ = 0.40	τ = 0.50	τ = 0.60	τ = 0.70	τ = 0.80	τ = 0.90
LnREXP	0.41200 **	0.4430 ***	0.0532 *	0.0706 **	0.1033 ***	0.1050 ***	0.1197 ***	0.1666 ***	0.1494 **	0.1937 ***	0.1658 *	0.2196 ***
P-value	(0.0230)	(0.0000)	(0.0600)	(0.0235)	(0.0001)	(0.0007)	(0.0022)	(0.0010)	(0.0161)	(0.0080)	(0.0542)	(0.0002)
LnTiG	-1.0492 ***	-0.6887 **	1.1401 ***	1.0319 ***	0.4127 ***	0.3773 ***	0.3230 *	0.0891	-0.1277	-0.5036 *	-0.9284 **	-1.8769 ***
P-value	(0.000)	(0.0450)	(0.0000)	(0.0000)	(0.0008)	(0.0044)	(0.0520)	(0.8050)	(0.6944)	(0.0530)	(0.0248)	(0.0000)
LnECN	0.5551	0.3453 *	0.6221 ***	0.7460 ***	0.7605 ***	0.7686 ***	0.7779 ***	0.8047 ***	0.8744 ***	0.9795 ***	0.9608 ***	0.7955 ***
P-value	(0.1220)	(0.086)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LnUrB	1.8595	0.1004	0.2995	-0.7834 ***	-0.5935 ***	-0.4169 *	-0.2827	-0.1036	-0.1841	-0.6933 **	-0.4261	0.7912 **
P-value	(0.7350)	(0.9710)	(0.6182)	(0.0013)	(0.0053)	(0.0776)	(0.1896)	(0.5994)	(0.4091)	(0.0482)	(0.3343)	(0.0242)
Observation	232	232	232	232	232	232	232	232	232	232	232	232
Wald test	23.08 ***	29.19 ***										
p-value	(0.0001)	(0.0000)										
No. Regressors	4	4	4	4	4	4	4	4	4	4	4	4
No. Group	8	8	8	8	8	8	8	8	8	8	8	8

*Source: Author's computation. Variables are in natural logarithms and the estimates were reported alongside the subscripts *, **, *** representing the statistical significance of the outputs at 10%, 5%, and 1% significance levels, respectively.*

4. Results and Discussion

From Table 5, estimates from both CCEMG and AMG estimators are similar in terms of the obtained coefficient signs. The AMG outcomes appear to be slightly better compared to the CCEMG nevertheless both reflect relatively close interpretations of relationships among variables in the model. From the outcome, real export, energy consumption, and urbanization have positive impacts on income levels among the countries. The positive impacts of real export and energy consumption on economic growth were significant while that of urbanization was not. A percentage increase in real export and energy consumption is expected to stimulate income level by 0.44% and 0.34%, respectively. This result strongly upholds the export-led growth hypothesis (ELGH) for the MENA region. The findings further support the claims from several studies regarding the stimulating impacts of energy consumption on economic growth in different economies (Dogan et al. 2020, Onifade et al. 2021, Ivanovski et al. 2021).

On the other hand, the impact of trade globalization variable was negative and significant as a percentage rise in trade globalization reduces growth by 0.68%. This is an indicator that the gains from trade among MENA countries in the panel study are still being inhibited by several trade-impacting factors including tariffs, regulation, and agreements. Findings from the QR technique corroborated the other two approaches and the QR estimates were much more insightful as the technique provided the estimates based on the observations across different quantiles.

Estimates from the QR are significant for both real export and energy consumption across all quantiles while those of trade globalization and urbanization vary significantly across quantiles. The QR approach clearly show that both real export and energy consumption were important growth stimulant as the positive impacts of these variables were significant across all quantiles. On the other hand, trade globalization demonstrated significant positive impact on growth only at the initial levels as shown by the output for the lower quantile, however, the impacts turn out to be negative at higher quantiles thus corroborating the output from the other approaches. Finally, urbanization exerts negative impacts on income levels among the country, however, the impacts were generally unstable across all quantiles.

