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The Welfare Implications of Wheat and Wheat Flour Price Volatility in Pakistan

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Abstract

The international food crisis has shown a sharp upward pattern and increased variability over the last two decades, sparking concerns that hunger and poverty will spread throughout the world. Rising agricultural commodity prices, however, also provide many low-income economies with an incentive and an opportunity to increase their growers' contribution to both domestic economic growth and poverty alleviation. In light of the global food crisis, which presents both opportunities and risks to different segments of society, the main objective of this paper is to categorize market participants in wheat and wheat flour into three groups: net-buyers, net-sellers, and subsistence. Net Benefit Ratio (NBR), introduced by Deaton (1989), is computed by gathering information from the eight modules of the Household Integrated Economic Survey (HIES). The findings demonstrate that 85 percent of the population under study was considered a net buyer of wheat and wheat flour, indicating that their welfare is negatively impacted by increases in wheat prices. Additionally, by acting to reduce risks and take advantage of opportunities presented by such a crisis, in comprehending the likely effects of the wheat crisis among heterogeneous households, this paper seeks to support national decision makers and their international development partners.

Keywords: Net Benefit Ratio (NBR), Net-buyers, Net-sellers, Self-sufficient, Wheat and wheat flour price.

Jel codes: Q18, Q02.



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1. Introduction

Wheat is a staple crop in Pakistan which constitutes around 72% of the caloric needs [Zulfiqar and Hussain (2014)]. According to Pakistan Economic Survey (2022-23) wheat was cultivated on 9.043 million hectares of land in 2022-23, recording a modest increase of 0.7 percent over last year. The wheat production also increased to 27.6 million tonnes in 2022-23 as against 26.2 million tonnes during the previous year. The significance of wheat goes beyond being a food crop for the country. It occupies more than one third of planted acreage, contributes 8.2 percent of agriculture value-added and 1.9 percent of GDP. Over the years, notwithstanding the phenomenal growth of population, Pakistan has been self-sufficient in wheat production. However, this phenomenon is witnessing a change in recent years due to multiple reasons including growth of population, large influx of migrants, smuggling of wheat to neighboring countries, rising prosperity in conjunction with under-investment in agriculture sector, adverse impacts of climatic change and global warming, and an unprecedented urban sprawl that is forcing agricultural farming towards marginal lands where the productivity of land is relatively low. Due to these multiple supply shocks and a steady increase in demand for wheat and wheat products, there is an increasing pressure to import wheat to maintain buffer stock and lessen the unsolicited upward pressure on prices for domestic consumers. The domestic price situation has been further aggravated by international events during the past two decades, starting with an unprecedented increase in commodity prices after the financial crisis of 2007-08, supply side disruptions due to COVID-19 pandemic and more recently by the Ukraine war. May it be added that an imbalance in supply and demand situation and the consequent pressure on prices has serious ramifications not only on health and nutrition of general masses, but there are also concerns about intra-family food availability and the achievement of Sustainable Development Goals (SDGs). The strategic public policy decision making with regard to ensuring wheat price stability and food security in the entire length and breadth of the country is also being compromised.

A closer look at food consumption in Pakistan reveals that a large proportion of mostly urbanized households allocated roughly 60 percent of their income on food and food products. Of this, the expenditure on wheat and wheat products consumes the largest chunk of their overall available resources [Idrees et al. (2012)]. Within this perspective, an increase in price has an obvious adverse impact on nutritional well-being of urban dwellers. The landless households and farmers with small and subsistence level farm holdings in rural areas also have to confront a similar situation. Compared to this, there is a small proportion of rural households who possess large tracts of land, the so-called big landlords, who cultivate and produce marketable surpluses of wheat. With higher support and market prices of wheat, this group benefits from upward movement in wheat prices. The anecdotal evidence, partly confirmed by Uregia (2012), suggests that the overall impact of wheat price change results into a mixed bag of fortunes for different segments of the society. A plausible explanation could be that when wheat prices increase, the farm revenues of a segment of farmers also increase. Higher household incomes of these farmers tend to increase demand for non-tradable commodities [Singh et al (1986)]. However, this change in price has little or no effect on subsistence farmers. On the other hand, the urban consumers who are the net purchasers of wheat tend to get worse-off. This clearly shows that wheat price volatility has serious distributional consequences that has not been addressed adequately in the literature probably due to lack of theoretical framework and empirical verification, especially at the disaggregate level, for meaningful policy analyses.

