INTERNATIONAL JOURNAL ON ECONOMICS, FINANCE AND SUSTAINABLE DEVELOPMENT
E-ISSN: 2620-6269

IJEFSD

Available online at www.researchparks.org

RESEARCH PARK

https://journals.researchparks.org/index.php/IJEFSD

Vol. 4 No. 9 | September 2022

Why Islam Entices Increasing Human Procreation? A Vector Error Correction Model (VECM) Analysis on Population and Economic Growth: The Case of the Philippines

Najeeb Razul A. Sali

Asst Professor IV, College of Islamic and Arabic Studies, Mindanao State University – Tawi-Tawi College of Technology and Oceanography, Tawi-Tawi, Philippines

PhD Candidate, Kulliyah of Islamic Revealed Knowledge and Human Sciences, International Islamic University Malaysia, Kuala Lumpur, Malaysia

ABSTRACT

This study investigated the effect of increasing population on economic growth. It highlights the Qur'anic injunctions as well as prophetic traditions pointing to the benefits of population growth and supports them with empirical findings using the Philippines settings as a case in point, it made use of econometrics data analysis using Augmented Dickey-Fuller test, the Johansen Cointegration, Vector Error Correction Model (VECM), Granger causality to analyze the time series data of the Philippine population from 1978 to 2020 as well as the country's Gross Domestic Product (GDP) from the same time frame as a proxy for economic growth of the Philippines. The result shows that with F-statistic = 4.26 and a p-value of 0.01, being $p < 0.05$ alpha level, it means that the null hypothesis that population does not Granger Cause GDP is rejected. On the contrary, with F-statistic = 0.49 and a p-value of 0.68, it suggested that the null hypothesis that GDP does not Granger Cause population is accepted. This study concludes that increasing population is associated with an increase in the size of the economy. In contrast, an in the economy does not lead to population growth in the country.

ARTICLEINFO

Article history:
Received 10 Jul 2022
Received in revised form
10 Aug 2022
Accepted 16 Sep 2022

Keywords: Philippine, population, economic growth.

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
. Hosting by Research Parks All rights reserved.

I. Introduction

According to a world population review, some countries welcome an increasing human population, and the top 5 countries that adopt such policy are: Canada, New Zealand, Mexico, Australia, and Germany. (*Easiest Countries To Immigrate To 2022*, n.d.) This is even though the United Nations emphasized the need to reduce the global population as part of its 2030 agenda. (*The World and the UN Must Reduce Population Growth | Population Matters*, n.d.). meanwhile studies conducted in developing countries found that increasing population is negatively associated with the poverty threshold (Dao, 2012). This means as their population increases, the poverty level in the country gets worsens accordingly. But is this always true?

In Islam, an increasing number of the Muslim population is encouraged to the point that the Holy Prophet Muhmmad (S.A.W) advised his companion not to marry a woman despite being 'from a good family and of good status, but she does not bear children' he said: "Marry the one who is fertile and loving, for I shall take pride in the great numbers of my ummah (nation)." ("Sunan An-Nasa'i 3227 - The Book of Marriage - الزواج كتاب - ," n.d.). Additionally, in the Qur'an Allah said: "Indeed lost are they who have killed their children, foolishly, without knowledge, and (they) have forbidden that which Allah has provided for them, inventing a lie against Allah. They have indeed gone astray and were not guided."

This study recognizes that increasing population can be beneficial to economic growth but the same coin, can also be detrimental. Depending on which country and the people comprising it, this study looks into the effect of human procreation on the economic growth of the Philippines.

II. Related Literature

According to conventional wisdom, population expansion has a negative impact on actual per capita incomes. It appears that the traditional viewpoint served as the foundation for China's rigorous population policy. The assertion that population growth is harmful to economic growth is refuted by a wealth of facts. The majority of empirical studies on the connection between population growth and economic expansion do not reveal a negative impact. Periods of sparse population have frequently occurred throughout world history. There have been times when the economy has grown slowly, and times when the population has grown rapidly have seen strong economic growth rates. Low populations and slow economic growth have characterized most of human history. Only recently have the population and economy grew rapidly(Johnson, 1999).

