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Linkages between Food Security and Human Well Bing in South Asia: An Empirical Analysis

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Abstract
A specific amount of food and safe drinking water are basic necessities of living human-beings. The study analysis the impact of agriculture, inflation, food import and food export on food production index for four South Asian countries, namely; Pakistan, Bangladesh, India and Sri Lanka. For statistical analysis, data used from 1990 to 2014 and data are collected from the World Bank data base, namely; World development indicator (WDI). Levin Lin Chu unit root test is used for exploring the stationary of the variables of the model. The result shows that inflation and food import have positive and significant relation with food production index in Pakistan, India, Bangladesh and Sri Lanka. The result shows that food export has a negative and insignificant relationship with the food production index in Pakistan, India, Bangladesh and Sri Lank. Agriculture has negative and insignificant relation to food production index. Government should adopt the agriculture policies to increase the production of food. The success in ensuring food security, or the lack of it, was conditioned by macro-economic developments as much as specific policies and programs addressed to resolve this problem. Macroeconomic policies in the countries in this region were pursued in the context of progressive liberalization, rather than de-bureaucratization, careful sequencing of reforms (starting from the industrial and financial sector reforms), and concern for stable price levels (i.e., curbing excessive inflation). This distinguished the growth experience of this region from that in the developing countries of Africa and Latin America.

Keywords: food insecurity, agriculture output, inflation, imports, exports
JEL Codes: E01, E31, Q18

I. Introduction

Food Security is one of real components of advancement and neediness mitigation and has been the objective of numerous universal and national open associations. The issue is important to the point that, as indicated by the condition of sustenance frailty on the planet 2012 distributed by FAO around 870 million individuals (out of which 852 million from creating nations) are assessed to have been undernourished in the period 2010-12. Food security is characterized as the circumstance when "all individuals, constantly, have physical, social and financial access to adequate, sheltered and nutritious nourishment that meets their dietary needs and nourishment inclinations for a dynamic and solid life" (FAO 2002). To accomplish sustenance security, nourishment ought to be accessible, open, and appropriately used constantly. In spite of the fact that the expression food security is being utilized generally, the definition and idea of sustenance security is subtle and being advanced and extended after some time. Food and water are fundamental for human presence and vitality is the way to human advancement. Access to these assets and their supportable administration are the reason for manageable improvement. The idea of the food, water, and vitality nexus is amazingly important to Asia as the locale needs to encourage 66% of the total populace (4.14 billion individuals) and records for 59% of the planet's water utilization. Guaranteeing sustenance security and giving access to safe drinking water and presently vitality for all remaining parts a key test for Asia's feasible improvement. The test is particularly awesome in the South Asian countries–Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka–where over 40% of the world's poor live and approximately 51% of the populace is food–energy inadequate (Ahmed et al., 2007). With only 3% of the world's property, South Asia has around one-fourth of the total populace (1.6 billion individuals). Rice and wheat, the staple nourishments in the sub region, require colossal measures of water and vitality.

The present and future difficulties to food security from the physical impacts of environmental change – changes in temperature and precipitation means and changeability – with concentrated on the most influenced and helpless areas and populaces. The condition of information on and requirement for farming adjustment to environmental change, with regards to the effectively vast difficulties to food security from the populace and pay development in reality as we know it where numerous nourishment delivering frameworks are as of now focused and unsustainable. Farming's present commitments to ozone harming substantial outflows and the potential for agribusiness in relief while taking care of the developing demand for food. Facilitated and intelligible national and worldwide strategy methodologies and activities for managing mutually with the food security and environmental change challenges. Freshwater, once plenteous, is under developing worry because of the expanded interest for contending uses, and environmental change is making extra vulnerabilities (Eriksson et al., 2009). Around 20% of the number of inhabitants in South Asia needs access to safe drinking water (Babel and Wahid, 2008).

The food security idea now in vogue stops at the examination of sustenance security at the family unit level. It doesn't take a gander at the nourishment security issues inside the family unit, i.e., the intra-family unit appropriation of sustenance. With the perceived sex inclination winning in all social orders this is a genuine oversight. Lamentably the accessible information doesn't allow us to go beneath the family unit level. Judged by the criteria of sustenance weakness and neediness, South Asia has the qualification of being the most noticeably awful influenced locales. An expansive lion's share of poor people and the sustenance uncertain individuals live in this piece of the (World Bank, 1990) where the rate of hunger is intense (UNICEF, 1996). The district is likewise in reverse as far as other social advancement pointers (UNDP, 1996). Any exertion of guaranteeing sustenance security to the poor family units ought to normally take a gander at the nations of this local.

