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Original Paper

Food Price Volatility and Household Welfare: A Case Study of Major Cities of Pakistan

Nigar Zehra* · Ambreen Fatima

Abstract The purpose of this paper is to find the impact of food price volatility on the welfare of urban households of Pakistan. Food price volatility in monthly prices of major food commodities for main cities of Pakistan is calculated through standard deviation method. Moreover, the study adopts the methodology provided by Alkire and Foster 2007, and Alkire and Santos 2010 to develop Household Deprived Welfare Index (DWI) for major cities of Pakistan. Following Deaton 1985 the study uses pseudo panel approach. Fixed Effect technique is applied to estimate the impact of volatility on household welfare. The results generated from pseudo panel fixed effect technique depicts that food price volatility has significant and negative impact on household welfare. This study lengthens the literature by identifying the impact of food price volatility on household welfare at city level in Pakistan, using four waves of PSLM/HIES data 2007-08, 2011-12, 2013-14 and 2014-15.This type of micro-level research has not been conducted (nationally or internationally) so far; therefore, it would help the policy makers to implement policies to combat the effect of volatile prices and develop programs for the welfare of severely affected areas.

Keywords :
Food price, volatility, Household, Welfare

1 Introduction

The rapid increase in food prices associated with rise in volatility impact the economy in several ways. One of its major consequences is on household welfare. Theoretically it is explained by many researchers like Sen (1997); Widodo

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(2006) that welfare of household depends on its utilization of goods and services, for example, food, clothing, housing, furniture, education, health and its access to light, water, sewerage, gas, and fuel. According to Marshallian demand function, the demand of households for goods and services depends on their prices, households income and also the availability of goods and services in the market. Thus, minor variation in prices of goods and services and the income (wage) will directly influence the amount of goods and services[1] which are used; while, indirectly, it will influence the household welfare Widodo 2006, by affecting the purchasing power. Further, the argument is extended by Medou (2008), Minepat (2008) and Von Braun et al (2008), stating that volatility in food prices also reduces the purchasing power of household.

Literature continuously pointing out that increase in prices of goods and services, especially in the price of food enlarge the households food expenditure share in their total income (Levell and Oldfield (2011)). This increase in food expenditure share and decline in real income (purchasing power); affect the decision of households relating further expenditures, especially on health, education and asset creation. Households shift their dietary pattern from micronutrient rich food to cheap starchy food. As households may not be able to afford the similar quantity of calories at higher prices, the reduced or inferior calories intake would affect their health. Similarly they stop sending their children to school and put them in labour market. Hence, it can be generalized that this may have some dire consequences on welfare of the households. It is generally said that households live in urban areas are suffered greatly, due to two main reasons: First, they use tradable products more as necessary food (e.g., wheat and rice). Second, mostly urban households do not produce their own food (FAO et al 2008; Zehra 2020).

Given severity of the subject, it is considered important to have some empirical assessment of the impact of food price volatility on wellbeing of urban households. In Pakistan few studies identified that the urban households widely suffer with welfare loss and face poverty, due to high food prices as they are net food buyers. After an extensive review of the literature it is found that the national and international gaps still exist for research, because the impact of higher food prices on household welfare may not be as severe as the price volatility which creates uncertainty. The uncertainty shifts the preference of household investments decisions towards maintenance of the current consumption. Empirically, the impact of food price volatility on household welfare at city level in Pakistan is still missing in literature. There is no literature available which explore this impact at regional level; specifically about urban areas. The impact of food price volatility in large cities may substantially differ from its impact on small cities or on rural areas. In rural areas where, cropping is concentrated towards food crop the impact of food price volatility on household welfare, remains low as majority of the households fulfill their food requirement

[1] Both substitute and complementary

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from their own fields and also beneficial for the barter system, that still exist.