The research objective of this study is to calculate the net-purchase-or-sale position of households within the wheat and wheat flour markets in Pakistan to identify net-buyers and net-sellers of wheat. Consistent with research objectives households are categorized as net consumers, net producers, and subsistence farmers on the basis of wheat cultivation and market-related wheat transactions. This analysis relies on utilization of the Net Benefit Ratio (NBR) approach, which is a non-parametric micro-simulation procedure advocated by Deaton (1989). The proposed notion of NBR characterizes the expenditure-shares of wheat and wheat flour for each participant in the market.¹ For empirical purposes, we have combined eight modules of the nationally representative Household Integrated Economic Survey (HIES) conducted by the Pakistan Bureau of Statistics (PBS) with approximated price-levels to generate a pooled cross-sectional sample of yearly price-indices at the household expenditure levels from 2000-01 to 2018-19.

The remainder of the paper is organized as follows: Section 2 presents a thorough review of the literature. 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.

2. Literature Review

Though earlier research strands discussed the long-term advantages of fluctuations in agricultural terms of trade, primarily from the perspectives of income distribution and structural transformation (de Janvry and Subbarao 1984, Sah & Stiglitz 1984), relatively little research assessed the distributive consequences of high agriculture

¹ The ratio is interpreted as the elasticity of expenditure with respect to the prices of staple commodity.

commodity prices preceding to the 2007-08 price crisis. In 1989, Deaton developed a framework for evaluating the short-term distributional ramifications of high commodity prices. Whether a household is a net-buyer or seller of a commodity has a significant impact on their well-being, as in:

$$dB/x = (w_i - p_i y_i/x) d \ln(p_i) \quad (2.1)$$

where dB/x is the amount of compensation expressed as a percentage of household expenditure (x); w_i is the expenditure-share of commodity i ; $p_i y_i/x$ is the value of production of commodity i as a share of household expenditure. Hence, the net-consumption ratio $(w_i - p_i y_i/x)$ determines whether a household gain or lose from a short-term price spike.

Deaton's (1989) original paper demonstrates that middle-income Thai farmers benefit more from high rice prices than the impoverished or wealthy. Following Deaton's methodology, Barrett and Dorosh (1996) discover that a large number of impoverished Madagascar farmers are net-buyers. According to Friedman and Levinsohn's 2002 World Bank study, Deaton's methodology is suggested as a rapid quick response tool for ex-ante estimations of the effects of economic crises. They retrospectively apply the non-parametric approach to the 1998 Indonesian financial crisis, in which rice prices experienced a 200 percent increase, utilizing a pre-crisis cross-sectional survey to assess the short-run distributional consequences. Their analysis demonstrates that urban poor are disproportionately affected by high rice prices, while those living in rural districts gain from their dual role as net-sellers.

In contrast to earlier studies employing this approach that produced inconsistent results across countries, applications of Deaton's Net Benefit Ratio (NBR) since 2008 more consistently discover that high commodity prices increase poverty in the short-term. Based on the Deaton's methodology, Ivanic and Martin (2008) approximated the effects of poverty for nine low- and middle-income economies using two stylized assumptions about the transmission of international prices into domestic markets (66 percent and 100 percent transmission scenarios). They discover primarily negative effects on impoverished incomes, indicating that the 2007-08 crisis would probably cause global poverty to increase. Based on a significantly larger data-set (though one that necessitated a significant impute of farm income shares), De Hoyos and Medvedev (2011) calculate that observable increases in commodity prices in developing countries would result in US\$1.25 per day poverty for 155.6 million people, almost all of whom would reside in South and Southeast Asia (141.2 million people). Using cross-sectional surveys from 31 developing countries, Ivanic and Martin (2014b), demonstrates that a 50 percent increase in agriculture commodity prices culminate in a 5.8 percent increase in poverty in an array of twenty-nine low-income countries, with the exception of Cambodia and China.

The vast movements of individuals into and out of poverty are accounted for in relatively few of the earlier studies. One study that did so discovered extraordinarily large gross movements around the poverty line: 68 million people fell into poverty and 24 million people escaped it, for a net gain of 44 million people (Ivanic et al.). In 2012).