Food security likewise requires that individuals feel genuinely sure about where their next feast is originating from. Vulnerability is a wellspring of uneasiness and can dishearten people, families, and firms from leaving on other financial exercises that could give them valuable long run impacts. For instance, family units may put off putting resources into training in the event that they feel powerless against wage or value stuns that undermine their capacity to buy nourishment. Inflation a backward assessment disproportionate affects the acquiring energy of the poor and their financial access to food. The inflation-poverty nexus signals macroeconomic ramifications for food security in south Asia have higher expansion than east. The farming area with bringing down yields bears the consumed of expansion prompted speculation cuts. Helplessness of food and nutrition security to environmental change is a component of all the driving elements specified previously. Biophysical changes from environmental change influence nourishment accessibility through supply impacts (e.g., changes in normal yields and increments in changeability) and the subsequent difficulties to employments of makers. Environmental change additionally has imperative ramifications for nourishment appropriation and access as they rely upon atmosphere strong street foundation, markets and other social and financial establishments. Notwithstanding these supply symptoms,

environmental change may influence the use (request by purchasers), through impacts on their earnings as well as utilization conduct. Outcomes for nourishment dependability could originate from expanded rate of extraordinary occasions prompting more incessant transitory sustenance deficiencies and weights on asset accessibility and adding to political turmoil.

II. Literature Review

Gopalan (1996) conducts an examination to see the sustenance and nourishment circumstance in South Asian and South East Asian nations. The outcomes demonstrate that the generation of nourishment in South Asian and South East Asian nations has demonstrated an upward pattern, however the populace is expanding by an extensive rate. The creator's whole up that the primary issues in these nations with respect to sustenance and nourishment are the sustenance accessibility and its generation, tyke mortality, low birth rate, soil and water disintegration and quickly expanding urbanization. Thus, to enhance the sustenance and nourishment circumstance in south Asian and southeast Asian nations, these issues ought to be experienced.

Moon (2009) investigation nourishment and wellbeing, security circumstance in northeast Asia. As indicated by the creator there are two principle issues exist with respect to wellbeing, security, one is the endless degenerative infection in Japan, China and South Korea and the other one is lack of healthy sustenance in South Korea and China. The creator presumes that the world nourishment cost can majorly affect sustenance security in low sustenance self-effective nations. As the quantity of matured individuals increments in these nations might not have nourishment security as a result of vanishing customary esteems. Populace and financial development will prompt ascent the sustenance issues. Environmental changes likewise adverse effect nourishment generation. The political unsteadiness will likewise cause nourishment uncertainty.

Yang and Hanson (2009) lead an exploration to see the enhanced nourishment availabilities impact on sustenance security in Asia-Pacific area. The creator reasons that the nourishment, security vigorously relies upon sustenance accessibility, yet it is not adequate to secure tasteful nutritional status. The sustenance, security requires an appropriate edge work of ecological conditions mindfulness, financial framework, nourishment and well-being. In this way, to enhance the sustenance accessibility and security I in the short run the low-salary nations should expand profitability in nourishment framework to get higher livelihoods for the laborers in the natural way of life. For the long run farming advancement to be center alongside advancement of nourishment based, methodologies and adjusted eating routine which inevitably prompts better wellbeing.

Chin (2010) investigations the immediate impact of wage on the wellbeing status and in the end prosperity. For the reason the creator utilized board information investigation for the period 2004-2008 from the Malawi Diffusion and Ideational Change Project (MDICP) and the Malawi Longitudinal Study of Families and Health (MLSFH). The creator utilizes settled impact methodologies and instrumental factors to deliver endogenety of wage to the wellbeing. The outcome demonstrates that there exists a positive and noteworthy relationship among pay wellbeing and prosperity, as by the outcomes salary of rustic Malawians increments by 10 percent the mean general wellbeing status enhances by 1 percent and mean subjective prosperity by 1.2 percent.