Keeping in mind this paper is an attempt to fill the gaps in the literature comprehensively, evaluating the impact of uncertain food prices on household welfare. To accomplish the task the first objective of this paper is to calculate food price volatility in monthly prices of major food commodities for different cities of Pakistan through standard deviation method. The study focuses on the prices of sixteen food commodities: beef, chicken, pulses (mash, moong, masoor), rice (IRI), wheat, tomatoes, potatoes, onions, ginger, garlic, milk, eggs, sugar and tea in thirteen main cities (Bahawalpur, Faisalabad, Hyderabad, Islamabad, Karachi, Lahore, Multan, Peshawar, Quetta, Rawalpindi, Sargodha, Sialkot and Sukkur). These cities were selected on the basis of the availability of its data. However, the selection of food commodities is based on their presence in SPI basket, which are sensitive to price change. The second objective of this paper is to develop the deprived welfare index by city and time - as a proxy of household welfare using the methodology employed by the United Nations Development Program (UNDP) for the development of Multidimensional Poverty Index. The data of Pakistan Social and Living Standard Measurement Survey (PSLM) for the periods 200708, 2011-12, 2013-14 and 2014-15 is utilized for the assessment purpose. The developed index will help to build an understanding regarding development or welfare status of the cities. Lastly, the study examines the impact and consequences of food price volatility on household welfare - deprived welfare index developed. The objective is fulfilled by employing pseudo panel approach following Deaton 1985. Fixed Effect technique is applied (recommended for estimating pseudo panel) to estimate the impact of volatility on household welfare.

This study contributes in existing literature by calculating the volatility in food prices of sixteen commodities and constructing the deprived welfare index for thirteen cities of Pakistan. The research not only facilitates in identifying the pattern of volatility but also builds an understanding regarding development status or household welfare among the large cities of Pakistan. This could help the policy makers to determine the dimensions of deprivation in each city and obtain improved picture, highlighting as to which dimension would need more attention and improvement; i.e., the health, education or standards of living. The research further contributes by identifying the impact of weighted food price volatility on household welfare by using deprived welfare index as proxy which will help the policy makers to provide and would build policies to combat the effect of volatile prices and developed welfare programs for the severely affected areas.

Following an introduction in section 1, the study is structured as follows: Section 2 is based on a brief review of studies focusing on the consequences of high and volatile food prices on household welfare. Section 3 provides the data and methodology; whereas, Section 4 is based on empirical analysis. Section 5 provides conclusion of the paper and finally the last section, Section 6 gives the policy implication.

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2 Literature review

This section covers both international and national review of studies which relate food prices or the volatility of food prices to household welfare. Ivanic and Martin (2008) examined the effects of increasing staple food prices (wheat, maize rice, beef, sugar dairy products and poultry) on poverty in nine developing countries: Cambodia in 200203, Madagascar in 2002, Nicaragua in 2001, Bolivia in 2005, Pakistan in 199899, Malawi in 2004, Zambia in 1998, Peru in 2003 and Vietnam in 1998 and 2004.They used expenditure function method to analyze consumption of household. Furthermore, they also used the approach of factor supply behavior and profit function to characterize the household production behavior in response to price change. On the basis of these methods they found that rising food prices led to rising poverty in majority of the countries where Pakistan is one of them. In case of Pakistan it has been noted that due to higher food prices rural poverty declined while urban poverty increased. However, rise in urban poverty outweighed the decreased in rural poverty; hence, overall at country level it has been found that poverty increased due to increase in food prices.

Zezza et al (2009) identified the relationship between high price of tradable staple food and household welfare. They used the cross sectional data for eleven developing countries and concluded that low income households which were net buyers of food, were badly affected while net sellers had positive impact on welfare. They also concluded that households who were land owners and had other agricultural productive inputs; had welfare gain even if they were poor households. According to Janvry and Sadoulet 2009 argued that the change in food prices; especially, the edible oils and cereals adversely affect the Indian rural households both farmers and nonfarmers. Further Leyaro et al (2010) extended the literature by using three waves of Tanzanian Household Budget Survey data 1991/92, 2000/01 and 2007and concluded that the burden of welfare loss was large for poor especially of rural areas as compare to non-poor especially of urban areas. Maltsoglou et al (2010) evaluated the consequences of rise in staple food prices data for 2004, especially the price of rice on different household groups in Cambodia. On the basis of expenditure function and price elasticities they concluded that rise in prices of rice was beneficial for the households in this country.

Further, Vu and Glewwe (2011) analyzed the impact of increasing food prices, (especially of rice) on poverty and welfare in Vietnam by assessing Vietnamese Household Living Standards Survey (VHLSS) for 2006. In Vietnam rice, is produced and also consumed; and hence, welfare change is measured through net food sale of households (difference between food sales and food purchases). They found that, on an average the household welfare increased, due to an increase in rice prices; because on an average the loss in welfare of net purchasers was smaller to gain in welfare of net sellers. On the other hand, poverty in Vietnam reduced, due to a slight increase in price of rice, while it increased due to large increase in price of rice. Additionally, the consequences of food and non-

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food inflation on welfare of Indian households was analyzed by Pons (2011), taking the National Sample Survey (NSS) expenditure data for 2004-05. The research concluded that increase in food prices (especially for cereals) negatively affect the poor households of both the rural, as well as urban areas; while the high prices of non-food items badly affected the rich households of urban areas.