To examine rural poverty in China using the decoupling theory and a multi-parameter income distribution model. It is found that the poor population in rural areas now has greater economic inequality. Although income growth can improve the living conditions of the rural poor, income inequality will to some extent, make it more challenging to eradicate poverty. In most cases, it has been discovered that the beneficial effects of economic progress on the reduction of rural poverty have vanished. That is, contrary to what was previously believed, economic growth cannot fully address the issue of rural poverty, and the aging of the population is now the primary factor determining the prevalence of poverty in the majority of rural areas (Chen et al., 2016).

In cross-country analysis, the effect of population growth to the economy varies from one country to another and from one categorization to another. In the case of developed countries, it is found that there is negative correlation between the rates of population increase and per capita income within the group of industrialized nations Methodology. This suggest that as the population grow, the economy, as measured by per capita income, shrink while on the other hand, it did not found uniform effect of the same variables in the case of underdeveloped countries (Kuznets, 2013).

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

By using the Malthusian model that takes into consideration the effect of the birthrate, land, law of variable proportion, capital accumulation and technology. It found that the rise in per capita income is positively associated with population growth. The model further suggests that the continuing progress in technological advancement helps increase not only the per capita income of also the growth of population. It suggest that that countries with relatively advanced technology has a tendency not only to which that led toward economic growth but at the same time increasing population, (Hagen, 1999).

Conversely, using a similar method to this study, in order to show the connections between population increase, growth in per capita output, and overall economic growth during the previous 200 years, in an article that makes use of historical data. It is found that while high population growth in low-income countries may hinder their economic growth, low population growth in high-income countries is likely to result in social and economic issues. Although many people are against it, migration could assist in correcting these disparities. According to economic evaluations of inequality, there is evidence that slower population growth and less migration may be factors in the rise of national and global economic disparity (Peterson, 2017).

Further, Integration techniques reveal there is no long-term correlation between growth in the population and the economy. However, the study discovers that for Japan, Korea, and Thailand, there is bidirectional Granger causality between population and economic growth. Population expansion has been found to be the primary driver of economic growth in China, Singapore, and the Philippines, not the other way around. Economic development is proven to cause population growth in Hong Kong and Malaysia, not the other way around. There is no proof of the Granger causation between population increase and economical expansion for Taiwan and Indonesia. Overall, the connection between population growth and economic development is not clear-cut. Economic growth may or may not be aided or hindered by population increase, and both may have an effect on one another (Tsen & Furuoka, 2005).

This study is similar to the above-cited studies in that they both looked into the effect of the population on economic growth. It differs only in the approach and settings of the study. It is found that Tsen and Furuoka may already have conducted a similar survey for the Philippines. Still, this particular work's contribution is not only that it is more focused on the Philippines but 17 years more recent than Tsen and Furuoka's work and that this work attempts to integrate the Islamic viewpoint as far as population and economic growth are concerned.

III. Methodology

This study used econometrics data from the Philippine's historical data relevant to its population on the one hand and the country's Gross Domestic Product (GDP) as a proxy for economic growth on the other hand. Both data collected from 1978 to 2020 were analyzed using Eviews econometrics software.

To ensure changes in time variance do not affect the analysis result, this study employed unit root testing. Once stationarity of the time series data was achieved, the Johansen Cointegration test was used to test for the presence of cointegrating properties between the variables. Johansen test also ascertains the succeeding statistical test to identify the long-run and short-run relationship between the GDP and the Philippine population, which may either be through the Vector Error Correction Model (VECM) or the Vector Auto Regression (VAR), Granger causality was also used in this study to identify the effect of GDP on population and *vice-versa*. Lastly, the result of the survey was contextualized using the Islamic perspective on the effect of population growth on the economy.

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

IV. Results and Discussion

Unit root test

Table no. 1.