Prior to the 2008 financial crisis, the general consensus was that majority of households living in poverty engaged in agriculture sector, and in consequence, they suffered from lower prices of agriculture commodities, including those caused by trade distortions (Swinnen and Squicciarini, 2012). Although the majority of the impoverished, including those who reside in rural districts, appear to be net-buyers based on the multipurpose cross-sectional surveys used in these simulations ((Aksoy and IsikDikmelik, 2008).

3. Data and Methodology

The distributional consequences of an increase in the agriculture commodity prices relied upon the net-purchase-or-sale position of the economic agents, which might differ by specific agriculture produce and the regional disparities within an economy.

The non-agriculture economic agents, who primarily resides in the urban districts, experienced a decrease in their nutritional well-being with regard to an increase in relative prices. However, the consequences on the economic agents, who resides in the rural districts, are more diversified. The World Bank Report (2007) documented a considerable proportion of the subsistence economic agents in the rural districts of Bangladesh, Bolivia, Ethiopia, Pakistan, and Zambia in comparison to the agriculture economic agents, on average. In consequence, the economic agents residing in the rural districts have detrimental consequences on their nutritional well-being with respect to an upsurge in agriculture commodity prices. Due to the restricted agriculture terrestrial acreage, the subsistence economic agents are unable to generate marketable surplus, requisite to augment their expenditures on the agriculture and non-agriculture commodities. To maintain these expenditures, they economically participate in market-related activities.

Therefore, the first step of the analysis utilizes the Net Benefit Ratio (NBR) to determine the net-purchase-or-sale position of the economic agents in the wheat and wheat flour markets of Pakistan. Deaton (1989) introduces a non-parametric micro-simulation that utilizes the information on the demand-and-supply patterns of a commodity to assess the short-term distributive ramifications of the price variations. For a specific household that buys and/or sells commodity (such as wheat), Deaton proposed the following formulation:

$$NBR_W = PR_W - CR_W \quad (3.1)$$

where PR_W and CR_W are the ratios of the value of wheat and wheat flour sales-or-purchases in the real-income. Expression (1) demonstrates that the difference between the PR_W and the CR_W is the negative of its elasticity of its cost-of-living with regard to the prices of wheat and wheat flour – called the benefit ratio. For non-agriculture households, the elasticity is negative, while for agriculture households the elasticity is positive. In addition, for subsistence households, the elasticity is equivalent to zero. A convenient method to evaluate the distributional effects of high wheat and wheat flour prices is to non-parametrically approximate the average net-benefit-ratio at every point along the distribution of per-capita expenditures, since households in different parts of the welfare distribution vary in their consumption and production patterns.

However, Chabe-Ferret (2005) demonstrated that this approach inaccurately magnifies the adverse consequences of the price variations on economic agents who are net-purchasers. Because, it solely captures the immediate effects and does not consider the potential for net-purchaser to alter their consumption choices with regard to high prices. Typically, it is expected that net-purchasers would gradually switch to other options when the prices of certain commodity increases in comparison.

Secondly, the analysis pre-supposes that the net-sellers fully reap the advantages of the price hike. In reality, this margin could be reduced by implementing larger margins for intermediaries and/or high production expenses (such as the high costs of transportation or fertilizer). This assumption exaggerates the positive effect of rising agriculture commodity prices on net-sellers.

Thirdly, the approach does not account for second-order effects, which occur when farmers modify their price expectations in order to determine which crops to plant the following year. If producers, including those who purchase more than they sell, have confidence in the long-term price upsurge, they are likely to increase their production. This would alleviate some of the upward force on agriculture commodity prices and also enhance the revenue generated from the production of the staple commodity. According to Ulimwengu and Ramadan's (2009) multi-market analysis, the second-order effects mitigate the negative welfare consequences of the price shock, but they do not fully offset them.

And lastly, the approach fails to reflect potential alleviating strategies, such as the implementation of subsidies, which might effectively mitigate the adverse effects of the agriculture commodity price shock.

To generate a pooled cross-sectional sample of annual price-indices at household expenditure levels from 2000-01 to 2018-19, eight modules of the nationally representative Household Integrated Economic Survey (HIES) were combined with approximate price-levels for empirical purposes. 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. 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.

