



Population and food insecurity in Pakistan: An Empirical Analysis

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Abstract

A specific amount of food and safe drinking water are basic necessities of living human-being. More than one billion individual's square measure calculable to lack adequate dietary energy avails, and a minimum of double that variety suffers matter deficiencies. As a result of indicators inform action, a lot of current analysis focuses on rising food insecurity menstruation. The study has tested the population theory of Malthus in case of Pakistan. For investigating the long run relationship among the variables of the model Johansson Co integration technique is applied. For examining the short run dynamic Error Correction Model (ECM) is applied. Furthermore, the higher population growth rate increases the food insecurity, not only in the long run, but also in the short run in case of Pakistan.

Keywords: population growth, food insecurity, gross domestic product, consumer price index.

JEL Codes: Q56, Q18. O1, E31

I. Introduction

Malthus (1798) started the debate that food scarcity as an important issue for the growing population of the globe; he developed a theoretical framework between earth's carrying capacity and growing population. "The power of population is indefinitely greater than the power in the earth to produce subsistence for man" (Malthus, 1798). The empiric reveals that the availability of clean drinking water and cultivable land are going scare while the population is growing at a constant pace. This alarming rise in population puts human-being in a universal famine as predicated by Malthus (1798). Now-a-days the availability of sufficient food for a growing population is the prime concern of developed and developing countries. Being the biggest continent, Asia has lots of water and cultivated land reserves. But on the other hand, Asia also has a large proportion of world population (36% of the world population) with high population density and growth rate (The United Nations Population Fund, UNFPA, 2003). This rising trend in population growth reduces per capita cultivable land even more in coming years. The economies of South Asia are also facing the problem of rising population with limited cultivable land, moreover old agriculture methods of these economies cause low agriculture productivity. Pakistan and India are facing soil erosion due to deforestation, water logging due to poorly managed irrigation systems, increased soil salinity, and pollution of drinking water supplies (Kanwer, 2003). According to the Economic Survey of Pakistan (2011-12) the estimated population of Pakistan is 182.1 million. Although Pakistan is the second most populous country in South Asia, but it has the highest population growth in the region. Moreover, with this population growth by 2050 Pakistan would be the fourth most populous country of the world surpassing Indonesia and Brazil (SBP, 2007). This enormous rise in population is causing serious concerns regarding the food insecurity in Pakistan, more than half of the Pakistan's population is food insecure (UNFPA, 2003). The food insecurity in Pakistan is directly linked to low agricultural productivity. The empirics show that the share of agriculture to GDP is decreasing with every passing year (Economic Survey 2011-12). But no serious attention has been paid to the agriculture sector for obtaining food security and enhancing agricultural productivity. Pakistan is an interesting case study for examining the problem of food insecurity. In the case of Pakistan, the concept of food insecurity should be eliminated through dynamic changes in agriculture production. The low productivity of the food crops occupies a special position when we study the linkages between the rising population and food security issues. The food crops, mainly include wheat, rice, sugar cane, barley, maize and other minor crops. In the year 2011, the country witnessed the worst wheat crisis of its history and the same is the case with the other food crops (Economic Survey 2011-12). This study will enable the policy makers to judge the problem of food insecurity in Pakistan and find its long run solutions.

II. Literature Review

The rapid growth population has increase was mainly caused by a decreasing death rate (more than birth rate), and particularly in increase average human age. Overpopulation/Rising population is an undesirable condition where the number of existing human population exceeds. Our population is only strength if it is well educated, if they provide with job and people living in household earn good income. Food insecurity which "consistent access to adequate food is limited by a lack of money and other resources at times during the years" people who do not consume enough food each day suffer from food insecurity which a person unable a sufficient amount of healthy food on a day-to-day basis. The result of food insecure people suffers poor nutrition and are, therefore, less likely to have healthy and productive lives. According to the Economic Survey of Pakistan (2011-12) the estimated population of Pakistan is 18.21 million. Although Pakistan is the second most populous country in South Asia, but it has the highest population growth in the region. Moreover, with this population growth by 2050 Pakistan would be the fourth most populous country of the world surpassing Indonesia and Brazil (SBP, 2007). Nowadays the availability sufficient food for growing population is the prime concern of developed and developing countries. The food insecurity in Pakistan is directly linked to low agricultural productivity. There is a vast food of literature is available discover the relationship between availability of food and population growth among high and low-income countries. The developing countries suffer from food insecurity due to different reasons, but diets deficit is faced nearly all groups of age like infants, young children, adolescent girls and women of productive age (Kennedy and Meyers, 2005).

