



THE IMPACT OF POPULATION ON ECONOMIC GROWTH: EVIDENCE FROM PAKISTAN

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Abstract

Growing population is one of the major component of economic growth. The existing theoretical and empirical literature have found both positive and negative impact of population on economic growth. This paper inspects the impact of population on economic growth of Pakistan for the time period of 1961 to 2020. Data on dependent and independent variables were taken from world development indicator. Moreover, the study used (ARDL) to analyze the data. Findings of this study indicates that Population and Crude death rate have positive effect on economic growth in the short and long run. While, Fertility has a negative effect on economic growth in both short and long run. Finally, the result of this study are unbiased as evidenced by different diagnostic test used.

Key Words: Population growth, Economic growth, ARDL.



Introduction

In early periods of human history, the population growth was 0.002% per year till the 17th century which was very low. After growth of agriculture and then advancement in industrial sector population start to grow fast. Form beginning till year 1800 population reached at 1 billion and from 1800 till now world population have reached to an estimated figure of around 8 billion. 1.5 million More people added to the planet every week (Agarwal, 2012)

Pakistan, being the 5th most populous country and has 2nd largest Muslim population with total population of 207,774,520 with mean annual growth of 2.40 from 1998 to 2017. Rural population grew at average of 2.23 and urban population grew at mean annual growth of 2.70. Population of Pakistan increased from 130,857,717 to 207,774,520 from 1998 to 2017. This is an increase of 76.9 million (Pakistan Bureau of Statistics, 2017). Figure 1 is indicating population growth of Pakistan from 1961 to 2020. From 1961 to 1983 population were increasing and started decreasing since 1992. From 1998 till 2020 it has been decreasing from 2.84 to 1.97.

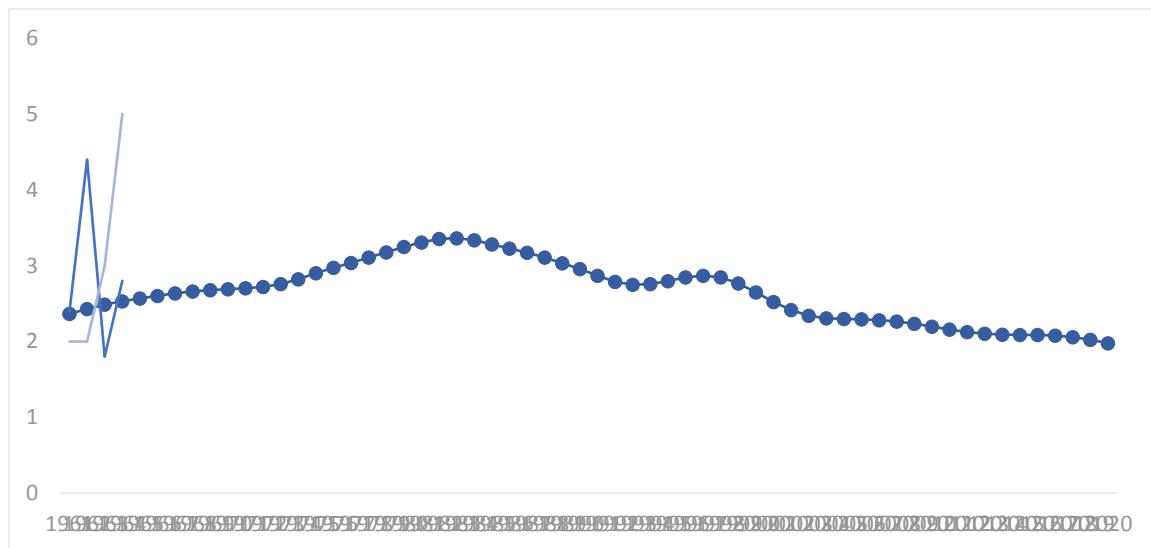


Figure 1: Population growth in Pakistan

Source: WDI, World Bank

Table 1 is showing the projected demographic for Pakistan till 2040. Based on this projection the population of Pakistan is expected to reach 300.02 million in 2040. Population growth is projected to decrease from 2.28% to 1.33% from 2010 to 2040.



Finally, the population density measures population per unit area with increase in population density is expected to reach at 391.93 in 2040.

