

**NEXUS BETWEEN FOOD SECURITY,
INFLATION, INCOME, AND SAFETY NET
POLICIES
A STUDY OF RURAL HOUSEHOLDS
(2012-2014)**



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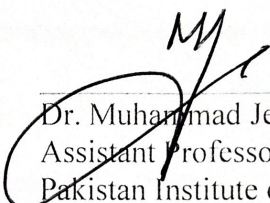
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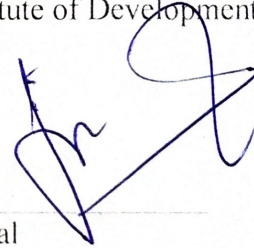
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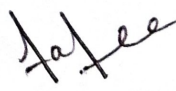
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Author's Declaration

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At any time if my statement is found to be incorrect even after my graduation the university has the right to withdraw my M.Phil. Degree.

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MUHAMMAD MAMOON HASSAN

Dedications

I would like to dedicate this research work to my parents and my brother who had been a constant support for me throughout the process. A special feeling of gratitude to my loving parents, whose words of encouragement helped me through the demanding process.

I also dedicate this dissertation to my many friends who have supported me throughout the process. I will always appreciate all they have done, especially Hamad, Irtaza, & Zaryab for helping me develop my research skills.

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Abstract

The Study explores the combined effect of household income, food prices and safety net participation on household Food security. An aggregated analysis has been done to observe how household income, food inflation, and BISP safety net participation determine household food security status. Additionally, the impact of household size, household head gender and household literacy status have been observed on household food security. Secondly, an additional analysis has been conducted for the impact of household income, prices of the food item and BISP transfer payments on the consumption of each of the food item individually selected in household consumption basket, to observe the sensitivity of food items towards changes in income, own price and BISP unconditional cash transfer. Data is taken from Pakistan Rural Household Panel Survey Data collected by International Food Policy Research Institute. Household income has been found to be positively contributing towards food security in both aggregated and disaggregated models. Inflation has been observed to be negatively impacting household food security and negatively impacting consumption of most of the food items in basket. BISP cash transfer have been observed to have positive impact on household food consumption. Among other variables, household size is strongly negatively and household literacy status is positively related to food security. Provision of better education will improve the household food security directly and indirectly through improving their incomes. Increasing the BISP cash amount and including more beneficiaries will improve the overall food security situation of households. Apart from that, government should prioritise controlling prices of staple foods like wheat flour and rice, vegetables and sugar, as they are the most sensitive towards changes in prices and income.

Keywords: Food Security, Sustainable Development Goals, Household Income, Inflation, Safety Net policies, Education, Economic Development.

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LIST OF ABBREVIATIONS

| | |
|--------------|--|
| BISP | Benazir Income Support Program |
| FAO | Food and Agriculture Organization |
| FSIN | Food Security Information Network |
| GDP | Gross Domestic Product |
| IFPRI | International Food Policy Research Institute |
| PRHPS | Pakistan Rural Household Panel Survey |
| SBP | State Bank of Pakistan |
| SDG | Sustainable Development Goals |
| UN | United Nations |
| UNDP | United Nations Development Program |
| USDA | United States Department of Agriculture |
| WFP | World Food Program |

CHAPTER 1

INTRODUCTION

1.1 Introduction

The study examined the combined impact of household income, food prices and safety net participation by household on household food security¹ state. The key arguments that lie at the core are based in the implication of inflation and household income. Most of the households in low-income countries are food buyers. When inflation rises they are likely to lose access to sufficient staple food. Income of households define their purchasing power for food. The study examined the impact of income and price changes on household food consumption. Government safety net provisions also provide households with additional incomes. The impact of these safety net cash transfers on household energy intake through food consumption has been examined. Apart from this, the study examines the impact of number of members in a household, household literacy and household head's gender on the state of food security of household.

Globally, the situation regarding trends on starvation, undernourishment and food insecurity is alarming with trends rising towards adversity. Nourishment frailty and poor dietary diversity effected more than 820 million people in 2018. Severe food insecurity occurs when people are not even able to attain minimum nourishment for healthy lifestyle, and it translates into survival situation. Around 700 million people were facing severe food insecurity. Also, more than 2 billion people who were facing difficulties in attaining regular access to food are moderately food insecure. Africa

¹ Food security is defined as “the people's right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population, on the basis of small and medium-sized production, respecting their own cultures and the diversity of peasant, fishing indigenous forms of agricultural production, marketing and management of rural areas, in which women play a fundamental role”. [World Forum on Food Sovereignty, 2001]

records more than 20 percent ratio of undernourished people. 7 percent people in Latin America and Caribbean regions are food insecure. Since 2010 West Asia shows a persistent increase, with more than 12 percent of people exposed to malnourishment and food security. In South Asia, 14 percent of population suffers from ailing health due to malnutrition. It is pertinent to address the urgent needs of those who are hungry. At the same time, governments and international humanitarian organizations need to go beyond hunger and ensuring access not only to sufficient food, but also to nutritious foods that constitute a healthy diet [The state of Food Security and Nutrition in the World 2019, FAO]².

The situation regarding nutritional parameters for children is particularly adverse. More than Seventy five million children who have hindered growth are living in developing or underdeveloped countries facing acute food crisis. Limited consumption of nutritionally diverse food, drinking water and medical services is major hurdle in achieving dietary vitality. This poor food security situation and malnutrition also decreases their immunity to overcome viral diseases [2020 Global Report on Food Crises, FSIN]³

Like other regions, trends in Households Food security⁴ in Pakistan are worrying. According to Global Report on Food Crises published by Food security Information Network, 11.5% children consume minimally diverse diet for growth and development. 46.4 percent children that are under five years of age are suffering from malnutrition. In Pakistan, out of 6 million people analysed, 3.1 million were found to be in crisis or

² The report was published by Food and Agriculture Organization of United Nations.

³ The report was published by Food Security Information Network

⁴ 'Food Security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life'. [World Food Summit 1996].

were. 1 million people were in emergency phase. An additional population of 1.4 million people was food stressed regarding food security.

Factors causing worsening of food insecurity⁵ crisis in Pakistan include extreme weather conditions like poor or ill-timed rainfall, economic causes like rising food prices and currency devaluation. Apart from that there lies an inimical threat of food shortage due to poor production amid terrible locust infestation on the staple crops. This threaten the nutritional states of most the highly susceptible poor agricultural households. This threat caused phase 3 food crisis in North Western regions of Pakistan in fall 2020.

Pakistan is a developing country with a significant proportion of population living under poverty line. According to UNDP, 29 percent people in Pakistan live in income poverty. [UNDP, 2015]. Due to low incomes of people their purchasing power for food items is low, hence people are food insecure. Reducing food insecurity⁶ is essential to socioeconomic development. Food security and economic growth mutually strengthen each other [Timmer (2004)]. Making people Food secure and eradicating hunger is a goal in the Sustainable Development Goals set by United Nations. Among the goals in SDGs for 2030 ending severe food insecurity and malnutrition for all population, ensuring reliable and regular availability and buying power for food, nutritional adequacy and diversity for children under five years of age and infants are major targets.

⁵ Acute food insecurity is any manifestation of food insecurity at a specific time that threatens livelihood of households. These episodes are highly susceptible to economic shocks that negatively affect food security.

⁶ Food insecurity is defined as the lack of secure access to sufficient amount of safe and nutritious food for human survival and normal growth and development and an active and healthy life. Sufficient and nutritiously diverse food must be consistently available and accessible for people to be food secure. Apart from availability, the households must be able to utilize (store, cook, prepare and share) the food in a way that has positive⁶ impact on nutritional needs (FSIN, 2020). [Global Network against Food Crises, FSIN 2020, Global report on food Crises].

Agriculture Production be made consistent and incomes of small agriculture households be certain and higher 2030 by securing land tenure, educating farmers about latest production enhancing techniques by using technology and other available resources. [UNDP 2015].

The price spikes of food items in the first decade of 21st century raised alarm bell for global development agenda. The situation called for academic study on the multiple aspects of food security. Pakistan is no exception. To measure household food security state objectively we will take the measure of calories intake by household members. The combined impact of food inflation and income shocks, and safety net participation on rural household's food security state will be examined. Data from year 2013-14 will be examined. The world was recovering form financial crisis in the face of rising petroleum prices. Pakistan saw very high inflation in those years. According to annual reports of State bank of Pakistan, Pakistan saw inflation of 13% and 11% in financial year 2010-11 and 2011-12. The impact of this high inflation and shrinking income along with other independent variables will be examined.

Benazir income support program is a social safety net arrangement launched by the Pakistan Peoples Party's Government in July 2008. The purpose behind the initiative was to make the programme the leading social safety net institution with primary objectives of providing people with purchasing power for consumption smoothing and moderating the unfavourable effects of financial crisis and the slow economic growth. The Programme aims to provide cash transfers to the most vulnerable poor families from the poorest households across the country. The selection criteria for households is free from any political, racial identity, geographic, and religious biases. The long term

objectives⁷ of the programmes are in line with the targets set by the United Nations in its Sustainable Development Goals (SDGs). The programmes strives to eradicate extreme poverty and securing the right to food for entire population. The cash transfers provided by the programme increase the transitory additional income and allow the recipient households to spend in according by their own choice. Households make small investments to increase incomes and also spend to achieve food security and nutritional diversity. Apart from that households spend the amount in healthcare and education also. If we consider the benefit of BISP on household food security, when regularity of consumption of specific items is investigated, a positive impact of the BISP is found on the consumption of fish, eggs and wheat for households [BISP, 2013].

The research helped us point out the sensitivity of each independent variable to the household's food security. This helped us reach meaningful conclusion and give policy recommendations about how change in economic entitlement can push households into Food insecurity. The study provided us information about the variable which can prove to the accoutrement to deal with food insecurity.

1.2 What is food Security?

When we say that a household is food secure it implies that it has access to adequate amount of food to meet dietary needs of all its members [Pinstrup-Andersen (2009)]. The definition implies that the quantity of food consumed by the household does not hold weight in itself, but the nutritional value of the food items is rather important. Food

⁷ The goals of the programme are

- to enhance financial capacity of poor people and their dependent family members
- formulate and implement comprehensive policies and targeted programmes for the uplift of underprivileged and vulnerable people
- Reduce poverty and promote equitable distribution of wealth especially for the low income groups.
[<https://bisp.gov.pk>]
[<https://bisp.gov.pk/Detail/ZjE4YTtk4MzAtM2MzMC00NzYyLTlhNDktMzFkNDBhOGNINGQ2>]
]

security has generally been investigated through the lens of supply side. This dimensions caters the question of production of sufficient quantity of food [Pinstrup-Andersen (2009)]. Recently the agenda has taken into account other factors that are related to food security but not entirely limited to the production of food. Ensuring sufficient production does not guarantee food security for all. The ability of household to access the food is also vital.

The ability to access food at all time is pertinent for household food security⁸. The access to food includes both physical and economic access. The economic access to the food entails ability to produce or buy the food [Timmer (2000)]. Food has to be consistently available in the markets but it is not sufficient for food security. Lack of income or purchasing power can cause in security even of food is available. To achieve state of food security both conditions, availability and access, need to be fulfilled. According to definition food security is not just question of availability of food. The world may be producing more food than required to fulfil nutritional needs of all the people, but this does not guarantee food security for everyone. Access to the available food is also fundamental.

‘Entitlement to food’ entail the economic strength to purchase food. Food households to be food secure they need both physical and economic access to the food [Sen (1982)]. The entitlement can be assured by having the purchasing power to buy food.

The capability approach to wellbeing presented by Amartya Sen, Indian economist, had the capability to be well-nourished among the top priorities. The Immediate causes of

⁸ Food security is the people's right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population, on the basis of small and medium-sized production, respecting their own cultures and the diversity of peasant, fishing indigenous forms of agricultural production, marketing and management of rural areas, in which women play a fundamental role. [World Forum on Food Sovereignty, 2001]

loss of access to the required food is the fluctuations in the entitlement part of the access to food. That may take place due to rising prices, shrinking incomes or trade relations. [Cohen (1993)].

In the development context, food insecurity and undernourishment is taken as the failure of development practices by international humanitarian agencies. The entitlement approach given by Amartya Sen in 1981 puts that the entitlement of households to food is not just a matter of food production. It involves a dimension of governance also. The academia and the development actors have now taken account of the approach that crises in food crises can occur due economic reasons including food inflation and unemployment, weather conditions like poor rainfalls, lack of agriculture inputs, and conflict situations. Addressing food insecurity in a development frame requires integrated policy in which a multitude of measures linking different domains of are integrated throughout the chain of implementation [Bishop, C., & Hilhorst, D. (2010)]. With this integrated policy framework come the idea of resilience to food insecurity. The idea believes that crisis in food systems are inevitable. Governments and international bodies should work toward making people capable to deal with these crises to make them resilient against food insecurity.

1.3 Significance of Research

The study examines how household's incomes, food inflation, and government's safety nets, among other control variables, qualitatively as well as quantitatively, impact household's food security status and how these factors are related to the energy intake of household. Previously, most of the studies conducted on the issue of income and food prices and their impact on household food security have been simulation based [Ivanic and Martin, 2008; Brinkman et al.,2010; de Hoyos and Medvedev, 2011]. This

is an empirical study with data collected from more than two thousand households. Empirical studies provide much more valuable conclusions in order to make policy recommendation regarding impact of household food security caused by prices and income [Akter and Basher, 2014].

Apart from income and food prices, the study incorporated additional variables like safety net provisions by government, number of households, gender and education of household head. Previously the impact of BISP has been calculated and found positive impact on beneficiaries as compared to non-beneficiaries on a single district level [Amrin & Ashfaq, 2020]. This study measures household food security not only through their food expenditure, but also through their energy intake, measured in calories, by consumption of food items in food basket.

The time period chosen (2012-2014) is important because during this duration Pakistan suffered from very high inflation, global food prices were high and the global economy was recovering from financial crises.

To the best of my knowledge, empirical studies examining household food security, both qualitatively and quantitatively, in association with household income, food prices and impact of safety net using household empirical data are rare. The previous studies were mostly based on simulation mechanism. Sufficient study, using empirical data, had not been done to examine the factors affecting food entitlement of rural households in Pakistan. This study had been a beneficial contribution as it had taken empirical data of rural households collected by IFPRI. The study using empirical data examined the impact of Household income, Inflation, and Safety Net participation on Household Food Security.

1.4 Problem Statements

The food security and energy intake is a vital element in subject in development paradigms, especially in labour economics, health economics and development economic. From the above stated argument, it is pivotal to inquire that how food security state of an average rural household, measured through their energy intake is determined by the household's income, price of the food items in the consumption basket, and the safety net provisions provided by government. How Households respond to food inflation, changes in income, and provision of safety nets, by altering food consumptions. How household size, their literacy and head's gender impact households food security. Among the food items in the household consumption basket, which are most or least sensitive to changes in explanatory variables.