4. Discussion of Results

To determine the net-purchase-or-sale position of heterogeneous economic agents within the wheat and wheat flour markets of Pakistan, we utilized the Net Benefit Ratio (NBR), proposed by Deaton (1989). The Net Benefit Ratio (NBR), a non-parametric micro-simulation, uses the information on the demand-and-supply patterns of a commodity to assess the short-term distributive ramifications of price variations. Deaton, in his study, reveals that the difference between the households' value of production and the value of consumption of a particular commodity as a share of expenditures (PR-CR) represents the negative of its elasticity of its cost-of-living with regard to the price of that commodity – called the benefit-ratio. The proportion of households who are net wheat-buyer, self-sufficient and net wheat-seller in Pakistan is given in Table 01 for wheat and wheat flour.

This analysis requires cross-sectional information, which was gathered from the eight modules of Household Integrated Economic Survey (HIES) from 2001-02, 2005-06, 2007-08, 2010-11, 2011-12, 2013-14, 2015-16 to

2018-19. The empirical findings are presented in Table 01, which shows the distributional proportion of heterogeneous economic agents in the markets of wheat and wheat flour.

Table 1. Percentage Distribution of Heterogeneous Economic Agents in Pakistan

REFERENCE PERIOD	PR<CR	PR>CR	PR=CR	SAMPLE SIZE
2001-02	11,061	506	1,806	13,373
2005-06	10,575	500	2,078	13,153
2007-08	11,232	339	1,816	13,387
2010-11	12,485	330	1,638	14,453
2011-12	11,987	375	1,628	13,990
2013-14	13,202	538	2,163	15,903
2015-16	20,049	386	1,675	22,110
2018-19	18,179	902	3,230	22,311
SUM	108,770	3,876	16,034	128,680
PER HUNDRED	84.53	3.01	12.46	100.00
CUMULATIVE	84.53	87.54	100.00	-

Source: Author's calculations from the eight series of Household Integrated Economic Survey HIES.

The estimates of PR and CR shows that, based on the sample-dimension of 128,600 heterogeneous economic agents, roughly eighty-five percent of them have an average numerical value of PR less than the average numerical value of CR . These economic agents are labelled as the non-agriculture economic agents, who purchase wheat and wheat flour.

In comparison to this, a relatively small proportion of around three percent of economic agents are discerned to have a numerical value of PR more than the numerical value of CR . These particular economic agents are labelled as the agriculture economic agents, who engender marketed surpluses of wheat. And lastly, approximately twelve percent of economic agents, with corresponding mean numerical values of PR and CR are categorized as the subsistence economic agents, who grow wheat for their self-consumption.

Table 2. Net Benefit Ratio (NBR) w.r.t Wheat and Wheat Flour

	PR	CR	NBR=PR-CR
NON-AGRICULTURE HOUSEHOLDS	0	0.092	-0.092
SUBSISTENCE HOUSEHOLDS	0.357	0.357	0
AGRICULTURE HOUSEHOLDS	0.556	0.284	0.271

Source: Author's calculations from the eight series of Household Integrated Economic Survey HIES.

Relying on the mean numerical values of Net Benefit Ratio (NBR), Table 02 reports the potential consequences of high wheat and wheat flour prices on the nutritional well-being of three distinct classifications of economic agents.

A negative mean numerical value of NBR for the non-agriculture economic agents implies that, a surge in the prices of wheat and wheat flour deteriorates their nutritional well-being relative to the agriculture economic agents, where a positive numerical value of NBR has an opposite effect. As per economic theory of demand, the economic agents who are net-purchasers suffer more from the variations in the prices of wheat and wheat flour.

This empirical outcome further reinforced by a zero numerical value of PR . Compared to this, the average numerical value of NBR is found to be zero for subsistence economic agents. Since by definition, they do not participate in the wheat and wheat flour markets, therefore, they largely remain un-affected by variations in the prices of wheat and wheat flour.