Table 1: Demographic projection of Pakistan 2010-2040

Year	Population	Pop. growth	Pop. density
2010	179,424,641	2.28%	232.75
2015	199,426,964	2.14%	258.70
2020	220,892,340	2.00%	286.55
2025	242,234,056	1.86%	314.23
2030	262,958,794	1.65%	341.12
2035	282,863,442	1.47%	366.94
2040	302,129,193	1.33%	391.93

Source: United Nation Population division (2002).

Population growth and economic growth

Different empirical and theoretical literature have different views regarding this relationship (Headey & Hoge, 2009). Economists like Malthus and Ricardo alarmed regarding link between population growth and population growth. But they had proven wrong as the rapid population growth resulted in industrialization in Western Europe and increased in economic activity (Cremaschi & Dascal, 1998).

In Solow growth model or neoclassical growth model, population growth increase the growth rate of total output but no permanent increase in per capita output (Mixon & Sockwell, 2007). Moreover, endogenous growth model also focuses on the role of Population growth, Human capital and investment on economic growth. According to endogenous growth model increase in labor producing ideas increases the long run economic growth (Cvetanović et al., 2015).

Population growth has been a hot topic for policymakers around the world in the last two centuries, as the world's population has increased dramatically. The human population is increasing at a rate of roughly 83 million people per year. Alshalalda, (2019) Population growth is the major concern for many nations around the globe. Which is mostly



facilitated by industrialization and urbanization that brought some crucial economic advancement in many western nations. (Golor, 2007) Also the past century has been defined by two major transformations: industrialisation and urbanisation. Langeweg, F., Hilderink, H., & Maas, R. (2000).

Population growth and economic development in a country have a direct and reciprocal relationship. (Menike, H. A. 2018). Growth of human populations have resulted in localized overexploitation of natural resources in the past, resulting in the extinction or collapse of some ancient cultures. The world population increase in a rapid manner in last half of century. (Brueckner, M., & Schwandt, H. (2015).

Research Gap

The existing literature is quite rich by finding the effect of population on economic performance in developing countries like India, Bangladesh and Nigeria (see: Mamun et al., 2019; Ogunleye & Owolabi, 2018). The literature have ignored or used inappropriate econometric models in case of Pakistan. Thus, this study will fill this gap by inspecting the effect of population growth on economic growth of Pakistan in short and long run. Furthermore, this study used dynamic and appropriate econometric model.

Significance of the study

Growing population is contributing a mixed effect on economic growth in developing countries like Pakistan. The existing literature argued that a population growth with improved human capital contribute positively to economic growth and contribute negatively otherwise. Since, population of Pakistan is growing rapidly like other developing countries, therefore, it's important to investigate the impact of population growth on economic growth.

Objective of the Research.

1. To check the short run effect of population growth on economic growth of Pakistan.
2. To check the long run effect of population growth on economic growth of Pakistan.

Research Hypotheses

H_0 : There is insignificance effect of population on economic growth of Pakistan.

H_1 : There is significance effect of population on economic growth of Pakistan.

Brief literature Review



Ogunleye & Owolabi, (2018) investigated the effect of population growth on economic growth of Nigeria. They have taken the data from 1981 to 2015 and applied ordinary least square, the study used fertility rate, population growth and exchange rate as independent variables and revealed that population and economic growth are positively linked in Nigeria. Additionally, the remaining both independent variables found to be statistically insignificance. Similarly, (Tartiyus, Dauda and Peter 2015) ; (Ali et al., 2013) also found the same result for Nigerian economy.

Peterson (2017) uses a graph to show the relationship between rising population, per capita output growth, and total economic performance during the last 200 years. He also claims that low population growth in high-income countries causes economic problems, whereas fast population surge in developing countries is likely to stifle development. In addition, he stated that migration could be a remedy to this imbalance, despite the fact that many in the literature disagree.

Mahmud, (2015) checked link between population and economic growth, all the variables used were stationary at first difference so the study taken the data from 1980 to 2013 and applied VECM to check long run and short run relationship. The study found that there is positive relationship between population growth and economic development in India in short run and long run. Additionally, according to (Dawson & Tiffin, 1998) there is no relationship between per capita income growth and population growth in India.

Dao, (2013) studied on the effect of population on economic development in Africa. The paper check the effect of urban and rural population independently. Findings of this study showed that rural and urban population both affect economic development. Moreover, the squared of population is likewise checked to know if this relationship is nonlinear or not, which observed to be insignificance meaning this relationship is direct. Essentially, Golley and Wei, (2015) studied the effect of population on economic growth taking the data of china from 1981 to 2007 and applied OLS to dissect the information. The study's outcome shows that population growth altogether affect economic growth of china. The paper utilized GDP per capita to measure economic growth.

