Sustaining Food Security in the Philippines: A Time Series Analysis

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ABSTRACT---- ***With the complexities of life that modernization has offered to humans, many forgot that basic needs comes from the environment. This research proved that Philippines as a predominantly agricultural country must focused on its strength in sustaining the country's food needs. Factors that sustain food security condition of the country was identified guided by the economic model by Smith and Haddad that specified that in an agrarian economy food security will be achieved through increasing food productivity. Secondary data were used in the study covering 23 years from 1990 to 2013 and were estimated using the Ordinary Least Square (OLS) regression. Empirical findings show that the share of agricultural budget to the total General Appropriations Act has significant positive effect on the food security index increasing by 3.72. The study concluded that food security will be sustainable if the population depending on agriculture, fishery, hunting and forestry will be decreased. This suggests that experts on agriculture must intervene on the micro level dealing on the production decisions made by farmers and fishermen as this has an impact on the food security condition of the country.***

Keywords— Food security, agriculture, Ordinary Least Square Regression and Philippines

1. INTRODUCTION

Food security has become a global concern today. According to the Food and Agriculture Organization (FAO) the world's population is projected to reach 9.3 billion by 2050. In this connection, to feed this greatly increased population, food production must rise by 70%. Improved production is a necessity in ever country to guarantee adequate food access.

Asia, the most populous region in the world, still has the highest number of undernourished which is 65% of the world's hungry population (IRRI, 2010). With the continuous growth in population, increasing demand from changing diet, dwindling land and water resources for agriculture, higher energy costs, and huge uncertainties regarding the effects of climate change, it has become challenging to attain and maintain food security. Being one of the member of ASEAN community, the food security situation in the Philippines is as important as in other countries. Among the Asia's "tiger cub economies" from 2005-2012 the Philippines has the highest preponderance of food inadequacy (FAO, 2014). According to National Nutrition Survey (NNS) in 2011, 36% of the Filipino adults and 23% of children claimed to be food insecure. The Autonomous Region in Muslim Mindanao (ARMM) has the highest pervasiveness of food insecurity.

In the face of continuous growth and development of the country which is backed up by the challenges of globalization, it is evident that there is a strong need to understand the food security situation as well as the determinants to sustain it. Understanding the determinants is essential because it will help the policy makers keep track of the main variables that matter in sustaining food security in the country. Food security and food insecurity can be examined at many levels such as national or country, household and individual level. In the national level, a country is food secure when on the continuous and stable basis, the food supply and effective demand are bale to cover the food requirement of its population. Food requirement can be fulfilled by a country either by means of domestic production, access to food beyond domestic production or combination of both factors (Aker & Lemtouni, 2000). This infers that the country level of food security is determined by the interaction of domestic and global forces. In this regard, it is vital to have the analysis done at the national level which cover-up the actual food security situation in the country, taking into account the macroeconomic factors perceived to sustain food securities.

2. METHODS

2.1. Data

The number of observations was based on the central limit theorem in statistics. The central limit theorem state that as the number of discrete events increases, the function begins to resemble a normal distribution. Annual data from the year 1990 to 2013 for a period of 23 years were used in the study. Time series data of the selected indicators on the three dimensions namely: availability, accessibility and utilization were sourced from the published statistical reports from the Bureau of Agricultural Statistics, Department of Agriculture, and Philippine Food Security Information System under the Philippine Statistical Authority. For other relevant documents required such as those having to do with studies and literatures directly and indirectly connected with the study, the library facilities of the UST, UP School of Economics, NEDA Philippine Institute of Development Studies, Ateneo de Manila University, and the Asian Social Institute were tapped for the materials available at their end

Table 1 shows the food security dimensions and the indicators that were used in the study. The time series data on food available per capita and food production index focused on the following commodities: rice, corn, cassava, sweet potato, chicken meat and egg, pork, milkfish and tilapia. The stock and cropping intensity indices covered rice/palay and corn. The import dependency ratios were examined for the focused commodities with imports such as rice, corn, cassava, pork, chicken and chicken eggs, milk fish and tilapia. Moreover, the food accessibility indicators such as the time series data on farmer's share in consumer peso were examined for rice, corn, sweet potato, banana (saba), pork, chicken, tilapia and milkfish. The CPI was analyzed by commodity group except for rice and corn. Lastly, the determinants of food utilization that look at the nutritional status of individuals are the percentage of children under five years old who are stunted, underweight and wasted and infant and under five mortality rates. Adequacy of food is determined by the indicator on the ratio of food to total family expenditures. Nutrient intake of food is measured through Dietary nutrients (energy) consumed as proportion to RENI and dietary energy supply (DES) of cereals, roots and tubers.