In a nutshell, the results regarding both energy consumption and urbanization have significant implications for the region at large. A look at the trend of all variables in Figure 1 show that both variables have witnessed significant upward trend in the region, especially in the decades after the advent of oil and gas production in commercial quantity in the region. In fact, as of 2014, majority of the MENA countries in the study including Qatar, Oman, Saudi Arabia, Algeria, and Iran have fossil fuel energy consumption accounting for over 99% of the total energy consumption, while urban population could account for as high as 99.18% and 100% of the total population in Qatar and Kuwait (WDI 2020). While the present study has revealed the significant role of energy consumption in economic growth, several studies have elaborated on the dangers of fossil energy consumption vis-à-vis the exacerbation of growing carbon emission levels (Hanif 2018, Hanif et al. 2019, Newell & Simms 2020, Shahbaz et al. 2021). As such, current findings are indicators for policymakers to strategize towards investment in clean energy to help maintain sustainable environment for the region's growing urbanization level.

<**Insert Figure 1**>

Lastly, we have provided relevant diagnostic tests of slope equality for the QR estimates, and a variance inflation factor (VIF) test. The quantile slope equality test results based on the significance of the Wald test outputs show that the obtained slope coefficients are significantly different across the quantile levels while the VIF test also confirmed that the model is not suffering from multicollinearity issues as the VIFs were below the threshold of 10. The quantile slope equality test and the VIF test were presented in Tables 7 & Table 8,. The null hypothesis of slope equality is accepted for all regressors between the 20th and 40th quantile but the hypothesis is rejected at different quantiles for each of the variable for instance, while the null can be accepted for energy consumption at the 30th quantile, it can be rejected at the 50th, 70th, and 90th quantiles. As such, the test further corroborated the conclusions from the initial estimates that the impacts of the regressors on economic growth varies across quantiles.

4.1. Panel Causality Tests

To consolidate the findings, we explored the causality nexus among the variables using Dumitrescu and Hurlin (DH 2012) panel causality tests in line with the observed importance of such tests in existing empirical studies (Adedoyin et al. 2020, Dong et al. 2018, Onifade et al. 2020b, Le & Ozturk 2020) and the obtained results are detailed out in Table 6.

<Insert Table 6>

Based on the result of the DH panel causality test in Table 6, the trio of real exports, energy consumption, and trade globalization granger cause economic growth among the countries. In addition, there was a bi-directional causality between economic growth, energy consumption, and trade globalization. The causality results also reveal that both urbanization and rising income levels are drivers of energy consumption as these variables granger cause the level of energy consumption among the countries in the panel study.

5. Conclusion and Recommendations

This study has established the existence of a long-run relationship between real exports, globalization in trade, energy consumption, urbanization, and the economic growth performances of selected MENA countries between 1990 and 2018. The empirical results through a combination of second-generation techniques including the Augmented Mean Group (AMG), Common Correlated Effects Mean Group (CCEMG), and Quantile Regression (QR) affirm the validity of the export-led growth hypothesis (ELGH) for selected countries in the MENA region including Algeria, Egypt, Iran, Qatar, Saudi Arabia, Kuwait, Oman, and Morocco. However, when other salient trade impacting factors like regulations, taxes, tariffs, and agreements were accounted for, trade globalization only demonstrate significant positive impacts on income levels at lower quantiles while the distribution of the impacts turn out to be negatively significant at higher quantiles.

5.1 Policy and Recommendation

The result is an indication that the countries in the MENA region are yet to implement sufficient policy measures and reforms that can position the region towards harnessing the expected gains from trade. On the other hand, while urbanization among the countries demonstrate varying degrees of impacts on growth, energy consumption came out clear as an important growth stimulant as its impact was clearly significant across all quantiles. Finally, evidence from the Granger Causality corroborated the estimated coefficients as both the trade and the energy components granger cause the income levels for the panel study.

Hence, we recommend implementation of policies frameworks that can facilitate removal of various trade barriers by ensuring favorable tax regimes and trade regulations. Besides, strengthening of the institutions among the countries in the region to facilitate transparency and removal of bottlenecks in trade related matters would also be beneficial for the entire region to be well positioned in benefiting from trade dynamics in contemporary times.