Shimeles and Woldemichael (2013) examined the welfare effects of changes in relative food prices in rural and urban Ethiopia, for household level panel data set from 1994 to 2004. They used concentration curves (Lorenz curves) for variety of consumption commodities. The increase in price of any commodity was observed as an implicit tax, and variation in expenditure on commodity which exhibited the welfare effect. They found that variation in prices of wheat, maize and teff had badly affected the people of rural areas related to higher income quintile group. However, increased prices of consumption goods badly affected the population of urban areas related to lower income quintile group. It was also noted that rise in price of such commodities were used as necessities; e.g., coffee and cooking oil reduced the welfare of rural poor. Ziegelhofer (2015) analyzed the long term impact of food inflation on household welfare for 38 countries. The author used child health (weight for age z-score), as proxy for household welfare. On the basis of pseudo panel fixed effect technique, concluded that food prices had adverse impact on household welfare. These adverse impacts were transmitted through volatility in food prices and also through permanent price shocks.

Weber (2015) analyzed the consumer behavior (consumption pattern), towards high food prices by estimating the demand system and consumer welfare through compensating variation for Indian households, for 2011-12. It was analyzed on the basis of own, cross and income elasticities showing that expensive goods like milk, fruit and livestock products were highly sensitive to own prices and income; hence, they were substituted with cheaper goods. On the basis of compensating variation it was identified that households in rural areas suffered greatly as compared to households in the urban areas.

However, in the perspective of Pakistan, very few studies are found which identified the impact of high and volatile food prices on household welfare; for e.g., Thompson and Amjad (2008) examined the effect of rising food and energy prices on poverty head count[2], and the poverty gap ratio[3] for Pakistan. They utilized the PSLM (2004-05) data and the MICS (2003-04) household level data. With the help of expenditure minimization method the poverty gap elasticity was estimated with respect to the change in each commodity price. It was concluded that in Pakistan, the impact of high food prices was greater than the effect of high energy prices on poverty. Furthermore, it was also identified that this impact was greater on rural population as compared to urban and higher

[2] The fraction of households with per capita income less than the poverty line.

[3] The degree to which the per capita income of household is less than the poverty line or poverty depth.

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food prices significantly increased poverty in Pakistan.

Welfare losses due to food price crisis were measured through compensating variation (the percentage of overall expenditure needed to bring back the pre-crisis consumption level) by using three waves of PSLM data from 2005-06, 2007-08 and 2010 by Friedman et al (2011). They concluded that urban households were more badly affected as compare to rural households, because rural households are self-sufficient in producing their food for themselves. Additionally Idrees et al (2012) examined the effect of food price changes on welfare in Pakistan, both for urban as well as the rural areas. For this purpose they analyzed HIES data of two survey periods 2001-02 and 2005-06. The change in consumer welfare measured in terms of equivalent income and equivalent variations (as a percentage of their total expenditure after price change) for thirteen consumption groups. Results showed that on an average the total loss was larger for poor households as compared to rich, in both the urban and rural areas. It was also found that loss in welfare in terms of equivalent income was greater than in terms of equivalent variation; except for the commodities of edible oil, meat and fruits.

Similarly, in Aftab et al (2015) determined the consequences of increase in food prices on the level of poverty in Pakistan, both in short-term and long-term. The time series data for the period 1973 to 2013 was analyzed. On the basis of ARDL technique and error correction model, it was concluded that rising food prices increased poverty in Pakistan; both in the short-term and long-term by decreasing the purchasing power of consumer. Further ELLAHI et al (2018) also concluded that food price inflation significantly raised the poverty index. The literature widely used compensating variation, equivalent variation, poverty and child health, as a measure of change in household welfare. However, empirically the effect of food price volatility on urban households of Pakistan is still missing.