Table 1: Food security dimensions and indicators

Dimensions	Definition	Indicator
Food Availability	Availability of sufficient quantities of food of appropriate quality supplied through domestic production or imports	Food Availability Index 1.Food Available per capita 2. Food Production Index 3. Cereals stock index 4. Cropping intensity index 5. Import Dependency Ratio
Food Accessibility	Access of individuals to adequate resources acquiring appropriate foods for a nutritious diet	Food Accessibility Index 1.Farmer's Share in Consumer Peso 2.Consumer Price Index
Food Utilization	Ability of the human body to ingest and metabolize food through adequate diet, clean water, good sanitation and health care to reach a state of nutritional well-being where all physiological needs are met	Food Utilization Index 1.Prevalence of stunting, underweight and wasting among children aged 0 to 5 years old 2. Infant and under five mortality rates 3. Share of food in total family expenditures 4. Dietary Energy Supply of Cereals, tuber and root crops 5. Dietary Nutrients (energy) consumed as proportion to RENI (Recommended Energy and Nutrient Intake)

The selection of the commodities and crops was based on the priority crops under the Food Staples Sufficiency Program (FSSP) of the Department of Agriculture (DA). Rice is the main staple food while corn, cassava, sweet potato and banana

(saba) are substitutes. Pork, chicken, chicken egg, tilapia and milk fish are the common commodities purchased by wage earners.

2.2. Variable

In Table 2, a summary of the explanatory variables related to food security. These variables were times series in nature and were computed using the following formula (Table 2) :

Table 2: Economic determinants, definition and computational formula

Economic Determinants	Definition	Computational Formula
Share of Population Engaged in Agriculture to Total Population (SAT)	Refers to the percentage of the country's population depending on agriculture, hunting, fishing and forestry for their source of livelihood	*SAT* = (Agricultural population / total population) x 100
Proportion of Employed Person in Agriculture to Total Employed (PEP)	Employed persons in agriculture (including fishery and forestry) expressed as percentage of the total employed persons	*PEP* = (Employed persons in agriculture/total employed persons) X 100
Ratio of Agricultural Food Imports to Total Food Imports (RAI)	Proportion of agricultural food imports (raw/unprocessed) expressed in percent	*RAI* = Agricultural food imports/Total food imports x 100
Share of Agricultural budget in total GAA (SBG)	Proportion of agricultural budget to total budget	*SBG* = (Agricultural budget/Total GAA) x 100

2.3. Empirical Model

The empirical model proposes that food security index as the dependent variable. Food security index is defined in its three dimensions: food availability, accessibility and utilization. Food availability refers to the total amount of food available for human consumption. It is the availability of sufficient quantities of food appropriate quality supplied throughout the domestic production or imports. The second dimension is food accessibility. The concept refers to the access of the individuals to adequate resources for acquiring appropriate foods for a nutritious diet. It diverge from food availability in that it measures actual access to food supplies, meaning either access to own production or to food purchases. There maybe sufficient food supplies, but certain individuals or households within a country may have insufficient entitlements to express their food needs. It serves as an aggregate indicator of the internal market's ability to distribute food among the population. Lastly, food utilization refers to the ability of the human body to absorb and metabolize food using sufficient diet, clean water, good sanitation and health care to effectuate a state of nutritional well-being where all physiological needs are met.

On the other hand, the independent variables were the economic determinants related to agriculture namely: share of population engaged in agriculture to total population, proportion of employed person in agriculture to total employed, ratio of agricultural food imports to total food imports and share of agricultural budget in total general appropriations act.

$$\mathbf{FS = \mathit{f}\ (SAT, PEP, RAI, SBG)}$$

where:
FS = dependent variable (Food Security Index)
SAT = share of population engaged in agriculture to total population
PEP = proportion of employed person in agriculture to total employed
RAI = ratio of agricultural food imports to total food imports
SBG =share of agricultural Budget in total general appropriations act

Since the data used in the regression model is time series data, it is necessary to test if the results are nor spurious. Regression results may look " fabulous", The R^2 is extremely high, the t-value is high as well, but if we check Durbin

Watson, it is low, then we may suspect that spurious regression may be present (Gujarati, 2003). As Granger and Newbold have suggested, an $R^2 > d$ is a good rule of thumb to suspect that the estimated regression suffers from spurious or nonsense regression.

