International Journal of Social Science and Entrepreneurship ***(IJSSE)*** ***Vol 4 , Issue 1***
ISSN (Online): 2790-7716, ISSN (Print): 2790-7724 ***January to March 2024***

The Nutritional Implications of High Wheat Prices on Agriculture Households in Pakistan

Isra Asif
Ph.D. Scholar, Department of Economics (S3H),
National University of Sciences & Technology (NUST), Islamabad,
isra.phd16s3h@student.nust.edu.pk

Ather Maqsood Ahmed
Professor, Department of Economics (S3H),
National University of Sciences & Technology (NUST), Islamabad,
ather.ahmed@s3h.nust.edu.pk

Abstract

This study analyzes the potential repercussions of high wheat prices on agriculture household economic and nutritional well-being in Pakistan. This task was accomplished by formulating a theoretical model to capture the economic behavior of agricultural households that produce marketable surpluses of wheat. For empirical verification, eight modules of nationally representative Household Integrated Economic Survey (HIES) were combined with approximate price levels to create a pooled cross-sectional sample of annual price-indices for household expenditure from 2000-01 to 2018-19. The study uses the Linear Approximate of Almost Ideal Demand System (LA-AIDS) model to derive demand elasticities and conduct a comparative static analysis. Finally, the model is extended to assess household nutritional well-being by linking price effects to calorie intake. The empirical findings demonstrated that high wheat prices resulted in high farm revenues for agricultural households. Although wheat consumption has declined, these households have used excess profits to diversify the food basket, which in turn led to an improvement in calorie intake. An indirect spillover effect from changes in wheat prices has also been observed, leading to an increase in demand for domestically produced commodities. Since the overall impact of wheat price increase on agricultural and non-agricultural households is mixed, it is proposed to pursue a careful food security policy to ensure the economic and nutritional well-being of the entire society. This study adopts a two-pronged approach of social to integrating social safety nets that does not hinder agricultural growth to achieve a mutually rewarding outcome.

Keywords: *Agriculture households, wheat prices, nutritional implications*

Introduction

Background

Wheat is a staple food in Pakistan which constitutes around 72 percent of the caloric requirements [Zulfiqar and Hussian (2014)]. The significance of wheat goes beyond just being used as a food crop for the country. It occupies more than one third of planted acreage, contributes 8.2 percent to agricultural value-added and 1.9 percent to Gross Domestic Product (GDP).[1] Over the years, Pakistan has been self-sufficient in wheat production despite phenomenal population growth. However, in recent years, food security has been at stake for various reasons, including the negative impact of climate change and global warming on agricultural production, increasing prosperity, the smuggling of wheat and wheat products to neighboring countries, and inadequate investment in agricultural research and extension, and unprecedented urban sprawl that is shifting agriculture to peripheral areas where land productivity is relatively low.[2] The combined effect of both, demand and supply side shocks is now being felt not only on domestic prices but also on the maintenance of buffer stocks of wheat as a strategic reserve. Furthermore, unprecedented global events over the past two decades have added salt to injury. Following the 2007-08 financial crises, there was an unprecedented surge in commodity prices. This situation was further aggravated first by the COVID-19 pandemic and then by the Russo-Ukrainian war, which seriously disrupted the global wheat supply situation. We assume that this imbalance in supply and demand and the resulting price pressures have already raised concerns for the nutritional well-being of the masses. Concerns are also raised regarding food availability within the family and Pakistan's poor performance on relevant Sustainable Development Goals (SDGs).[3] The constant demand pressure has also jeopardized the goal of ensuring price stability through an effective policy-making process in all provinces and regions of the country.[4]

[1] Pakistan Economic Survey (2022-23) and Barkley (1992).

[2] Willenbockel (2022) has confirmed that the wheat stock to use ratio has declined from 103 million tonnes in 2018-19 to 91 million tonnes in 2021-22.

[3] See Idrees *et al.* (2013) and Filho (2020).

[4] Given the strategic significance of wheat for nutritional well-being, successive governments in Pakistan have intervened in wheat markets with an objective to stabilize prices to make them affordable for consumers. An excellent discussion on how these interventions had influenced economic efficiency can be found in Dorosh *et al.* (2008).