Group unit root test: At level
Series: GDP, POPULATION
Sample: 1978-2020

At level	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	0.00041	1.0000	2	75
PP - Fisher Chi-square	0.00057	1.0000	2	84
At 1st level, differencing				
ADF - Fisher Chi-square	11.6197	0.0204	2	78
PP - Fisher Chi-square	13.5413	0.0089	2	82

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table no. 1 shows that at level, the GDP and population of the country failed to reject the stationarity test using Augmented Dickey-Fuller (ADF) test, statistic = 0.00, cross-section = 2, Obs = 75 with *p-value* = 1.00. this result is also second by Philips-Pernson (PP) test, static =0.00, cross-sections = 2, Obs = 84 and a *p-value* = 1.00. With $p > 0.05$ alpha level of significance, this means that there is a linear trend in the time series data. This suggests that it cannot be used to empirically analyze the relationship between GDP and the population of the country. Because, the linear trend in the data may falsely suggest that the increasing time is associated with an increase in value which may not always have been the case.

Table no.1 also showed the at 1st level differencing the ADF statistic value turned 11.61, cross-sections = 2, Obs. = 78 with corresponding *p-value* of 0.02. The PP stationarity test also reported the same essential result, PP statistic = 11.54, cross-sections = 2, on total Obs. = 82 and a *p-value* = 0.00. This suggests that the combined time series data from GDP and population of the country is station at 1st level differencing. This makes the data stationary and free from the effect time variance in the data, (Ivanova et al., 2021).

Table 2. Lag Selection Criteria

VAR Lag Order Selection Criteria
Included observations: 32

Lag	LogL	LR	FPE	AIC	SC	HQ
0	172.4404	NA	8.10e-08	-10.65253	-10.56092	-10.62216
1	247.8890	136.7506	9.33e-10	-15.11806	-14.84324	-15.02697
2	257.8515	16.81160	6.45e-10	-15.49072	-15.03267	-15.33889
3	267.4756	15.03771*	4.58e-10*	-15.84222	-15.20097*	-15.62967*
4	268.9858	2.170875	5.44e-10	-15.68661	-14.86213	-15.41332
5	270.7512	2.317086	6.43e-10	-15.54695	-14.53925	-15.21293

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

6	273.9303	3.775214	7.06e-10	-15.49564	-14.30473	-15.10089
7	276.7038	2.946885	8.08e-10	-15.41899	-14.04486	-14.96351
8	280.5753	3.629461	8.86e-10	-15.41095	-13.85361	-14.89474
9	288.9997	6.844871	7.55e-10	-15.68748	-13.94692	-15.11054
10	298.1961	6.322501	6.41e-10	-16.01226*	-14.08848	-15.37458

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2 shows that the maximum lag selected by the Akike Information Criterion (AIC) is lag no. 10. However, most of the lag selector criteria like the sequential modified LR test, the Final Prediction Error (FPE), the Schwarz information criterion (SC) and similarly the Hannan-Quinn information criterion (HQ), all of them suggested to use lag no. 3. Hence, this study proceeds with lag no 3 in the initial statistical tests to follow, (Uremadu et al., 2014).

Table 3. Johansen Cointegration Test

Series: D(LOG(GDP)) D(LOG(POPULATION)) Lags interval (in first differences): 1 to 3 Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.385303	20.93594	15.49471	0.0068
At most 1	0.062295	2.444153	3.841466	0.1180
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-value s				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.385303	18.49179	14.26460	0.0101
At most 1	0.062295	2.444153	3.841466	0.1180
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-value s				

Following lag 3 as suggested by most lag selection criteria in the previous test, the Johansen cointegration test via the Trace Statistic shows that with the Critical Value (15.49) lower than the trace statistic value (20.93) it yielded a *p*-value of 0.00. with $p < 0.05$ alpha level of significance, if failed to reject the null hypothesis of no cointegration, it suggested that there is at least 1 cointegrating vector between the GPD and the Philippine population. When the null hypothesis of at most 1 cointegration was tested, the data showed that with 3.84 critical value which is now higher that the trace statistic

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

value of 2.44 and a corresponding *p*-value = 0.11. Since the critical value was higher that the traces statistics and a *p*-value of higher that the 0.05 alpha level, it suggested that the number of cointegrating vector is not more than 1.