The study, using the empirical data of rural households, quantitatively as well as qualitatively analysis rural households food security, and contributes into the literature how the explanatory variables like household income, inflation, safety net participation, household size, literacy status, and household head gender play their role in determining rural household food security. For that matter, both aggregated and disaggregated analysis are done to show how the explanatory variables impact overall food consumption and the consumption of specific food items from food groups separately, respectively.

1.5 Research Questions

- a) What are the factors that determine whether the household is food secure?
- b) How the variations in the household income, food prices, and BISP cash transfers affect the food security of household?

- c) How household size, their literacy and household head's gender impact household's food security?
- d) Which food items among the food basket of household are most or least sensitive to changes in household income, food prices and BISP cash transfers?

1.6 Research Objectives

- a) To analyse the factors that determine the food security status of households.
- b) To examine the impact of explanatory variables on the food security of the household.
- c) To analyse which food items are most sensitive to changes in incomes, own price and BISP cash transfer.

1.7 Organization of study

The first chapter introduced the overall topic of the study. Significance of the research, research questions and its objectives have been discussed.

In the second chapter, the brief review of the literature related to the topic has been given. The chapter encompasses the previous literature related to food security, about various theories that explain food insecurity. Literature related to the explanatory variables as of how Price of food items, household incomes, and safety net transfer are related to household's food consumption is reviewed. In the third chapter, the theoretical and the quantitative framework of the study has been explained. The fourth chapter of the study explains the sources of data and construction of both the dependent and independent variables. In the chapter it has been explained how variables like calorie intakes and household income has been calculated. In the fifth chapter the empirical results are given with their explanation. The results and their description is based on the data analysis explained in quantitative methodology. Sixth chapter

concludes the whole study and gives policy recommendations based on the results of the estimations in the light of theoretical build of the model.

CHAPTER 2

LITERATURE REVIEW

Food insecurity is the uncertainty faced by households regarding the physical and economic access to sufficient amount of safe and nutritionally diverse food for human survival, normal growth and development, and an active and healthy life. Sufficient and nutritiously diverse food must be consistently available and accessible for people to be food secure. Latest academic literature and work by development organizations suggests that food crisis are matter of food availability and food utilization too. Food utilization by households means that they should be able to store the staple food and meat and dairy products, cook them according to their traditional patterns, prepare it to improve it nutritionally and share with other households (FSIN⁹, 2020). This definition caters food security in multiple dimensions. Food must be available in the market and households should have economic access in the form of purchasing power to buy food. Apart from that, household should have storage facilities so as to store food for utilization in crises periods.

Food insecurity is broadly classified under categories of Acute and Chronic food Insecurity when it comes to the duration of their prevalence. Acute food insecurity is the situation when household are uncertain about their consumption of food either due to crisis in the availability of food, which depends upon its production, and access to sufficient amount of nutritious food, which entails economic as well as physical access, at a specific point in time due to severe circumstances. These circumstances may be due to climate change, extreme weather conditions, conflict situations or slow economic growth. These episode of acute food insecurity can occur within short amount of time.

⁹ 2020 Global Report on Food Crises, Food Security Information Network.

These might be caused by sudden environmental changes or economic shocks. These shocks negatively impact the determinants of household food security and nutrition. These episodes of acute food insecurity are often short-term and temporary and represent the household inability to meet minimum dietary needs for healthy lifestyle. The duration of crises is quite significant for households. Prolonged acute food crisis may threaten the lives and livelihood. Long-term food insecurities in populations are chronic food insecurity. FAO defines this as ‘undernourishment’ as they may persist for long durations (FSIN, 2020).

Food insecurity is also classified with respect to its intensity. Moderate food insecurity means the challenges and uncertainty that households encounter about their ability to access sufficient and nutritionally adequate food in the near future. They are forced to consume low-calorie foods during the crisis period. The quality and quantity of food they consume gets compromised due to lack of money or other environmental circumstances. Moderate food insecurity is thus referred to as absence of consistent access to food, which diminishes dietary quality, disrupts normal eating patterns, and can have negative consequences for nutrition, health and well-being. While on the other end of the spectrum, severe food is an extreme condition. Severe food insecurity is running out of food, experience hunger and, at the most extreme, go for days without eating, putting their health and well-being at grave risk (FAO et al., 2019).

Ever since the emergence of food security as a concern among international development agencies, the approaches to food security developed by academic research have evolved through the time. The main approaches had been Food availability approach, Income-based approach, Basic needs approach, and the Entitlement approach. The food availability approach had been the initial approach towards food security based on Malthusian perspective. It focuses on the disequilibrium between

population growth and growth rate of food production. Population grows at a much higher rate than food production, causing fall in food supplies with the increase in population. In order to maintain this equilibrium the rate of growth of food availability should be in pace with the rate of growth of population. This approach takes food security a problem of mere aggregate food availability. According to it, what governments can do to improve food security for the population is fairly straightforward. On one side, policymakers need to curb the aggregate demand for food by controlling the rate of population growth. While on the other hand, food supplies should be enhanced by improving agricultural yields by educating farmers about latest farming technologies. Higher food production will increase the per capita food availability, this ensuring food security. Income of a household is the most significant factor in determining the status of its food security. Macroeconomic theory, likewise, suggests that the national income, Gross Domestic Product (GDP), determines the national food security status. Countries that face low aggregate food supplies can import food from the other food surplus economies. The theory is used in microeconomic perspective for households too (Reutlinger and Selowsky 1976; Haq 1976; Griffin and Khan 1977). Income-based approach to food security has similarities with the poverty assessment. Food insecurity is treated as a sub-category of poverty implying that person does not have enough resources to purchase the food required for survival. (Sibrian et al. 2007; Sibrian 2008). If the calorie intake of household members is found below the threshold healthy level, the household is food insecure. Through household surveys providing information on their incomes, estimates on the amount of food consumed, under the assumption that poorer households use a larger proportion of their income to buy food. Food consumption is then used to judge the food security by converting it into calories. Households with above the threshold level intake are food secure. More

useful are the household expenditures surveys, from which it is possible to sort out the amount of expenditures on a (limited) number of food items. Many applied economists have estimated the calorie contents of each food item and then aggregate them in order to have the total amount of calories available for household members. The Basic need approach adopted in 1970s assess food security in two coherent ways. The approach aims to ensure satisfaction of basic need to people. For food security, the approach assumes that households should be able to consume minimum amount of food that ensures healthy life. Basic needs approach measures the frequency of food intakes, which takes the number of meals eaten per day. Food consumption of households is also directly observed. All the household members are observed during meals in order to have a direct information of the calories consumed. (Hoddinott and Yohannes 2002).

Amartya Sen's entitlement approach challenged the conventional wisdom that believed that having enough aggregate national food supply is a sufficient condition for food security. "The entitlement approach concentrates on each person's entitlements to commodity bundles including food, and views starvation as resulting from a failure to be entitled to any bundle with enough food" (Sen 1981: 434).

People should be able to access food at all time for healthy life. The ability to access food is known as the entitlement to food. Entitlements depend on the resources a person legally owns such as house, livestock, land, and nontangible goods and the set of commodities the person can have access to through income (Osmani 1995). Secondly the market conditions determines the real purchasing power of the resources owned by the person. A fall in value of productive resources due to market circumstances means the loss of entitlement to food (Burchi & Muro, 2015).

Apart from taking expenditure on the food as the measure of food security, another way measure the state of household food security is through the measurement of the calories

consumed by households through various food items. Changes in calorie intake with changes in price or income provide valuable insight regarding food security dependency on prices and incomes. It was found that in Sri Lanka calorie consumption through rice consumption is four times price elastic than any other commodity (Sahn, 1988).

The factors that cause the prevalence and intensity of hunger and malnutrition are known as the drivers of food insecurity. These factors are usually mutually enforcing and interlinked, which makes it difficult to pinpoint the specific trigger. Significant among the drivers of food insecurity are environmental shock and economic shock. Environmental shocks like extreme weathers cause crop failures which leads to hike in prices of staple foods in the future. The environmental and economic drivers of insecurity are interdependent.

Economic shocks effect the household purchasing power by lowering their incomes and increase in the price of food commodities. Macroeconomic shocks like high inflation or hyperinflation, currency depreciation, high unemployment rates and loss of income, can cause food crisis for households. Due to these economic circumstances people suffering poverty face food insecurity. Overall economy-wide crisis can cause hike in prices of agriculture inputs and can also increase the price of production. In microeconomic aspect, this hike of prices can reduce the production and cause difficulty in food availability. While at same time, due to loss in purchasing power households also lose access to food.

Slow economic growth induces can induce hunger or dietary frailty among developed or underdeveloped countries as government safety nets are not capable to deal with crisis. Economic slowdowns and financial crises often result in businesses closing down and government cutting their fiscal expenses. The contraction in economic activities lead to rising unemployment with declining in wages. Consequently, falling

purchasing power challenges access to food and essential social services for the poor. This induced poverty leads to poor nutrition and inability to enjoy essential healthcare and educational services.

Households adopt various coping strategies to overcome the loss in the incomes due to economic and financial downturns. People look for alternatives to earn incomes in order to attain purchasing power to be able to afford minimum dietary needs for healthy life. People choose to take jobs in informal and unregulated sector that pay less. At these employments, people usually encounter poor workplace environment, negatively contributing to their welfare. Also, due to austerity drives followed by most governments during economic slowdowns, public spending on safety nets are cut down. Economic fluctuations ultimately have adverse impact on food security and nutrition, and increase poverty. (WFP, 2019).

The effect of food inflation and income shocks combines to create sharp increase in poverty and aggravate hunger and food insecurity in low income countries. (FAO, 2009a, 2009b). Shocks in food prices during 2007-09 and 2012-14 have pushed food insecurity and its implications of wellbeing of households of low income countries on top of the agenda. Price increases have mixed effects on poverty and hunger: They increase the cost of food for consumers but increase incomes of farmers, who represent the bulk of the world's poor.

Food security is sensitive to prices. High prices can cause food insecurity as households are unable to buy food. Once the prices start to rise, households change their eating habits, start buying food in bulk, or can even convert to cheaper and less nutritious food brands (Mkhawani et. al., 2016). Moreover, food inflation can create food insecurity even food surplus countries. Even though incomes keep rising gradually, but food prices grow comparatively quickly and render the impact of high incomes futile. This

reduced purchasing powers create poverty. High prices of food items thus create food insecurity. (Sleet, 2019)

Higher Food prices have pushed millions of people in the developing countries further into hunger and poverty [OXFAM (2011)]. When the prices of food items rise, the purchasing power falls, hence causing severe food security crisis. If the household are buyers of the food, high prices will have negative repercussion on their wellbeing [Swinnen and Squicciarini, (2012)]. The key argument that lies at the core of the claim is that most of the households in the low-income countries are net buyers of food items. When the food prices rise, household's access to food items is reduced. Secondly, when the incomes of household fall, their purchasing power for food items is reduced. Finally the household coping strategies are also an important determinant of if household is food secure or not. These all elements combine to increase food insecurity (Akter, S. & Basher (2014).

Measuring the impact of rising food prices on household Food security has not been really straightforward. While for the net food sellers who produce more than they consume, higher prices may be beneficial, the welfare implications for net food buyers are adverse. Most of the poor are net food buyers. The overall result of the situation need closer attention in short-run but in the long-run higher prices increase food insecurity for poor [Ivanic, M., & Martin, W. (2008)]. The spike in food prices between 2005 and the first half of 2008 has highlighted the vulnerabilities of poor consumers to higher prices of agricultural goods and generated calls for massive policy action. Studies found that a 5.5 percent increase in agricultural prices (due to rising demand for first-generation biofuels) could raise global poverty in 2010 by 0.6 percentage points at the extreme poverty line and 0.9 percentage points at the moderate poverty line. Poverty increases at the regional level vary substantially, with nearly all of the increase

in extreme poverty occurring in South Asia and Sub-Saharan Africa [De Hoyos, R. E., & Medvedev, D. (2009)]. According to United States Department of Agriculture the consequence of food inflation and income shocks have been detrimental for household food security. They resulted in more than 80 million additional people being food insecure [USDA, (2009)].

Another factor that needs attention in examining household food security is the income of households. In developing countries households face fluctuations in their incomes due to imperfect markets. During the episodes of fluctuation the households try to smoothen their consumption. Savings are made during period of high income, and they are consumed during the low-income periods. In the permanent income hypothesis Keynes concluded, “it is fundamental psychological rule of any modern community that, when its real income is increased, it will not increase its consumption by an equal absolute amount” and stated somewhat less definitely that “as a rule . . . a greater proportion of income. . . (is) saved as real income increases” [Alimi, R. S. (2013)].

However later empirical examinations concluded that the current consumption were highly dependable function of current incomes. Consumers, in general, grow their consumptions in accordance with the growth in their income. The current consumption is determined by the current income [Carroll, C. D. (1997)]. Income and consumption behaviour of household is also a function of the presence of absence of credit market. In the absence of efficient credit markets the current expenditure is strong function of income [Carroll, C. D. (2001)].

To make households food secure, women can play an important role. Women, given equal opportunities in agricultural sector, can do wonders all the three pillars of food security: food production, economic access to food, and nutrition security. Women account for more than 70% of household food production in sub-Saharan Africa, 65%

in Asia, and 45% in Latin America and the Caribbean. Women face unequal poor working environment. Women have unequal access to land, to inputs such as improved seeds and fertilizer, and to information. By resolving these issues and providing women with resources agricultural production can be increased. Educating women about sustainable farming practices can be an important factor.

Economic access to food mainly depends upon the income level of households by increasing their purchasing power. Incomes earned by women household members have been observed to be significant and can improve nutrition parameters of households considerably high. Studies have found the women spend a higher proportion of income on food items than men. Women income is also strongly associated with the health and nutrition of children in the households. Women tend to spend more in making sure that household members, especially children, receive an adequate quantity of quality food for healthy lifestyle. Policy makers must increase women's ability to generate income to maximize the household food security and nutrition. Nutrition security implies adequate protein, energy, micronutrients, and minerals for all household members. Ensuring diverse nutritional attainment and security is usually done by women households. Women can play a pivotal role in nutrition security of children also (Agnes et al., IFPRI, 1996).