Problem Statement

We argue that attempts to predict the distributional consequences of high wheat prices are often hampered by complex behavioral patterns of semi-commercialized rural households. The heterogeneity is such that most households in rural districts of Pakistan produce wheat partly for sale and partly for own consumption. They also purchase some of their agricultural inputs (e.g. fertilizers) and provide some (e.g. family labor) from their own resources. Fluctuations in wheat prices affect not only their production decisions but also consumption and labor-supply decisions. On the other hand, there are households whose land holdings are rather small. These households produce wheat only for their own consumption without generating a marketable surplus[5]. Their decisions about production, consumption, and labor supply differ not only from those of households in the first category, but also from those of landless households who had to purchase wheat by engaging into some sort of work effort.

Research Objectives

The research objectives of this study are two-fold:

- To understand how price fluctuations of wheat and wheat flour alter the expenditure patterns of agriculture households in Pakistan. This will be based in the first step on the theoretical demand modeling and then on the decomposition of total price effect into different components; and
- To assess the potential consequences of an increase in the prices of wheat and wheat flour on the nutritional well-being of agriculture households in Pakistan.

Consistent with research objectives, we formulate a constrained optimization problem[6] for these rural households to derive welfare implications from wheat price fluctuations. A key assumption of the model is that agriculture households make decisions as if markets were complete. This underpins the extremely powerful finding that the simultaneous production and utility maximization problems can be modeled recursively, with maximization of farm revenues occurring in a first stage without reference to decisions about consumption of goods and leisure. In the second stage, agricultural households maximize their utility and treating the profits on the production side as given. This argument holds that since the household can always buy or sell wheat at a fixed price, the amount of wheat to be produced can be determined independently of

[5] Marketable surplus is the proportion of total produce that the farmer sells in the market.
[6] Constrained optimization problem is the process of maximizing an objective function subject to constraints.

the amount of wheat to be consumed. Similar to this, since the difference can be hired at a fixed wage, the amount of labor used to produce wheat can be determined independently of the amount of family labor to be used. The only factor limiting family labor or wheat consumption is household income. The household cannot consume more wheat or leisure (that is, reduce its labor supply and use more hired laborers) than it's allowed by their total income. Since the household always prefers more income, it makes sense to maximize profits and then allocate the resulting income to non-agriculture commodities given the prevailing market prices. With price fixed, therefore, the two components of the model are related only through income and only in one direction, from the production side of the model to the consumption and labor-supply side. This argument is similar to that of Singh *et al.* (1986). Demand analysis naturally leads to a careful breakdown of the total price effect using the augmented Slutsky Decomposition technique[7], which in turn, would be useful for inferring nutritional implications when assessed jointly employing caloric-intake charts. The possible effects of wheat price spikes on Pakistani agricultural households' nutritional well-being, however, are not well understood empirically. Empirical findings can offer helpful information for rethinking current policy initiatives and programs or launching new ones in order to improve living conditions of households in Pakistan.

Layout of the Study

The remainder of the paper is organized as follows: Section 2 presents the theoretical framework for generating demand functions for distinct categories of households. Relevant details with regard to data and methodology are presented in Section 3. Empirical findings and analysis are presented in Section 4, and the final Section 5 concludes the study with policy suggestions.

Literature Review

The impact of income, price and other socioeconomic factors on global food demand has received considerable research attention. Theoretically, demand for food - considered essential - should be positively influenced by income and negatively price inelastic, with some possible exceptions, such as: B. certain nutrient-poor foods that are consumed primarily in small quantities by poor or destitute people with low income. These theoretical positions are well supported by empirical data (see, for example, Babu, Gajanan and Hallam, 2017 for a summary

[7] The Slutsky Decomposition, introduced by Eugen Slutsky, relates changes in Marshallian demand to changes in Hicksian demand. There are two components of the Slutsky Equation, namely the expenditure effect, and substitution effect.

of food demand studies conducted around the world over the years). The evidence from Haq et al. refer to Pakistan. (2011), Ullah (2018), Shaheen (2020), to name a few, generally support these theoretical positions. The primary starting points are the relative strengths of price and income effects across different food commodities and groups, as well as specific cases of commodities whose demand appears to be defying expectations.