Since the majority of the impoverished, even those residing in rural districts, are net-buyers, there has been a consensus that high prices of agriculture commodity are detrimental to them (Ravallion, 1989; Byerlee, Myers and Jayne, 2006; Seshan & Umali-Deininger, 2007; Ivanic & Martin, 2008). Although there are few empirical studies that approximate the numbers of net-buyers and sellers along with their incomes, the majority of them have showed that net-buyers are more likely to be impoverished households than sellers, leading them to argue that price increase would harm the greater number of net-buying households. For example, Christiaensen & Demery (2006) analyzed staple crops growers in rural districts of four African countries and discovered that net-buyers out-number net-sellers even in areas where agriculture predominates. This relationship persisted across all income quintiles, and even among the poorest, net-buyers outnumbered net-sellers by a large margin. Jayne, Yamano, Nyoro, and Awuor (2001) demonstrated that Kenyan net-sellers of maize possessed higher incomes, exhibited greater concentration, and were fewer in number relative to the net-buyers.

This empirical finding is further supported by the structure of farm-holdings in Pakistan. Table 03 provides information on the distribution of farms, cultivated and farm acreage among diverse farm size categories.

Table 3. Structure of Farm Holdings in Pakistan, 2010

Farm Categories	Number of Farms (Percentage)	Farms Area (Percentage)	Cultivated Area (Percentage)
Under 5 acres	64	19	22
5 to under 7.5 acres	14	12	14
7.5 to under 12.5 acres	11	17	19
12.5 to under 25 acres	7	18	19
25 to under 50 acres	3	13	13
50 to under 100 acres	1	8	7
100 to under 150 acres	-	3	2
150 acres and above	-	11	4

Source: Agriculture Census, 2010

This table indicates that the distribution of farm area (52 million acres) among total farms (8.2 million) is highly skewed and that the structure of farm holdings in Pakistan is characterized by extremes. Small farms, or those that operate less than 5 acres, account for 64 percent of total farms, but they command 19 percent of the farm area and 22 percent of the cultivated area. Large farms, those that operate 50 acres or more, are at the other end of the spectrum. Although they comprises of only 1 percent of total farms, they account for 14 percent of the farm area and 6 percent of the cultivated acreage.

Moreover, it seems that the cultivated acreage distribution across different farms is less skewed. This is because, in comparison to large farms, small farms have a comparatively higher proportion of cultivated land. If we consider 12.5 acres as the limit of subsistence holdings, 89 percent of the total farms in the country fall below the subsistence level. Out of the total farm and cultivated area, these subsistence units account for 48 percent and 55 percent, respectively. Furthermore, of the total 23 million hectares of cultivated land in Pakistan, 25 percent of area is described as rain-fed (Baig et al. 2013). Small agriculture land holdings are the primary characteristic of these areas (Adnan et al. 2009). In these regions, water is the only thing impeding the growth of sustainable agriculture. There is significant spatial and temporal variability in the occurrence of rainfall in *barani* (rain-fed) areas. The annual water loss from surface runoff is approximately 3.4 million acre-feet (MAF), with monsoon season (July to September) accounting for the majority of rainfall. Because rainfall patterns are unpredictable, farmers are always hesitant to invest in crops and use fewer inputs to lower their risk of loss in the event of a drought. Due to land fragmentation and water scarcity, farmers' incomes have decreased to the point where they primarily rely on non-farm income. Adopting appropriate techniques for the development, harvesting, and management of water resources could quadruple crop yields.

5. Conclusion

We employed Deaton's methodology to determine the net-purchase-or-sale position of heterogeneous households in wheat and wheat flour markets of Pakistan. The Net Benefit Ratio (NBR), a non-parametric micro-simulation, evaluate the short-term distributional consequences of price fluctuations using information on the demand and supply patterns of a staple grain. Analysis of eight modules of the Household Integrated Economic Survey (HIES) revealed that roughly 85 percent of households are non-agriculture households purchasing wheat and wheat flour, while nearly 3 percent are agriculture households producing surplus wheat, and 12 percent are subsistence households growing wheat for self-consumption. Therefore, while non-agriculture households worse-off from high wheat prices, agriculture households are likely to be better-off. The price fluctuations largely have no effect on subsistence households. These empirical findings suggest that high prices for staple grain necessitate a fundamental re-evaluation of grain production and the natural resources it depends on, in particular agriculture land and irrigation. The difficulty lies in effectively managing the transition to a new economics of agriculture and in achieving stable prices and supply that will both protect the most vulnerable populations and provide long-term incentives for agriculture output. While long-term price patterns should be permitted to direct the distribution of resources, action must also be taken to lessen short-term cyclical volatility.

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