Charls et al (2010) conducts an investigation to see that how the world will nourish approx. 9 billion individuals. The investigation proposes that as the populace and utilization is continue expanding the shortage issue thrives. Thus, there is the need of period that the effect on nature by the sustenance framework must be decreased. However, the creator presumes that the person are a great deal more competent to conquer these issues by expanding the effectiveness and efficiency to coordinate the generation level with the request. The creator additionally recommended that a few systems ought to likewise be made at the world level to beat this issue in future.

Campbell (1991) recommends that the wonder inexactly named hunger in the 1980s is currently being examined as nourishment security or frailty. The estimation of nourishment instability at the family unit or individual level includes the estimation of those quantitative, subjective, mental and social or regulating develops that are integral to the experience of sustenance uncertainty, qualified by their requirement and periodicity. The exact connections between nourishment uncertainty and its hazard elements and potential results require a great deal more research now that there is a developing agreement on the definition and estimation of sustenance frailty. Markers of nourishment security or frailty are proposed as an essential segment of the center measures of the nutritious condition of people, groups or countries.

Cordell et al (2008) conducts an exploration to see that whether Food generation requires use of composts containing phosphorus, nitrogen and potassium on horticultural fields to maintain edit yields or not and How current agribusiness is subject to phosphorus got from phosphate shake. While phosphorus request is anticipated to build, the normal worldwide crest in phosphorus creation is anticipated to happen around 2030. The correct planning of pinnacle phosphorus creation may be questioned; nonetheless, it is generally recognized inside the compost business that the nature of outstanding phosphate shake is diminishing and generation costs are expanding. Open doors for recuperating phosphorus and decreasing interest are likewise tended to together with institutional difficulties.

Kennedy (1992) conducts an exploration to see the state of house hold nourishment security and kid's sustenance. The investigation is finished by utilizing the information of Kenya and Malawi. Information from Kenya and Malawi propose that nourishment security and preschooler wholesome status are affected by the cooperation of salary and sexual orientation of the head of family instead of just either. Not exclusively is family nourishment security impacted by added up to family pay however the extent of pay controlled by ladies affects family unit caloric admission. In both Kenya and Malawi, the accepted female-headed families had the most minimal salary; regardless of this low pay, preschoolers' wholesome status was essentially superior to in the higher wage male-headed and by law female-headed families. The discoveries propose that intercessions that endeavor motivating forces to put resources into youngsters can give more prompt upgrades in kid wellbeing and nourishment where managed pay development is conceivable just in the long haul.

Weiler et al (2014) examination sustenance power, nourishment security and wellbeing value by a Meta story mapping exercise. We embraced exploratory checking and mapping phases of a 'meta-account amalgamations on pathways from worldwide nourishment frameworks to wellbeing value results. The audit was situated by a calculated structure portraying eight pathways to wellbeing (in) value through the sustenance framework Multi-Scalar Environmental, Social Context, Occupational Exposures, Environmental Change, Traditional Livelihoods, Cultural Continuity, Intake of Contaminants, Nutrition, Social Determinants of Health and Political, Economic and Regulatory setting. .An examination motivation to investigate extends - based mediations in the sustenance framework along these pathways can bolster the distinguishing proof of approaches to fortify both nourishment power and wellbeing value.

Wealth (2002) conducts an exploration to see the circumstance of sustenance bank and nourishment security connects to the welfare changes, human rights, and social strategies. The nation considered to see the circumstance of these linkages is Canada. This paper investigates the development of sustenance managing an account in Canada and examinations its part regarding propelling the human ideal to nourishment, its viability in accomplishing nourishment security and the degree to which it adds to, and additionally counters the expanding accentuation by governments on welfare change strategies educated by neo–conservative belief system. Nourishment banks are inspected from the viewpoint of their birthplaces and purposes, standardization, utilization, sustenance appropriated and adequacy. The ascent of nourishment banks in Canada is solid confirmation both breakdown of the social security net and the co modification of social help. For the conclusion in nations where they are in their outset, the subject of whether to help their advancement ought to involve earnest open verbal confrontation.