Many studies have examined the impact of food price spikes and/or volatility on diet quality, poverty, and food insecurity, among other issues. These studies followed the global food crisis of 2007-2008 and have continued since then. In a cross-country study, Anríquez, Daidone, and Mane (2013) found that rising food prices not only cause people to consume less high-calorie foods, but they also worsen the distribution of food calories within households, which worsens the nutritional status of people , who live in developing countries such as Bangladesh, Cambodia, Guatemala, Kenya, Malawi, Nepal, Pakistan, Tajikistan and Vietnam. García-Germán, Bardají, and Garrido (2018) focused on households in 26 EU member states and also found that rising food prices for consumers that followed the global increase in agricultural commodity prices from 2007 to 2012 led to an increase in food consumption contributed to disadvantage, particularly for low-income households in the densely populated areas of EU Member States and in the lowest income quintiles.

The impact of grain price shocks on household food security in Tanzania was examined by Rudolf (2019). The results showed that shocks to grain prices had negative impacts on households in both rural and urban areas, with rural landless households most at risk. Specifically, a fifty percent increase in grain prices causes rural, urban, and rural landless households' calorie consumption to decrease by four percent, five percent, and twelve percent, respectively. Hoang (2018) conducted a study that found that low-income households in Vietnam were more vulnerable to malnutrition because they reduced their daily calorie intake in response to price shocks in the food market. Similarly, Wossen, Berger, Haile, and Troost (2018) found that price fluctuations had a negative impact on the food security of agricultural households in East and West Africa

The Theoretical Framework

We assume that the utility of agriculture households is described by the following quasi-concave Cobb-Douglas utility function:

$$U = C_W^{\alpha} C_F^{\beta} C_{NF}^{\gamma} L^{\theta} \quad (1)$$

where the commodities are classified as: agriculture staple (wheat and wheat flour C_W); other agriculture (C_F) and non-agriculture (C_{NF}) commodities; and time allocated to leisure activities (L). The coefficients α, β, γ, and θ are positive constants that reflect returns to scale. The concavity of the function is assumed by the following restrictions: $U_{C_W} > 0$; $U_{C_F} > 0$; $U_{C_{NF}} > 0$; and $U_L > 0$; and $U_{C_W C_W} < 0$; $U_{C_F C_F} < 0$; $U_{C_{NF} C_{NF}} < 0$; and $U_{LL} < 0$. The objective of maximizing utility is subjected to the following budget constraint:

$$P_W(Q_W - C_W) - \sum_{i=1}^{N} P_i R_i - w_M(N - N_F) + V = P_F C_F + P_{NF} C_{NF} \quad (2)$$

where Q_W is the production of wheat and wheat flour (so that, $Q_W - C_W$ is its marketable surplus. The agricultural household experiences a time constraint (3) which shows that the total time (T) is allocated between farm employment (N_F) and leisure activities (L) as:

$$T = N_F + L \quad (3)$$

Agricultural activity may require additional workers in addition to family labor. In this case $N - N_F$ would represent non-family hired workers. However, a negative value of $N - N_F$ would represent family labor only. It is assumed that family and hired labor are perfect substitutes, therefore can be added directly. We defined R_i as a non-labor variable representing agricultural inputs such as chemical fertilizers, pesticides, and seeds; and P_i is the market-price of the non-labor variable agricultural input. The market wage is defined as w_M so that, $w_M T_M$ is the income from off-farm employment. V is the monetary income from non-agricultural sources such as remittances. Finally, P_W, P_F, and P_{NF} are the prices of C_W, C_F, and C_{NF}, respectively.

The household's production decision is further clarified. We assume that agricultural households experience a production constraint, which depicts the relationship between variable and fixed inputs and farm output as follows:

$$Q_W = Q_W(N, R_i, A, K) \quad (4)$$

where A and K are the fixed quantities of agricultural land and capital, respectively. Production is assumed to be non-risky. Finally, and perhaps most importantly, the four prices in the model assumed to be unaffected by the activities of the agriculture households. That is, they are price

takers in four markets; this leads to a recursive model. Incorporating expression (4) into expression (2) for Q_W and incorporating expression (3) into expression (2) for N_F yields the revised single budget constraint:

$$w_M T + \pi + V = P_W C_W + P_F C_F + P_{NF} C_{NF} + w_M L \qquad (5)$$

where $\pi = P_W Q_W(N, R_i, A, K) - w_M N - P_i R_i$ is a measure of farm-revenues and $w_M T$ is the value of the stock of time.