Food production depends on natural resources, agriculture sector, public investments and incentives for private farmer in rural health care supply. The food crops, mainly include wheat, rice, sugar cane, maize and other minor crops. More people mean more exploitation of fixed resources. Population is not a universal challenge. To control the rising population and food insecurity. Food insecurity control and better the use of fertilizer more efficiently, raise low water productivity, target food for direct consumption, and reduce food waste. A large number of studies organized on the relationship of food security and population on the basis of different economic, social, and demographic characteristics such black-white, rural urban and families with children and without children.

Government should be able to overcome the food with rising population. If the government protects small and medium farmer through the proper functioning in the economy. So, there is more need to focus on research and development in the field of high yield varieties. Moreover, growing urbanization and vulnerability of low-income urbanization and food production shocks may worsen the situation of food insecurity in developing countries.

III. The Model

Data on all selected variables has been obtained from World Development Indicators (WDI), International Financial Statistics (IFS) and various issues of Economic Survey of Pakistan. The study utilizes the data period from 1971 up to 2013. Following the methodologies of Ali, (2011), Ali (2015), Ali (2018), Ali and Bibi (2017), Ali and Ahmad (2014), Ali and Audi (2016), Ali and Audi (2018), Ali and Rehman (2015), Ali and Zulfiqar (2018), Haider and Ali (2015), Ali et al., (2016), Ashraf and Ali (2018), Audi and Ali (2018), Ali and Senturk (2019) and Kassem et al., (2019). The functional forms of the models become as:

$$FPI = \phi_0 + \phi_1 POP + \phi_2 GDP + \phi_3 CPI + \phi_4 AGR + \phi_5 Trend + \mu_t \dots \dots \dots (1)$$

Where;

FPI= Food production index

POP= population growth rate

GDP= GDP growth rate

CPI= Consumer price index

AGR= Percentage share of Agriculture in GDP

t= Time period

IV. Johansen Co-integration Technique

Time series is indulged with unit root problem and unit root problem make the error of time series nonstationary. Augmented Dickey-Fuller (1981) is used for examining the stationarity of the variables of the model. Johansen (1988) proposed Johansen Co-integration test and Johansen and Juselius (1990) extended it for finding long run relationship of the variables when they are stationary at some order of integration. Originally, the co-integration concept was developed by Engle and Granger (1987). Engle and Granger (1987) proposed a two steps estimation for only one co-integrating vector, but Johansen (1988) and Johansen and Juselius (1990) proposed maximum likelihood test for finding the number of co-integrating vectors in demonstration of Vector Autoregressive (VAR). The common method of VAR is as below:

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \dots + \alpha_k X_{t-k} + \varepsilon_t \quad (2)$$

Where X_t is a $(n \times 1)$ vector of variables that are integrated at same order, α_0 is a $(n \times 1)$ vector of constant terms, $\alpha_1 \dots \alpha_{t-k}$ are parameters and ε_t is the residual term, for Vector Error Correction Model (VECM) the VAR can be written in following form.

$$\Delta X_t = \mu + \sum_{i=0}^{p-1} \phi_i \Delta X_{t-i} + \Upsilon X_{t-1} + \varepsilon_t \quad (3)$$

Where X_t is a $(n \times 1)$ column vector of p variables, μ is a $(n \times 1)$ vector of constant terms, ε_t is $(n \times 1)$ vector of usual error term, Δ is difference operator and ϕ as well as Υ represent coefficient matrices. The coefficient matrix Υ is representing the long run equilibrium relationship for the matrix. In this analysis two types of likelihood ratio tests are utilized (trace test statistics and maximum eigenvalue test statistics) for finding co-integrating vectors.