Afzal, (2009) tried the connection of populace development on economic development of Pakistan for the time-frame of 1981 to 2005. The review utilized Ordinary Least Square OLS technique and found that there is positive connection of populace on financial development. This review disregarded the since quite a while ago run connection between population and economic development as OLS just creates short run results.



Chowdhury, (2018) examined the connection of population development with economic growth of Bangladesh for the time span of 1979 to 2017. The paper took GDP per capita as intermediary to quantify financial turn of events and presume that populace development adversely affects economic growth of Bangladesh. Additionally, Nakibullah, (1998) utilizing ganger causality argued that population growth doesn't granger cause real GDP per capita and presume that population is endogenous in economic growth of Bangladesh.

Finally, Hassan (2010) looked into the impact of China's population on economic growth. To assess economic growth, he used GDP growth as a proxy. This study used data from 1952 to 1998 and used a vector error correction mechanism to discover that population and per capita GDP in China are positively related. Furthermore, Yao et al. (2013) discovered no link between population and economic growth.

Data and Methodology

The data used in this study are collected from World Bank for the time period of 1961 to 2020. Dependent variable of the study is economic growth, annual GDP growth rate is used as proxy for economic growth. Population is main independent variable, population annual growth rate is taken as proxy to measure population. Finally, Crude death rate and fertility rate are taken as control variables in this study. Crude death rate measure the number of death occurring per 1000 during a year while, fertility rate is measure as the number of live birth per 1000 women during the age of 15 to 49 years per year.

Econometric Model specification

This model can be expressed using the following linear econometric model:

$$Y_t = \alpha + \beta_1 PG_t + \beta_2 CDR_t + \beta_3 FR_t + \mu_t \quad (1)$$

In addition to the long run, short run model can be expressed through error correction model as follow:

$$\begin{aligned} \Delta Y_t = \beta_0 + \sum_{k=1}^p \beta_1 \Delta Y_{t-k} + \sum_{k=1}^p \beta_2 \Delta CDR_{t-k} + \sum_{k=1}^p \beta_3 \Delta FR_{t-k} + \theta_1 CDR_{t-1} + \theta_2 \Delta FR_{t-1} \\ + \theta ECT_{t-1} + \varepsilon_t \end{aligned}$$

Where Δ is differenced operator, β_s are showing short run coefficients, θ_s are long run coefficient. While θECT_{t-1} is indicating error correction term and ε_t is error term.

ARDL Technique:



The method of ARDL co-integration was initially established by (Pesaran and Shin, 1999) and then by (Pesaran et al, 2003). This method has some advantages over other techniques. Firstly, the data should not be integrated of same order, it also can be applied if the stationary order of the variable is mix. Secondly, ARDL approach separately estimate the short run and long run coefficients. As our sample size is less, (Ghattak and Siddiki, 2003) showed that incase of small sample size ARDL estimates are more efficient and appropriate. And finally, the long run coefficient using ARDL method are unbiased (Harris & Solis, 2003).

Results and Discussions

Table 2 presents the unit root test results. Using ADF only population is non stationary at level and stationary at first difference. Additionally, without trend GDP is non stationary but become stationary at first difference with and without trend. Moreover, using PP also population is stationary first difference. So, overall it is concluded from unit root that population is stationary at first difference and the remaining variables are stationary at level.

Table 2: Unit root result

Variables	Augmented DickeyFuller(ADF)			Philips Peron (PP)	
	Intercept with trend	Intercept without trend		Intercept with trend	Intercept without trend
At level					
GDP	-5.5519***	-1.3930		-5.6554***	-1.7867*
Population	-1.6658	-1.1502		-0.2861	-0.5556
fertility	-4.6251***	-4.8762***		1.3700	-2.1386**
Crude death	-4.5940***	-2.6813**		-8.7760***	-10.331***
At First difference					
GDP	-8.5523***	-8.5978***		-14.627***	-14.545***
Pop	-4.7211***	-4.6661***		-2.3686*	-2.3967**
Fertility	-6.1925***	-6.2728***		-6.8757***	-6.6945***