Solvi this constraint optimization problem leads to Marshallian demand functions for wheat and other products. The decomposition of total price effect is as follows: [8]

$$\frac{dC_W}{dP_W} = \frac{dC_W}{dP_W} + \frac{dC_W}{dM}\frac{dM}{dP_W} \qquad (6)$$

The first term on the right-side of this expression, i.e., $\frac{dC_W}{dP_W}$ is the standard result of consumer demand theory for a normal good, which is negative. The second term captures the profit-effect which accrues when an increase in the price of the staple crop increases farm profits and thus full income. Applying the envelope theorem to expression (6) we find that:

$$\frac{dM}{dP_W} dP_W = \frac{d\pi}{dP_W} dP_W = Q_W dP_W \qquad (7)$$

This is the positive profit effect, which is equal to production multiplied by the price increase. This is the innovation of standard demand theory that must be taken into account due to the simultaneity of production, consumption and labor supply decisions for farmers producing marketable wheat surpluses. It should be added that the standard model will hold for non-farm landless households; and the standard model, albeit with slight modifications, will hold for subsistence farmers.

Research Methodology

For empirical purposes, eight modules of the nationally representative Household Integrated Economic Survey (HIES) were combined with approximate price-levels to generate a pooled cross-sectional sample of annual price-indices at household expenditure levels from 2000-01 to

[8] The complete derivation is available with the corresponding author.

2018-19. This allowed us to determine the fluctuations in the prices of wheat and wheat flour throughout the cross-sectional surveys, which is necessary for analyzing adjustments in the spending patterns of agricultural households in response to an increase in the prices of wheat.[9] It is worth noting that the data gathered through HIES indicates household's expenditure for the last year, which incidentally spans multiple calendar-defined quarters. To align price data with irregular dates of interview, we created annual price indices to capture fluctuations in spending for each commodity at the aggregation level. These indices cover the periods 2001-02, 2005-06, 2007-08, 2010-11, 2011-12, 2013-14, 2015-16 and 2018-19. Finally, commodity prices were assigned to a household based on its interview data.

The complete demand system (inclusive of leisure) was approximated using a flexible functional form – the Linear Approximate of Almost Ideal Demand System (LA-AIDS) introduced by Deaton and Muellbauer (1980). The demand equations are approximated by applying the iterated linear least-squares (ILLS) estimation procedure of Blundell and Robin (1999) and used by Lecocq and Robin (2015). This approach differs from many other studies that have either restricted consumption and leisure demands to a small number of expenditure categories [West and Williams, (2004)], or approximated income and price elasticities utilizing a single cross-sectional survey [Jorgenson, (2013)]. We believe that the simultaneous use of the eight modules of cross-sectional surveys to approximate the demand of heterogeneous economic agents is an innovative idea that brings novelty to the analysis.

Knowing the expenditure and price variables for each expenditure category, the following budget share equation for farm households was approximated using the iterated linear least squares estimator.

$$w_{C_W} = \alpha_{C_W} + \sum_{C_F=1}^{n} \gamma_{C_W C_F} \ln(p_F) + \sum_{C_{NF}=1}^{n} \gamma_{C_W C_{NF}} ln(p_{NF}) + \sum_{C_L=1}^{n} \gamma_{C_W C_L} ln(w_M) + \sum_{R_i=1}^{n} \gamma_{C_W R_i} ln(p_i) + \beta_{C_W} \ln ({}^{M}/_{P^*}) \quad (8)$$

where $M = P_W(Q_W - C_W) - \sum_{i=1}^{n} P_i R_i - w_M N_F + V$ and w_{C_W} is the budget-share of wheat.

[9] Within the cross-sectional survey, the prices of wheat and wheat flour continue to be consistent.

The parameters – α, β and γ – are interpreted as.

$\boldsymbol{\alpha_{C_W}}$: The constant-term ($\alpha_{C_W}$) denotes the average expenditure share associated with logarithmic expenditure and wheat prices equivalent to unity.