3 Methodology

The paper uses monthly data of food prices for sixteen food commodities[4] namely; beef, chicken, pulse mash, pulse moong, pulse masoor, rice IRI, wheat, tomato, potato, onion, ginger, garlic, milk, egg, sugar and tea, from July 2002 to June 2016 for 13 large cities. The cities included in our analysis are Bahawalpur, Faisalabad, Hyderabad, Islamabad, Karachi, Lahore, Multan, Peshawar, Quetta, Rawalpindi, Sargodha, Sialkot and Sukkur. The data is gathered from various issues of Monthly Statistical Bulletin published by Pakistan Bureau of Statistics. Further four waves of Pakistan Social and Living Standard Measurement Survey (PSLM), and the Household Integrated Economic Survey (HIES) data for the years 2007-08, 2011-12, 2013-14 and 2014-15 is used to develop deprived welfare index (DWI).

[4] Units for the food commodities are given in table A1 (annexure).

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3.1 Volatility in food prices

Standard deviation method is used for determining the volatilities in the monthly price series of sixteen food commodities. Further to analyze the true impact of volatility on household welfare, weights[5] are assigned to the volatility of each commodity by multiplying the volatility of every commodity by its expenditure share[6] in total household expenditure. The average weighted values[7] of volatility in the prices of sixteen food commodities are used for further analysis.

3.2 Deprived welfare index

This paper adopts the methodology provided by Alkire and Foster (2007), and Alkire and Santos (2010) to develop Household Deprived Welfare Index (DWI) for thirteen major cities of Pakistan. This methodology was also used by the United Nations Development Program (UNDP) and the Oxford Poverty and Human Development [(OPHI) (2017)] for constructing Multidimensional Dimensional Poverty Index (MPI). The MPI includes the deprivation which a household faced in the three dimensions: education, health and standard of living, at a household level. Health and education dimensions carries the same weight; i.e., 0.333, while standard of living dimension carries weight, 0.26. All the three dimensions comprise of further thirteen indicators, having different weights depending on the availability of data, as at city level study.
Table 1 lists the indicators and weights assigned to indicators for constructing the index.

All indicators are dichotomous i.e. in 0 and 1, 1 means that a household is deprived and 0 means that it is not-deprived. To calculate the deprived welfare index, weighted deprived values of all thirteen indicators, are added and a cut-off value which is about one-third of all weighted indicators is applied; i.e., 0.3. This process enables to differentiate between the households who are facing or not, the welfare deprivation. If the value of Household Deprived Welfare Index (DWI) for a household is 0.3 or greater, than 0.3, household is considered deprived.

3.3 Estimation technique

The paper uses HIES/ PSLM data for four different time periods which do not follow the same individuals by time. Hence, the data is unable to give true

[5] The welfare of household is significantly hit by the low volatility food commodity if the household spends more on it, whereas the welfare of household is not affected by the highly volatile commodity if the household spends less on it

[6] City wise expenditure share of each commodity is given in annexure (tables A2-A4). The study used 2013-14 commodity expenditure shares for 2014-15 as HIES data for 2014-15 is not available.

[7] Values of average weighted food price volatility in all cities are reported in annexure (table A5)

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Table 1: Indicators and Weights used to Develop DWI

Dimension	Indicator	Weights
Education	Years of Schooling	(1/6)
	Attendance of Child in School	(1/8)
	Quality of Education	(1/24)
Health	Access to Health	(1/6)
	Immunization	(1/18)
	Prenatal care	(1/18)
	Trained Delivery	(1/18)
Standard of Living	Electricity	(1/21)
	Water	(1/21)
	Sanitation	(1/21)
	Cooking Fuel	(1/21)
	Households Assets Ownership	(1/21)
	Overcrowding(1/42)	(1/42)

Source: UNDP and OPHIs Human Development Report (2017).

panel due to the repeated cross sections. Therefore, for analyses, the data of four cross-sections (2007-08, 2011-12, 2013-14 and 2014-15) is pooled to make pseudo-panel. The selection of years is based on two main reasons. First, (as the world food crisis stared in 2007-08) to identify the impact of food price volatility on household welfare, the years are selected since 2007-08. Second, criteria of years selection, is based on availability of PSLM and HIES data. Further, in pseudo-panel, each individual is surveyed only once but the benefit of employing pseudo-panel methodology (as compared to simple cross section data) is its ability to take into account the previous characteristics, while exhibiting the future behavior [seeFatima (2017) for detail]. Hence, to analyze welfare deprivation over a given time period there is a need of panel of individuals or households which are surveyed repeatedly over a time to examine variations in their education, health and standard of living. However, the main problem to use the PSLM and HIES, is that they are only cross sectional data set. The estimation on these data sets can give a problem of unobserved individual heterogeneity. Deaton (1985) recommended the use of cohort as solution to overcome a problem, i.e., to estimate the empirical relationship among variables by using cohort as compare to individual observations.