Smith (2013) examines that how the nourishment security can be kept up by not expanding weight ashore. In this audit, creators analyze feasible escalation and consider options, for example, administration of sustenance request and waste diminishment. Sustenance generation can increment by growing rural region or expanding per-zone profitability. Growing agribusiness into woodlands and characteristic ranges is earth harming. To take care of future nourishment demand per-range profitability must increment, through "manageable increase". Manageable strengthening will be testing, and won't be without natural effect. The requirement for manageable increase can be diminished my overseeing interest and decreasing sustenance squander. Creator reasons that economical strengthening has a part to play, yet this must be joined by central change in worldwide sustenance frameworks.

Chilton (2007) addresses the significance of the initial three years of life to the creating kid additionally analyzes the significance of early youngster hood sustenance and the inconvenient consequences for tyke wellbeing and improvement because of neediness and nourishment weakness. The outcomes are the propagation of another era in destitution. Conceptualizing the ineffectively created tyke as an encapsulation of shamefulness helps ground two basic structures expected to address nourishment frailty and kid advancement. The human rights system outlines under nourishment and poor improvement of youthful youngsters as unfortunate for moral and lawful reasons and

gives a structure through which government and different organizations of the state and others can be considered responsible for reviewing such shameful acts.

Whltaker et al (2006) thinks about that if the commonness of dejection and tension in moms and the predominance of conduct issues in preschool-matured kids are more typical when moms report being nourishment shaky. A cross-sectional review of 2870 moms of 3-year-old youngsters was led in 2001–2003 out of 18 extensive US urban areas. In light of the grown-up sustenance security scale ascertained from the US Household Food Security Survey Module, moms were ordered into 3 levels: completely nourishment secure, imperceptibly sustenance secure, and nourishment shaky. The outcome demonstrates that Seventy-one percent of the respondents were completely sustenance secure, 17% were barely nourishment secure and 12% were nourishment unreliable. After change for sociodemographic factors in addition to maternal physical wellbeing, liquor utilize, medicate utilize, pre-birth smoking, and pre-birth physical abusive behavior at home, the rate of moms with either significant depressive scene or summed up tension issue expanded with expanding sustenance weakness: 16.9%, 21.0%, and 30.3% over the 3 levels. Among kids, after further alteration for maternal significant depressive scene and summed up tension issue, the rate with a conduct issue likewise expanded with expanding nourishment uncertainty: 22.7%, 31.1%, and 36.7%. For a conclusion, mental medical issues in moms and kids are more typical when moms are nourishment unreliable, a stressor that can conceivably be tended to by social strategy.

Galena et al (2013) conducts an examination to looks at the definitions and attributes of home gardens and after that gives a worldwide survey of their social, financial, and ecological commitments to groups in different financial settings. A large portion of the arrangements on home patio nurseries share research and encounters of creating nations in Africa, Asia, and Latin America. These examinations perceive positive effects of home greenery enclosures towards tending to nourishment weakness and ailing health and also giving extra advantages, for example, wage and employment open doors for asset poor families and conveying a few biological system administrations. Be that as it may, just a modest bunch of contextual analyses were found on post-emergency settings. This audit examines the home garden encounters of post-strife Sri Lanka, where home cultivating has been honed for a considerable length of time. While underscoring numerous advantages, creator likewise feature limitations to home garden nourishment generation. All in all, we stress the requirement for more research and experimental information to evaluate the part of home gardens in emergency and post-emergency circumstances, and also surveying their financial esteem and their effects on sustenance security, nourishment, monetary development, and sexual orientation issues.

III. The model and Data Source

The concept of food security has evolved over a period of time. Until the early 70s, adequate availability of food grains at the national level was considered a good measure of food security. Emphasis was placed on food self-sufficiency at the national level, principally through domestic production. The 1974 World Food Conference added another dimension to food security when it emphasized, apart from the overall availability, stability of food supplies within and over the years. Later, and mainly due to the writings of Amartya Sen, the question of 'access' and 'entitlement' gained prominence. An agreed definition of food security suggests that all households should be able to avail at all times of adequate food for a healthy living. This interpretation of food security, apart from emphasizing the elements of availability, stability and access, also includes - while giving due attention to "healthy" living - the nutritional dimension. This paper looks into the four dimensions of food security. The food security concept now in vogue stops at the examination of food security at the household level. It does not look at the food security issues within the household, i.e., the intra-household distribution of food. With the recognized gender bias prevailing in all societies this is a serious omission. Unfortunately, the available data do not permit us to go below the household level. Judged by the criteria of food insecurity and poverty, South Asia has the distinction of being the worst affected region. A large majority of the poor and the food-insecure people live in this part of the world (World Bank, 1990) where the incidence of malnutrition is very serious (UNICEF, 1996). The region is also backward in terms of other social development indicators (UNDP, 1996). Any effort of ensuring food security to the poor households should naturally look at the countries of this region. The countries covered by this study (Bangladesh, India, Nepal, Pakistan and Sri Lanka) apart from their geographical proximity, share a common history. Mainly due to the hegemony of British Colonial power for nearly two centuries these countries have common structures and socio-political institutions. There are marked similarities in their judicial and bureaucratic systems, as well as in their approach to education and health services and several other fields of public intervention. There is much that they can learn from each other. Also, there is vast scope for cooperation and complementary action. Some of the areas of cooperation will be identified in this paper. At the same time, and it bears repetition, action programmes in the area