V. Empirical Findings

This study is examining the links between the food production index and population in the case of Pakistan. The preliminary step in this analysis is concerned with establishing the degree of integration of each variable. We

employed Augmented Dickey Fuller (ADF) test to check stationary of the series. The results presented in Table-1 reveal that all variables are having unit root problem at the level I (0) but all are stationary at order 1 (1).

Table-1: Unit-Root Estimation

Variables	Level		First Difference	
	Intercept and trend	No. of Lags	Intercept and trend	No. of lags
POP	-1.045	0	2.827646	0
GDP	-2.482956	2	3.898531	2
LCPI	0.6935	4	-6.3578	1
LAGR	-2.125095	1	-2.252434	1
FPI	-2.4329	1	-4.4700	2

Table-2: Lag Length Selection

Lags	Akaike Information Criteria	Schwartz Bayesian Criteria	Log Likelihood
0	-54.7890	54.7380	-1032.747
1	38.5544	39.4164	-712.5348
2	32.9011	36.7353	-632.4947

After establishing that all the individual series under consideration are stationary, the Johansen Co-integration technique is used to estimate the long-run relationship among the variables, particularly population growth, GDP growth, the share of agriculture, consumer price index and food security. The results of Johansen Co-integration analysis are summarized in Table-3, where both maximum-eigen values and trace test values examine the null hypothesis of no co-integration against the alternative of co-integration. Starting with the null hypothesis of no co-integration (R=0) among the variables, the trace test statistics is 85.92, which is above the 1% critical values.

Table-3: Johansen's Multiple Co-integration Test Results

Hypotheses	Trace-Test	0.05 critical value	P-value	Hypotheses	Max-Eigen Statistic	0.05 critical value	P-value
R=0	85.9204	47.8561	0.0000	R=0	52.4623	27.5843	0.0000
R≤1	33.4580	29.7971	0.0181	R=1	22.2803	21.1316	0.0343
R≤2	11.1776	15.4947	0.2008	R=2	10.7112	14.2646	0.1693
R≤3	0.46638	3.8415	0.4947	R=3	0.46638	3.8415	0.4947

Hence it rejects the null hypothesis R=0 in favor of the general alternative R=1. It is concluded that there is one co-integrating vector amongst the five I (1) variables. Therefore, analysis of annual data from 1971 up to 2013 appears to support the proposition that there exists a long-run relationship among the variables in the case of small developing economy like Pakistan.

Table-4: Long Run Coefficients

Dependent Variable: FPI				
Variables	Coefficient	Prob-values	Coefficient	Prob-values
Constant	8.2137	0.0000	10.1327	0.0000
GDP	0.0080	0.0475	0.0123	0.0166
POP	-0.1933	0.0340	-0.29509	0.0269
CPI	0.0887	0.0883	0.2900	0.0000
AGR	0.3526	0.0539
R ² = 0.993 F-Statistics= 381.89(0.000) Adj-R ² =0.990 Durbin-Watson=1.99			R ² =0.966 F Statistic=300.01(0.000) Adj-R ² = 0.961 Durbin-Watson= 1.43	

The long run results of the study are presented in the table-4. The table-4 presents two types of results first Pakistan are closed economy with time trend and second Pakistan is an open economy without time trend and domestic

agriculture growth. The results show that there is a positive and significant relationship between economic growth and availability of food. The results show a 1 percent increase in economic growth bring 0.0080 percent increase in the availability of food in Pakistan. The estimated results show population growth has negative and significant impact on available food, the results show a 1 percent increase in population, 0.1933 percent decrease is occurring in available food in Pakistan. The results show inflation has a positive and significant relationship with available food in Pakistan.