Pseudo panel A simple linear Model with individual effects is analyzed and given by

$$Y_{i,t} = X_{i,t}\beta + \alpha_i + \mu_{i,t} \qquad t = 1.....T \tag{1}$$

where, $X_{i,t}$ is a (K1) vector of independent or explanatory variables, i denote the individuals (households) and t represents the time periods. As explained earlier the PSLM/HIES do not survey the same individual over time. Hence, this paper follows the Deaton 1985 methodology of Pseudo Panel based on cohorts here cohort selected is based on geographical boundaries, i.e., cities. Cohorts are identified on an assumption that ith household is a member of only one cohort

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in each period of time.

On Averaging over the cohorts, Equation (1) turns out as follows:

$$\overline{Y}_{i,t} = \overline{X}_{c,t}\beta + \overline{\alpha}_{c,t} + \overline{\mu}_{c,t} \qquad t = 1.....T \tag{2}$$

Now, it is supposed that the size of a group c, in the time period t is , hence the mean value of all s present in cohort c, for time period t is shown as:

$$X_{c,t} = m_{c,t}^{-1} \sum_{i \in c}^{s=t} X_{i,s} \tag{3}$$

The consequent data is a pseudo-panel data set which has repeated observations over the periods, and also over the cohorts. However, a major problem in the estimation of Equation (2) is that, $\overline{\alpha}_{c,t}$ is time (t) dependent and might be correlated with time t. It is considered that $\overline{\alpha}_{c,t}$ is random error which give inconsistent estimator although considering them as fixed unknown parameter which create identification problem unless the changes over time (t) can be overlooked $\overline{alpha_{c,t}} = \overline{\alpha_c}$. This assumption will only exist when total numbers of observations used to form cohort averages are large. To attain the consistency in fixed t and fixed i for each cohort Deatons estimator was modified by Verbeek and Nijman (1993). If total number of individuals is large in all cohorts, the cohorts size mc=M/C reaches to infinity and then the measurement errors and their estimates reach to zero. This results the estimator of cohort β which is asymptotically the same to Deaton (1985) estimator of β.

$$X_{c,t} = m_{c,t}^{-1} \sum_{i \in c}^{s=t} X_{i,s} \tag{4}$$

$$\hat{\beta} = \sum c_{c=1} \sum t_{t=1} m_{ct}((X_{ct})2) - 1)(\sum_{c} c = 1 \sum T_{t=1} m_{ct}(X_{ct})(Y_{ct} - Y_c) \tag{5}$$

where $\overline{X}_c = (\sum T_{t=1} C_{c=t})^{-1} \sum T_{t=1} m_{ct}(X_{ct})$, averages across cohort (c) over the time. The asymptotic properties are employed for properties of estimator . Deaton (1985) employed the asymptotic properties, i.e., if total number of cohorts (C) reaches to infinity, it means the total number of individuals reaches to infinity, while the cohort sizes remain constant. According to Moffitt (1993) the total number of cohort remains fixed but the size of cohort increases as the number of individuals rises. However, in this approach the problem of errors in variables vanishes. This study follows the Moffitts assumption; i.e., the number of cohort remains fixed to thirteen cities, but the size of cohort increases with the rise in number of individuals. Cities are selected as cohort because they will not change over time and are observed for every individual present in the sample. Further, it is also necessary that explanatory variables vary deferentially over the period of time across groups. In this study, the selection of cities as

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cohort fulfills this requirement.

Lastly, it is proposed by Verbeek and Nijman (1993) that, if the size of cohort is at least of 100 individuals and the variation of time in the means of cohort is sufficiently large, then the biased caused by measurement error becomes minor and can easily be ignored. On the basis of PSLM/HIES the size of cohorts as cities fulfill the criterion of Verbeek and Nijman (1993), in all cohorts. In this paper, about 73,247 observations, (individuals or households) are chosen from four periods of cross sectional data of PSLM/HIES. Pseudo-panel data is formed by computation of cohorts as large cities for the periods of 2007-08, 2011-12, 2013-14 and 2014-15, makes 13 groups of cohorts (large cities) having 52 total number of observations.

