GOVERNMENTAL STRATEGIES TO MAINTAIN BALANCE BETWEEN FOOD SECURITY AND POPULATION GROWTH
(A Quantitative Analysis of Pre and Post Covid Situation of Pakistan)

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Original Article

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Abstract

In this paper we present the assessment of the impact of COVID-19 on food systems with a strong focus on food security and nutrition for those affected in Pakistan. The research methodology is divided into two phases; first, a quantitative assessment was conducted to give a theoretical view of national food security, an empiricist study design using data from Pakistan's 1972-2019 time series was tested on the ARDL model to assess Pakistan's food insecurity. Second, qualitative interpretation is given to the impact and effects of Covid-19 on Pakistan's Economic growth and food insecurity. The results of ARDL appear to support the view that population growth is affecting crops and food production leading to food insecurity. It means that Pakistan needs to expand agricultural land if it is to meet the growing demand for food in Pakistan. Natural disasters, population growth, exports and agricultural imports, low agricultural development, food prices, income inequality, poverty and health issues are the main causes of food insecurity in the country.

Keywords: Food production, COVID-19, Food production, ARDL Testing, Pakistan Food insecurity

Introduction

For most of human history, the world's population has slowed down but over time, the population has grown from 1.5 billion to 7 billion over the last 120 years (Thomas Dietz, Jessica Bell, Christina Leshko, 2014). The reasons for this increase in population are, firstly, technological advancement in medical profession and another reason for this advancement in the agricultural sector because they are easier ways and means to obtain more production of food. Due to rising birth rates and declining mortality rates, demographic experts are predicting that this number will be used and an additional 2 billion people will be added to the world over the next 40 years (Food & Agricultural Organization, 2011).

It is estimated that by 2050, the world's population can grow by about 2.3 billion people while in the past it grew by 3.3 billion people. This number of emerging populations in the world is expected to occur in those developing regions. As a recent estimate, the population of sub-Saharan Africa will grow rapidly on Earth (114%) and East and Southeast Asia will grow significantly (13%). The number of rulers is moving to urban areas and by 2050; it is likely that 70 percent of the world's population would prefer to go to urban or developed areas (United Nations, 2019).

As a result of food deficiency nearly 1000 Million people are unable to get enough food to eat due to which they do not fit the criteria of nourishment & above 400 Million people suffering malnourished. Starvation is one of the cause due to which 11 Million children die under the age of 5 years (FAO, 2020).

In 2050 it is expected to raise the area of land by five hundred M hector, the productivity of agricultural land might decrease by current level (Kendall, Pimentel, 1994). Gilland contends that while feeding the present population of the world with the initial 2900 kcal, 420 kg of cereal is averagely is urgently requited per year but In 2050, it is estimated that there would be 360 kg cereal production; it shows a shortage of 60 kg ((Gilland, 2002).

The Theory of Food Security

Thomas Malthus. In his book "An Essay on the Principle of Population", published in 1798, an English economist openly expressed his views on human change and its relationship to access to resources (McCullum, 2005).

The basis of Malthus' theory is based on two fundamental concepts, namely, that food and love between the two sexes are essential for human existence. Malthus believed that the world's population often increased rapidly over food. Although the population is growing at a geometric level, production capacity is only growing in numbers (Nord, Mark, Margaret Andrews, and Steven Carlson, 2005). Therefore, in the absence of consistent monitoring of population growth, Malthus made the sad prediction that in the short term, scarce resources would have to be shared among the growing population (Kristina Hook, 2015).

The term Neo-Malthusianism was first introduced in 1877 (Meredith Marsh, Peter S. Alagona., 2008).The movement of Neo-Malthusianism was consequently not the same compared to the other common Malthusian movement in many ways: it emphasized the methods of contraception and recognized the working and middle class facing the problem of overcrowding. Overpopulated industrial areas have been recognized as areas of ethical decay (Dolan, Brian 2000).

There are many diverse definitions of Food Security, as Gentilini noted near about 205 definitions & Smith, Pointing & Maxwell calculated 200 diverse descriptions, this study will discuss the definition provided in 1996 by the World Food Summit which is acceptable for many (Gentilini, 2002), (Smith, M. Pointing, J. and Maxwell, S, 1993).