Furthermore, based on the empirical evidence from the study, although energy consumption is highly significant for the regional growth, we would also recommend that the authorities in the MENA region should ensure more commitments toward investment in clean energy and urban infrastructures. Firstly, doing this would go a great extent in helping the region in maintaining energy driven growth vis-à-vis income sustainability as such investments would be critical to the positioning of the region for imminent energy transition which may create possible distortions on the growth trajectory for the region. Secondly, clean energy and urban investments would also help in ensuring environmental sustainability of the region while trade policies are constantly reviewed to harness the benefits of trade among these countries in an increasingly globalized world.

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Appendix

<Insert Table 7>

<Insert Table 8>

Table 1. Summary Statistics and Correlation Matrix.

	LnY	LnREXP	LnTiG	LnECN	LnUrB
Mean	2.083001	8.758959	1.728305	2.065120	1.843739
Maximum	3.240322	10.11450	1.899490	3.057744	2.000000
Minimum	1.164281	7.635893	1.343358	1.075986	1.630000
Std. Dev.	0.474586	0.450564	0.142830	0.554114	0.118202
Skewness	-0.140240	-0.021450	-0.882963	-0.001618	-0.333959
Observations	232	232	232	232	232
Correlation Matrix					
	LnY	**LnREXP**	**LnTiG**	**LnECN**	**LnUrB**
LnY	1				
p-value	-				
LnREXP	0.2790***	1			
p-value	(0.0000)	-			
LnTiG	0.4558***	-0.1652**	1		
p-value	(0.0000)	(0.0117)	-		
LnLnECN	0.8508***	0.0610	0.5457***	1	
p-value	(0.0000)	(0.3543)	(0.0000)	-	
LnUrB	0.7205***	-0.0612	0.5319***	0.8899***	1
p-value	(0.0000)	(0.3529)	(0.0000)	(0.0000)	-

*Source: Author's computation. Note: ***, ** and * are 1%, 5% and 10% significant level, respectively.*

Table 2. Cross-sectional dependency (CD) test.

Model	**Pesaran (2007) CD Test**	**Pesaran (2015) LM Test**	**Breusch and Pagan (1980) LM Test**
LnY = f (LnREXP, LnTiG, LnECN, LnUrB)	10.40***	-2.73 ***	70.25 ***
p-value	(0.0000)	(0.0060)	(0.0000)

*Source: Author's computation. Where ***, ** and * are 1%, 5%, and 10% significant leve,l respectively*

Table 3. *Panel unit root test.*

VARIABLES	CIPS		IPS	
	Level	*First Difference*	*Level*	*First Difference*
	C&T	C&T	C&T	C&T
LnY	*-2.620*	-4.802 ***	*-2.0713*	*-5.0224* ***
LnREXP	*-2.725*	*-4.292* ***	*-1.9812*	*-5.0725* ***
LnTiG	*-2.467*	*-5.104* ***	*-1.9206*	*-5.1054* ***
LnECN	*-2.168*	*-5.061* ***	*-2.0016**	*-5.8335* ***
LnUrB	*-0.750*	*-3.316* ***	*-1.8605*	*-3.2968* ***

*Source: Author's computation. Variables are in natural logarithms and the unit root tests were reported alongside the subscripts *, **, *** representing the statistical significance of the outputs at 10%, 5%, and 1% significance levels respectively. C&T represent model with both constant and trend. We report the t-bar stat for the IPS.*

Table 4. Panel Cointegration Test (Westerlund 2007).

Statistics	Value	Robust P-value
G**τ**	-2.521 ***	(0.000)
Gα	-7.330 ***	(0.000)
Pτ	-5.413 ***	(0.000)
Pα	-8.921 ***	(0.000)

*Source: Author's computation. The subscripts *, **, *** represent the statistical significance of the outputs at 10%, 5%, and 1% significance levels, respectively.*