3.4 Model of the study

To explain the impact of food price volatility on household welfare, the study uses Deprived Welfare Index as a proxy of household welfare, the reason for choosing it (as a proxy) is its combination of thirteen different deprivation variables which covers three main dimensions (Education, Health and Standards of Living) of the household. Once the food price shocks arise, poor individuals or households adopt different foods and nonfood managing policies to defend their primary needs as their most important concern is to maintain their level of energy consumption (Ruel et al 2010. Food managing policies include reduction in calories intake, consuming low-quality and low priced food. These policies directly hit all members of the household, specially the children (Ruel et al 2010) while further nonfood managing policies include a wife looking for job, child labour, reducing expenditure on education and health.

$$DWI_{it} = \alpha_0 + \alpha_1 FVI_{it} + \alpha_2 HHS_{it} + \alpha_3 HNEMP_{it} + \alpha_4 HHMEEMP_{it} + \alpha_i + error_{i,t} \quad (6)$$

DWI represents Deprived Welfare Index,
FV represents Weighted Food Price Volatility,
HHS represents Household Size,
HNEMP represents Head Non-agricultural Employment,
HHMEEMP represents Household Maximum Education of Employed, and i represents Household Surveyed t represents time period

Beside food price volatility the above model also includes some other socioeconomic variables, to explore the impact of social, economical and demographic conditions resulting in deprivation household faced. Household size is included to check the impact of dependency causing deprivation; study assumed that as the number of individuals in a household increases it put burdens on the resources available hence may increase deprivation. Similarly according to the

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literature impact of heads non- agricultural employment is negative on household welfare (Aksoy and Isik-Dikmelik (2008) as they are the net buyers of food and would therefore, may suffer by the increase and volatile food prices and to manage the higher prices household reduce their expenditures. Further it is assumed that maximum education of the individuals who are employed in the household plays vital role in household decision making process if the education level among the individuals is high they may take better decision and may also become a source of earning and hence welfare will improve. All variables are collapsed at city level to come up with the average values for all cross-section periods and then pooled to make pseudo panel.

4 Results and discussion

This section, first provides the results of weighted food price volatility in thirteen cities of Pakistan, Deprived Welfare Index, and then presents the empirical findings of impact of food price volatility on deprived welfare index.

4.1 Food price volatility

This section, first provides the results of weighted food price volatility in thirteen cities of Pakistan, Deprived Welfare Index, and then presents the empirical findings of impact of food price volatility on deprived welfare index.

4.2 Results of food price volatility

It is exhibited from figure 1, that the volatility in the food prices has increased from 2007-08 to 2013-14 in all thirteen cities of Pakistan. This rising trend is the result of international food crisis, when food prices of the world were doubled during the year 2007-08; and in this year, the FAO Index of the food price went up by 27 per cent. It was noticed that the prices of major staple food commodities, especially the wheat and rice increased by 121 and 76 per cent, respectively. Similarly, the prices of dairy products were increased by 90 per cent, and the maize prices also went up by 80 per cent. In 2010 there was a highest reduction in the production of wheat. Further, Russian drought increased the international wheat prices by approximately 85 per cent (Ruel et al 2010). While in the year 2014-15 the volatility decreased due to the reduction in prices of various food commodities, especially the wheat, chicken, rice, potatoes and eggs, etc. This reduction in food prices was due to low fuel/oil prices.

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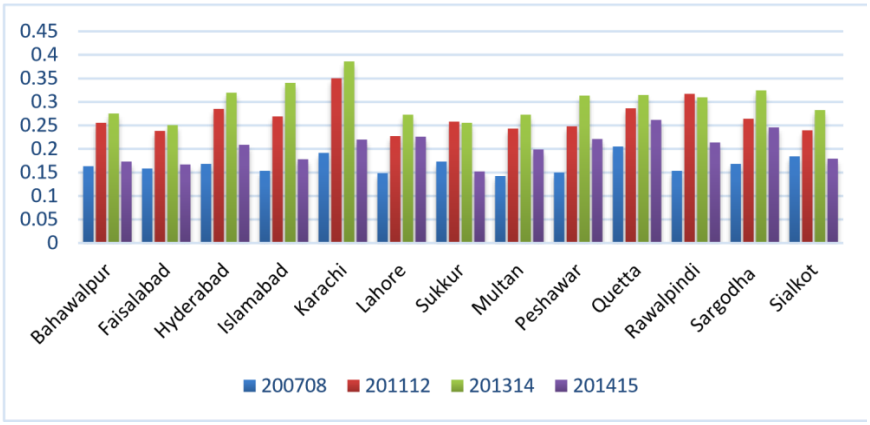