"Security of Food occurs as soon as every person, every day, have social, physical & financial accessibility to adequate, harmless & nourishing food which can meet their dietetic requirements & food inclinations for leading an energetic & healthy life". (FAO, 1996) in 2002 they added word "Social" while amending 1996 definition (World Food Program, 2002).

Defining Food Insecurity

FAO defines insecurity of food as: "A condition which occurs when an individual doesn't have safe access to adequate quantity of harmless & nutritive diet for regular development & growth to lead a dynamic & healthy natural life" (FAO, 2011).

Four aspects of Food Securities

Security of Food includes four dimensions explained as Four Dimensions of Food Securities. These aspects are taken as WFS defines food Security. All of these aspects covers every aspect of dietary needs of a human being and together forms useful method to measure food security.

Availability

Availability is the 1st dimension among four. WFS define availability as "sufficient". It was defined by World Food Program as "The food quantity which is in stock in an area, nation or region by all methods of production whether domestic, food stocks, imports & food support" (WFP, 2009) (Ayalew, 2013).

Access

Next aspect to security of food is access. WFS define it as "having socio-Economic &

physical, access" World Food Program defined this food access concept as "A family's capacity for acquiring suitable quantity of diet on a regular basis via mixture of exchange, borrowings &buying, food aid or donations" (WFP, 2009).

Utilization Aspect

As 3rd dimension in the security of food is utilization of food. As the World Food Summit defines utilization, by referring to "harmless & nutritive foodstuff which can meet the dietetic wants of a person". It's not adequate that diet might be accessible & available to families for making sure that individuals should have "harmless & nourishing" food. Many components get involved for instance: collection of diet products, their management & planning in addition to the concentration of nutrient (Jones, 2013).

The Stability

Stability is the number fourth dimension of food security. As per definition of WFS (world food security) is to; "at all times". Food security could not occur immediately or season or a day, food stability related with sustainability by permanent bases. By the (Devereux, 2006) the food stability is based on the two phases one is "food Chronic & other one is food insecurity transitory" (Proietti, 2009).

Food security and population growth nexus

Growth in Population in the developing world has affected the population to shift from rural to urban areas. Some communities or individuals have been forced to relocate due to limited job opportunities offered to them and to rent or sell to fast-growing machinery farmers thus leading to a shortage of available land for a small number of low-income farmers (Massey, Arango & Hugo, 1993)

Situation in Pakistan

Pakistan's food insecurity and hunger levels underscore the crisis and call for urgent action. The vast majority of people do not get food or malnutrition not only because food is scarce but also because various other social and economic factors prevent people from getting nutritious and healthy food. According to the World Food Program, about 43 percent of Pakistanis have no food. Of this number, 18% are severely malnourished. This has to do with the fact that most of these people rely heavily on agriculture for their livelihood. This means that food security is inextricably linked to overall government policies aimed at eradicating poverty, increasing domestic agricultural productivity, reducing inflation and ensuring food security with regard to agricultural production (Farooq, 2010).

In simple terms, a person is 'not protected from food' if he or she cannot reach the calorie target of 2,100 kilocalories per day. Just think: 90.7 million Pakistanis cannot reach the caloric target of 2,100 kilocalories a day. Ironically, in five countries - Pakistan, Bangladesh, India, Sri Lanka and Nepal - Pakistan has the largest 'food gap' (the food gap is defined as the amount of food needed for all food insecurity to reach a caloric level of 2,100 kcal / day). The food gap in Pakistan stands at 389; Bangladesh 300; India 289; Sri Lanka 258; and Nepal 255. In fact, the food gap indicates 'strong food security'. Ironically, in five countries - Pakistan, Bangladesh, India, Sri Lanka and Nepal - food security is very high in Pakistan (Sana, Adila 2012).

Empirical Testing and Model Selection

This section will discuss techniques and model used to estimate econometric results & analysis. Data for all selected variables were obtained from the International Financial Statistics (IFS), World Development Index (WDI) & various Pakistani Economic Survey issues. The study uses data time from 1972 to 2019.