Table no. 3 also reveals the Johansen cointegration test using the Max-Eigen Value approach to ascertain the presence of cointegrating vector between the two time series data. It suggested that since the Critical Value = 14.26 was lower that the Max-Eigen Value of 18.49 and a *p-value* = 0.01. It also failed to reject the null hypothesis of no cointegrating vector between the variables. It means that there is a presence of at least 1 cointegration between the data. Further, when the null hypothesis of the presence of at least more than 1 cointegration was tested, the critical value = 3.84 appeared higher than the Max-Eigen Value = 2.44 with corresponding *p-value* = 0.11. This suggested that the number of cointegrating vector present between the GDP and population of the country is not more than 1, (Turner, 2009).

Table 4. Long-run relationship test using Vector Error Correction Model (VECM)

Estimation Method: Least Squares Included observations: 38 Total system (balanced) observations 114				
	Coefficient	Std. Error	t-Statistic	Prob.
Error Correction Term (ECT)	-1.673659	0.525308	-3.186051	0.0020
Determinant residual covariance		2.11E+09		

Table 4 show that Std. Error = 0.52, t-Statistic = -3.18, and a negative ECT = -1.67 with *p*-value =0.00. Being $p > 0.05$ alpha level of significance, it suggested that there is a presence of long-run relationship running from the population of the country to its gross domestic product. It means in the future, both GDP and Philippine growth is supplemental to each other, (Hapsari et al., 2021).

This finding aligns with the Islamic perspective that population and economic growth are positively correlated. The increasing population should not cause Muslims to worry since economic prosperity and financial sustenance, even at the micro level, do not depend on family size or the ability of the couple to generate income. One can find a consistent example of a family with a small size but relatively poorer than those with a comparably larger size. The ultimate Sustainer of all that exists is Allah (S.W.T). He said: "In fact, Allah is the All-Sustainer, Possessor of power, the Strong." Economic prosperity should also not be the reason to reduce the population, which in most cases results in abortion. Allah will provide for them. In the Qur'an, Allah said: "Kill not your children for fear of want: We shall provide sustenance for them as well as for you verily the killing of them is a great sin" (Al-Israa, verse 31).

Table 5. Short-run relationship between GDP and Population

Pairwise Granger Causality Tests Date: 04/09/22 Time: 18:34 Sample: 1978 2020 Lags: 3			
Null Hypothesis:	Obs.	F-Statistic	Prob.
POPULATION does not Granger Cause GDP	40	4.26142	0.0119
GDP does not Granger Cause POPULATION		0.49263	0.6898

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

Table no. 5 indicated that own 40 total number of observations, and F-Statistic = 4.26 and a *p*-value of 0.01, being p < 0.05 alpha level, it means that the null hypothesis that population does not granger cause GDP is rejected. This means that an increase in population causes an increase in the country's GDP (Friston et al., 2014; Strokes & Purdon, 2018).

In Islam, an increasing population is encouraged at various levels. As stated previously, as early as choosing a bride to marry, Islam encourages increasing the human population as it prefers women who can give birth to plenty of children at the expense of even being in a good family and good status ("Sunan An-Nasa'i 3227 - The Book of Marriage - نکاح کی کتاب - ," n.d.). During the marriage, Islam forbids abortion (Albar, 2001; Bowen, 1997; Hassanin et al., 2019) and other forms of killing.

The problem is too much adherence to the Malthusian theory that too much population would lead to famine and shortage of food (Taher & Hussein, 2017), forgetting the fact that "There is no moving creature on earth but its sustenance dependeth on Allah: He knoweth its resting place and its temporary deposit: All is in a clear Record" (Hud, verse 6).

Similarly, table 5 also reveals the causality test result for GDP on population. It shows that with F-Statistics = 0.49 and a *p*-value of 0.68, it suggested that the null hypothesis that GDP does not Granger Cause population is accepted. This means that increasing GDP does not cause an increase in the county's population.