A time series is said to be stationary if its mean value and association function are constant over time, and the covariance between two time periods hinge on only on the lag between the two time periods. Any disturbances or exogenous shock introduced to the series will bring a temporary effect. Over time, the effects of the shocks will dissipate and the series will revert back to its long run mean level (Cortes and Cruz, 2007).

A test of stationarity or (non-stationarity) that has become widely popular is the Unit Root Test. This can be written as:

$$\Delta Y_t = Y_{t-1} + \mu$$

If the coefficient of Y_{t-1} is equal to 1, then the variable at level is said to have a unit root and therefore non-stationary. Regressing non-stationary variables poses a problem as it may lead to spurious regression results when said variables are trending upward or downward, as often the case for many economic variables. The spurious results could be due to the correlation in trends of the variables in the model even if there is no meaningful relationship between them. However, regression of non-stationary variables is still possible if they are co integrated. To determine if the variables of a model are stationary or non-stationary, the Augmented Dickey-Fuller (DF test with provision for intercept, μ, and the deterministic time trend, t, augmented by lagged terms of the variable) will be used as follows:

$$\Delta y = \mu + \varphi t + (p - 1)\, y_{t-1} + \beta \Delta y_{t-1} + v_t$$

where
- y_{t-1} = the level series of y lagged by 1 period
- μ = if original series has intercept
- t = if series has deterministic time trend
- Δy_{t-1} = lagged term
- v_t = white noise

If the coefficient (p-1) is more negative than 1%, 5% and 10% levels of significance, based on Mackinnon critical values, then the series at level is said to have unit root while its first difference, Δy, is stationary. All variables would be tested for unit root while its first difference, Δy, is stationary. All variables would be tested for unit roots.

2.4. Statistical Treatment of Data

The economic model presented are dynamic in nature because the variables is affected by several exogenous factors. . Therefore, it is necessary to test the theory. Since the data are time series in nature the appropriate tool to be use is time series regression using OLS. The model for multiple regression equation consists of a slope and an intercept. (Salvatore, 2001).The following economic model is designed to provide statistical basis for accepting the null hypothesis of this study. The model was estimated using multiple regression analysis.

$$Fs_t = \alpha_0 - \beta_0 SAT_t + \beta_1 PEP_t + \beta_2 RAI_t + \beta_3 SBG_t + \mu.$$

where:
- Fs_t = Food Security Index
- SAT_t = Share of population engaged in agriculture to total population
- PEP_t = Proportion of employed person in agriculture to total employed
- RAI_t = Ratio of agricultural food imports to total food imports
- SBG_t = Share of agricultural budget in total general appropriations act
- μ = error term

The parameters of the model were tested for statistical significance at 5 percent level using t-test:

$$t = \frac{\beta k}{Se(\beta k)}$$

where:
- βk = parameter of the kth variable
- $Se(\beta k)$ = standard error of parameter of the kth variable

If the computed t-ratio of a coefficient exceeds, in absolute value, the critical value of the t-ratio at the 5 percent level of significance, then the parameters are statistically significant.

In determining the overall statistical significance of the regression equation, F test were used. Its formula is as follows:

$$F = \frac{R^2 / 1}{(1-R^2) / (n-2)}$$

In this equation, R^2 is the coefficient of determination which measures the proportion of the total variation of dependent variable, the food security index that is explained by the regression equation, and is n equal to the number of observations. Five percent level of significance were used in the study. If the computed F exceeds the critical value, then the model is statistically significant.

Durbin Watson test were utilized to check if autocorrelation among the residuals existed. Autocorrelation may arise because of several reasons, like stagnation or sluggishness of economic time series, specification distortion resulting from excluding important variables from the model or using incorrect functional form, the cobweb phenomenon, data massaging and data transformation.

$$D.W. = \frac{\sum (e_t - e_{t-1})^2}{\sum e^2_t}$$

To test if there is a serial correlation that exists the value of the Durbin-Watson Statistics is subjected to a result range. (Gujarati, 2004)

Value of the DW	Result
4 – dl <DW < 4	Reject the null hypothesis, negative serial correlation is present
4 – du < DW < 4 - dl	Result indeterminate
2 < DW < 4 - du	Accept the null hypothesis that there is no serial correlation that exists in the model
du< DW<2	Accept the null hypothesis that there is no serial correlation that exists in he model
dl< DW< du	Result indeterminate
0 < DW < dl	Reject the null hypothesis; positive serial correlation is present

where:

dl = the DW statistic lower limit table value
du = the DW statistic upper limit table value

Time series is susceptible to structural changes that can be attributed to a host of economic, political, technological and social changes over the time period of study. Therefore, the parameters of the model were unstable and unreliable from a policy standpoint.