$\boldsymbol{\beta_{C_W}}$: With wheat prices kept constant, β_{C_W} denotes the percentage change in the expenditure share of wheat in response to an increase in monetary income; and

$\boldsymbol{\gamma_{C_W C_F}}$: With monetary income remains unchanged, $\gamma_{C_W C_F}$ denotes the percentage change in the expenditure share of wheat and wheat flour in response to an increase in composite commodity prices.[10]

In the final step of the empirical work, the model was extended to evaluate the nutritional well-being of agricultural households. For this purpose, Strauss's (1986) method for breaking down goods with different calorie content was adopted. The Food Composition Table for Pakistan has been utilized to extract the calorie concentrations for wheat and composite commodities. While expenditure data from cross-sectional surveys is reported in different measurement units, calorie concentrations are typically provided per 100 grams for each food item in the Food Composition databases. The quantities of each food item, therefore, are transformed into grams, when necessary. The quantities of each food item consumed in grams were then multiplied by the database's conversion ratios of calories per 100 grams; so, the result is calorie availability.
In our study, we prefer to use the AIDS functional form because it provides an effective mix of global regularity and great flexibility in addressing price and income components. Other functional forms, such as LES, QES, QUAIDS, and AIDADS have favorable regularity characteristics but a lack of flexibility. A study by Cranfield et al. (2002) compares the performance of different functional forms (i.e., LES, AIDS, AIDADS, QUAIDS, and QES) using a sample of countries with varying income-levels. They found that the functional form of AIDS, QUAIDS, and QES outperform LES and AIDADS, both in-and-out sampling criteria.

Discussion and Analysis

Similar to many other studies, we also estimated the demand system for agricultural households in Pakistan based on the expenditure shares and prices of each commodity. However, as noted, our analyses are based on information spanning nearly two decades. Table 1 shows the

[10] $\gamma_{C_W C_{NF}}$ interpreted in a similar way.

uncompensated elasticity matrix with cross-price elasticities (off-diagonal elements) and own-price elasticities (on-diagonal elements) calculated for farm households from the full system of demand equations.[11] The row-elements are the expenditure-shares of wheat and wheat flour (S_{C_W}), agriculture commodity (S_F), non-agriculture commodity (S_{NF}), and leisure (S_L). The column-elements are the prices of C_W, C_F, C_{NF}, and L, respectively. The table also demonstrates the ramifications of price fluctuations in wheat and wheat flour (P_W)on C_W, C_F, C_{NF}, and L.

Table 1:
Un-compensated Cross-and-Own Price Elasticities of Agriculture Households Producing Surplus Wheat

	P_W	P_{cc}	P_{NF}	P_i
S_{C_W}	-0.086**	0.335***	0.176*	-0.186***
	(0.032)	(0.097)	(0.10)	(0.046)
S_{cc}	0.488***	-0.658***	0.108***	-0.006***
	(0.053)	(0.022)	(0.031)	(0.010)
S_{NF}	1.021***	0.004	-0.408***	-0.021***
	(0.079)	(0.033)	(0.046)	(0.015)
S_L	0.058***	-0.015***	-0.022***	-0.011***
	(0.004)	(0.002)	(0.002)	(0.001)
S_{R_i}	0.747***	0.222***	0.225***	-0.981***
	(0.073)	(0.030)	(0.042)	(0.014)

***** p<0.01, ** p<0.05, * p<0.1**

Own-Price Elasticity: A negative or relatively inelastic own price elasticity of wheat and wheat flour causes farm households to reduce their consumption of wheat and wheat flour by -0.086

[11] We have calculated the Hicksian (compensated) and Marshallian (un-compensated) cross-and-own price elasticities. Hayat et al. (2022) argued that Marshallian (un-compensated) elasticities provide a more accurate picture of complements and substitutes in comparison to Hicksian (compensated) elasticities. Therefore, we have only discussed cross-and-own price effects of un-compensated elasticities in detail.

percentage points in response to a one percent price increase. This suggests that households are comparatively unresponsive to price fluctuations. We consider this result to be plausible for two reasons. First, the sample of households used in the present study belongs to farmers who produce marketable surplus and are therefore classified as net sellers of wheat. An increase in the price of wheat acts as a favorable price shock for them, increasing their agricultural income. As these households' income increases, they tend to spend less on agricultural staples (wheat) and more on agricultural and non-agricultural goods, which is consistent with Engel's Law. Thus, the result does not rule out the possibility that the conventional negative price effect is counter-balanced by the positive profit effect.

Second, although our results do not support earlier findings of Singh *et al.* (1986) and Haq *et. al* (2011) who found a positive own-price elasticity, they are in conformity with the findings of Ahmad *et al.* (2015); and Malik *et al.* (2015) where it was shown that high-income rural households in Pakistan spend a large fraction of their disposable incomes on dairy products compared to low-income rural households whose expenditures are largely limited to cereal grains (such as rice and wheat) and legumes.