Conclusion

Islam's universal message cuts across time and space. The Holy Prophet Muhammad's hadith about his enticement for Muslims to increase in population aims not only to attain superiority in terms of numbers but also economic prosperity for their respective nation-states. This study finds in economic growth, the increasing population has a role to play in improving its standing. An increase in population is associated with an increase in the national economy. This study does not also disregard the problem raised by the Malthusian theory, as Islam also encourages moderation in all aspects. But in the case of the Philippines, evidence has shown that it did not yet reach an alarming level where population growth becomes detrimental to its economy.

Diagnostic test

Heteroskedasticity Test

To assure the reliability and validity of the analysis result, the model must pass the following diagnostic tests. The Heteroskedasticity Prob. Chi-Square should be higher than the 0.05 alpha level of significance.

Table 6. Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.094681	Prob. F(1,40)	0.1556
Obs*R-squared	2.089969	Prob. Chi-Square(1)	0.1483
Scaled explained SS	1.707401	Prob. Chi-Square(1)	0.1913

Table 6 show that the Prob. Chi-Square of heteroskedasticity test is 0.14 and 0.19 respectively. With the Chi-square value above the 0.05 alpha level, it means the model passed the heteroskedasticity test. This means that the model does not suffer from inefficient coefficients which can lead to improper estimates resulting in finding bewilderment that eventually ends up being bias, (Williams, 2020).

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

Normality test

Another diagnostic test that a valid and reliable Vector Error Correction Model (VECM) has to pass is the normality of equation residual. It is normally distributed if the histogram bar in the plot reveals a general trend of seemingly pyramid shape and is confirm by a normality test probability value of greater than the 0.05 alpha level of significance (Hapsari et al., 2021).

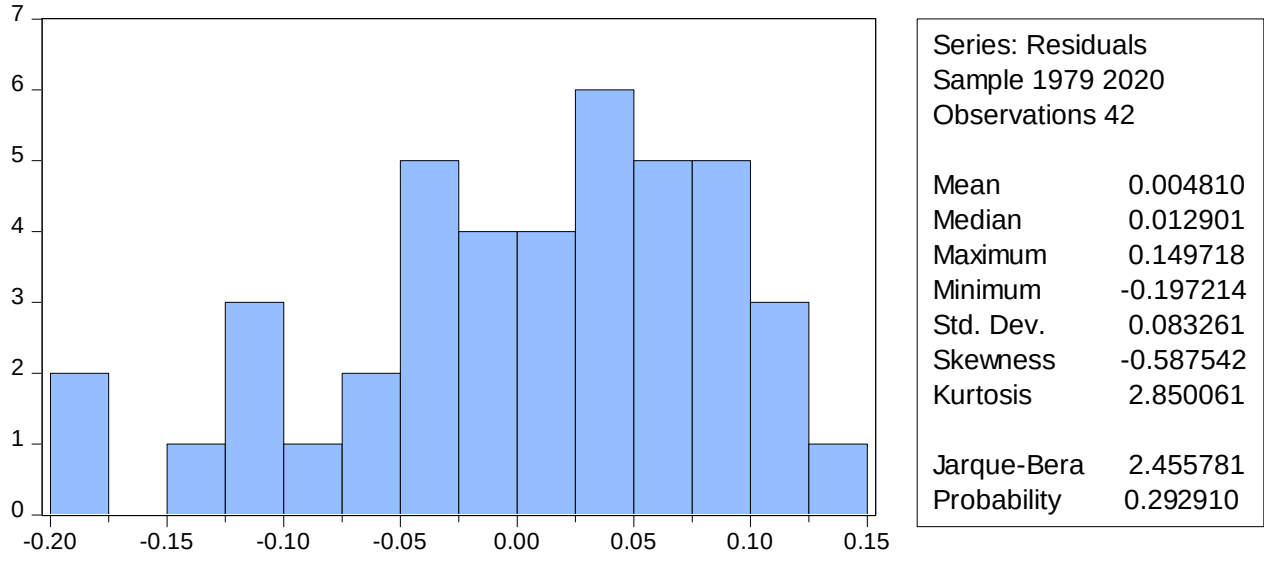


Figure 1. Histogram plot of residuals for normality test.