Poor households that migrate from rural areas to urban areas have been found to be at peril of losing food secure status. Globally, people are migrating from rural to urban areas as urban centres provide of better education institutes, healthcare facilities, employment opportunities and living standards. With this rapid growth in urban population, demand to food is also rising. Urban growth is happening at a rate that is higher than the local governments' ability to deal with growing needs of population. Poor migrants are at higher risk of becoming food insecure. Evidence has been found

that proves that the households that are involved in urban agriculture as source of livelihood enjoy better food security. These urban agriculture household consume the agricultural production themselves as well as sell the produce for making income. Households involved in agricultural activities tend to enjoy greater quantities of food (sometimes up to 30%), consume more fruits and vegetables, and have a more diverse diet (Jessica et al., 2019).

Safety nets social assistance programmes by government to help people whose welfare needs are not being met. Poverty or inability to make sufficient income to make the ends meet is a primary cause. Circumstances like that create serious concerns about household food security state. Safety nets are provided to support household to become food secure. They can be either straight cash transfer or in the form food supplies. One of safety nets were initiated by Canadian government to support elderly household. The policy guaranteed a fixed income for people above sixty five years of age. A huge proportion of elderly people were living below low-income threshold cut-off incomes. These provisions improved the economic social wellbeing of the elderly households. A significant reduction in food insecurity was observed for the beneficiary household was improved by the guaranteed income (MCINTYRE et al., (2016).

Another example of safety nets was Productive Safety Net Programme (PSNP) initiated by government of Ethiopia to bring food security to five million people. The programmes included providing social security to close the hunger gap. Apart from that it coupled development projects to permanently lift them out of poverty permanently. Although results were successful, but political situation was a major impediment in achieving the projected results. Overall the project had a positive impact on food security state (Bishop, C., & Hilhorst, D. (2010).

During 1960s and 1970s USA government provided households with safety net to increase their purchasing power for food. Safety nets are created for economic, moral, and political reasons. Safety nets ensure a minimum level of income and consumption for households. They can be viewed as social insurances as they help people through livelihood shocks and stresses. In fiscal year 2005, Federal funding for nutrition assistance programs was 51 Billion Dollars. Apart from financial assistance, food stamp programs are also important for food security. Food stamp programs provide households with increased purchasing power to acquire food.

Government provided assistance to ensure food security of households is an important measure to ensure household wellbeing. To find out how much government assistance reduce the probability of vulnerable households experiencing food insecurity, a study was conducted by of Harvard University. His research indicated that if the public assistance is cut by 10 percent population of beneficiary households, the share of food insecure household increase by 5 percent. [LeBlanc, M., Lin, B. H., & Smallwood, D. M. (2007)].

Apart from safety nets, emergency food assistance networks are also vital to household food security. Relationship between establishment and growth of emergency food assistance network and food security state of household holds significance. Food security is defined as obtaining a culturally acceptable, nutritionally adequate diet through affordable, non-emergency sources. Poverty is defined as lack of purchasing power, so households living under poverty are vulnerable to food insecurity. Widespread hunger is a consequence of poverty. Whereas hunger is based on an individual's experience not necessarily representative of entire population, food security takes a wider picture of the society. It takes into account incomes of household,

food transportations system, storage of food, and cultural acceptability of food. It measure the existence of adequate resources to prevent hunger.

The Ethiopian government has initiated a number of safety nets for ensuring food security among poor households. The Productive Safety Net Program is one of those programs implemented by the Ethiopian government to control food insecurity. It provides adequate food and cash transfer to target beneficiary. It helps address the needs of chronically food ensure households. The programme has improved household consumption, increased job opportunities, and betterment of livelihoods. The study showed that the majority (43.3%) of respondents appreciated the programme and said that it has improved their food consumption and overall livelihood conditions. Through the provision of cash, food or both, it was helping households to improve their consumption patterns by creating consumption smoothing patterns. To improve the efficacy of the programme government must try to educate the people and enhance their level of awareness. The inclusion criteria for eligible households should be revised so as to improve nutritional and livelihood status of more households (Lukas & Mandado, 2018).

The emergency food assistance network plays its role when safety nets are failing to meet the needs of all population. Emergency food assistance consists of food banks, food pantries, and soup kitchens operated by non-profit organizations. These networks provide food to needy people. These emergency networks have proved beneficial toward food security [Curtis, K., & McClellan, S. (1995)].

To deal with food insecurity governments, Non-government organizations, Humanitarian agencies, and International financial institutions need early assessments of future food trends globally. These studies can be effective tools for preparation to deal with food crisis. The assessments should include the availability and diversity of

agriculture inputs, production estimates, market price mechanism studies, and weather forecasts. These assessments need careful judgements as they will be used for estimating uncertainty regarding future food availability and consumption. With the studies that had been conducted, the two major sources discovered that are source of uncertainty are associated with complex weather phenomena and conflict. Weather uncertainties can cause havoc for agriculture productions causing decline in current as well as future production. Conflicts are also important source of uncertainty as they can cause loss of income and livelihood for the households (Krishnamurthy et al., 2020).

Food insecurity can be measured in both ways, indirectly or directly. Indirectly we take judgements about food insecurity of household by measuring their purchasing power through their income or through taking survey on their food expenditure. Direct measurement of food insecurity is done through asking household about their insecurity experience. Rasch model-based procedures has eight scales for categorising insecurity experience. Experience-based models are getting importance as they are endorsed by United Nations statistical Commission to measure the food security goal of suitable development goals. The model contributed in making a global model for measuring insecurity. The proposed calibration method can be applied to other existing experience-based food security scales that use similar items, thus affording the possibility to use data collected with those instruments to produce internationally comparable measures of the prevalence of food insecurity (Cafiero et al., 2017).

Making measurements about food security has been a challenging task as devising gauging tools has not been straightforward for development practitioners. Over time, measures for objective measurement have been devised. Most commonly, judgements regarding household's food security are done through the calorific value of the food

they consume. Apart from that measures taking into account food consumption diversity have been done. Measuring dietary adequacy done through calorific value is conducted by setting up threshold calorific value and then comparing per day consumption value of each member of household. After collecting consumption data from households, researcher can find out the odd whether household is food secure or not. Certain different selections regarding the threshold calorific value have been made. (Amjad and Kemal, 1997; Malik 1988) 2250 calories for each household member in a day been used in literature. (Jamal 2013; Malik 2014, 2015) incorporated 1700 calories per day per individual. Planning Commission of Pakistan (2003) has also suggested the 2340 calories intake per adult equivalent per day at national level in Pakistan [Hashmi et al., 2019].

The qualitative analysis regarding household food security can take other socioeconomic variables other than income and inflation. Family size, dependency ratios, cattle ownership, size of cultivated land, off-farm incomes, and household head gender, education and age, are among the variable that have significant impact on household food security status. Larger family sizes have been observed to be negatively associated with food security. Cattle-ownership and farm size have been observed to increase the odds of households becoming food secure [Tefera & Tefera, 2014].

Another approach towards measuring insecurity in dietary adequacy for healthy lifestyle is to measure the cost of food basket that would provide minimum dietary energy requirement (MDER). MDER is described by FAO as the minimum dietary energy requirement that would be attained by consumption of food basket that has fats, calories and carbohydrates in it. For Pakistan, in year 2007-08, an estimated thresholds for sedentary, moderate and active lifestyle are 1770, 2066 and 2340 calories per person per day. The United States department of Agriculture has also calculated an average

MDER of 2000 calories per person per day for 67 developing countries [Kakwani & H. Son, 2016].

Studies conducted in Pakistan also reveal the same fact that ownership of livestock assets can increase the odds of household being food secure. Family size has negative impact, while education of household positive impact on food security. The logistic regression directly estimates the probability of an event occurring for more than one independent variable (Hailu and Nigatu, 2007) [Bashir et. Al, 2013].

Household's monthly income and household head's education levels of middle and intermediate were positively impacting household food security. On the other hand, household heads' age and family size were negatively associated with household food security. Rural household food security can be improved by focussing on education, creation of income generating opportunities and family planning programs. [Bashir et. Al, 2014].

Food security has long been a concern for international governing organizations. Initially the discussion on food security based on food production, distribution, and consumption in order to avoid food emergencies. The discourse on food security and nutrition has taken a new turn and shifted from food security to resilience against food insecurity. International organizations like World Food Programme are propagating the idea that rather than making people food secure, the focus should be on making them resilient against food insecurity. Resilience assumes the unpredictable and high shock crisis in food chain as inevitable. These shocks may be due to economic reasons, weather conditions or conflicts. Households should have the capability to adapt and bounce back from those events. The thought originates from an admission of failure of international organizations in making people food secure. Resilience accepts the inevitability of unpredictable events. Efforts toward resilience have two elements. On

the one hand calculations are made for the elements of environment that can cause disruptions in food systems. On the other, mechanisms be built to deal with the worst circumstances anywhere around the globe. (O'Connor et al., 2016).

CHAPTER 3

ANALYTICAL AND ECONOMETRIC METHODOLOGY

3.1 Introduction

In the previous chapter the academic work that had already been done on the topic was discussed. The chapter briefly elaborated the work that explained the relationship between household food security and its income, food prices, participation in safety net transfers and how household food security status is determined by number of households, household literacy and household head's gender. Different approaches to explain food insecurity had been discussed briefly. This chapter explains the theoretical and econometric construct of the study.

3.2 Research Philosophy

The study is an exploratory data analysis. It is conducted under cross-sectional research design as data from more than two thousand households is taken for all the variables. Study is a positivist and objectivist analysis as quantitative data is used and numerical estimators are calculated for desired parameters for the impact of household income, food inflation, BISP safety net participation, number of households, and household head's gender and literacy status of household on household food security status, and households are examined as a part of the overall economic and social framework and take decision with considering unaltered market conditions. Households are unable to influence the economic environment in an effective way which would alter their food security status positively to increase their energy intake. The study is deductive analysis as previous literature is consulted and the empirical model employed in this study is built on theoretical demand function framework. Data and quantitative techniques are applied to test household food security using its approximation through calories energy

intake, as function of household income, price of food items and BISP safety net participation, with support variables like household size, household size and household head's gender.

3.3 Conceptual Framework

Household's food security is measured through their per capita calorie intake in a day. This helps us in objectively measuring the impact of household income, food inflation, safety net transfers, number of households, household head's gender, and household literacy on household food security status. Household's caloric intake from consumption of food basket is calculated in calories to make judgements about their food security status. If the per capita energy intake of a household is above the minimum calorie level then the household is declared food secure [Hashmi et. Al, 2019] [Kakwani & H. Son, 2016].

Furthermore, to look into the objective of how different food items in household basket react to changes in variables effecting purchasing power, these items chosen in the baskets are examined for their dependency on explanatory variables of household income, food prices, and safety net transfers. To check sensitivity of each item to above given variables, energy intake from consumption of every specific commodity in the household consumption basket is taken as the dependant variable. The impact of changes in household income, change in food prices, and changes in safety net transfers is measured through changes in calories intake by households. Among the food commodities chosen in the household food consumption basket, all good have different responses to changes in prices, household incomes, and safety net transfer. This explains changes energy intake through change in food consumption due to income and prices (Sahn 1988).

Household income, price of food item, and cash transfers of safety nets are the variables which determine the purchasing power of the household. This purchasing power provides households economic access to food and determines the household's entitlement to food [Sen (1982)]. The income approach to food security elaborates that when household have enough income to access the minimum amount of food for healthy and active lifestyle, households are food secure. The minimum calories intake through is crucial in determining household food security state (Sibrian et al. 2007; Sibrian 2008).

When the prices of food items rise the purchasing power of households fall. Since majority of the rural poor are the net buyers of food, this price hike has negative consequences for their food security and overall wellbeing. Due to decreased purchasing power, households consume less food and their energy intake falls [Akter, S., & Basher, S. A. (2014)].

Income of household is the basic variable that defines the purchasing power of households for food items. Current income in developing countries is fluctuating due to weak market structures. Since current consumptions are strong and dependable function of current income, household's energy intake is function of current income [Carroll, C. D. (1997)]. Secondly, due to absence of credit market households are not unable to borrow in the periods of low income. Therefore the food security strongly depends upon the income of households. [Carroll, C. D. (2001)].

Safety nets for food security provide households with straight cash transfers or food supplies. When cash transfers are given to household their purchasing power for food items increase, resulting in higher food consumption. Safety nets therefore improve household energy intake (Mcintyre et al., 2016). Safety net programs have proved to be very beneficial in removing hunger and malnutrition from poor countries of Africa

like Ethiopia. The productive safety net program by Ethiopian government, which provide cash transfers as well as food to the poor households, has improved the country's food security statistics (Lukas & Mandado, 2018).

Benazir income Support Program has been chosen as the safety net program in study. Previous study has proved that the BISP cash transfers had improved food consumption expenditure of rural household of District Faisalabad (Amrin & Ashfaq, 2020). Apart from household food expenditure, BISP has been observed to improve the child nutrition among poor household as well (Mustafa et al., 2019). This study examines the impact of BISP transfers on household energy intake through food consumption.

Apart from the variables that determine the household's purchasing power for food items, there are other numerous control variables that affect the household's food security status. Among those variables number of household members, household head's education and gender have significant impact on household's food security status [Bashir et. Al, 2013] [Agnes et al., IFPRI, 1996].

The model take Food security, measured through calories intakes, through consumption of chosen food item of household consumption basket as the dependent variable. The explanatory variables that determine the consumption are Household's annual income, inflation, and the cash transfer from Benazir income support program. Other control variables are Household head education, Household head gender, and number of households.