HYPOTHESIS

- H0: population growth causing no threats to food insecurity in Pakistan
- H1:population growth causing threats to food insecurity in Pakistan
- H0:the sources of food security are not other than agriculture production
- H1: the sources of food security are other than agriculture production

1. Model Specification and Data Sources

FPI=

□0+□□□PG□□□□□□□□+□□□AGL+□□□CPI

The model will be used to check over all food productivity in Pakistan. Which will help us to determine whether food Security exists in Pakistan or not

Dependent & Independent variables

"FPI" Food production index, PG= population Growth, AGL= agricultural land, CPI= Consumer Price Index, ARMI= Agriculture Raw Material Import

Unit Root Test

In order to determine the statistical model, the study will first conduct Unit Root Test. (ADF) for avoiding spurious regression the unit root test is very essential, the test defines that variables which are used in regression are stationary or not (Robinson & Mahadeva 2004). ADF" results shows that all the variables included in the model are non-stationary at the level. We compared the critical value of a variable with the ADF value at 1% and 5% level of significance. The results of (ADF) test shown in Table1, which indicates that FPI, PG, AGL, ARMI are integrated I(0) while CPI is integrated on I(1) 1st difference.

Table 1: Augmented Dickey Fuller Test

Variable	ADF	1%	5%	P Value	Stationary
FPI	-1.961	-1.949	-1.611	0.0487	I(0)
CPI	-6.592	-3.61	-2.938	0.000	I (1)
PG	-3.760	-3.533	-3.198	0.0301	I (0)
AGL	-4.72	-4.23	-3.54	0.0029	I (0)
ARMI	-6.294	-3.596	-2.933	0.0000	I (0)

Source: Author's Own Calculations and results

THE ARDL BOUND TEST FOR COINTEGRATION

The study employed ARDL bound testing as ADF test suggests that data is stationary but mixed at 1(0) and 1(1) as suggested by Pesaran and Shin (1999) and Pesaran et al (2001).

In order to check food security of Pakistan and relationship between different variables, the study has device a model.

Model: FPI=f (CPI, PG, AGL, ARMI)

FPI = β0 + β1ln CPIt + β2lnPGt+ β3ln AGL$_t$ + β4ln AGLt + β5ln ARMIt + ε

The Model will elaborate impact of independent variables on food production index. Food production is a proxy for food supply will be measured using independent variables as mentioned in Model.

Results and Discussion

Descriptive statistics

Descriptive statistical analysis is very essential because it describes the basic characteristics of the time series data. Table 2explains the results of descriptive statistics and shows that all the variables are normally disturbed. As Jarque-Bera is greater than its P- value and P- value of all the variables are greater than 0.05. Therefore, it is stated that all the variables included in the model are normally distributed. The result suggests that "null hypothesis" H0 shows normal distribution, therefore, H1 is rejected as it is not normally distributed and the study accepts H0 as it is based at 5% level of significance.

TABLE 2: Descriptive statistical analyses

	AGL	ARMI	FPI	PG	CPI
Mean	46.95957	4.327859	69.69095	2.628911	39.19788
Median	46.76993	4.249477	66.80500	2.551687	25.51415
Maximum	49.95460	6.169730	117.9100	3.344131	141.7023
Minimum	45.66988	3.301476	30.76000	2.027808	3.920184
Std.Dev	0.913940	0.739071	28.33470	0.481439	37.25040
Skewness	0.878975	-0.8430273	0.217012	-0.1235607	1.338808
Kurtosis	4.133802	2.975941	1.722850	1.469164	3.866604
Jarque-Bera	7.657812	4.975879	3.184108	4.207923	3.86110530
Probability	0.07133381	0.083081	0.203507	0.121972	0.129774640
Sum	1972.302	181.7701	2927.020	110.4143	1646.311
Sum Sq.Dev	34.24676	22.39528	32917.07	9.503111	56891.27
Observation	42	42	42	42	42

Source: Author's Own Calculations and results

Bound Test

The results of Bound test are shown in the table 3. The end result of bound testing leads to the conclusion of cointegration. The computed F-statistics (8.616962) of the model is higher than critical value of upper bound (3.49) at 5% level of significance. This confirms that there is cointegration long run relationship among variables, FPI, CPI, PG, AGL, and ARMI. Thus, H0 which shows no cointegration among these variables is rejected & H1 which shows cointegration is accepted.

Table 3: Bound Test

ARDL Bounds Test
Sample: 1976
Included
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	8.616962	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

SHORT RUN & LONG RUN COEFFICIENT

Short Run Impact

Here the study will discuss short run impact. The results provide evidence of the short run equilibrium relation between Food production index and independent. In results, The cointegration (-1) of Model is -1.327666, which is significant highly & it has negative sign, as the study has hypothesized & imply after a shock it will try to reach to the equilibrium at fairly high speed of one year and four months approximately.