Note: ***, **, * are level of significance at 1, 5 and 10%

**Table 3: Lag length criteria**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-261.9092	NA	0.185989	9.669425	9.815413	9.725880
1	248.7957	928.5544	2.87e-09	-8.319845	-7.589906	-8.037571
2	507.6342	432.9662	4.24e-13	-17.15034	-15.83645	-16.64224
3	640.9185	203.5614	6.10e-15	-21.41522	-19.51738	-20.68131
4	675.1995	47.37009*	3.29e-15*	-22.07998*	-19.59819*	-21.12025*

The results for choosing the optimum lag are depicted in table 3. Different criterion suggest different lags to be selected. In this study, out of six, five criteria 4 of them optimum lags to be selected as shown with star.

Table 4: ARDL bound test results

T-statistics	Value	K
F-statistics	11.0195***	3
Significance Level	Lower Bound	Upper Bound
10%	2.37	3.2
5%	2.79	3.67
1%	3.65	4.66

After selecting the optimum lags the next step is to check whether long run relationship exist or not? Table 4 represent the results of ARDL bound test. Null hypothesis of bound test assumes that there is no long run association while, alternative hypothesis assumes long run association. The decision can be made by comparing f-statistics by comparing lower and upper bounds. In this case f-statistics is 11.0195. We reject null hypothesis and conclude that long run association exist between the variables in our model.

The long run results are depicted in table 5, the coefficient of population and crude death are positive and statistically significant while fertility rate has a negative impact. The coefficient are indicating that one unit increase in population growth will increase economic growth by 14.77 units in the long run in Pakistan.

**Table 5: Long run results**

Dependent variable is GDP growth		
Variable	Coefficients	t-statistics
POP	14.7767***	5.4614
FER	-11.2200***	-6.0529
CRUDED	4.3705***	4.8709
Constant	-16.3505	-4.7863

Note: *** shows the significance level at 1%

Secondly, one unit increase in crude death rate add up 4.37 to economic growth in long run. Finally, the coefficient of fertility rate is indicating that one unit increase in fertility rate reduce economic growth by 11.22 units in the long run in Pakistan. The results are also supported by other studies like (Mamun, 2020; Ogunleye and Owolabi, 2018; Agarwal 2012).

The short run results are shown in table 6. The coefficients are indicating that the lagged value of GDP, population and crude death rate have positive and significance impact on economic growth in short run in Pakistan while fertility has a negative and significance impact. Additionally, the coefficient of error correction mechanism ECM is according to expectation. ECM is indicating that if any disequilibrium occur in the short run it will converge back to long run equilibrium at the speed of 74% per year.

Table 6: Short run Coefficients

Dependent variable is GDP growth		
Variable	Coefficient	t-statistics
D(GDP(-1))	0.2228*	1.7442
D(Pop)	64.573*	2.0105
D(CRUDED)	41.70***	7.6102
D(FER)	-197.66***	-3.6954
ECM	-0.7401***	-7.5298

Diagnostic test results	
Serial correlation	1.6546(0.2040)
Heteroscedasticity	0.7446(0.6468)
Normality	36.1220*** (0.000)
Functional Form	0.1706(0.8654)

Note: *, **, *** are rejection of null hypothesis at 10%, 5% and 1% respectively.

**Table 1: Short run Coefficients**

Note: *, **, ** are rejection of null hypothesis at 10%, 5% and 1% respectively. In addition, to check the reliability and unbiasedness of results different diagnostic tests were used such as , heteroscedasticity , functional form and normality all diagnostic test expect normality proved that there is no diagnostic issue in the model used. Our estimated result are still unbiased and efficient with normality problem.