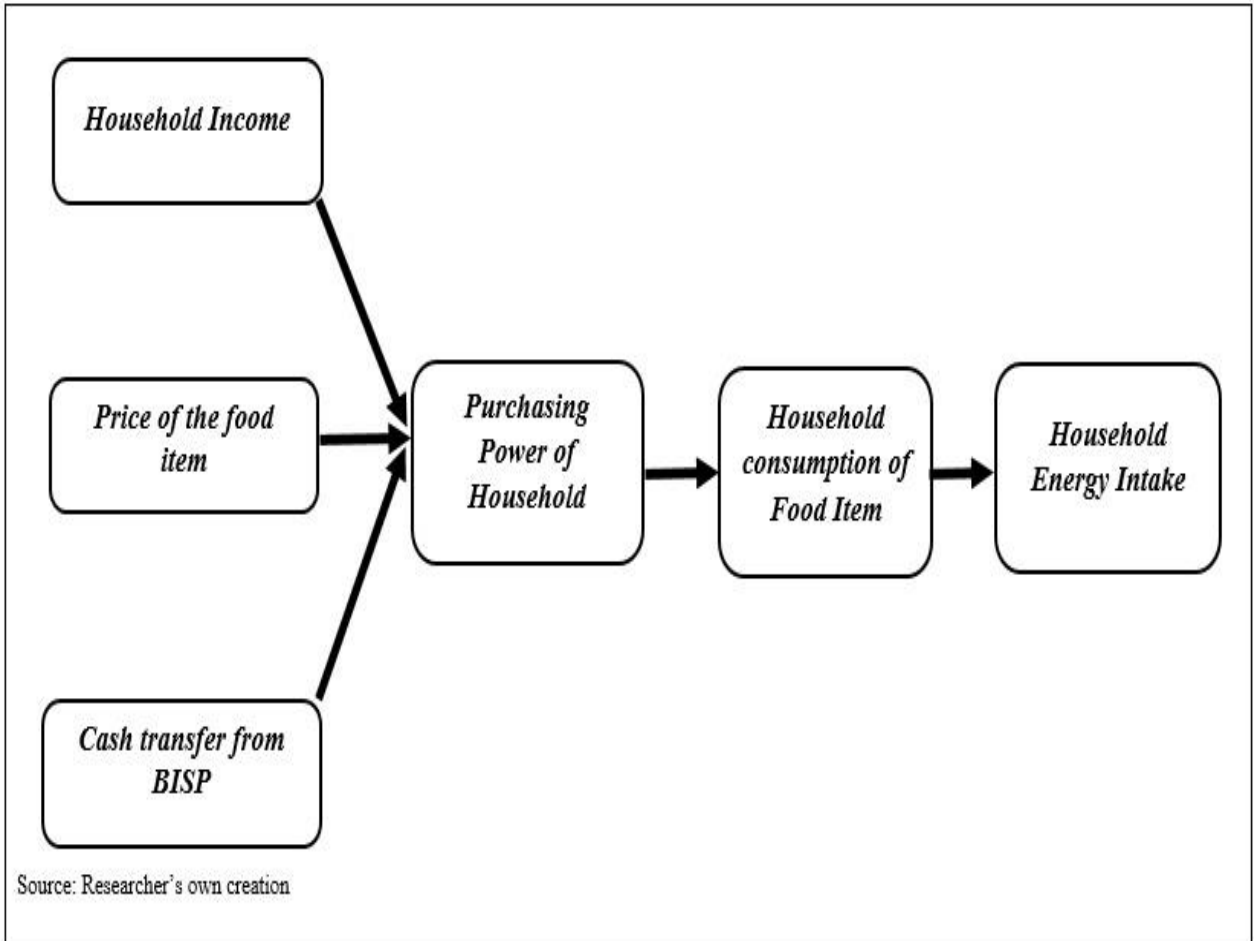


Figure 3.1 Conceptual Framework of Study

The study uses the following conceptual model:

Food security (denoted by FS) of household, measured through their caloric intake, is taken as function of household's income (denoted by Y_j), food inflation (denoted by Inf) and BISP safety net participation (denoted by BISP).

$$Food\ security = f (Income , Inflation , BISP) \quad (3.1)$$

In notational expression, this equation can be written as:

$$FS_j = f [Y_j, Inf_j, BISP_j] \quad (3.2)$$

Introducing the other additional variables in the model the complete, in the notational expression, takes the form:

$$FS_j = f [Y_j, Inf_j, Bisp_j, NH_j, HL_j, HG_j] \quad (3.3)$$

3.4 Quantitative Methodology

From this point onwards the analysis has been divided into three parts. In first part (section 3.3.1) an aggregated qualitative analysis has been done with logit regression technique with dependent variable taken as binary variable. In the second part (section 3.3.2) aggregate OLS regression is run for dependent variable as continuous to measure impact of explanatory variables, household income, BISP participation, inflation, household size, household head's gender, and household literacy, on dependant variable. In last section (section 3.3.3) disaggregated analysis of all the food items in consumption basket has been conducted to judge the impact of household income, their own prices and BISP cash transfers on consumption of each of the commodity. BISP cash transfers is taken as continuous variable with cash amount received by households to measure the impact on household consumption.

3.4.1 Aggregate Qualitative Analysis of Food Security

The aggregate model takes food security, measured through energy intake in calories per person per day through consumption of whole household consumption basket, as the dependent variable. Food security has been treated as dependent variable which is going to be treated as binary categorical variable. 2340 calories per individual per day is the threshold for food secure households. Household with threshold level calories per individual per day or above are declared food secure. On independent side we take household income, inflation, and BISP safety net, number of households, household head's gender and household literacy.

The model is derived from equation 3.3.

$$FS_j = f [Y_j, Inf_j, Bisp_j, NH_j, HL_j, HG_j] \quad (3.3)$$

From the above equation, the model 1 is:

$$FS_j = f [Y_j, Inf_j, BISP_j, X_j]$$

Where X represents the variables Household head gender, Household literacy and household size.

Since the dependent variable is a categorical variable, Logit regression technique is appropriate. In Logit model odds ratio is calculated for happening of an event. In our model we calculate the likelihood of a household being food secure determined by the explanatory variables.

Logit model calculates the ratio of probability of success to probability of its complement.

$$Pi = E (Y = 1 \mid X_{ij=1, \dots, k}) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_i)}} \quad (3.4)$$

Above equation can be written as:

$$P_i = \frac{1}{1 + e^{-Z_i}} = \frac{e^Z}{1 + e^Z} \quad (3.5)$$

Where $Z_i = \beta_1 + \beta_2 X_i$

The value of P_i ranges from zero to one and is nonlinearly related to Z_i . If P_i is the probability of an event taking place, $1 - P_i$ will be the probability of it not taking place.

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \quad (3.6)$$

We can calculate the odds ratio using equations 3.5 and 3.6 as:

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i} \quad (3.7)$$

Taking the natural log of above equation we obtain:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_1 + \beta_2 X_i \quad (3.8)$$

The model can be extended to multiple linear regression model for more than one explanatory variables:

$$L_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots \dots \dots + \beta_k X_{ki} + u_i \quad (3.9)$$

In the logit model the dependent variable is a categorical binary variable, measured in calories per household member per day. Households with per individual calorie intake above 1700 calories are food secure and below the threshold are insecure. Independent variables are food inflation, Household annual income, and cash transfer received from Benazir Income Support Programme. [Akter, S., & Basher, S. A. (2014)]. Apart from that the model takes into account other variable like household head education, household head gender and number of households. [Bashir et. Al, 2013] [Agnes et al., IFPRI, 1996].

$$FS_j = \beta_1 + \beta_2 Y_j + \beta_3 Inf_j + \beta_4 BISP_j + \beta_5 NH_j + \beta_6 HL_j + \beta_7 HG_j \quad (3.10)$$

3.4.2 Aggregate Quantitative Analysis of Food Security

In this section, an aggregate ordinary least square analysis is done for checking quantitative impact of explanatory variables, household income, BISP participation, inflation, household size, household head's gender, and household literacy on the dependant variable of food security, which is taken as continuous variable. The model estimates change in food security, through change in per household member calorie intake per day, due to change in explanatory variables.

The model is derived from equation 3.3.

$$FS_j = f [Y_j, Inf_j, Bisp_j, NH_j, HL_j, HG_j] \quad (3.3)$$

Multiple regression model is used which has the general form:

$$Y_i = \alpha + \beta_j \sum_{j=1}^n X_i + u_i$$

In our model the dependent variable is the continuous variable of food security, measured in calories. Independent variables are household income, BISP participation, inflation, household size, household head's gender, and household literacy. The multiple regression will take the form:

$$FS_j = \beta_1 + \beta_2 Y_j + \beta_3 Inf_j + \beta_4 BISP_j + \beta_5 NH_j + \beta_6 HL_j + \beta_7 HG_j \quad (3.11)$$

For the estimation of model parameters, we used Ordinary Least Square method because the food security (calorie intake) was a continuous variable.

The sum of the squared residuals is minimized:

$$RSS = \sum_{j=1}^n \hat{u}_j^2 \quad (3.12)$$

In equation (3.12) \hat{u}_j is the difference between the actual FS_j and the estimated \widehat{FS}_j .

Therefore, the residual term would be like:

$$\hat{u}_j = FS_j - \widehat{FS}_j = FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j \quad (3.13)$$

Substituting equation (3.13) in equation (3.12) we get:

$$RSS = \sum_{j=1}^n \hat{u}_j^2 = \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j)^2 \quad (3.14)$$

Equation (3.14) is then used for First Order Conditions (FOCs) for a minimum:

$$\frac{\partial RSS}{\partial \hat{\alpha}} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) = 0 \quad (3.15)$$

$$\frac{\partial RSS}{\partial \hat{\beta}_1} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) Y_j = 0 \quad (3.16)$$

$$\frac{\partial RSS}{\partial \hat{\beta}_2} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) Inf_j = 0 \quad (3.17)$$

$$\frac{\partial RSS}{\partial \hat{\beta}_3} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) BISP_j = 0 \quad (3.18)$$

$$\frac{\partial RSS}{\partial \hat{\beta}_4} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) NH_j = 0 \quad (3.19)$$

$$\frac{\partial RSS}{\partial \hat{\beta}_5} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_j - \widehat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) HL_j = 0 \quad (3.20)$$

$$\frac{\partial RSS}{\partial \hat{\beta}_6} = -2 \sum_{j=1}^n (FS_j - \hat{\alpha} - \hat{\beta}_1 Y_j - \hat{\beta}_2 Inf_j - \hat{\beta}_3 BISP_j - \hat{\beta}_4 NH_j - \hat{\beta}_5 HL_j - \hat{\beta}_6 HG_j) HG_j = 0 \quad (3.21)$$

Solving these F.O.Cs. i.e. equation 3.15 to 3.21, we get the following normal equations:

$$\sum_{j=1}^n FS_j = n \hat{\alpha} + \hat{\beta}_1 \sum_{j=1}^n Y_j + \hat{\beta}_2 \sum_{j=1}^n Inf_j + \hat{\beta}_3 \sum_{j=1}^n BISP_j + \hat{\beta}_4 \sum_{j=1}^n NH_j + \hat{\beta}_5 \sum_{j=1}^n HL_j + \hat{\beta}_6 \sum_{j=1}^n HG_j \quad (3.22)$$

$$\sum_{j=1}^n FS_j Y_j = \hat{\alpha} \sum_{j=1}^n Y_j + \hat{\beta}_1 \sum_{j=1}^n Y_j^2 + \hat{\beta}_2 \sum_{j=1}^n Inf_j Y_j + \hat{\beta}_3 \sum_{j=1}^n BISP_j Y_j + \hat{\beta}_4 \sum_{j=1}^n NH_j Y_j + \hat{\beta}_5 \sum_{j=1}^n HL_j Y_j + \hat{\beta}_6 \sum_{j=1}^n HG_j Y_j \quad (3.23)$$

$$\sum_{j=1}^n FS_j Inf_j = \hat{\alpha} \sum_{j=1}^n Inf_j + \hat{\beta}_1 \sum_{j=1}^n Inf_j Y_j + \hat{\beta}_2 \sum_{j=1}^n Inf_j^2 + \hat{\beta}_3 \sum_{j=1}^n BISP_j Inf_j + \hat{\beta}_4 \sum_{j=1}^n NH_j Inf_j + \hat{\beta}_5 \sum_{j=1}^n HL_j Inf_j + \hat{\beta}_6 \sum_{j=1}^n HG_j Inf_j \quad (3.24)$$

$$\sum_{j=1}^n FS_j BISP_j = \hat{\alpha} \sum_{j=1}^n BISP_j + \hat{\beta}_1 \sum_{j=1}^n BISP_j Y_j + \hat{\beta}_2 \sum_{j=1}^n BISP_j Inf_j + \hat{\beta}_3 \sum_{j=1}^n BISP_j^2 + \hat{\beta}_4 \sum_{j=1}^n BISP_j NH_j + \hat{\beta}_5 \sum_{j=1}^n BISP_j HL_j + \hat{\beta}_6 \sum_{j=1}^n BISP_j HG_j \quad (3.25)$$

$$\sum_{j=1}^n FS_j NH_j = \hat{\alpha} \sum_{j=1}^n NH_j + \hat{\beta}_1 \sum_{j=1}^n NH_j Y_j + \hat{\beta}_2 \sum_{j=1}^n NH_j Inf_j + \hat{\beta}_3 \sum_{j=1}^n NH_j BISP_j + \hat{\beta}_4 \sum_{j=1}^n NH_j^2 + \hat{\beta}_5 \sum_{j=1}^n NH_j HL_j + \hat{\beta}_6 \sum_{j=1}^n NH_j HG_j \quad (3.26)$$

$$\sum_{j=1}^n FS_j HL_j = \hat{\alpha} \sum_{j=1}^n HL_j + \hat{\beta}_1 \sum_{j=1}^n HL_j Y_j + \hat{\beta}_2 \sum_{j=1}^n HL_j Inf_j + \hat{\beta}_3 \sum_{j=1}^n HL_j BISP_j + \hat{\beta}_4 \sum_{j=1}^n HL_j NH_j + \hat{\beta}_5 \sum_{j=1}^n HL_j^2 + \hat{\beta}_6 \sum_{j=1}^n HL_j HG_j \quad (3.27)$$

$$\begin{aligned} \sum_{j=1}^n FS_j HG_j = & \hat{\alpha} \sum_{j=1}^n HG_j + \hat{\beta}_1 \sum_{j=1}^n HG_j Y_j + \hat{\beta}_2 \sum_{j=1}^n HG_j Inf_j + \\ & \hat{\beta}_3 \sum_{j=1}^n BISP_j HG_j + \hat{\beta}_4 \sum_{j=1}^n HG_j NH_j + \hat{\beta}_5 \sum_{j=1}^n HG_j HL_j + \hat{\beta}_6 \sum_{j=1}^n HG_j^2 \end{aligned} \quad (3.28)$$

When these normal equation are solved simultaneously, these would provide solution for separate coefficients of unknown parameters.

3.4.3 Disaggregated analysis of Food items in Basket

In this section, a disaggregate analysis is done for checking purely economic impact on household food security, being measured through their energy intake, by consumption of specific food items in the baskets separately measured for all the food items in the basket. The section measures how different commodities in food basket behave against changes in Income, Prices and BISP cash allowances. For that purpose consumption data of a year of all the included food items is taken.

Multiple regression models are used for the food items chosen in the consumption basket of household as the variation in energy intake (dependent variable) is being explained by more than one independent variables.