Cross-Price Elasticities: We find that the cross-price elasticities of agriculture and non-agriculture commodities ($\eta_{C_F P_W}$) and ($\eta_{C_{NF} P_W}$) are positive, implying that the agriculture households increase their consumption of C_F and C_{NF} with respect to a 1% increase in the prices of wheat and wheat flour (P_W). These approximate cross-price elasticities are in-line with the empirical findings of Shaheen *et al.* (2022), who also showed substitutability between certain commodities. However, the estimated cross-price elasticities are significantly larger due to a positive profit effect that offsets the conventional negative income effect and the substitution effect. Again, an increase in the price of wheat may have been the source of an increase in farm revenue, which in turn may have increased demand for the commodities produced by landless rural households. As a consequence, the negative effect of rising wheat prices on non-agriculture households is mitigated to some extent by the spillover of profit-effect through output markets, thereby dispersing the benefits throughout the rural community.[12] The result regarding leisure time is even more revealing in this regard. Farm households appear to have experienced an

[12] The remaining cross-price elasticities are interpreted in a similar way.

increase in leisure time in response to the rise in wheat prices. Their willingness to devote a significant percentage of their increased agricultural income to leisure activities results in a reduction in family work effort.

The approximate cross-price elasticities of the present study, particularly with respect to leisure, are consistent with previous empirical research by Singh *et al.* (1986) that assessed the economic behavior of semi-commercialized rural households in seven low- and middle-income economies in Japan, Korea, Malaysia, Nigeria, Sierra Leone, Taiwan, and Thailand. Using the Linear Expenditure System (LES), the authors were also able to demonstrate a positive cross-price elasticity of leisure with regard to the price of rice.

Nutritional Implications: In Table 2 we present the uncompensated price elasticity of calorie availability for agricultural households. These households are encouraged to improve their calorie intake in response to increasing farm income. Although the wheat consumption of these surplus wheat farmers is declining, the excess profits used to diversify food purchasing may be responsible for the increase in total calorie intake. Our estimated price-calorie elasticity is consistent with the empirical findings of Friedman et al. (2011) who also examined the possible impact of high wheat prices on calorie availability in Pakistan. Using compensating variation (CV), they found that rural households with access to land had 5 percent higher calorie availability compared to households without access to agricultural land after wheat prices increased by 40 percent.

Table 2
Un-compensated Price Elasticity of Calorie Availability

	P_W
S_{c_W}	-0.144
	(0.065)**
S_{c_c}	0.234***
	(0.055)
NET EFFECT	0.09

***** p<0.01, ** p<0.05, * p<0.1**

Conclusion and Recommendation

This study attempted to develop a theoretical model for agricultural households producing surplus wheat in Pakistan, integrating consumption, labor-leisure and production decisions are simultaneously and in a consistent manner. This model was then subject to empirical testing using multiple rounds of HIES employing the Linear Approximate of Almost Ideal Demand System (LA-AIDS), which approximates the complete demand system inclusive of leisure. This model was then further extended to explore the effects of high wheat prices on the nutritional well-being of agriculture households.

The study found a negative own-price effect of wheat price on consumption. On the other hand, the cross-price elasticities were found to be positive and sizeable. Finally, the estimated price-calorie elasticity confirmed that an increase in the price of wheat generated a profit effect that enabled food basket diversification for net-sellers of wheat, which in turn led to increased calorie intake. This leads to an improvement in their nutritional well-being. The study also observed an indirect spill-over effect of positive changes in wheat and wheat flour prices on non-agricultural commodities, where an increase in demand for domestically produced goods was observed. However, since a large proportion of predominantly urban households still depend on wheat and purchase wheat in the market, the net effect of wheat price volatility, regardless of gains, is likely to be unfavorable for rural households with a wheat surplus. In the light of this, the study suggests that the vision of social protection has to go beyond cash and food transfers to include a comprehensive range of interventions, including measures that not only protect consumers and but also are supportive of producers. There is a great potential for synergies between systems that integrate social protection of vulnerable groups and also provide support for local wheat production. Therefore, instead of separating social protection and agricultural growth as two distinct areas, a two-pronged approach of integrating of the two is likely to be more rewarding.

References

Ahmad, N., Sheikh, M. R., & Saeed, K. (2015). Rural urban food consumption analysis in Pakistan: Expenditure elasticities approach. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *9*(1), 159-170.