Table 5. QR and CCEMG estimates

Techniques	CCEMG	AMG	*Quantile Regression (QR)*									
Dependent (var): LnY			τ = 0.05	τ = 0.10	τ = 0.20	τ = 0.30	τ = 0.40	τ = 0.50	τ = 0.60	τ = 0.70	τ = 0.80	τ = 0.90
LnREXP	0.41200 **	0.4430 ***	0.0532 *	0.0706 **	0.1033 ***	0.1050 ***	0.1197 ***	0.1666 ***	0.1494 **	0.1937 ***	0.1658 *	0.2196 ***
P-value	(0.0230)	(0.0000)	(0.0600)	(0.0235)	(0.0001)	(0.0007)	(0.0022)	(0.0010)	(0.0161)	(0.0080)	(0.0542)	(0.0002)
LnTiG	-1.0492 ***	-0.6887 **	1.1401 ***	1.0319 ***	0.4127 ***	0.3773 ***	0.3230 *	0.0891	-0.1277	-0.5036 *	-0.9284 **	-1.8769 ***
P-value	(0.000)	(0.0450)	(0.0000)	(0.0000)	(0.0008)	(0.0044)	(0.0520)	(0.8050)	(0.6944)	(0.0530)	(0.0248)	(0.0000)
LnECN	0.5551	0.3453 *	0.6221 ***	0.7460 ***	0.7605 ***	0.7686 ***	0.7779 ***	0.8047 ***	0.8744 ***	0.9795 ***	0.9608 ***	0.7955 ***
P-value	(0.1220)	(0.086)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LnUrB	1.8595	0.1004	0.2995	-0.7834 ***	-0.5935 ***	-0.4169 *	-0.2827	-0.1036	-0.1841	-0.6933 **	-0.4261	0.7912 **
P-value	(0.7350)	(0.9710)	(0.6182)	(0.0013)	(0.0053)	(0.0776)	(0.1896)	(0.5994)	(0.4091)	(0.0482)	(0.3343)	(0.0242)
Observation	232	232	232	232	232	232	232	232	232	232	232	232
Wald test	23.08 ***	29.19 ***										
p-value	(0.0001)	(0.0000)										
No. Regressors	4	4	4	4	4	4	4	4	4	4	4	4
No. Group	8	8	8	8	8	8	8	8	8	8	8	8

*Source: Author's computation. Variables are in natural logarithms and the estimates were reported alongside the subscripts *, **, *** representing the statistical significance of the outputs at 10%, 5%, and 1% significance levels, respectively.*

Table 6: Dumitrescu and Hurlin (DH) Panel Causality Tests.

	W-Statistics					
Variables	**LnY**	**LnREXP**	**LnTiG**	**LnECN**	**LnUrB**	**Direction of Causality**
LnY	_	1.65884	2.23580 **	3.0843 **	7.8514 ***	LnY → LnTiG, LnECN, LnUrB
p-value		(0.3250)	(0.0480)	(0.0006)	(0.0000)	
LnREXP	4.6282 ***	_	1.5356	2.3816 **	3.6335 ***	LnREXP → LnY, LnECN, LnUrB
p-value	(0.0000)		(0.4400)	(0.0259)	(0.0000)	
LnTiG	4.1965 ***	2.9556 ***	_	4.9951 ***	5.4254 ***	LnTiG → LnY, LnREXP, LnECN, LnUrB
p-value	(0.0000)	(0.0013)		(0.0000)	(0.0000)	
LnECN	4.0405 ***	1.7724	2.7228 ***	_	15.5751 ***	LnECN → LnY, LnTiG, LnUrB
p-value	(0.0000)	(0.2381)	(0.0049)		(0.0000)	
LnUrB	1.9402	2.7197 ***	2.2056 *	5.3503 ***	_	LnUrB → LnREXP, LnTiG, LnECN
p-value	(0.1419)	(0.0050)	(0.0542)	(0.0000)		

*Source: Author's computation. Variables are in natural logarithms the test statistics were reported alongside the subscripts *, **, *** representing the statistical significance of the outputs at 10%, 5%, and 1% significance levels, respectively.*

Figure 1: Graphical representation of the variables.