Fig. 1: Volatility in Food Prices

4.3 4.2 Results of Deprived Welfare Index

The results of Deprived Welfare Index are revealed in Table A6 (Annexure) and shown in Figure 2. Figure 2 presents the trend of DWI in thirteen cities for four rounds of PSLM/HIES data (2007-08, 2011-12, 2013-14 and 2014-15). The data reveals upward trend of DWI in all cities if 2007-08 and 2014-15 are considered, only. DWI for Lahore, Faisalabad, Sargodha, Bahawalpur, Karachi, Hyderabad, Sukkur, Peshawar, and Quetta cities have shown the same pattern because first it decreased (from 2007-08 to 2011-12) and then it increased in 2013-14 and 2014-15; while in Sialkot DWI remain same in 2007-08 and 2011-12 then it showed a rising trend in 2013-14 and 2014-15. In Rawalpindi DWI, first decreased in 2011-12 and continued to decrease till 2013-14; but in 2014-15 the deprivation was increased. In Multan the value of DWI was first decreased in 2011-12 then increased in 2013-14 again it decreased in 2014-15 but remained higher than the DWI value in 2007-08. However in Islamabad the value of DWI was rising since 2007-08.

Quetta city remained the most deprived city among other cities since 2011-12. However, if ranking of cities is discussed (comparing DWI between 2007-08 and 2014-15) in Table A6 (Appendix), Lahore city stood at 12th position in 2014-15 while in 2007-08 it was at rank[8] 7th among the thirteen cities. It improved its position among other cities in terms of welfare; while Faisalabad city stood at rank 7th in 2014-15, whereas, it was at rank 9th in 2007-08; showing the city became comparatively more deprived in terms of welfare among other cities. Rawalpindi city, improved its welfare position and reached to rank 11th in 2014-15 from rank 8th in 2007-08. On the other hand, Multan maintained its rank and remained at 6th position. Sargodha decreased its welfare position from 11th to 8th and similarly, Sialkot descended from 12th to 10th, Bahawalpur

[8] Values of average weighted food price volatility in all cities are reported in annexure (table A5)

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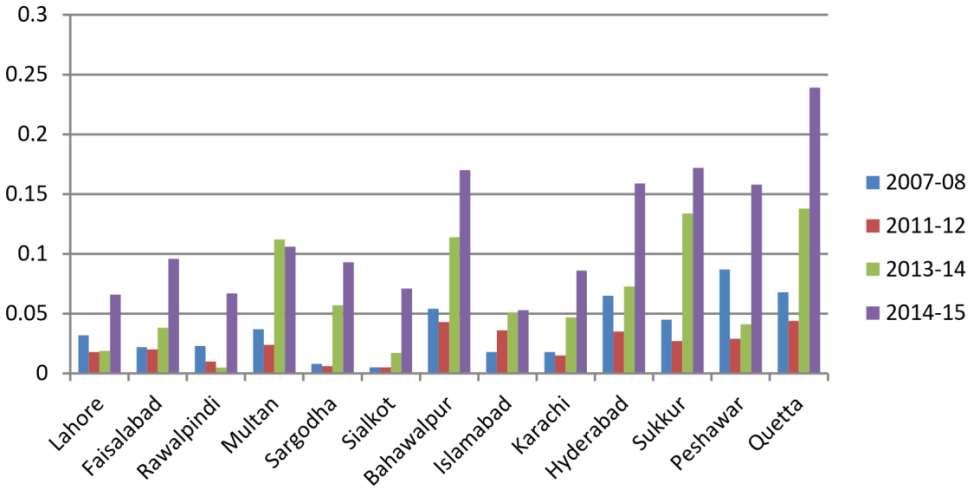

Fig. 2: Volatility in Food Prices

from 4th to 3rd, Karachi 10th to 9th, Sukkur 5th to 2nd, and Quetta 2nd to 1st. However, Islamabad, Hyderabad and Peshawar improved their welfare position among other cities and ascended from 10th to 13th, 3rd to 4th, 1st to 5th, respectively.

4.4 4.3 Results of Food Price Volatility Impact on DWI

This sub-section explains the impact of weighted food price volatility on deprived welfare index by using fixed effect methodology, recommended for pseudo panel.