The model 2 is derived from equation 3.2.

$$FS_j = f [Y_j, Inf_j, BISP_j] \quad (3.2)$$

The multiple regression model has the form:

$$Y_i = \alpha + \beta_j \sum_{j=1}^n X_i + u_i$$

In this model the dependent variable is the continuous variable of calorie intake, for every food item. Independent variables were the Price of the specific item paid by household, Household annual income, and cash transfer received from Benazir Income

Support Programme. The Income of Households and the price of food item are the major determinants of food consumption. [Akter, S., & Basher, S. A. (2014)].

$$FS_j = \alpha + \beta_1 Y_j + \beta_2 Inf_{ij} + u_{ij} \quad (3.29)$$

Previously there has been work done with the price and income as the explanatory variables for consumption. This construction of model is also estimated as baseline model in the empirical analysis. The study included an additional variable of safety net participation. The variable takes into account the cash transfers received by households from Benazir Income support program. The study also examined the impact of BISP transfers on household's energy intake through consumption (Mustafa et al., 2019).

$$E_{ij} = \alpha + \beta_1 Y_j + \beta_2 Inf_{ij} + \beta_3 BISP_j + u_{ij} \quad (3.30)$$

This safety net transfer by BISP augmented model is estimated as the final model for each consumption commodity.

For the estimation of model parameters, we used Ordinary Least Square method because the dependent variable (Energy Intake) was a continuous variable, and the model built in the study for estimation of parameters fulfilled all the assumptions of the Classical Linear Regression Model.

The sum of the squared residuals is minimized:

$$RSS = \sum_{i,j=1}^n \hat{u}_{ij}^2 \quad (3.31)$$

In equation (3.6) \hat{u}_{ij} is the difference between the actual energy intake E_{ij} and the estimated energy intake \hat{E}_{ij} . Therefore, the residual term would be like:

$$\hat{u}_{ij} = FS_{ij} - \widehat{FS}_{ij} = FS_{ij} - \hat{\alpha} - \widehat{\beta}_1 Y_j - \widehat{\beta}_2 Inf_{ij} - \widehat{\beta}_3 BISP_j \quad (3.32)$$

Substituting equation (3.32) in equation (3.31) we get:

$$RSS = \sum_{i,j=1}^n \hat{u}_{ij}^2 = \sum_{i,j=1}^n (FS_{ij} - \hat{\alpha} - \hat{\beta}_1 Y_j - \hat{\beta}_2 Inf_{ij} - \hat{\beta}_3 BISP_j)^2 \quad (3.33)$$

Equation (3.33) is then used for First Order Conditions (FOCs) for a minimum. First order conditions are solved to get the normal equations:

$$\sum_{i,j=1}^n FS_{ij} = n \hat{\alpha} + \hat{\beta}_1 \sum_{j=1}^n Y_j + \hat{\beta}_2 \sum_{i,j=1}^n Inf_{ij} + \hat{\beta}_3 \sum_{j=1}^n BISP_j \quad (3.34)$$

$$\sum_{i,j=1}^n FS_{ij} Y_j = \hat{\alpha} \sum_{j=1}^n Y_j + \hat{\beta}_1 \sum_{j=1}^n Y_j^2 + \hat{\beta}_2 \sum_{i,j=1}^n Inf_{ij} Y_j + \hat{\beta}_3 \sum_{j=1}^n BISP_j Y_j \quad (3.35)$$

$$\begin{aligned} \sum_{i,j=1}^n FS_{ij} Inf_{ij} &= \hat{\alpha} \sum_{i,j=1}^n Inf_{ij} + \hat{\beta}_1 \sum_{i,j=1}^n Inf_{ij} Y_j + \hat{\beta}_2 \sum_{i,j=1}^n Inf_{ij}^2 + \\ &\hat{\beta}_3 \sum_{i,j=1}^n BISP_j Inf_{ij} \end{aligned} \quad (3.36)$$

$$\begin{aligned} \sum_{i,j=1}^n FS_{ij} BISP_j &= \hat{\alpha} \sum_{j=1}^n BISP_j + \hat{\beta}_1 \sum_{j=1}^n BISP_j Y_j + \hat{\beta}_2 \sum_{i,j=1}^n BISP_j Inf_{ij} + \\ &\hat{\beta}_3 \sum_{j=1}^n BISP_j^2 \end{aligned} \quad (3.37)$$

When these normal equation are solved simultaneously, these would provide solution for separate coefficients of unknown parameters.

CHAPTER 4

DATA AND VARIABLE CONSTRUCTION

In the previous chapter, the research philosophy, theoretical framework and the quantitative methodology used for building the model of the study had been explained. This chapter explains the sources of data and the construction of dependent and independent variables. Household food security is taken as dependent variable, while household income, food inflation, and cash transfers received by household from Benazir Income Support Program, are taken as explanatory variables. Apart from that aggregated analysis portion also takes number of households, household head's gender and household literacy as explanatory variables to take a qualitative analysis of household food security.

4.1 Data and its Sources

The study took the data from Pakistan Rural Household Panel Survey (PRHPS) collected by IFPRI¹⁰. Data had been collected by IFPRI for more than two thousand rural household from all areas of Pakistan during the time period 2012-2014. Data of more than 1000 Rural Households across Pakistan was used.

The following section explains the construction of both dependent and independent variables.

4.2 Explanation of Variables

4.2.1 Dependent Variable

¹⁰ International Food Policy Research Institute

4.2.1.1 Food Security

In model 1, the variable of aggregated Food security is a categorical dummy variable. For food secure households, whose per individual per day energy intake is equal to higher than the threshold value, its value will be 1, and for insecure households its value will be 0. The threshold value for food secure individual has been set at 1700 calories per day per household member.

In model 2, Food security will be measured through total caloric intake as its proxy. It measures caloric intake per individual per day from consumption of entire basket. The variable in aggregate OLS model, explains variation in overall caloric intake through entire basket per household.

In model 3, Food security will be measured through caloric intake as its proxy. It measures caloric intake per individual per day from consumption a single food item in the basket. The variable in OLS model, explains variation in caloric intake through consumption of every food item separately for household members in a day.

Data for the consumption of units by households was taken from consumption section of the Pakistan Panel Rural Household survey data. The value of the variable was measured by taking product of the per unit calorie value of the item and the number of items consumed by the household. Table 4.1 carries the caloric values of the food items in the basket. For variable in Model 1 and 2, caloric value of entire basket is added to measure total caloric intake [Bashir et. Al, 2013][Hashmi et. Al, 2019][Kakwani & H. Son, 2016][Sahn 1988].

4.2.2 Independent Variables

4.2.2.1 Inflation

In Model 1 and 2, an inflation index is calculated through Fisher price index formula to measure aggregated impact of food inflation on household food security. The index is built for each household using their consumption basket. Loged function of the index is taken for analyses. The construction of inflation index is given in the Appendix.

In model 3, the Inflation variable takes price of each food item separately to measure disaggregated impact of change in price of each food item on household food energy intake. The variable takes into account the price faced by household of every item in consumption basket. It is measured in Rupees. Log function of the prices is taken for the econometric analysis. Data was be taken from the Consumption section of Pakistan Panel Rural Households survey conducted by International Food Policy Research Institute. Changes in prices of food commodities change the calories intakes through the food commodity by households (Sahn 1988).

4.2.2.2 Household's Income

The variable is be the sum of annual incomes of all the members of the household. It included the farm income earned during Rabi and Kharif seasons, non-farm incomes earned during the year, and income from household-owned enterprises and rental incomes from properties owned. It was measured in Rupees. Log function of income variable is taken for econometric analysis. Data was be taken from Income and Employment section of Pakistan Panel Rural Households survey conducted by International Food Policy Research Institute. Income of household is crucial in determining their calories intake, hence food security. (Sibrian et al. 2007; Sibrian 2008).

Table 4.1 Calorific Value chart of the Food items chosen in the Food Basket

| Calorific values chart of food items chosen in Basket | | | |
|--|------------------------------|----------------------------|-------------------------|
| Sr. | Name of the food item | Unit of measurement | Calorie per unit |
| 1. Cereals | | | |
| 1.1 | Atta (Wheat Flour) | Kilograms (Kg) | 3400 Calories |
| 1.2 | Basmati Rice | Kilograms (Kg) | 1300 Calories |
| 2. Meats and Poultry | | | |
| 2.1 | Chicken | Kilograms (Kg) | 2100 calories |
| 2.2 | Eggs | Numbers | 80 Calories |
| 2.3 | Mutton (Goat Meat) | Kilograms (Kg) | 1540 Calories |
| 2.4 | Beaf (Buffalo Meat) | Kilograms (Kg) | 2440 Calories |
| 3. Fresh Fruits | | | |
| 3.1 | Apple | Kilograms (Kg) | 570 Calories |
| 3.2 | Oranges (Citrus Fruits) | Kilograms (Kg) | 470 Calories |
| 3.3 | Bananas | Numbers | 96 Calories |
| 4. Vegetables | | | |
| 4.1 | Potatoes | Kilograms (Kg) | 760 calories |
| 4.2 | Tomatoes | Kilograms (Kg) | 180 Calories |
| 4.3 | Onions | Kilograms (Kg) | 440 Calories |
| 5. Pulses | | | |
| 5.1 | Maash | Kilograms (Kg) | 3410 Calories |
| 5.2 | Moong | Kilograms (Kg) | 1200 Calories |
| 5.3 | Masoor | Kilograms (Kg) | 3530 Calories |
| 6. Edible Oils | | | |
| 6.1 | Pure Ghee | Kilograms (Kg) | 7210 calories |
| 6.2 | Cooking Oil | Liters | 8800 Calories |
| 7. Sugar and prepared products | | | |
| 7.1 | Sugar | Kilograms (Kg) | 3800 Calories |
| 8. Milk and Dairy products | | | |
| 8.1 | Milk | Liters | 610 Calories |
| 8.2 | Yogurt | Kilograms (Kg) | 690 Calories |

4.2.2.3 Safety Net Participation – BISP unconditional cash transfer

In model 1 and 2, BISP is a categorical dummy variables with values 1 or 0 with 1 being for the families who receive BISP cash transfers and 0 for the families who do not.

In model 3, the variable takes into account the cash transfers received by households during the year from Benazir Income Support Program. The variable is measured in Rupees per year. Log function of the BISP variable is taken for the econometric analysis.

Data is taken from Safety Net section of Pakistan Panel Rural Households Survey conducted by International Food Policy Research Institute. BISP transferred have been observed to have positive impact on household food security (Amrin & Ashfaq, 2020) through increasing food expenditure and child nutrition (Mustafa et al., 2019).

4.2.2.4 Number of households

The variable takes into account number of households. Number of households have been observed to be negatively associated with household food security [Bashir et. Al, 2013].

4.2.2.5 Household head's gender

The variable takes into account gender of household head. It is binomial variable for having value 1 for males and 0 for females. [Bashir et. Al, 2013] [Agnes et al., IFPRI, 1996].

4.2.2.6 Household Literacy

This variable takes into account the literacy status of the household. The data is taken from Education section of the Pakistan Panel Rural Households survey. Households

with members who have been educated are observed to have better food security.

Variable is a binomial variable with two values for literate and illiterate households.

[Bashir et. Al, 2013]

The Summary of the variables, their symbols, and their brief description has been given in the Table 4.2. Table 4.2 (panel a) contains details of dependant variable.

Table 4.2 (panel b) contains details of dependant variable. Table 4.3 carries descriptive statistics and tabulation of all variables.

Table 4.2 Summary details of dependant variables

| Sr. | Variable Name | Variable Symbol | Variable Description |
|-----|---------------|-----------------|--|
| 1 | Food Security | FS | <p>Model 1: Model 1 measures the variable as categorical variable. Households with aggregated energy intake through consumption of entire food basket above 1700 calories per individual per day are declared food secure while below 1700 calories per individual per day are food insecure.</p> <p>Food secure = 1 Food Insecure = 0</p> <p>Model 2: Food security is caloric intake per individual per day from consumption of entire basket. The variable in aggregate OLS model, explains variation in overall caloric intake through entire basket per household.</p> <p>Model 3: In model 3, The variable measures the household energy intake measured in calories per individual per day through consumption of specific food item.</p> |

Table 4.3 (Panel a) Summary details of explanatory variables

| Sr. | Variable Name | Variable Symbol | Variable Description |
|------------|--------------------------|------------------------|---|
| 1 | Household Income | Y | It is be the sum of annual incomes of all members of households. The variable is measured in Rupees. |
| 2 | Inflation | Inf | Model 1 and 2: In model 1 and 2, inflation is calculated through Fisher inflation index. The index takes into account the whole food basket to measure aggregated inflation impact. Model 3: In model 3, the variable measures the Rupee cost faced by the household for each item of consumption basket. The variable was measured in Rupees. |
| 3 | Safety Net Participation | BISP | Model 1 and 2: Model 1 and 2 take the variable as categorical variable to measure the impact of BISP allowances on household food security. BISP participant = 1 BISP non-participant = 0 Model 3: In model 2, the variable takes the cash transfers received by households from BISP. The variable was measured in Rupees. |

Table 4.3 (Panel b) Summary details of explanatory variables

| Sr. | Variable Name | Variable Symbol | Variable Description |
|------------|-----------------------|------------------------|--|
| 4 | Number of households | NH | The variable stands for number of members in the household. It is measured in numeric numbers. |
| 5 | Household Literacy | HL | The variable whether the member of household are educated. It is binomial variable with: 1= Literate 0= Illiterate |
| 6 | Household Head Gender | HG | The variable stands for the gender of the household head. It is a binary variable with: 1 = Male 0 = Female |

CHAPTER 5

EMPIRICAL RESULTS AND DISCUSSION

5.1 Introduction

Chapter 3 explained the conceptual framework and econometric methodologies being applied. Chapter 4 explained the construction of variables used in the analysis. This chapter consists of the descriptive statistics and the empirical results of analyses discussed in the chapter 3, using the variables with specific constructions in Chapter 4.

5.2 Empirical Results and Discussion

Table 5.1 provides the descriptive statistics of the variables in the study. Table provide the descriptive statistics of the continuous variables. Apart from that table provides the detail of split of data between categorical variables.

If we look into the dependant variable of food security, which speaks for the calories intake by household members per day, we find out that among in our dataset almost 54.3 percent households are food secure as they consume equal to or above threshold values of calories and remaining 45.6 percent are insecure as they fall below the threshold calorie intake level for foods security. The average daily per capita calorie intake from our dataset is 1844.29 calories with standard deviation of 1128.7. Minimum and maximum per capita calories intake are 42.7 and 21653.8, respectively

In the explanatory variables, mean annual household income is 132062.6 with standard deviation of 168804.6. For the variable of BISP, among our dataset only 14 percent households are the beneficiaries. For inflation variable, average inflation is found to be 98.06 with standard deviation 81.96, while maximum inflation index is 1222.2. Mean cash allowance received from BISP is 9450.8 with standard deviation of 5582.1. Minimum and maximum cash allowances

received from BISP are 1000 and 24000. Average household size is 6.67 members with standard deviation of 3.03. Minimum and maximum household sizes are 2 and 35. Households with male heads dominate the dataset with almost 97 percent households having male heads. Households with female heads are only 3 percent. In our dataset, 69 percent households are declared literate while 31 percent of the households are illiterate.