The results in the table-4 reveal that there is a positive and significant relationship between agricultural growth and availability of food in Pakistan. There is positive and significant relationship between time trend and available food in Pakistan over the selected time period. On the other hand, when Pakistan is an open economy, the results show there is a positive and significant relationship between economic growth and available food. The estimated results show population growth has negative and significant impact on availability of food in Pakistan. The results reveal that inflation and availability of food have positive and significant long run relationship. Trade openness is influencing availability of food in Pakistan negatively and significantly over the selected time period. The estimated coefficients of economic growth, population growth, inflation rate reveal stronger impact on availability of food in case of open economy as compared to closed economy. The overall long run results show population growth and trade openness are becoming the big reasons of food insecurity in Pakistan.

Table-5: Short Run Error Correction Model

Dependent variable: FPI			
Variables	Coefficient	T-values	Prob-values
Constant	0.0289	1.2756	0.2130
DPOP	-0.3236	-2.1169	0.0436
DGDP	0.0056	2.0413	0.0511
DGDpt-1	0.0054	2.7878	0.0096
DCPI	-0.0064	-0.1784	0.8597
DAGR	0.0116	2.1447	0.0411
CR(-1)	-0.9640	-4.3551	0.0002
R-squared = 0.5969		Akaike info criterion = -3.268	
Adjusted-R ² = 0.4924		Schwarz criterion = -2.913	
Durbin-Waston stat = 1.860		F-statistic = 5.7113 (0.00)	

The short run results are reported in table 5. The estimated results reveal that GDP agricultural growth improves food availability position in short span of time. Time trend and food prices increase the food insecurity in Pakistan in the short run. The ECM coefficient explains the speed of adjustment to equilibrium and it should have a statistically significant coefficient with negative sign that is another indication of Co integration among the variables (Bannered et al., 1998). The coefficient of the CRt-1 term is significant at the 1 percent level of significance appears with a negative sign, ensuring that long run equilibrium can be attained. The coefficient of CR (-1) is equal to (-0.964) for a short run model which implies that divergence from the long-term food availability is corrected by (96.4) percent over the each year. The conducted sensitivity analysis indicates that the equations are well specified. None of the statistics shown in the Table-2 are significant at the 5 %. The model fulfilled the conditions of non-serial correlation, functional form specification and normality of disturbance term. Finally, there is evidence for existence of heteroskedesticity in the short run model.

VI. Conclusions

In case of Pakistan, data show a rising trend in both population and food. The combined Co integration approach to examine the long run relationship between the variables and long run relationship is tested by applying the ARDL bound testing approach. Our results confirm the presence of long run relationship among the variables. Thus, our empirical study nexus between Food insecurity and Population rising. At the low level of income, people are not willing to better food intake. The country has initiated special employment and income supporting polices for improving the purchasing power of rural and urban such as sport prices to input, agriculture loans to meet the food insecurity. Growth in GDP and rising prices of food item reduce the food insecurity. However, government should not neglect the part of the agriculture sector. Government should be able to importance of the agriculture sector. Agriculture is that the mainstay of Pakistan's economy, accounting for twenty five percent of the value, sixty

percent of export earnings and forty eight percent of employment. Government should also be able to overcome the food problem with increase population if government protects the small and medium farmers through the proper functioning of the agribusiness of the economy. It has been determined that the worst victims of food insecurity square measure fishermen, peasants and farm laborers United Nations agency square measure largely landless members of society. The large landholders have all the political powers and economic blessings. The power of landowners is actually a monopoly that has served as a barrier to the social and economic progress of the poor and is one amongst the main reasons behind food insecurity within the country. In this way, the production of food crop secures in future and rising population demand for food with the low level of poverty in rural areas particularly. Further, smuggling of food items should be controlled in the southern and western border. Older varieties of seed are cropping causes the least yield in the food items. So, there is more need to focus on the research and development in the field of high yield varieties.