Figure 1 shows that the histogram shape shows the general trend of pyramid-like form with a probability value of 0.29. with $p > 0.05$, it suggests that the residual of the equation used in this study is usually distributed.

When there is a lack of independence between paired historical data for analysis, autocorrelation occurs. As a result, the findings may suggest the existence of a relationship between the variables when there is none. For empirical findings, the Breusch-Godfrey serial correlation LM test was used. The model exhibits the presence of autocorrelation if the p-value is 0.05 or below otherwise it passes the autocorrelation diagnostic test, (Madıto & Khumalo, 2014).

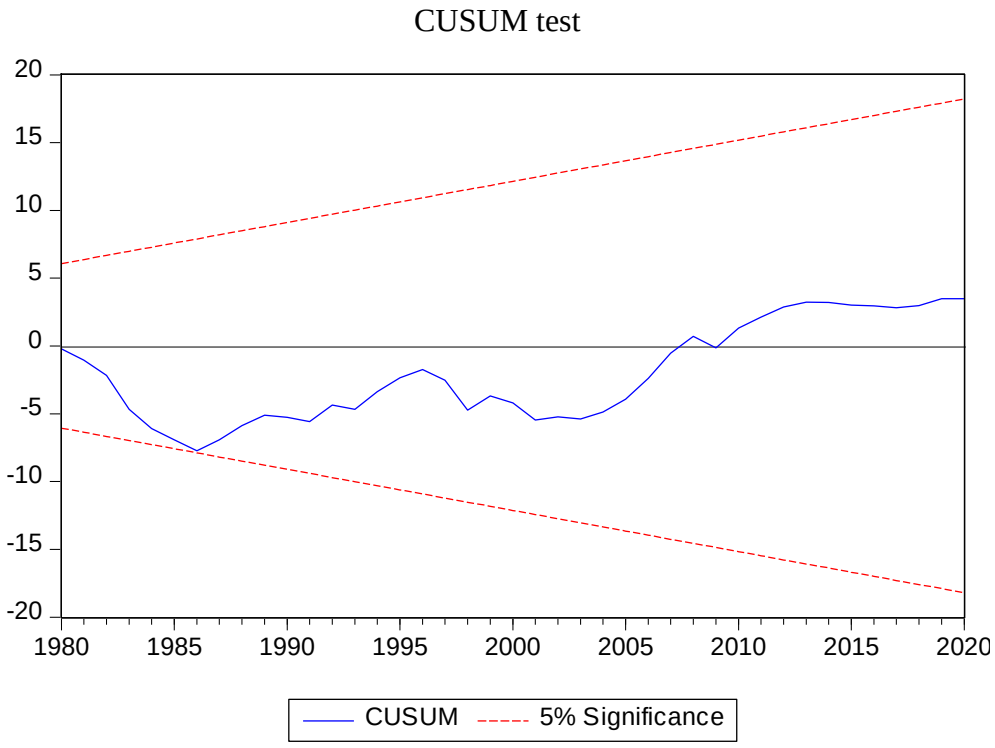
Table 7. Breusch-Godfrey Serial Correlation LM Test:

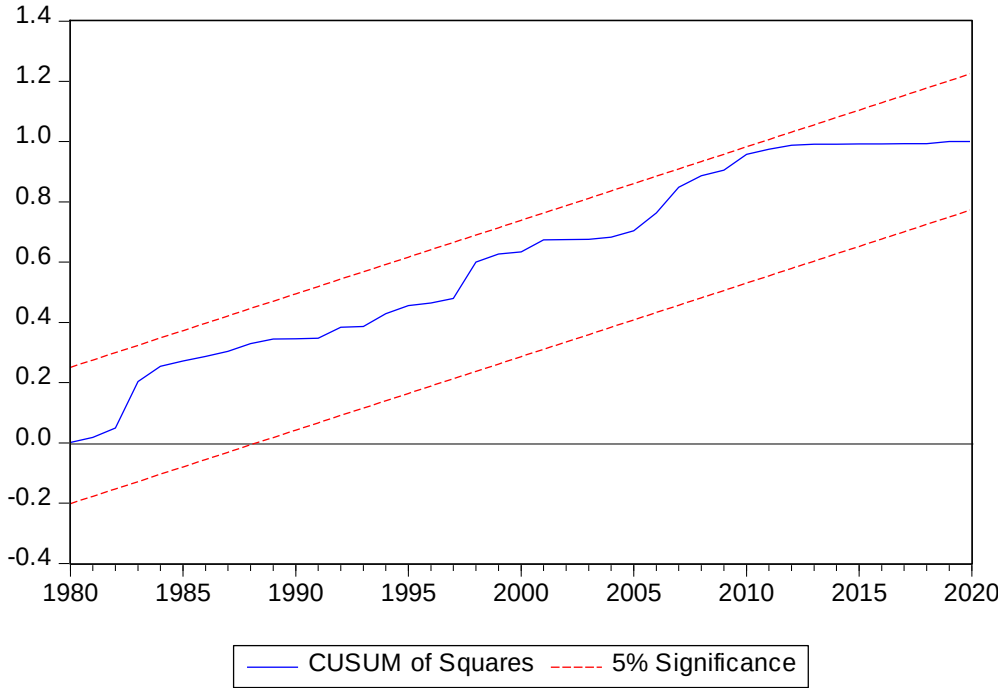
F-statistic	3.193633	Prob. F(2,39)	0.0519
Obs*R-squared	5.910583	Prob. Chi-Square(2)	0.0521

Table 7 shows that the probability value of the Breusch-Godfrey Serial Correlation LM Test was 0.052, higher than the 0.05 level of significance. This means that it passed the autocorrelation test.

Stability test

The cumulative sum or (CUSUM) test of the recursive residuals is also a vital gauge for the stability of the chronological data over time. Using Eviews10 software, it calculates the cumulative sum and projects a plot that shows how stable the data was within a given 5% critical line. The data, represented by the red-dotted line, is the upper and lower bound should not be passed through by the blue line in the plot, is stable if it stays within the red-dotted line significance level (Saleem, 2007).





CUSUM stability test shows that the blue line stayed within the red-dotted critical line in both the standard CUSUM and CUSUM of Square test. This suggests that the data was stable within the time frame allotted in this study.

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

With all major diagnostic tests passing all the required indicators, it means that the Vector Error Correction Model (VECM) used in this study was statistically consistent and reliable.