Table 5.1 Descriptive Statistic of the variables

| Descriptive Statistics of Continuous Variables | | | | | |
|---|------------------------|----------------------------|---------------------------|-----------------------------|----------------|
| Variable Name | Variable Symbol | Mean | Standard Deviation | Minimum | Maximum |
| Food Security | FS | 1844.295 | 1128.658 | 42.78575 | 21653.84 |
| Household Income | Y | 132062.6 | 168804.6 | 15 | 4250000 |
| Inflation | Inf | 98.60839 | 81.9698 | 0 | 1222.2 |
| BISP Cash Allowance | BISP | 9450.8 | 5582.09 | 1000 | 24000 |
| Household Size | NH | 6.67 | 3.03 | 2 | 35 |
| Tabulation of Binomial Variables | | | | | |
| Variable Name | Variable Symbol | Variable Value = 1 | | Variable Value = 0 | |
| Food Security | FS | 54.3 % Food Secure | | 45.6 % Food Insecure | |
| BISP Participant | BISP | 14 % BISP participants | | 86% BISP non-participants | |
| Household Head Gender | HG | 97.3 % Male Household Head | | 2.7 % Female Household Head | |
| Household Literacy | HL | 69 % Literate Household | | 31 % Illiterate Household | |

Table 5.2 presents the results of Logit regression analyses of household data. Household food security is a categorical variable with two possibilities, i.e; food secure and insecure. The independent variables are household income, BISP participation, food inflation, household size, household head gender and household literacy. The logit regression analyses explains how each explanatory variable contributes into probability of household being food secure.

Statistically significant results are as follows: Household income is positively impacting towards household food security with its logit coefficient 0.083 and marginal value 0.0203 which suggests that as the household income increases by one percent, probability of household being food secure increases by 0.0203. The increase in household probability of being food secure is due to the increase in their purchasing power as a result of higher income, which enables them to spend more on food items. As the household income decreases by one percent, probability of household being food secure decreases by 0.0203. The decrease in household probability of being food secure is due to the decrease in their purchasing power as a result of lower income, which makes them spend less on food items. Odds ratio for household income is 1.086, which suggests that as the income increases by one percent the odds of household being food secure are multiplied by 1.086.

Household size is negatively impacting food security with its logit regression coefficient being -0.170. The marginal impact of household size is -0.041 which suggests that as the household size increases by 1 member the probability of food security decreases by 0.041. Odds ratio for household size is 0.843, which implies that with one additional member odds of being food secure are multiplied by 0.843. The decrease in probability of household being food secure with 1 additional member is that with additional member per capita food expenditure falls, which implies less calories intake. Thus, causing food insecurity.

Table 5.3 explains the results of aggregate OLS regression analysis. The analysis takes households food security, measured through calories per day per household members, as dependent upon income of household, their participation in BISP, food inflation, household size, gender of the household head and the literacy of household.

Generally, Household annual income, BISP participation and literacy are positively related to the food security. They are positively impacting household member's calorie intake in day. Inflation, household size are negatively related to household food security. They are negatively impacting household member's calorie intake in day. In case of household head's gender, as we move from households that have female heads to households that have male heads, the impact upon household food security is negative. Households with female family heads have been observed to have higher calorie intake per day per household member.

Statistically significant results from analysis are as follows: Household income is positively impacting household food security as household members per day calories is positively related to income. The regression coefficient is 0.023, which is highly significant, and it suggests that with 1 percent increase in income of household, per member per day calorie intake increases by 0.023 percent. The increase in calories intake is due to higher purchasing power as a result of higher income, which implies household is able to spend more on food items. With 1 percent decrease in income of household per member per day calorie intake decreases by 0.023 percent. The decrease in calories intake is due to lower purchasing power as a result of lower income, which implies household has to spend less on food items.

Household size is negatively impacting household food security as household members per day calories is negatively related to income. The regression coefficient is -0.041, which is highly significant, and it suggests that with 1 additional household member, per member per day calorie intake decreases by -0.041 percent.

In table 5.2 and table 5.3, the inflation variable has been found negative but statistically insignificant. The results are according to the findings based on the dataset. Moreover, since the data is based on rural households, most of the households are involved in agricultural and food production related activities. Higher food prices thus can have lower negative impact on

consumption of food. Thus rendering impact of inflation on food security statistically insignificant.

The table 5.4 provides the empirical results of household food security measured in energy intakes by analyses of the demand functions of selected food commodities. Food security, measured in energy intake, is taken as function of food item's own price, household income and BISP annual transfers (having two models for each food item, i.e., Baseline model with price and income as explanatory variable, and BISP augmented model for households that receive BISP allowance as additional explanatory variable).

Generally, food items in the category of cereals, vegetables, sugar and sugar products, and dairy have been observed to be highly responsive to changes in prices and income. These include Atta (wheat flour), Basmati rice, Potato, Tomato, Onion, Sugar, Milk and Yogurt. Additionally, these food items have been observed to have positive impact on their consumption because of BISP cash transfer.

Table 5.4 (panel a) consists of commodities in the category of Cereals which include Wheat Aata and Basmati rice. Overall, income of households has been observed to have positive impact on household energy intake, and inflation, measured through variation in own price, has negative impact. While BISP transfers have been observed to be positively contributing in household food security. Statistically significant results in table 5.4 (panel a) are as follows: One percent rise in price of Atta will decrease energy intake through Aata by 369.3 calories in Model 1 and by 352.2 calories in Model 1*. One percent rise in income increases energy intake through Basmati Rice by 2.43 calories in Model 2.

Table 5.2: Aggregated Logit Model results with Food Security as binary Variable

| Aggregated Data Logit Regression Analyses Results | | | |
|--|-------------------------------|---------------------------------|-------------------------|
| Dependent Variable: Food Security | | | |
| Regressor | Regression Coefficient | Marginal Results (dY/dX) | Logit Odds Ratio |
| Income | 0.083** | 0.0203 | 1.086 |
| | (0.035) | (0.0086) | (0.0382) |
| BISP | 0.029 | 0.007 | 1.028 |
| | (0.13) | (0.0318) | (0.1328) |
| Inflation | -0.035 | -0.0086 | 0.965 |
| | (0.071) | (0.0174) | (0.0682) |
| Household Size | -0.170*** | -0.0418 | 0.843 |
| | (0.025) | (0.0046) | (0.015) |
| Household Head Gender | -0.348 | -0.0867 | 0.705 |
| | (0.271) | (0.067) | (0.189) |
| Household Literacy status | 0.076 | 0.0186 | 1.079 |
| | (0.101) | (0.0243) | (0.1073) |
| Constant | 0.392 | | 1.48 |
| | (0.566) | | (0.837) |
| Observations | 2,239 | 2,239 | 2,239 |
| Notes: | | | |
| Robust Standard errors in parentheses | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | |

Table 5.3 Aggregated OLS regression results with Food security as dependent variable

| OLS Regression Results with Food Security as continuous variable | |
|---|-------------------------------|
| Dependent Variable: Food Security | |
| Regressor | Regression Coefficient |
| Income | 0.023*** |
| | (0.007) |
| BISP | 0.012 |
| | (0.027) |
| Inflation | -0.001 |
| | (0.015) |
| Household Size | -0.041*** |
| | (0.005) |
| Household Head Gender | -0.020 |
| | (0.053) |
| Household Literacy status | 0.033 |
| | (0.021) |
| Constant | 7.392*** |
| | (0.118) |
| Observations | 2,239 |
| R-squared | 0.081 |
| Note: Robust Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 | |

Table 5.4 (panel b) consists of food items in category of Chicken and Poultry. Statistically significant results are as follows: One percent increase in price of chicken increase energy intake through chicken by 5.9 calories in Model 3.

Table 5.4 (Panel c) consists of food items in category of Edible oils. The number of observations in the category had been recorded very low. Statistically significant results are as follows: one percent increase in price of cooking oil increases energy intake through cooking oil by 1020.7 calories in Model 5*. One percent increase in BISP allowance increases energy intake by cooking oil by 165.7 calories.

Table 5.4 (Panel d) consists of food items in category of Fresh fruits. It includes Apples, Oranges and Bananas. The number of observations in the category have been low. Generally Apple and oranges are negatively related to income, positively related to price, and positively related to BISP.

Table 5.4 (panel e) consists of food items in the category of Vegetables. It includes Potatoes, Tomato and Onion. Generally, vegetables are positively related to household income, negatively related to items price and negatively related to BISP. Statistically significant results are as follows: one percent increase in price of potatoes decrease energy intake by potatoes by 8.57 calories in Model 10. One percent increase in income decreases energy intake by 1.15 calories in Model 10, while with BISP included in Model 10* one percent increase in income increases energy intake by potatoes by 3.39 calories. One percent increase in income increase energy intake by tomatoes by 0.161 calories in Model 11, while by 0.156 calories in Model 11*.

Table 5.4 (panel f) includes Pulses which include Maash, Moong and Masoor. In case of Maash, it is negatively related to income, positively related to price, while BISP has positive impact on consumption of Maash. Moong is positively related to all three independent variables

of income, own price and BISP. Moong is negatively related to its price, positively related to both household income and BISP.

Table 5.4 (panel g) consists of sugar. Sugar is negatively related to its price, positively related to income and positively related to BISP also. Statistically significant results are as follows: one percent increase in household income increases energy intake through sugar by 6.30 calories in Model 16 and by 24.22 calories in Model 16*.

Table 5.4 (panel h) consists of food items in category of Milk and Dairy. It includes Milk and Yogurt. Both, milk and yogurt, are generally negatively related to own price and positively related to household income and BISP. Statistically significant results are as follows: one percent increase in price of milk decrease caloric intake through milk by 42.19 calories, and one percent increase in income increases energy intake by 5.34 calories in Model 17. One percent increase in price of yogurt decreases energy intake by yogurt by 971.1 calories in Model 18 and by 1296.2 calories in Model 18*.

Table 5.4 (Panel i) consists of food items in category of Meats. It includes Mutton and Beef. Number of observations are low in the category. BISP has been observed to have positive impact on energy intake through Mutton and Beef. Statically significant results are as follows: one percent increase in income decreases energy intake by Beef by 6.4 calories in Model 19*.

Table 5.4: Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | |
|--|----------------|-----------------|---------------------|-----------------|
| Category: Cereals | | | | |
| | Atta | | Basmati Rice | |
| Regressor | Model 1 | Model 1* | Model 2 | Model 2* |
| Inflation | -369.302*** | -352.273* | -1.490 | -33.811 |
| | (66.380) | (182.657) | (6.809) | (45.397) |
| Income | -4.937 | 18.930 | 2.438* | 14.606 |
| | (13.466) | (41.871) | (1.302) | (11.947) |
| BISP | | 25.867 | | 3.070 |
| | | (62.670) | | (6.003) |
| Constant | 2,508.507*** | 1,960.389* | 15.693 | 11.238 |
| | (276.774) | (1,012.258) | (31.531) | (116.686) |
| Observations | 1,017 | 195 | 388 | 51 |
| R-Squared | 0.026 | 0.011 | 0.006 | 0.047 |
| Robust standard errors in parentheses | | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | | |
| * This model couldn't be estimated due to having no match in the datasets. | | | | |

Table 5.4 (Panel b): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | |
|--|----------------|-----------------|----------------|-----------------|
| Category: Chicken and Poultry | | | | |
| | Chicken | | Eggs | |
| Regressor | Model 3 | Model 3* | Model 4 | Model 4* |
| Inflation | 5.939* | 8.577 | 1.930 | 4.978 |
| | (3.348) | (7.589) | (2.656) | (4.575) |
| Income | 0.337 | -1.152 | 0.196 | -0.299 |
| | (0.738) | (1.644) | (0.450) | (1.315) |
| BISP | | -2.100 | | 0.146 |
| | | (3.429) | | (1.338) |
| Constant | 7.259 | 20.863 | 2.395 | -0.493 |
| | (19.531) | (58.604) | (8.169) | (15.910) |
| Observations | 726 | 119 | 414 | 62 |
| R-Squared | 0.004 | 0.015 | 0.002 | 0.022 |
| Robust standard errors in parentheses | | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | | |
| * This model couldn't be estimated due to having no match in the datasets. | | | | |

Table 5.4 (Panel c): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | |
|--|----------------------|------------------------------|---------------------|------------|
| Category: Edible Oils | | | | |
| | Cooking Oil | | Pure Ghee | |
| Regressor | Model 5 | Model 5* | Model 6 | Model 6* * |
| Inflation | 5.927 (86.411) | 1,020.701*** (256.556) | 11.624 (9.531) | -- |
| Income | -12.328 (15.066) | 14.536 (26.972) | -2.381 (2.290) | -- |
| BISP | | 165.729*** (46.349) | | -- |
| Constant | 466.541 (444.407) | -6,309.949*** (1,587.709) | -24.980 (56.670) | -- |
| Observations | 139 | 12 | 25 | -- |
| R-Squared | 0.007 | 0.701 | 0.093 | -- |
| Robust standard errors in parentheses | | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | | |
| * This model couldn't be estimated due to having no match in the datasets. | | | | |

Table 5.4 (Panel d): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | | | |
|--|-------------------|---------------------|--------------------|---------------|-----------------------|---------------------|
| Category: Fresh Fruits | | | | | | |
| | Apples | | Oranges | | Bananas | |
| Regressor | Model 7 | Model 7* | Model 8 | Model 8* ‡ | Model 9 | Model 9* |
| Inflation | 0.579 (1.144) | 5.770 (4.668) | 0.282 (3.453) | -- | -3.651 (2.418) | -3.952 (10.288) |
| Income | -0.097 (0.422) | 0.923 (0.659) | -0.220 (0.991) | -- | -0.214 (0.848) | -2.251 (2.619) |
| BISP | | 0.640 (2.051) | | -- | | -4.907 (3.714) |
| Constant | 9.119 (6.023) | -31.147 (33.407) | 14.766 (20.902) | -- | 30.268*** (10.398) | 96.052* (49.537) |
| Observations | 204 | 24 | 48 | -- | 220 | 35 |
| R-Squared | 0.001 | 0.173 | 0.001 | -- | 0.012 | 0.053 |
| Robust standard errors in parentheses | | | | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | | | | |
| ‡ This model couldn't be estimated due to having no match in the datasets. | | | | | | |