of poverty reduction and food security have to be grounded primarily within the countries, while regional collaboration may supplement country-level action. 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), Ali et al., (2016), Ali and Arshad (2016) and Ahmad and Ali (2016), the model of this study becomes as:

FPI= F (INF, FM, FX, AGRI) (1)

Where
FPI= food production index
INF= inflation
FM= food import
FX= food export
AGRI= agriculture
The data of selected variables has been taken from World Development Indicator.

IV. Econometric Methodology

Application of econometric methods on macro-economic variables is an imperative feature within numerical economic inquiry. For baseline estimation, ordinary least square (OLS) method has not been applied. A constraint of this method is that it applies on linear time series data if data is non-linear OLS provides unreliable estimates of the parameters. It means that, the measurements from consideration will not essentially reach near the accurate population parameters on the bases of sample data. Moreover, time series data have unit root or non-stationarity issues (Nelson and Plosser 1982). In applied econometrics, there are many tests of unit root. Following different specifications, Levin et al., (2002) have introduced various tests of unit root. LLC unit root test is based on homogeneity as compared to previous autocorrelation based tests. LLC test uses the procedure of ADF test. The equation of LLC becomes as:

$$\Delta y_{i,t} = \gamma_{0i} + p y_{it-1+} \sum_{i-1}^{pi} \gamma_{1i} \Delta y_{i,t-j} + u_{i,t} \quad (2)$$

In eq.3

constant term γ_{0i} is different for all cross sectional units

undistinguishable coefficient of autoregressive is p,

lag order γ_i,

error term $u_{i,t}$ is white noise

For each cross section, The ARMA model becomes as:

$$u_{i,t} = \sum_{j-0}^{\infty} \gamma_{1i} \Delta y_{i,t-j} + \varepsilon_{i,t} \quad (3)$$

Now null and alternative hypotheses can be developed as:

H_0: $p_i = p = 0$

H_a: $p_i = p < 0$ for all i

LLC test is based on t-statistic,
here p is constant across the units under the null and alternative hypothesis.

$$t_p = \frac{\overset{\Lambda}{p}}{\overset{\Lambda}{SE(p)}} \quad (4)$$

As we have assumed that error term is white noise, the panel regression test statistic tp converge to standard normal distribution when N and $T \to \infty$ and $\sqrt{\frac{N}{T}} \to 0$. But if the cross sectional units are dependent, error term is

serially correlated and time trend is present then test statistic does not converge to 0. Under such situations LLC suggests modified version of the test statistics as:

$$t_p = \frac{t_p - N\hat{T}\hat{S}_N\hat{\sigma}^{-2}(\hat{p})u_m^*}{\sigma_m^*} \qquad (5)$$

Where u_m^* and σ_m^* are adjusted mean of error term and standard deviation of error term, the estimates of u_m^* and σ_m^* are collected with the help of Monte Carlo Simulation by LLC (2002).