References

1. Albar, M. A. (2001). Induced abortion from an islamic perspective: Is it criminal or just elective? *Journal of Family and Community Medicine*, *8*(3), 25–35.
2. Bowen, D. L. (1997). Abortion, Islam, and the 1994 Cairo population conference. *International Journal of Middle East Studies*, *29*(2), 161–184. https://doi.org/10.1017/S002074380006445X
3. Chen, J., Wang, Y., Wen, J., Fang, F., & Song, M. (2016). The influences of aging population and economic growth on Chinese rural poverty. *Journal of Rural Studies*, *47*, 665–676. https://doi.org/10.1016/j.jrurstud.2015.11.002
4. Dao, M. Q. (2012). Population and economic growth in developed countries. *International Review of Applied Economics*, *2*(1), 6–17. https://doi.org/10.1080/02692171.2022.2069688
5. *Easiest Countries To Immigrate To 2022*. (n.d.). Retrieved August 4, 2022, from https://worldpopulationreview.com/country-rankings/easiest-countries-to-immigrate-to
6. Friston, K. J., Bastos, A. M., Oswal, A., van Wijk, B., Richter, C., & Litvak, V. (2014). Granger causality revisited. *NeuroImage*, *101*, 796–808. https://doi.org/10.1016/j.neuroimage.2014.06.062
7. Hagen, E. (1999). Population and economic growth. *American Economic Review*, *89*(2), 145–149. https://doi.org/10.1257/aer.89.2.145
8. Hapsari, M. R., Astutik, S., & Soehono, L. A. (2021). VECM and Bayesian VECM for Overparameterization Problem VECM and Bayesian VECM for Overparameterization Problem. *Journal of Physics: Conference Series*, *1811*, 1–10. https://doi.org/10.1088/1742-6596/1811/1/012086
9. Hassanin, M. A. A., Munawarah, S. H., Misnaniarti, M., Isnurhadi, I., Komunitas, J. K., Rumbai, P., City, P., Komitmen, P., Kbpkp, P., Commitment, S., Kbpkp, F., Dewi, N. M. ., Hardy, I. P. D. ., Sugianto, M. ., 19, T., Ninla Elmawati Falabiba, Anton Kristijono, Sandra, C., Herawati, Y. T., … Kesehatan, I. (2019). Causes, Times and Ways of Prevention according to Ibn Sina. *Paper Knowledge . Toward a Media History of Documents*, *7*(1), 1–33. https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/MT_Globalization_Report_2018.pdf%0Ahttp://eprints.lse.ac.uk/43447/1/India_globalisation%2C society and inequalities%28lsero%29.pdf%0Ahttps://www.quora.com/What-is-the
10. Ivanova, M., Angelova, R., & Dospatliev, L. (2021). Vector error correction model assessing the impact of consumption, investment and export on import on Bulgarian economy. *AIP Conference Proceedings*, *2333*(March), 100001–100010. https://doi.org/10.1063/5.0041752
11. Johnson, D. G. (1999). Population and economic development. *China Economic Review*, *10*(1), 1–16. https://doi.org/10.1016/S1043-951X(99)00002-4
12. Kuznets, S. (2013). Population and Economic Growth. *American Philosophical Society*, *111*(3), 170–193.
13. Madıto, O., & Khumalo, J. (2014). Economic growth - Unemployment nexus in South Africa: VECM approach. *Mediterranean Journal of Social Sciences*, *5*(20), 79–84. https://doi.org/10.5901/mjss.2014.v5n20p79

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.

14. Peterson, E. W. F. (2017). The role of population in economic growth. *SAGE Open*, *7*(4). https://doi.org/10.1177/2158244017736094
15. Saleem, S. (2007). Role of Islamic Banks in Economic Development. *MPRA Munich Personal RePEc Archive*, *2116*, 1–33.
16. Strokes, P., & Purdon, P. (2018). Granger causality. *PNAS*, *115*(29), 1–11. https://doi.org/10.4249/SCHOLARPEDIA.1667
17. Sunan an-Nasa'i 3227 - The Book of Marriage - نكاح كتاب الـ - . (n.d.). In *Sunan an-Nasa'i* (Vols. 4, Book 26, Issue Hadith 3229). Sunnah.com. Retrieved August 31, 2022, from https://sunnah.com/nasai:3227
18. Taher, F. B., & Hussein, A. M. K. (2017). Population Growth and Economic Development : An Islamic Perspective College of Applied Studies and Community Service University of Dammam – Saudi Arabia. *Journal of Business and Economic Policy*, *4*(2), 55–61.
19. *The World and the UN Must Reduce Population Growth | Population Matters*. (n.d.). Retrieved August 4, 2022, from https://populationmatters.org/news/2019/09/world-and-un-must-reduce-population-growth
20. Tsen, W. H., & Furuoka, F. (2005). The Relationship between Population and Economic Growth in Asian Economies. *Asean Economic Bulletin*, *22*(3), 314–330. https://doi.org/10.1355/ae22-3e
21. Turner, P. (2009). Testing for cointegration using the Johansen approach: are we using the correct critical values? *Journal of Applied Econometrics*, *24*(5), 825–831. https://doi.org/10.1002/JAE.1073
22. Uremadu, S. O., I. Ani, O., & Odili, O. (2014). Banking System Credit to Small and Medium Scale Enterprises (SMEs) and Economic Growth in Nigeria: A Co-integration Approach. *IOSR Journal of Economics and Finance*, *5*(6), 41–51. https://doi.org/10.9790/5933-05624151
23. Williams, R. (2020). Lecture Notes on Heteroskedasticity. *Lecture Notes on Heteroskedasticity*, 1–16.