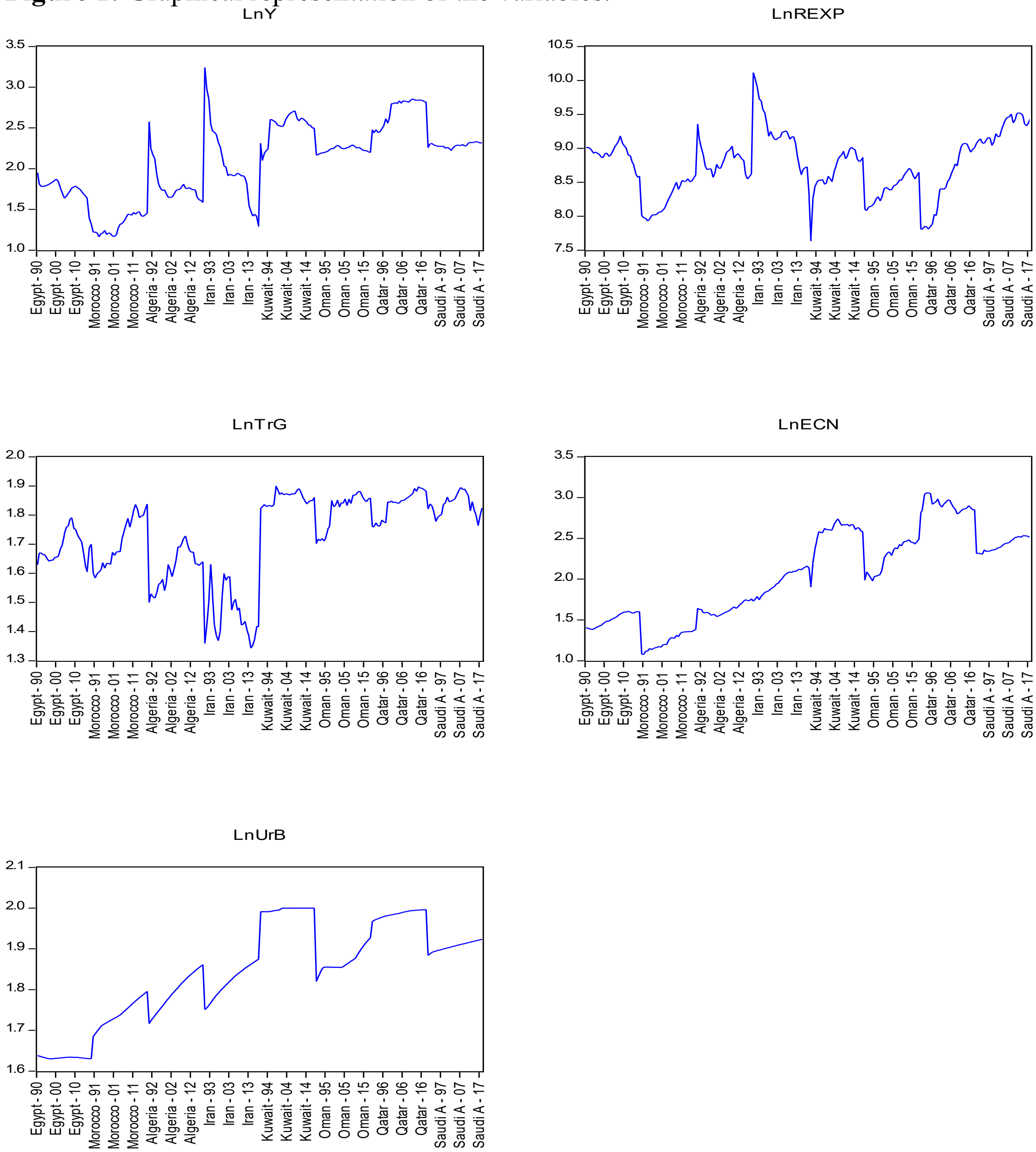

Table 7. Wald tests for slopes equality.

	0.05 vs. 0.1	0.1 vs. 0.2	0.2 vs. 0.3	0.3 vs. 0.4	0.4 vs. 0.5	0.5 vs. 0.6	0.6 vs. 0.7	0.7 vs. 0.8	0.8 vs. 0.9
LnREXP	-0.0174	-0.0327	-0.0016	-0.0147	-0.0468	0.0171	-0.0442	0.0278	-0.0537
LnTiG	0.1081	0.6192***	0.0353	0.0543	0.2339	0.2169	0.3758*	0.4248	0.9484 ***
LnECN	-0.1239 **	-0.0144	-0.0080	-0.0092	-0.0267	-0.0696*	-0.1050 **	0.0186	0.1652 ***
LnUrB	1.0829 **	-0.1898	-0.1766	-0.1342	-0.1791	0.0805	0.5092 **	-0.2671	-1.2173***
Wald Test (Chi-Sq. Stat)		224.3977							
P-value		0.0000							

Table 8. Variance inflation factor table.

Variables	VIF
LnREXP	1.13
LnTiG	1.52
LnECN	5.45
LnUrB	5.16
Mean VIF	3.32