Table 5.4 (Panel e): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | | | |
|--|---------------|-----------|---------------|-----------|--------------|-----------|
| Category: Vegetables | | | | | | |
| | Potato | | Tomato | | Onion | |
| Regressor | Model 10 | Model 10* | Model 11 | Model 11* | Model 12 | Model 12* |
| Inflation | -8.579* | -6.842 | -0.114 | -0.124 | -25.502 | -3.013 |
| | (4.556) | (4.238) | (0.259) | (0.262) | (18.325) | (2.297) |
| Income | -1.151* | 3.392* | 0.161* | 0.156* | 1.175* | 0.679 |
| | (0.643) | (1.781) | (0.089) | (0.088) | (0.630) | (0.437) |
| BISP | | -1.882 | | -0.000 | | -0.865 |
| | | (3.017) | | (0.000) | | (0.747) |
| Constant | 84.607*** | 49.678 | 2.827** | 2.957** | 98.546 | 24.799* |
| | (16.523) | (37.325) | (1.292) | (1.312) | (64.180) | (14.915) |
| Observations | 1,393 | 257 | 1,174 | 1,174 | 1,408 | 253 |
| R-Squared | 0.009 | 0.015 | 0.003 | 0.004 | 0.193 | 0.018 |
| Robust standard errors in parentheses | | | | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | | | | |
| * This model couldn't be estimated due to having no match in the datasets. | | | | | | |

Table 5.4 (Panel f): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | | | |
|--|---------------------|----------------------|---------------------|-------------------|--------------------|---------------------|
| Category: Pulses | | | | | | |
| | Maash | | Moong | | Masoor | |
| Regressor | Model 13 | Model 13* | Model 14 | Model 14* | Model 15 | Model 15* |
| Inflation | 0.832 (3.910) | 46.587** (16.339) | -0.062 (0.110) | 0.123 (0.485) | 2.594 (3.849) | -0.695 (8.185) |
| Income | -0.951 (1.180) | -8.680*** (2.738) | -0.064** (0.032) | 0.112 (0.149) | -0.506 (1.333) | 3.466 (3.412) |
| BISP | | 0.646 (5.432) | | 0.307 (0.208) | | 2.421 (4.980) |
| Constant | 47.568* (24.461) | -67.687 (81.283) | 2.513*** (0.650) | -2.767 (2.349) | 36.889 (25.589) | -16.587 (99.303) |
| Observations | 212 | 20 | 524 | 110 | 303 | 70 |
| R-Squared | 0.003 | 0.321 | 0.004 | 0.009 | 0.002 | 0.021 |
| Robust standard errors in parentheses | | | | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | | | | |
| * This model couldn't be estimated due to having no match in the datasets. | | | | | | |

Table 5.4 (Panel g): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Food Security (Energy Intake) | | |
|--|-----------------|------------------|
| Category: Sugar and sugar Products | | |
| Sugar | | |
| Regressor | Model 16 | Model 16* |
| Inflation | 32.199 | -97.362 |
| | (34.006) | (119.957) |
| Income | 6.307** | 24.228*** |
| | (2.974) | (7.968) |
| BISP | | 6.334 |
| | | (14.148) |
| Constant | 42.325 | 308.156 |
| | (139.259) | (471.650) |
| Observations | 1,447 | 265 |
| R-Squared | 0.004 | 0.032 |
| Robust standard errors in parentheses | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | |
| * This model couldn't be estimated due to having no match in the datasets. | | |

Table 5.4 (Panel h): Impact of inflation, Income and BISP allowance on Food Security
(Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | |
|--|-------------|-----------|---------------|---------------|
| Category: Milk and Dairy | | | | |
| | Milk | | Yogurt | |
| Regressor | Model 17 | Model 17* | Model 18 | Model 18* |
| Inflation | -42.198*** | -41.573 | -971.178** | -1,296.225*** |
| | (14.201) | (26.745) | (483.303) | (439.061) |
| Income | 5.341** | 5.228 | 19.621 | 108.201 |
| | (2.312) | (7.879) | (24.092) | (69.656) |
| BISP | | -1.826 | | -204.721 |
| | | (6.180) | | (251.644) |
| Constant | 214.407*** | 220.559 | 3,738.007** | 6,005.202** |
| | (55.906) | (161.581) | (1,857.490) | (2,455.890) |
| Observations | 782 | 143 | 193 | 41 |
| R-Squared | 0.013 | 0.014 | 0.517 | 0.722 |

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1
 * This model couldn't be estimated due to having no match in the datasets.

Table 5.4 (Panel i): Impact of inflation, Income and BISP allowance on Food Security (Calorie intake by food item)

| Dependent Variable: Food Security (Energy Intake) | | | | |
|--|-------------|-----------|---------------|-----------|
| Category: Meats | | | | |
| | Beef | | Mutton | |
| Regressor | Model 19 | Model 19* | Model 20 | Model 20* |
| Inflation | -14.806 | 12.105 | 6.779 | -24.945 |
| | (19.233) | (15.923) | (5.834) | (6.078) |
| Income | -4.559** | -6.407*** | -0.027 | 2.260 |
| | (2.226) | (2.168) | (1.613) | (1.001) |
| BISP | | 0.256 | | 16.842 |
| | | (6.790) | | (5.082) |
| Constant | 182.348* | 51.643 | -13.246 | -12.619 |
| | (104.647) | (123.257) | (25.692) | (32.979) |
| Observations | 281 | 27 | 53 | 5 |
| R-Squared | 0.034 | 0.083 | 0.021 | 0.943 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
* This model couldn't be estimated due to having no match in the datasets.

CHAPTER 6

CONCLUSION

The study is an attempt to examine the impact of household income, food inflation, and social safety cash transfers (Benazir Income Support Program) on household food security. The study has explored how the changes in household income, price of food commodities, and BISP cash transfers impact household food security through consumption of food items chosen. The study also explores the qualitative impact of other supporting variables like household size, gender of household head and household Literacy on food security of household. Apart from that, the study examines the sensitivity of each food item chosen for changes in household income, its own price, and BISP cash transfers. A selective basket of food items is considered for empirical analysis, comprising the categories of cereals, fresh fruits, vegetable, meat and poultry products, pulses, milk and milk products and sugar.

The analysis is performed using the Data of Pakistan Rural Household Panel Survey conducted by International Food Policy Research Institute. The econometric techniques of Logit model and Ordinary Least Square model are used in aggregated analysis with all variable. To study the sensitivity of food items separately Ordinary Least Square method is employed to quantify their response to change in income, price and BISP cash transfer. On the bases of the findings of the study it's found that household's income is positively related to their food security. It is evident from both aggregated data models that income is positively and significantly related to food security. Secondly, from demand functions analyses it has been found that income is positively impacting consumption of most of the goods. Inflation on the other hand has negative impact on household food security. It is evident from both OLS and Logit models. In

case of disaggregated analysis of food items also, it has been observed to have negative and significant relationship with food security in case of most food items. Households that participate in safety net program of Benazir Income support program have been observed to be more food secure than those that do not. According to both logit model and OLS model, BISP participation is positively linked to household food security. In disaggregated demand functions framework, BISP cash allowances have been observed to have positive impact on caloric intake of number of food items and has been observed to reinforce the positive impact of income. Although the purpose of BISP cash transfer is to alleviate poverty, yet there is significant impact of BISP unconditional cash transfers on consumption of food item as the transfers significantly improve the purchasing power of households. This improves the household food security status through social safety net that is in line with the goal 2.1 of Sustainable Development goals. The goal sets the target of ending hunger and alleviation of poverty. Fulfilment of the goal is pivotal for economic growth, as better security for households will ensure better physical growth, and consequently more productive labour force. Household size has been observed to have negative impact on household food security while household literacy has positive impact on food security.

6.1 Policy Recommendations

On the bases of findings of the study, following recommendations to improve food security standards can be made:

- Household income is found to be positively impacting the household food security. To improve the household incomes, government should provide education and professional trainings to the households to equip them with skillset and help them get employed and increase incomes.

- Household literacy is significantly impacting the food security status of households. To improve the food security goals, government should provide education and professional trainings to the rural households to create livelihood opportunities for them. This will improve their income potential and improve food security situation.
- It has been found in the literature and in the analysis that women can play very significant role in the food security of the household. To empower women, government should take initiative to give trainings and skills to women.
- Household size has been observed to have negative impact on household food security. To overcome this situation, government should initiate awareness programs for public about family planning programs and should make effort to de-stigmatize such initiatives, so as to engage large population.
- Among the food items chosen, items in category of cereals, particularly Atta (wheat flour) and Basmati rice, are highly responsive to prices and income. Similar patterns have been observed in case of vegetables, sugar and sugar products, and dairy products. To improve the food security situation, prices of above-mentioned commodities should be maintained on priority bases as they are highly sensitive to prices.
- BISP has been observed to have positive impact on household food security. To improve the results of the social safety program, government should increase the amount of BISP Unconditional cash transfer to households. Apart from unconditional transfers, BISP should increase the horizons of educational programs under BISP and other safety net programs too as it is evident from the study that safety net programs have positive impact on household welfare.
- It has been found in the literature that in-kind food supply transfer will improve food security situation significantly, as there is probability that households might

not be spending the unconditional cash transfer for improving energy intake by increasing food consumption. This recommendation is in line with government's recent initiative of 'Koi Bhooka Na Soye' programme under umbrella of BISP. Its scale should be increased to benefit more people.

- Government should include more households in the beneficiaries of the BISP program as it will alleviate poverty and improve nutrition status of greater population. Fresh surveys should be conducted and more deserving households be included in the beneficiaries.
- Apart from Federal level initiatives, government should create alliances with provincial departments also to improve vertical and horizontal coordination and collaboration for achieving the goal of food security across country.

REFERENCES

- Ahmad, M., & Farooq, U. (2010). The State of Food Security in Pakistan: Future Challenges and Coping Strategies. *The Pakistan Development Review*, 49(4), 903-923. Retrieved February 16, 2020, from www.jstor.org/stable/41428696
- Akter, S., & Basher, S. A. (2014). The impacts of food price and income shocks on household food security and economic well-being: Evidence from rural Bangladesh. *Global Environmental Change*, 25, 150-162.
- Alimi, R. S. (2013). Keynes' Absolute Income Hypothesis and Kuznets Paradox.
- Ambler, K., & De Brauw, A. (2017). *The impacts of cash transfers on women's empowerment: learning from Pakistan's BISP program*. World Bank.
- Amrin, S., & Ashfaq, M. (2020). The impact of Benazir income support program BISP on household food expenditures in Faisalabad. *Pakistan Journal of Agricultural Sciences*, 57(1).
- Bashir, M. K., Schilizzi, S., & Pandit, R. (2013). Regional sensitivity of rural household food security: The case of Punjab, Pakistan. *The Journal of Animal and Plant Sciences*, 23(4), 1200-1206.
- Bashir, M. K., Schilizzi, S., & Pandit, R. (2012). *The determinants of rural household food security for landless households of the Punjab, Pakistan* (No. 1784-2016-141849).
- Bishop, C., & Hilhorst, D. (2010). From food aid to food security: The case of the Safety Net policy in Ethiopia. *The Journal of Modern African Studies*, 48(2), 181-202. Retrieved February 16, 2020, from www.jstor.org/stable/40864714
- BISP Impact Evaluation Report 2013

- Burchi, F., & De Muro, P. (2012). A human development and capability approach to food security: conceptual framework and informational basis. *Background paper*, 8.
- Cafiero, C., Viviani, S., & Nord, M. (2018). Food security measurement in a global context: The food insecurity experience scale. *Measurement*, 116, 146-152.
- Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *The Quarterly journal of economics*, 112(1), 1-55.
- Carroll, C. D. (2001). A theory of the consumption function, with and without liquidity constraints. *Journal of Economic perspectives*, 15(3), 23-45.
- Cohen, G. (1993). Amartya Sen's Unequal World. *Economic and Political Weekly*, 28(40), 2156-2160. Retrieved February 15, 2020, from www.jstor.org/stable/4400230
- Curtis, K., & McClellan, S. (1995). Falling Through The Safety Net: Poverty, Food Assistance And Shopping Constraints In An American City. *Urban Anthropology and Studies of Cultural Systems and World Economic Development*, 24(1/2), 93-135. Retrieved May 12, 2020, from www.jstor.org/stable/40553280
- De Hoyos, R. E., & Medvedev, D. (2009). *Poverty effects of higher food prices: a global perspective*. The World Bank.
- de Paulo Farias, D., & dos Santos Gomes, M. G. (2020). COVID-19 outbreak: What should be done to avoid food shortages?. *Trends in Food Science & Technology*.
- Diehl, J. A., Oviatt, K., Chandra, A. J., & Kaur, H. (2019). Household food consumption patterns and food security among low-income migrant urban farmers in Delhi, Jakarta, and Quito. *Sustainability*, 11(5), 1378.
- Doss, C., Summerfield, G., & Tsikata, D. (2014). Land, gender, and food security.

FAO (Food and Agriculture Organisation) (1998) *The State of Food and Agriculture* 1998. Rome: Food and Agriculture Organisation of the United Nations. URL: <http://www.fao.org/WFS/>

FAO, 2009a. *Food Security and the Financial Crisis*. World Summit on Food Security, Rome 16–18 November 2009. WSFS Secretariat Office of the Assistant Director – General Natural Resources Management and Environment Department, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome

FAO, 2009a. *Food Security and the Financial Crisis*. World Summit on Food Security, Rome 16–18 November 2009. WSFS Secretariat Office of the Assistant Director – General Natural Resources Management and Environment Department, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome.

FAO, 2009b. *The State of Food Insecurity in the World 2008*. Food and Agriculture Organization, Rome. FAO, 2013. *World Food Situation, FAO Food Price Index, Food and Agriculture Organization*, Rome. <http://www.fao.org/worldfoodsituation/FoodPricesIndex/en/>

Hashmi, A. A., Sial, M. H., Akram, W., & Hashmi, M. H. (2019). Assessing food insecurity trends and determinants by using mix methods in Pakistan: Evidence from household pooled data (2005–2014). *Sarhad Journal of Agriculture*, 35(1), 87-101.

Hoddinott, J., & Yohannes, Y. (2002). *Dietary diversity as a food security indicator* (No. 583-2016-39532).

Huang, J., Nie, F., & Bi, J. (2015, November). Comparison of Food Consumption Score (FCS) and Calorie Intake Indicators to Measure Food Security. In *2015*

International Conference on Social Science, Education Management and Sports Education (pp. 1152-1158). Atlantis Press.

Institute for Agriculture & Trade Policy. Final Declaration of the World Forum on Food Sovereignty. URL: <https://www.iatp.org/documents/final-declaration-of-the-world-forum-on-food-sovereignty-0>

Ivanic, M., & Martin, W. (2008). *Implications of higher global food prices for poverty in low-income countries*. The World Bank.

Kakwani, N., & Son, H. H. (2016). Measuring food insecurity: Global estimates. In *Social welfare functions and development* (pp. 253-294). Palgrave Macmillan, London.