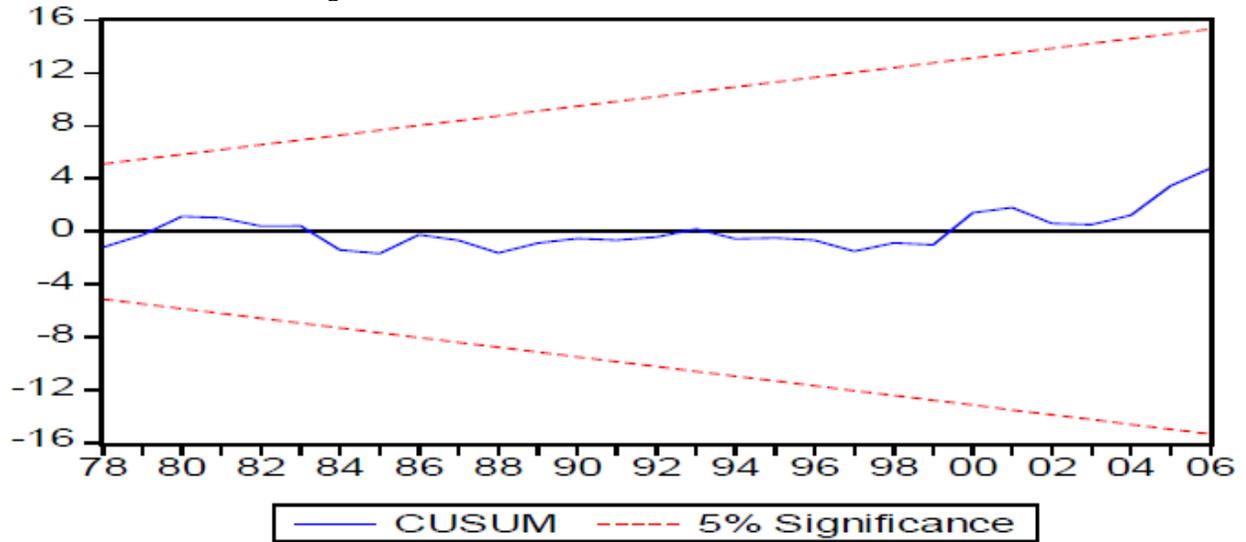
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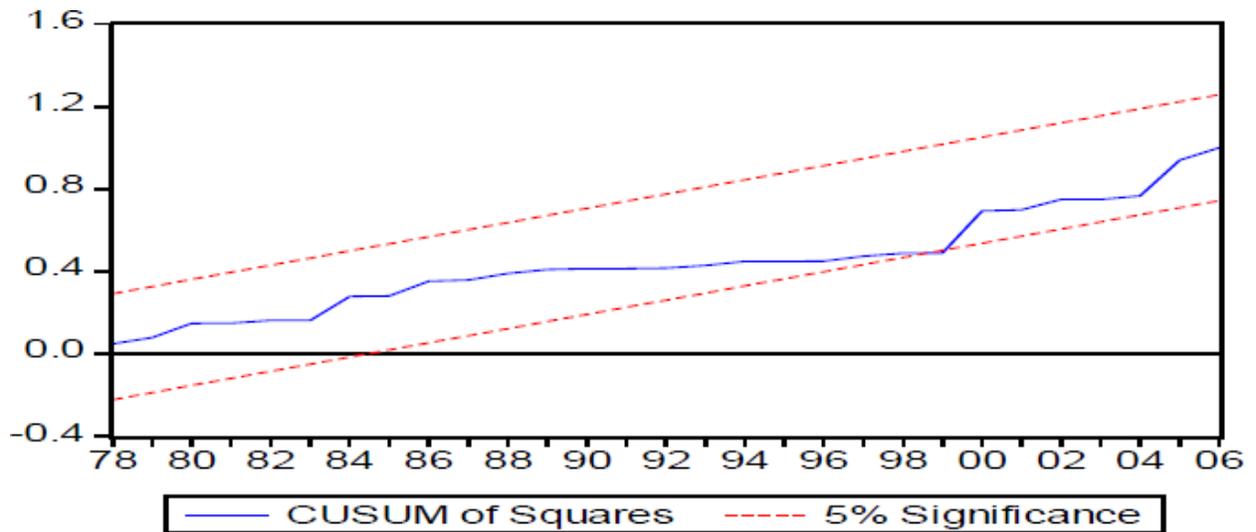
Appendix-A

Figure 1 Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Figure 2 Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level