Im et al., (2003) introduce a unit root test for examining the stationarity of the variables when there is heterogeneous panel data set is available. This test too follows the methodology of ADF unit root test but this test uses simple mean of each series, a series in ADF panel is denoted as:

$$\Delta y_{i,t} = \bar{w}_i + py_{it-1+}\sum_{i-1}^{pi}\gamma_{1i}\Delta y_{i,t-j} + v_{i,t} \qquad (6)$$

Heterogeneity in v_i value is also allowed in IPS test, the equation of IPS unit root test can be presented as:

$$\bar{t}_T = \frac{1}{N}\sum_{i-1}^{N} t_{1,i}(p_i) \qquad (7)$$

Where $t_{i,t}$ is the ADF test statistic, p_i is the lag order. This can be calculated in ADF unit root test as:

$$A_t -- = \frac{\sqrt{N(T)}[\bar{t}_T - E(t_T)]}{\sqrt{Var(t_T)}} \qquad (8)$$

As the issue of unit is resolved, the long and short coefficient of the model can be examined. Pesaran et al., (1999) introduced Pooled Mean Group (PMG) test to examine non-stationary dynamic panels. The solution of non-stationarity issue is very necessary in case of dynamic panels analysis. PMG test uses amalgamating and averaging process for measuring the coefficients [Peraran et al., (1999)]. Following the proposed assumptions of PMG, the short run coefficient of the model can be estimated for group. PMG eq. becomes as:

$$y_{it} = \sum_{j-1}^{p}\lambda_{ii}y_{i,t-j} + \sum_{j-0}^{q}\delta_{ij}X_{i,t-j} + u_t + \varepsilon_{it} \qquad (9)$$

Where number of cross section i=1,2,3,4,5,…..N and time t=1,2,3,4,5,…..T. X_{it} is a vector of Kx1 regressors, λ_{ij} is a scalar, u_i is group specific effects. If the variables are I(1) cointegrated then the disturbance term is an I(0) process. A major characteristic of co-integrated variables is their rejoinder to any deviance from long run equilibrium. This characteristic infers error correction dynamics of the variables in the system that are swayed by the deviance from equilibrium. The error correction term can be written as:

$$y_{it} = \phi_i y_{i,t-j} - \theta_i X_{i,t-j}\sum_{j-1}^{p-1}\lambda_{ii}\Delta y_{i,t-j} + \sum_{j-0}^{q-1}\delta_{ij}\Delta X_{i,t-j} + u_t + \varepsilon_{it} \qquad (10)$$

The error correction parameter φ_i indicates the speed of modification from short run towards long run. $\varphi_i = 0$ shows the existence of long run relation the variables. For convergence, it is a necessary and sufficient condition that φ_i must be negative and significant.

V. Empirical Results

According to the latest Food Price Watch, global food prices increased 10% between June and July 2012 with staples such as wheat increasing 25% in the period. The crisis continues to have effects on food and nutrition security throughout South Asia. Bad weather, trade curbs, oil prices and bio-fuel diversions have all led to higher food prices, which destabilizes the incomes and food security of millions across the region. While rising food prices

risks higher core inflation in the developing countries, the volatility proportionally squeezes the poor with considerably detrimental effects for their nutrition outcomes. José Cuesta, Senior Economist at the World Bank said, "food prices increased sharply in the month of July…we see that the effects on poverty can reach up to 20% and the impact on the performance of children in school, their development and growth are not only transitory but can last a lifetime." Studies in the last few years in Afghanistan and elsewhere have confirmed that rises in the cost of food have led to a switch in consumption from nutrient rich foods, such as vegetables, meats and other proteins to nutrient-poor staples, such as rice and wheat. There is also evidence of children's food intake being protected, typically at the cost of women's consumption. When the effects of the crisis are more severe, households may also sell productive assets, take children out of school, and reduce expenses on health. "The poverty and nutritional impact of food price spikes on the poor is significant since they spend a larger fraction of their income on food than relatively better off individuals," said Kalpana Kochhar, Chief Economist of the South Asia region of the World Bank in the South Asia Economic Focus on Food Inflation. While these are not preferred outcomes, they are sadly a reality for the many poor households that face rapidly fluctuating prices. Another South Asia report, Food Price Increases in South Asia: National Responses and Regional Dimensions found that households who previously were living not far above the poverty line are likely to have fallen into poverty as the result of higher food prices. To continuously monitor such fluctuations, the World Bank's Poverty Reduction and Equity Group produces its quarterly Food Price Watch which is complementary to the Food and Agriculture Organization (FAO's) GIEWS Country Briefs on Food Security at the country level.