While checking short run impact, it was observed that CPI has a positive coefficient and consistent of one unit increase of the Consumer price index will lead to increase Food Production Index by 0.216 unit. This result confirms positive impact on Food production index. Similarly, AGL has positive impact on food production index. An increase in one hector of Agricultural Land can lead to increase Food Production Index by 0.58 units. The result shows the positive impact on (FPI) food production index. Increase in Agriculture land, Therefore provides the opportunity to increase food production. As increase in population growth has negative impact on Food production index. An increase of 1 million in population leads to decrease FPI by 1.3 unit, rapidly increase in population will decrease agricultural production by Neo-Malthusians believes. In the results, it has been measured that an increase in ARMI has negative impact on Food production index. An increase of 1 unit of ARMI leads to decrease in FPI by 1.37 units.

Short Run Cointegration

ARDL cointegration and long run form original dep. Variable: FPI Selected Model. Ardl (4,3,3,1,4) date: 2:9:2021 time 117:19 Sample: 1972 2019 included observations: 47

Table 4 Cointegration Form

Variable	Coefficient	Std .Error	t-Statistic	Prob.
D(FPI(-1))	1.479436	0.301222	4.911609	0.0001
D(FPI(-2))	2.005239	0.315758	6.350590	0.0000
D(FPI(-3))	0.918100	0.396669	2.314629	0.0326
D(CPI)	0.211666	0.253591	0.834760	0.0410
D(CPI(-1))	0.838249	0.319881	2.620509	0.0173
D(CPI(-2))	0.977158	0.320789	3.046118	0.0070
D(AGL)	0.585200	0.582310	1.005000	0.0321
D(AGL(-1))	3.840805	0.892422	4.303790	0.0004
D(AGL(-2))	2.415136	0.631816	3.822530	0.0012
D(PG)	-1.391300	8.638824	-6.643570	0.0000
D(ARMI)	-1.374409	0.527010	-2.607910	0.0178
D(ARMI(-1))	-6.054093	1.138045	-5.319730	0.0000
D(ARMI(-2))	-3.694340	0.855230	-4.319705	0.0004
D(ARMI(-3))	-1.166017	0.492212	-2.368931	0.0292
CointEq(-1)	-1.327666	0.163348	8.127938	0.0000

Source: Author's Own Calculations and results

Long Run Impact

Food production index is showing Long-run elasticity with other independent variables. According to the table 5FPI and Consumer Price indexes are cointegrated. In Long-run CPI (0.72) is higher than short-run (0.211), it means that there exists long run impact of CPI on food security. This positive impact suggests that one percent change in CPI leads to increase in FPI about 0.72 %.

While working on long run impact of AGL it shows positive impact on FPI from 3.62 units. AGL "Agriculture land" shows positive relation to FPI & also with an estimated coefficient of 3.627936 which is significant as the p- value 0.000; it shows that increase in one hector of Agricultural Land can increase in Food production index by 3.62 %.

While Agriculture raw material import "ARMI" has shown negative relation with FPI & has an estimated significant coefficient -3.72773, one percent increase in ARMI leads to reduction in FPI of Pakistan to 3.73 percent. Too much reliance on imported food is bad for any economy, it can lead to disaster and in the event of a recession as we have recently stated, the country will be left with no choice but to rely on food aid and so on, to expose the world to a state of chronic food insecurity.

Similarly, "PG" Population growth has negative relation with FPI & has an estimated significant coefficient of -20.83783 ,it means that one Million increase in Population can lead to reduce "FPI" Food production index by magnitude of -21% approximately.

Long Run Coefficients

Table 5: Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.726666	0.114089	6.369289	0.0000
AGL	3.627936	0.705411	5.143008	0.0001
ARMI	-3.72773	3.107899	-2.486482	0.0229
PG	-20.83783	2.132356	-9.772210	0.0000
C	-44.757037	28.343196	-1.579110	0.1317

Source: Author's Own Calculations and results

Food Security situation in Covid days

A growing number of countries are experiencing rising levels of malnutrition, which is holding back years of development benefits. These effects of COVID-19 epidemic have led to a dramatic& extensive intensification in worldwide food insecurity, while affecting vulnerable families in virtually every country and every society, and the effects that are predictable to continue until 2021, 2022, and possibly beyond. This brief looks at the increase in food insecurity during the COVID-19 violence and World Bank responses to date (ILO, 2021).