Anríquez, G., Daidone, S., & Mane, E. (2013). Rising food prices and undernourishment: A cross-country inquiry. Food Policy, 38, 190–202.

Babu, S. C., Gajanan, S. N., & Hallam, J. A. (2017). Consumer theory and estimation of demand for food. *Nutrition Economics*, 81-115.

Barkley, A. P. (1992). Wheat price policy in Pakistan: a welfare economics approach. *The Pakistan Development Review*, *31*(4), 1145-1156.

Blundell, R., & Robin, J. M. (1999). Estimation in large and disaggregated demand systems: An estimator for conditionally linear systems. *Journal of Applied Econometrics*, *14*(3), 209-232.

Cranfield, J. A., Preckel, P. V., Eales, J. S., & Hertel, T. W. (2002). Estimating consumer demands across the development spectrum: maximum likelihood estimates of an implicit direct additivity model. *Journal of Development Economics*, *68*(2), 289-307.

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *The American economic review*, *70*(3), 312-326.

Dorosh, P., & Salam, A. (2008). Wheat markets and price stabilization in Pakistan: An analysis of policy options. *The Pakistan Development Review*, 71-87.

Friedman, J., Hong, S. Y., & Hou, X. (2011). *The impact of the food price crisis on consumption and caloric availability in Pakistan: evidence from repeated cross-sectional and panel data*. World Bank, Washington, DC.

García-Germán, S., Bardají, I., & Garrido, A. (2018). Do increasing prices affect food deprivation in the European Union? Spanish Journal of Agricultural Research, 16(1), e0103, 14.

Haq, Z., Nazli, H., Meilke, K., Ishaq, M., Khattak, A., Hashmi, A. H., & Rehman, F. U. (2011). Food demand patterns in Pakistani Punjab. *Sarhad Journal of Agriculture*, *27*(2).

Hayat, N., Mustafa, G., Alotaibi, B. A., & Traore, A. (2022). Nutritional Demand and Consumption Pattern: A Case Study of Pakistan. *Sustainability*, *14*(12), 7068.

Hoang, H. K. (2018). Analysis of food demand in Vietnam and short-term impacts of market shocks on quantity and calorie consumption. Agricultural Economics, 49(1), 83–95.

Idrees, M., Asma, M., & Khalid, Z. (2013). Welfare impacts of food price inflation in Pakistan.

Jorgenson, D. W. (2013). *Double dividend: environmental taxes and fiscal reform in the United States*. MIT press.

Leal Filho, W., Trevisan, L. V., Rampasso, I. S., Anholon, R., Dinis, M. A. P., Brandli, L. L., ... & Mazutti, J. (2023). When the alarm bells ring: Why the UN sustainable development goals may not be achieved by 2030. *Journal of Cleaner Production*, *407*, 137108.

Lecocq, S., & Robin, J. M. (2015). Estimating almost-ideal demand systems with endogenous regressors. *The Stata Journal*, *15*(2), 554-573.

Malik, S. J., Nazli, H., & Whitney, E. (2015). Food consumption patterns and implications for poverty reduction in Pakistan. *The Pakistan Development Review*, 651-669.

Rudolf, R. (2019). The impact of maize price shocks on household food security: Panel evidence from Tanzania. Food Policy, 85, 40–54. Article in Press.

Shaheen, S., Almas, L., & Usman, M. (2022). Wheat consumption determinants and food security challenges: Evidence from Pakistan.

Singh, I., Squire, L., & Strauss, J. (1985). Agricultural household models: a survey of recent findings and their policy implications.

Strauss, J. (1986). Estimating the determinants of food consumption and caloric availability in rural Sierra Leone. *Agricultural Household Models: Extensions, Applications, and Policy*, 116-152.

Ullah, I. (2018). Food consumption in Pakistan: Applications of linear approximate almost ideal demand system (LA/AIDS).

West, S. E., & Williams, R. C. (2017). Estimates from a consumer demand system: implications for the incidence of environmental taxes. In *Distributional Effects of Environmental and Energy Policy* (pp. 117-140). Routledge.

Zulfiqar, F., & Hussain, A. (2014). Forecasting wheat production gaps to assess the state of future food security in Pakistan. *Journal of Food and Nutritional Disorders*, *3*(3), 2.