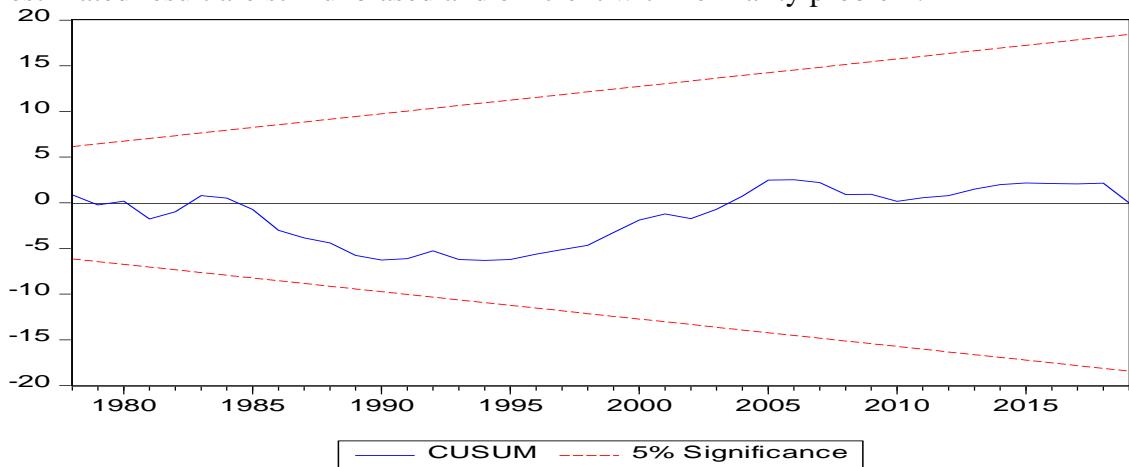
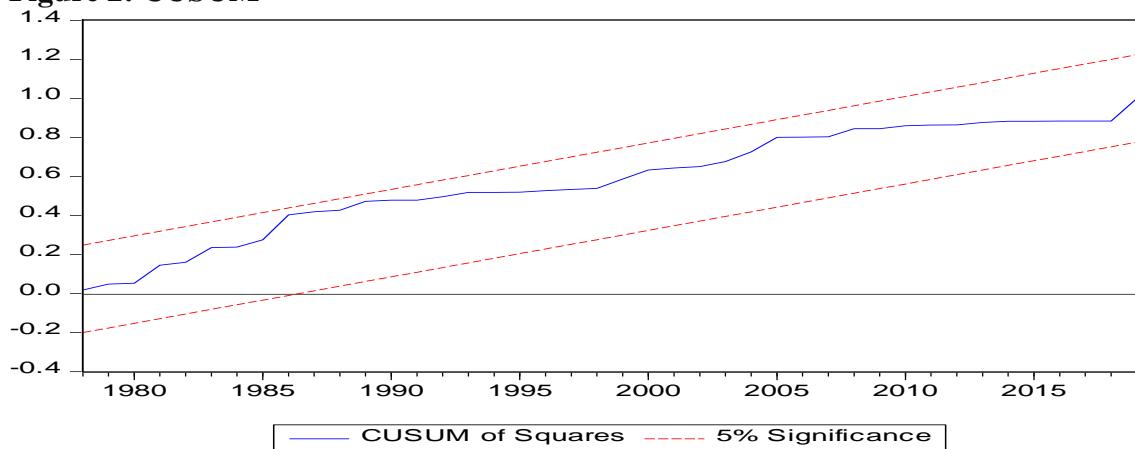
**Figure 2: CUSUM****Figure 3: CUSUM Square**

Figure 1 and 2 are showing the parameter stability plots. The residual plot did not cross the parameter stability line at 5% indicating that the parameters are stable in our model.



Conclusion

The existing literature has mixed link between population and economic growth. This study used ARDL approach and found that there is positive relationship between population and economic growth in Pakistan. Furthermore, the study used crude death rate and fertility rate as control variable and revealed that crude death rate has positively related with economic growth and fertility rate has adverse effect on economic growth of Pakistan. Additionally, all the diagnostic test also evidence that the model is stable in this study. ECM shows that any disequilibrium will be corrected to long run equilibrium at speed of 74% per year. Thus, this study conclude with a conclusion that population growth with better human capital will improve the economic performance in Pakistan.

Recommendations

- Since population is positively related with economic growth in Pakistan. Therefore it is recommended that policies should be adopted such as education, increase in population along with human capital will improve economic growth and development.
- Based on this study since fertility rate is negatively related with economic growth. It is suggested to improve the health sector and awareness to reduce fertility.
- The government should make the policies that promote economically friendly environment to encourage and attract the foreign and domestic investors. Which will be translated in more job opportunities and will be a good reason for population to contribute to the economy.
- Only healthy labor can contribute in economic activity and for better standard of living health play the major role. It is recommended that government should increase the health expenditure to reduce mortality. Policies should be made to reduce the cost of hospitalization and improve the health access of citizen.
- Finally, Child mortality and fertility very much close and interlinked with one another, it is recommended to policy makers to tackle this critical issue from both ends. In addition, the effort must be made to increase the access of female to earning income process.



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