To test for stability of the parameters of regression models, the Chow tests were adopted. The procedures were as follows:

a) Divide the series into two periods. The number of observations in the two periods can be equal or unequal, provided that each period contains more observations than the number of coefficients. Estimate the equation for the entire sample and obtain the residual sum of squares (RSS)

b) Obtain the F-ratio based on the following formula

$$F = \frac{RSS-(RSS1+RSS2)/k}{(RSS1+RSS2)/(n-2k)} \sim F(k, n-2k)$$

where: k = number of regressors including intercept
n = number of observations
RSS = regression sum of squares

c) If the computed F is statistically significant, then there is no structural change.

The results of this study determine whether to accept or reject Hypothesis. The Chow test validates whether a structural change occurred between the sample periods of 23 years.

In the design of economic models the ambiguity of the underlying theory may lead the researcher to commit error in the specification of the functional relationships. Such errors could have arisen due to omission of variables, inclusion of unnecessary variables, or wrong functional form. In any case, this could result to larger variances and render the parameters statistically insignificant.

To minimize the incidence of these lapses, Ramsey's regression specification error test (RESET) was applied on each of the models. The testing procedures were as follows:

a) Assuming that a model is potentially mis-specified, it's estimated mean value, were obtained.

b) The model is re-run by introducing Y, in some form, as an additional repressor (s).

c) The R^2 for both regression results were be obtained and the F test were applied on it as follows:

$$F = (R2\ new - R2\ old)/k'/(\text{I-R2 new}) / \text{n- no of parameters in new model}$$

d) If the computed F is statistically significant, then the model is miss specified.

The results of this test determine whether to accept or reject Hypothesis

Regression equations may lead to spurious results if the variables are non-stationary or have unit roots. This problem is often encountered when regressing one time-series variable on another or other time series variables. In this case, the usual diagnostic tests (R^2, t and F test) fail or cannot apply. However, even if the variables are non-stationary, regression is still possible if said variables are cointegrated.

Cointegration means that despite being individually non-stationary, provided the variables are integrated of the same order (number of differencing required to convert a non-stationary series into a stationary one), a linear combination of two or more time series can be stationary. To apply this test on each equation, the equations were considered as co integrating regressions.

Once a series of residuals for each equation is obtained, then the Augmented Engle-Granger (AEG) or Johansen Co integration Test could be applied to examine if the regression has unit root. The test works by regressing the first difference of the errors. The results of this test determine whether to accept or reject Hypothesis. If the slope coefficient is significant, then there is no unit root and regression variables are co integrated.

3. RESULTS AND DISCUSSIONS

"Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2002). The food security index shows an upward trending pattern implying food security (Figure 1). This suggests that the Philippines is food secure taken collectively the interaction of the three dimensions: availability, accessibility, and utilization. Food availability dimension addresses the supply side of the food security and requires adequate quantities of quality food from local agricultural production or imports. The upward trend can be attributed to the availability of the major food items from 1995 to 2010. Other factors that might contribute was the increasing government budget for agriculture (Philippine Statistical Authority, 2013). However, the declining pattern of major food items especially rice stocks might threaten food security in the coming years. However, it is expected to recover because of the increase in agricultural budget as depicted by the upward trending graph of production and cereal stock index of rice. The recovery is also supported by the stability shown by the cropping intensity index, because of the government interventions such as the Five Cropping in Two Years, Early Wet Planting and Quick Turn Around Programs.