Many countries are facing rising food prices at the lowest level and this is the case in many developing Countries where weak price market committees and strong Political influence causing this menace, reflecting fragile service delivery disruptions because of COVID-19 SOPs and safety measures, being the main cause inflation, & with other secondary factors. This price hike has caused negative impact on the lives and living styles of many people in middle-income &low income countries as they have to spend most of their revenue on food items comparing with people in high income countries (Downs. 2020).

Pandemic COVID-19 is projected to significantly increase the how many people facing stark food insecurity by 2020-2021. This has been estimated by WFP that almost 272 million people in the world are already at risk or can be at risk of undernourishment in the nations where it operates. Severe food insecurity can be defined as when a person's life or livelihood can be at stake immediately due to malnutrition (OECD, 2020a).

Effect of Covid-19 on Pakistan's Food Security Situation

This COVID-19 epidemic has had another devastating effect on food &agriculture security in Pakistan (Suleri, 2020a). Transport limitations, staff shortages, & farmer limitations market access is one of the key challenges. The supply of other foods such as oil &pulses can be at risk because of export restrictions forced by productive countries. These effects of COVID-19 on food security are even of poorer quality. Key features contributing to the worsening deterioration in purchasing capacity due to unemployment and loss of livelihood Food security has become a major task for consecutive managements in Pakistan (Suleri and Haq, 2009; Suleri and Iqbal., 2019). Nevertheless, throughout COVID-19epidemic, the weakness of the digestive system is most evident. This weakness has been exposed both the supply side and the need for a meal plan, as well as important gaps in policies, institutional skills, and reaction tactics at every levels. The diet plan is tested on the report as well-defined by FAO (2018) "covers the entire range of actors and their linked activities to add value involved in the production, assembly, processing, distribution, use and use and production of products. Disposal of food products from agriculture, forestry or fisheries, and part of the border the economic, social, and environmental environment is entrenched". The foremost &first problem that arose in peak times of pandemic days was job loss and unemployment physical access to food. Various studies say that the key is the lock and the limits of movement reasons for food intolerance (Moeen et al., 2021; FAO, 2020ab; WFP and FAO, 2020; Shafi et al.,

2020; Asghar et al., 2020; UNDP, 2020; Salik and Suleri, 2020; Suleri, 2020b).

Conclusion & Policy Recommendations

Food security is a multi-faceted issue. National as well as international political actions are required that could be the basis for setting goals, thus needing to adopt simple policy analysis indicators. Something like the analysis of the "Global food insecurity situation" should be done. Subsequently, malnutrition and food insecurity is all about uncertainties &risks, formal analysis should include both chronic and short-term malnutrition, major insecurity that reflects the instability of the economic and food system.

The digital food safety dashboard may be established at every district of the country to provide vital nutrients that reflect the nutritional position production, consumption of food, shares, and prices across the country to be effective as well informed decision making. In this regard, the MNSFR (at the level of government) must develop I dashboard and manage it by linking state-of-the-art food, agriculture and public administration departments for effective decision-making, data management and measures need to ensure the availability of essential food in the country.

Necessary improve internet access and better communication technology in rural areas to such as enhancing the digital production of the food supply chain as already proposed in Digital Pakistan (2018) and Broadband policies (2004). In this regard, the Ministry of National Food Security and Research, the Department of Information Technology and Communication Technology, and provincial ministers and relevant departments must align themselves with efforts to improve agricultural information (about pest distribution and diseases, farm prices and availability, water-related updates, weather conditions, market information, etc.) & should support in food delivery chains.

The provincial governments must ensure the availability of farm assets and their sustainability food storage prices go up during the epidemic. For this purpose, the role of agricultural sector and cooperatives needs to be invigorated by provincial and district agriculture and expansion doors. This will certainly help to expand cash flow matters (small and medium).To educate Farmers for using better agricultural debt financing under a separate government plans during floods, droughts and the COVID-19 epidemic.

The dire need is to design an increase in post-harvest standards specially perishable food to decrease loss and improvement of revenue during limited travel, lack of transportation and merchant and reducing consumer demands with the support of the provincial departments of agriculture.

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