Table 1: Unit root test (Levin Lin Chu): At level:

Variables	t-statistics	p-value
Food production index	1.37195	0.0850
Agriculture	2.3205	0.9898
Food import	-1.50457	0.0662
Food export	-0.99881	0.1589
Inflation	-2.74201	0.0031

At 1st difference:

Variables	t-statistics	p-value
Food production index	14.559	1.0000
Agriculture	3.00991	0.0013
Food import	-5.94949	0.0000
Food export	-5.26209	0.0000
Inflation	-7.83188	0.0000

The Model of Liven Li Chu unit root shows that the only three variables inflation and food production index and food import are stationary at level. And the food export and agriculture are stationary at 1st difference. The results represent that there are mix order of integration among the variables of the model and we have the option for applying the pooled mean/ARDL method. Pooled mean group/ARDL is the modern co integration method. It has many advantages, pooled mean is use on mix order of co integration and it provides best results for small sample size data.

Table2: Dependent Variable: LFPI

Variable	Coefficient	Std. Error	t-Statistic	Probability
LAGRI	-0.656600	0.559532	-1.173481	0.2445
INFLA	0.065738	0.037268	1.763953	0.0820
FX	-0.121990	0.046557	-2.620247	0.0107
FM	0.045342	0.026209	1.730028	0.0879

There is vast food of literature is available which discover the relationship between availability of food and population growth among high and low income countries. The food production depends on natural resources, agriculture sector performance, public investments and incentives for private farmer in rural health care supply and privately funded research and development plan and intervention produce spillovers for significantly strengthen agricultural productivity sector. In previous literature a number of studies analyze the agriculture productivity with

some physical inputs such as fertilizer and pesticides. Some comprised labour inputs in their analyses, human capital to explain growth in food (Antholt, 1994; Beal, 1994; Evenson and McKinsey, 1991; Jamison and Lau 1982; Nehru and Dhareshwar, 1994; Pardey et al., 1992; Pray and Evenson, 1991; Rosegrant and Evenson 1992). 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 reproductive age (Kennedy and Meyers, 2005). But due to lack of micro level data the picture of food insecurity is still ambiguous.

Table 3: Short run

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	3.116980	1.571575	1.983348	0.0511
D(LAGRI)	0.050252	0.119906	0.419093	0.6764
D(INFLA)	-0.006880	0.002525	-2.725323	0.0081
D(FX)	0.018088	0.005214	3.469170	0.0009
D(FM)	-0.007404	0.003269	-2.264917	0.0265
ECT(-1)	-0.152751	0.080316	-1.901864	0.0612

The calculated results show that agriculture and food production index have negative and insignificant relationship in the long run. The study shows that inflation and food production index have a positive and significant relationship in the long run in Pakistan, India, Sri Lanka and Bangladesh. 1% increase in inflation causes (0.065738) increase in food production index. Food export has negative and significant relationship with the food production index. A 1 % increase in export causes (0.121990) decrease in food production index. Food import is a positive and significant relation with food production index. 1% increase in import causes (0.065738) increase in food production index. The error correction model is used to check the short run relationship between the variables of the model. The error correction term for the pooled mean group /ARDL estimator is significant with a value of negative (-0.152751). This suggests that around 15% of the deviation from the long run relationship is corrected in the first year. The significant calculated coefficient of ECM also predicts Co integration among the variables of the model.

VI. Conclusions

The study analysis the impact of agriculture, inflation, food import and food export on food production index for four South Asian countries, namely; Pakistan, Bangladesh, India and Sri Lanka. For statistical analysis, data used from 1990 to 2014 and data are collected from the World Bank data base, namely; World development indicator (WDI). Levin Lin Chu unit root test is used for exploring the stationary of the variables of the model. The result shows that inflation and food import have positive and significant relation with food production index in Pakistan, India, Bangladesh and Sri Lanka. The result shows that food export has a negative and insignificant relationship with the food production index in Pakistan, India, Bangladesh and Sri Lank. Agriculture has negative and insignificant relation to food production index. For the policy recommendation, governments should be able to overcome the food problem with rising population if governments protect the small and medium farmers through the proper functioning of the agribusiness in their economies. Excessive rent seeking, hoarding, lack of credit facilities and such others bottlenecks have to be properly managed by the governments. In this way, the production of food crop secures in the future and meet the rising population demand for food with low levels of poverty in the rural areas particularly. Further, smuggling of food items should be controlled across the borders. 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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