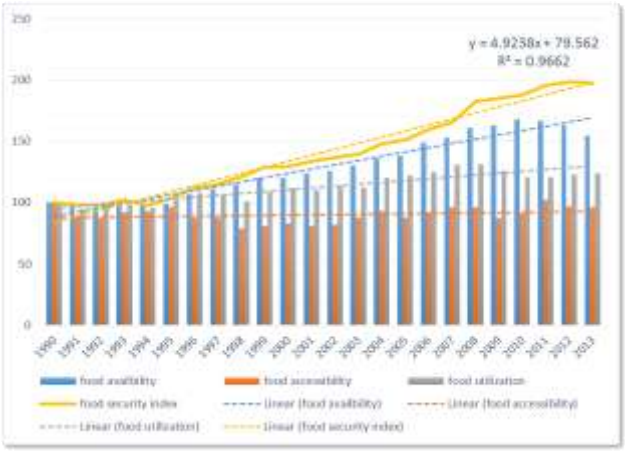

Figure 1: Food security index, Philippines, 2009 – 2013

Food accessibility refers to access by individuals to adequate resources for acquiring appropriate foods for the nutritious diet. The indicators are Farmer's share in consumer peso and consumer price index. The accessibility dimension of food security addresses whether the households or individuals have sufficient resources to acquire the relevant quantity of quality foods, encompassing their income, expenditure and buying capacity. The trend shows that in terms of food accessibility, the food security situation is threatened by the continuous increase in food price as depicted by the upward trending line of consumer price index. However, with the continuous rise in farmer's income in relation to money spent on food items, food security will improve.

The utilization dimension of food security knows if the available food in a given period of time had been accessed and utilized. A household makes decisions on what food to consume and how to allocate food within the household. Appropriate food intake is essential for the nutritional status of the populace. The highest peak of food utilization was experienced in 2006 where the increasing share of food in total family expenditures was noted until 2012. According to Philippine Statistical Authority (2013), food expenditures comprised 42.80 percent of the total family expenditures. However, on the average, the proportion of food expenditures contracted by almost two percent per annum as also reflected in the decreasing food utilization for the next year.

Since the data in the model are in time series form, it is necessary to test the series if it is stationary or not using the Unit Root test before regressing it. The results show that there is a unit root that exists and must be subjected to ADF at first difference to replace the level form. After first differencing the computed ADF statistics for all the variables remained above the ADF critical values at one percent, five percent and 10 percent levels of significance in absolute terms (Table 3). All of the variables are stationary and have no unit root at fist difference. In other words, regression of time series variables is feasible in its level form.

Table 3: Results of Augmented Dickey Fuller test of All the Variables at First Difference

VARIABLES	1% C.V.	5% C.V.	10% C.V.	ADF STAT LEVEL FORM
(FS)Food security index	-3.769597	-3.00486	-2.64224	-4.501258
(SAT) Share of population engaged in agriculture to total population	-3.769597	-3.00486	-2.64224	-5.685989
(PEP)Proportion of population employed in agriculture to total population	-3.769597	-3.00486	-2.64224	-4.208977
(RAI) Ratio of agricultural food imports to total food imports	-4.440739	-3.6329	-3.25467	-5.500504
(SGB) Share of agricultural budget to GAA	-4.440739	-3.6329	-3.25467	-7.463181

Ordinary Least Square Regression is then used to estimate the model. This method explains the causal relationship that emanates among variables. The result shows that share of the population engaged in agriculture to total population (SAT) is highly significant at one percent level. Moreover, the ratio of agricultural food imports to total food imports (RAI) and share of the agricultural budget to total GAA (SBG) are significant at five percent level. The results show that share of population engaged in agriculture to total population (SAT), the proportion of the population employed in agriculture to total population and share of the agricultural budget to total GAA are factors that have significant effect on the food security of the Philippines. Only proportion of the population employed in agriculture to total population have no significant relationship to food security.

Table 4: Regression Result using Ordinary Least Square Regression on food security in the Philippines

	Intercept	SAT	PEP	RAI	SBG	F Stat	R square	DW
Coefficient	436.7279	-5.7123	-2.0112	-0.2445	3.7184	186.4480	0.9752	1.4245
t-statistics	20.4668	-4.9307	-1.7453	-2.5138	2.3419			
p value	0.0000**	0.0001**	0.0885	0.0211*	0.0302*	0.0000**		

*p value (probability value) < 0.05 level of significance

** p value <0.01 level of significance

Thus, economic determinants tends to exert a significant positive effect on food security if share of agricultural budget to total GAA is the determinant which is consistent with Baracol (2003) that food security and rice self-sufficiency in the Philippines are component of the national goals of the administration. Assistance of the government through government budgets for research and development boost the agricultural sector which provides them majority of the country's food needs.

On the other hand if the determinant used was share of population engaged in agriculture to total population and ratio of ratio of agricultural food imports to total food imports were used, a negative effect on food security will be observed. The empirical result validates the inverse relationship on food importation and food security as the result of the study conducted by Tiongco and Francisco (2011), at massive level, the food trade balance shows that food security has rapidly worsened due to rising food imports (dominated by rice imports) thus the corresponding cost for obtaining food is high. This creates a serious problem for the country's food security unless productivity growth expeditiously increases at a phase faster than population growth rate. Madley (2000) that food importation also intensify rural poverty. Competition will lead to the decrease in income of local farmers. Filipino farmers will eventually do not have enough food to satisfy their nutritional requirements. Moreover, the displacement of farmers and the shift of production to higher-leading cash crops for export will lead to food insecurity. The computed test of Durbin Watson suggests that there is no autocorrelation among the residuals of the variables. Therefore, OLS assumption that error terms are uncorrelated is not violated.