Krishnamurthy, P. K., Choularton, R. J., & Kareiva, P. (2020). Dealing with uncertainty in famine predictions: How complex events affect food security early warning skill in the Greater Horn of Africa. *Global Food Security*, 26, 100374.

Laborde, D., Martin, W., Swinnen, J., & Vos, R. (2020). COVID-19 risks to global food security. *Science*, 369(6503), 500-502.

LeBlanc, M., Lin, B. H., & Smallwood, D. M. (2007). *Food assistance: How strong is the safety net?* (No. 1490-2016-127526, pp. 40-45)

Lukas, P., & Mandado, M. (2018). The Impact of Productive Safety Net Program on Food Security of Beneficiary Households: The Case of Damot Gale, Damot Pulasa and Damot Sore Woredas in Wolaita Zone, Ethiopia. *Developing Countries Studies*, 8(1), 53-59.

Mcintyre, L., Dutton, D., Kwok, C., & Emery, J. (2016). Reduction of Food Insecurity among Low-Income Canadian Seniors as a Likely Impact of a Guaranteed Annual

Income. *Canadian Public Policy / Analyse De Politiques*, 42(3), 274-286. Retrieved February 15, 2020, from www.jstor.org/stable/canapublpolialanal.42.3.274

Millennium Development Goals, UNDP 2000. url: https://www.undp.org/content/undp/en/home/sdgoverview/mdg_goals.html

Mkhawani, K., Motadi, S. A., Mabapa, N. S., Mbhenyane, X. G., & Blaauw, R. (2016). Effects of rising food prices on household food security on femaleheaded households in Runnymede Village, Mopani District, South Africa. *South African journal of clinical nutrition*, 29(2), 69-74.

Mustafa, G., Ali, A., & Iqbal, N. Impact of Unconditional Cash Transfer on Child Nutrition in Pakistan: Evidence from Benazir Income Support Program (BISP).

Osmani, S. (1995). The entitlement approach to famine: an assessment. *Choice, Welfare and Development*. Oxford University Press, Oxford.

OXFAM International, Agriculture campaign - Global food prices in 2011: Questions & answers; www.oxfam.org/en/campaigns/agriculture/food-price-crisis-questions-answers.

Pinstrup-Andersen, P. (2009). Food security: definition and measurement. *Food security*, 1(1), 5-7.

Planning Commission, Islamabad, UNDP, UNOPS, November 2003. pp. 264. Lahore J. Econ. 9(1): 179-181.

Quisumbing, A. R., Brown, L. R., Feldstein, H. S., Haddad, L., & Peña, C. (1996). Women: The key to food security. *Food and Nutrition Bulletin*, 17(1), 1-2.

Reutlinger, S. (1977). Malnutrition: a poverty or a food problem?. *World Development*, 5(8), 715-724.

Reutlinger, S., & Selowsky, M. (1976). *Malnutrition and poverty. Magnitude and policy options*. Published for the World Bank by the Johns Hopkins University Press, Baltimore, Maryland 21218, USA.

Roy, D., Boss, R., & Pradhan, M. (2020). How India's food-based safety net is responding to the COVID-19 lockdown. *IFPRI book chapters*, 106-110.

Sahn, D. E. (1988). The effect of price and income changes on food-energy intake in Sri Lanka. *Economic development and cultural Change*, 36(2), 315-340.

SDPI. 2014. "The state of food security in Pakistan and options, Policy Review", SDPI. <https://www.sdpi.org/publications/files/Stateof-Food-Security-in-Pakistan-and-Policy-Options.pdf>

Seleiman, M. F., Selim, S., Alhammad, B. A., Alharbi, B. M., & Juliatti, F. C. (2020). Will novel coronavirus (Covid-19) pandemic impact agriculture, food security and animal sectors?. *Bioscience Journal*, 36(4).

Sen, A. (1981). Ingredients of famine analysis: availability and entitlements. *The quarterly journal of economics*, 96(3), 433-464.

Sen, A. (1982). *Poverty and famines: an essay on entitlement and deprivation*. Oxford university press.

Sibrian, R. (2008). Deriving food security information from national household budget surveys: experiences, achievements, challenges.

Sibrián, R., Ramasawmy, S., & Mernies, J. (2007). Measuring hunger at sub national levels from household surveys using the FAO approach: MANUAL. *ESS/ESSA/005e*. Rome: FAO Statistics Division.

- Sleet, P. (2019). Food Security in Pakistan: Surplus Food is Not Enough to Create a Food Secure Country.
- Smith, M. D., & Wesselbaum, D. (2020). COVID-19, Food Insecurity, and Migration. *The Journal of nutrition*, 150(11), 2855-2858.
- Swinnen, J., & Squicciarini, P. (2012). Mixed Messages on Prices and Food Security. *Science*, 335(6067), 405-406. Retrieved February 16, 2020, from www.jstor.org/stable/41486352
- Tefera, T., & Tefera, F. (2014). Determinants of household's food security and coping strategies for food shortfall in Mareko District, Guraghe Zone Southern Ethiopia. *Journal of Food Security*, 2(3), 92-99.
- Timmer, C. P. (2000). The macro dimensions of food security: economic growth, equitable distribution, and food price stability. *Food policy*, 25(3), 283-295.
- Timmer, P. (2004). Food security and economic growth: an Asian perspective. *Center for global development Working Paper*, (51).
- UNDP, (2015), Multidimensional Poverty in Pakistan, Ministry of Planning, Development and Reform, Poverty Alleviation and SDGs Section. URL:<https://www.pk.undp.org/content/dam/pakistan/docs/MPI/Multidimensional%20Poverty%20in%20Pakistan.pdf>
- USDA, 2009. Food Security Assessment, 2008-09. United States Department of Agriculture, Washington, DC.

APPENDICES

Appendix A

FISHER¹¹ INFLATION INDEX

For the inflation index variable used in sections 3.3.1 and 3.3.2, the inflation index was constructed using Fisher index mechanism. Fischer index is the geometric mean of Laspeyres index and Paasche index. Fisher index has the advantage over other indices that it takes into account the basket of both years of analysis.

Formulas for Index are as following:

Laspeyres Index:

$$Laspeyres = \frac{(Current\ year\ Price\ of\ Base\ year\ Basket)}{(Base\ year\ price\ of\ base\ year\ Basket)} * (100)$$

Laspeyres index takes the food basket of the base year and measures index on its base. The current price of basket is calculated by taking product of the quantity consumed in the base year with the current prices of the food items for all items in the basket. The base year price of basket is calculated by taking product of the quantity consumed in the base year with the base year prices of the food items for all items in the basket. The ratio of both is taken and multiplied with 100 to calculate the Laspeyres index in percentage.

Paasche Index:

$$Paasches = \frac{Current\ price\ of\ current\ Basket}{Base\ year\ price\ of\ current\ Basket} * (100)$$

¹¹ [https://corporatefinanceinstitute.com/resources/knowledge/economics/fisher-price-index/#:~:text=Similar%20to%20other%20consumer%20price,same%20amount%20of%20money\)..](https://corporatefinanceinstitute.com/resources/knowledge/economics/fisher-price-index/#:~:text=Similar%20to%20other%20consumer%20price,same%20amount%20of%20money)..)

Paasche index takes the food basket of the current year and measures index on its base. The current price of basket is calculated by taking product of the quantity consumed in the current year with the current prices of the food items for all items in the basket. The base year price of basket is calculated by taking product of the quantity consumed in the current year with the base year prices of the food items for all items in the basket. The ratio of both is taken and multiplied with 100 to calculate the Paasche index in percentage.

Fischer Index:

In Fisher index, both Laspeyres and Paasche index are used.

$$Fischer\ index = (Laspeyres * Paasches)^{0.5}$$

Fischer index is calculated by taking the geometric mean of Laspeyres and Paasche index.

Appendix B

BENAZIR INCOME SUPPORT PROGRAM

In July 2008, Government of Pakistan introduced its flagship safety net program named Benazir Income Support Programme (BISP). The primary aims of the initiative included providing poor household with straight cash amounts to increase their incomes and overcome income poverty. The timing of the program is important as international economic recession had repercussion for poor countries also and specific poor population within them. Pulling people out of adverse and chronic poverty were among the major goals and fortunately it has been achieved significantly.

The safety net program has contributed a great deal in meeting dietary needs of poor strata. The program aims to do that by increasing expenditure on consumption. By analysing data collected from rural areas of District Faisalabad, it was found that 11 percent points are consumed more by beneficiaries of the programme on multiple meals per day by improving quality and quantity of food. The cash transfer also reduced hunger depth and improved diet quality (Brugh *et al* 2017). BISP has also caused positive impact of child nutrition statistic around the country. (Impact of Unconditional Cash Transfer on Child Nutrition in Pakistan: Evidence from Benazir Income Support Program (BISP) Ghulam Mustafa, Amannat Ali, Nasir Iqbal).

Apart from the gains in household food security, BISP has, under the umbrella of Ehsaas Koi Bhooka Na Soye, initiated an in-kind food security system. Under the initiatives free meals are distributed among poor and labours to improve their wellbeing and fulfil their dietary needs. The program operates through multiple truck kitchens in Lahore, Peshawar and Faisalabad. Each truck can feed more than 1500 people daily.

The beneficiaries receive cash transfers through numerous ways which include assistance from postal and banking services. The amount that the beneficiaries received at the time of inception was 3000 rupees per quarter, which now has increased to 5000.

The program also provides assistance for education of children aged 5 to 12 years through its Waseela-e-Taleem (WeT) programme. Cash awards are given to children if they meet minimum attendance and academic criteria. Studies on experience of beneficiaries elaborate that most of the households use the amount on food, health expenditure, clothing and education.

BISP hopes to alleviate its beneficiaries from poverty as it remains a goal in Sustainable Development Goals. Poverty rates of BISP beneficiaries remain high. BISP uses two poverty lines to as threshold for targeting the beneficiary population. These are Food Energy Intake poverty line which takes minimum expenditure required to meet threshold level of calories for healthy life, and cost of basic needs poverty line which accounts for factors other than food. According to BISP evaluation survey, in Pakistan around 33% beneficiaries of were Ultra-poor, 32 % were poor, and 20 % were vulnerable to poverty.

BISP has played an impressive role in government's relief initiative during COVID-19 pandemic. The dataset and the infrastructure developed by BISP was used to provide relief package to more than a million households. Initiatives like BISP help governments meet the basic development goals during national level crises.

BISP has proved to be a very beneficial initiative as Government of Pakistan's flagship safety net initiative. Numerous steps can be taken to improve its efficacy and efficiency. The amount of allowances should be revised more frequently to overcome the impacts of inflation as it has been observed through the study that inflation has negative impact on household food security. Vocational training can improve household's incomes and improve their dietary

need as education and skills trainings are positively impacting household food security.
Beneficiary population should be revised and more people should be accommodated.

Appendix C

COVID-19 PANDEMIC AND FOOD SECURITY

COVID-19 has brought devastating impact upon world's socioeconomic and health conditions. Till 10th January 2021, the world had recorded 90 million cases and nearly 1.9 million deaths. (WHO, 10th January 2021). The novel virus has put the world through the worst economic recession. Around the globe, 135 million people whose nutritional need were already in perilous condition, have become even more vulnerable. These bottom strata people around the globe need urgent attention. Low-income countries are facing a challenge in which they have choose among saving lives of their people or the economy. In the worst-case scenario, saving people from the corona virus implies them dying from hunger. To prevent the worst food insecurity crises, governments, non-government organizations and international organizations need to join to avoid hunger crisis.

Around the world governments, under recommendations from World Health Organization, are taking measures to minimize the human contact so as to contain the spread of virus. Industries, schools, universities, are operating online digitally. COVID-19 has also caused huge economic downturn threatening food security. ([Nicola et al., 2020](#); [WHO, 2020](#)). Due to closure of industries for containing spread of virus, unemployment, particularly for labour working in informal sector, is rising. This lack of livelihood is likely to induce food insecurity.

Covid-19 outbreak has not yet directly affected the global food supply chain. However, restrictions imposed by health authorities around the globe to curtail spread of virus can disturb the supply chains. Food supply chain is a very complex chain as it connects

agriculture sector with retails through numerous step. Smooth functioning of the chain is vital for avoiding food availability crisis. ([Siche, 2020](#)).

The virus has been observed to be constantly mutating from its advent, and this makes it hard to predict how long will it prevail. Food and Agriculture Organization has given its advisory to avoid food crisis during the crisis. In-kind safety nets providing food assistance should be introduced. Agriculture sector should be facilitated in whatever way possible to improve production and keep supply chain robust. Global food trade should be facilitated to improve global food security. ([Cullen, 2020](#)). ([FAO, 2020c](#)).

COVID-19 has elaborated the need for effective and wide-based safety nets that will safeguard the need of financially imperilled groups. The struggle to meet minimum dietary needs and dietary diversity objectives is life threatening for labour force working in informal sectors including self-employed, subcontracted labourers, small farmers, and landless workers. Given the novelty of the COVID-19 situation, the first option that health authorities have is to contain the disease. Unfortunately, this comes at a high socioeconomic cost of leaving labour force without work and creating food insecurity.

Like rest of the world, COVID-19 pandemic has hit Pakistan too and the infection is spreading fast in Pakistan. Till January 2021, over half a million confirmed cases and more than ten thousand deaths had been reported in Pakistan¹². Pakistan's economy was already going through high inflation and sluggish growth. This pandemic acted as an external shock to the economy and caused rapid increase in unemployment and loss of incomes among households. Food insecurity is already a major crisis in Pakistan, and around 30 percent of people in Pakistan face some kind of food crisis. There lies strong

¹² <https://covid.gov.pk/>

threat that the number of nutritionally challenged people will rise in areas hit by the COVID. The most vulnerable segment of the population is the poorest who already face acute hunger and malnutrition. Lockdowns imposed by government to contain the spread of COVID is impacting the livelihoods of poor people. The daily wage class in both agriculture and non-agriculture sectors are the at the risk of going into food insecurity.

The Coronavirus, lockdown and closure of a wide range of businesses in both urban and rural areas are adversely affecting the hundreds of thousands of workers and daily wagers and their families, particularly those without any financial resources to arrange even for essential daily food/non-food items required for their survival. The rising prices of basic food items is further adding to their stress and vulnerability.

Governments should allocate funds for food security programmes. In the wake of global pandemic, a major portion of funds is driven into health sector. But the policymakers should make sure allocation of funds for food security for the people whose livelihoods got affected due to the pandemic. Latest research and studies should be conducted to measure the prevalence and intensity of food insecurity and malnourishment among the poor. Special attention should be given to dietary conditions of women, children and elderly. This information can strengthen government's policy making and management over the food supply chains and facilitate farmers to make rational production decisions.