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The increasing population depending on agriculture for their main source of livelihood also contribute to food insecurity. The result is opposite with the economic theory that increasing labor will increase productivity. Food supply will definitely increase but the argument is that food security is not measured by food availability or supply alone, another dimension, accessibility, and utilization must be taken into consideration. The increase in population engaging in agricultural activities will increase food stocks available for local consumption or export. However, because of other factors such as trade liberalization, food security of the country is affected. This was supported by the study of Balisacan (2002) that domestic producers would benefit greatly from being capable of producing nutritionally superior food products that will cater diverse markets. Cabanilla (2006) revealed in his study that programs that expand supply oftentimes decrease rather than increase farmer's income. Thus, decreasing their entitlements to food. Another factor that was not captured by the regression results is the impact of natural disasters on agriculture and food security. Israel and Briones (2012) discussed that during the years 2000 to 2010 the crops with the most damaged were rice and corn which are the main staple food of the country.

To further validate the result of the regression test on the model because the result will be used in policy formulation, other econometric test on the normality of residuals, specification of errors, structural stability and co-integration among the variables tests are needed. The Jarque-Bera test shows the normal distribution of residuals having the probability of 0.80. The parameter estimates are valid (Figure 2). However, the Ramsey Reset result suggests that the probability of obtaining these statistics greatly exceeds the five percent level of significance having F statistics of 0.0259. Therefore, the hypothesis indicating that the economic models are misspecified is accepted. This suggests that the model obtained from the regression has omitted influential variable. This is so because the model focused only on the economic determinants related to agriculture. Other exogenous factors like environmental, political and demographic factors were not included in the analysis. Moreover, the computed F statistics is 5.78 with the p-value of 0.0042 , this is less than the 5% level of significance. The results denote that the model is not stable. The model cannot be used for policy formulation. The result also suggests that other exogenous variables need to be included in the regression. Co integration test is then utilized to avoid a possibility of spurious regression of the time series variables in the economic model. This was done after ensuring that the regression variables are stationary. Based on the cointegration test iusing the Johansen procedure, there are two cointegrating vectors present in the model. Given the result, spurious regression was ruled out and there exists a genuine long term or equilibrium relationship between the dependent and independent variables.

4. CONCLUSIONS AND RECOMMENDATIONS

This work focused on the macroeconomic dimension of food security in the Philippines. In order to explore food security in the Philippines, I defined food security in terms of its three dimension: availability, accessibility and utilization. Determinants was then analyzed using a model that captures the effect of the identified agricultural variables.

The results indicate that the food security taken individually in terms of food availability, accessibility and utilization exhibit a declining pattern showing threats on food security condition. However, taken collectively, results shows that the

food security condition is upward trending. Therefore, Philippines is food secure using the food security index with all of its dimensions measured collectively.

Secondly, results of the Ordinary Least Square (OLS) regression revealed that share of the population engaged in agriculture to total population and ratio of agricultural food imports to total food imports has a significant negative effect on food security. This suggest that government must formulate sustainable policies on agriculture. The negative relationship is not consistent with the theory of production that increase in labor increases productivity, which proposes that there is an endogenous variable that affect the production of foods and its supply. The study reveals that farmers and fisherman in the Philippines were not able to sustain the supply of food. Data shows that because of the opening of the country to global market, farmers shifted to producing high yielding crops therefore decreasing the availability of foods in the local market. On the other hand, food security and share of the agricultural budget to total GAA is positively related. The empirical evidence proves that the formulated conceptual framework based on the theoretical expectation that achieving food security relies on agricultural productivity.

Finally, a different form of model like the Log-log form model can be used to present the economic determinants that sustain food security can be used by the concerned authorities for policy formulation and forecasting. However, the generated negative relationship between food security and the share of the population engaged in agriculture to total population need to capture the effect of other exogenous variables. Therefore, the study recommends using other exogenous variables that have perceived influence with the share of the population engaged in agriculture to total population to explain the negativity of the regression result. Further research is needed to assess the country's food security condition with reference to inclusive growth.

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