Table 2: Results of Model

Dependent Variable : Deprived Welfare Index (DWI)	Coefficients	t-value
Weighted Food Price Volatility	0.407	2.82**
Household Size	0.0034	0.57
Head Employment in Non-agricultural Sector	0.681	4.43*
Household max education of employed person	-0.032	-4.66*
Constant	-0.424	-3.18*
R Square: Within	0.795	
Between	0.498	
Overall	0.681	
Number of Obs	52	
Number of Groups	13	
F-test(Prob. F-test)	19.73 (0.00)	

Source: Authors estimation based on four waves of PSLM data.
*shows significant at 1%, **shows significant at 5%.

Table 2 analyzes that there is a positive and significant relationship between the food price volatility and deprived welfare index. As volatility in food prices

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rises, it reduces the household welfare or increases deprivation. It means that 1 unit increase in food price volatility raises the deprivation in welfare index by 0.407 percent. The results prove the theoretical justification given by Martins-Filho and Torero 2016. They enlightened that in times of food price volatility, producers reduce their supply that hurt the households welfare; not only of poor consumers, but also of producers (if they are net buyers) by raising food prices.

In addition to volatility, the study also found a positive and significant link between employment of head in the non-agricultural sector and deprived welfare index (Aksoy and Isik-Dikmelik 2008). The literature highlighted that, the people employed in non-agricultural sector are the net buyers of food and would therefore, may suffer by the increase and volatile food prices, to manage the higher prices household reduce their expenditures on health and education that make them deprived. The results highlight that 1 person increase in employment of head in the non-agricultural sector increases the deprivation by 0.7 point. It is further analyzed that there is a negative and significant relationship between maximum education of households employed person and deprived welfare index. As the maximum education of households employed person raises by 1 level the deprivation is reduced by 0.03 point; thus, this result second the theory that if an individual is highly educated he/she can get a good job and could earn good income which will reduce deprivation.

5 Conclusion

This paper inter-links the deprived welfare index with food price volatility of sixteen staple food commodities using pseudo panel technique. To accomplish the core objective, the study further calculates the volatility in food prices and constructs the deprived welfare index. DWI identifies the household welfare status for thirteen large cities of Pakistan; using four waves of PSLM/ HIES data, i.e., 2007-08, 2011-12, 2013-14 and 2014-15. Specifically, the literature highlights that most of the work have been undertaken on the impact of food prices on household welfare; while the impact of food price volatility on household welfare has not been explored at regional level. This study fills the gaps found in the literature, for which the purpose, deprived welfare index, is used as a proxy for household welfare. The paper found that the volatility in food prices has raised during 2007-08 to 2013-14 and shown a decrease in it, due to the reduction in international oil prices. However, it can easily be said that there are inter-city disparities regarding DWI showing that Quetta is the most deprived large city and stand at the 1st rank since 2011-12. After Quetta, Sukkur, Bahawalpur, and Hyderabad are the most deprived cities considering education, health and standard of living in 2014-15. It is illustrated that deprivation has increased from 2007-08 to 2014-15 in all thirteen cities of Pakistan.

The results generated from pseudo panel depicts that food price volatility has significant and negative impact on household welfare or positive impact on

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household deprived welfare index. The research concludes that maximum education of employed person in a household play significant role in increasing household welfare showing the fact that if most people of a household are educated the welfare level will be high as they may have good earning and will have acknowledgment for importance of education; hence they will also encourage the education of their children, which reduces education deprivation and increases the household welfare. Similarly, employment of the head in a non-agricultural sector significantly reduces household welfare because they are net buyers of food; and thus, the increase in food prices reduce their real income or personal disposable income available to spend on health and education. Hence, it ultimately reduces the welfare. This research helps the policy makers in stabilizing the food prices by providing the exact picture of food price volatility in each city. While, with the help of deprived welfare index policy makers also analyze the welfare status of each city.

5.1 Policy Implication

To manage the adverse impact of volatile food prices on household welfare, the government must initiate some safety net programs for example; food stamps, offer cash for work; offer food on behalf of work as well as cash transfers, similarly can provide employment opportunities to the needy. These safety nets are believed to support the households in the most deprived cities of Pakistan. Such measures can work with effective checks and balance so the purchasing power of poor will not decrease in times of high and volatile food prices.
Government should build more schools with free provision of lunch. This will dispirit parents to take out their children from schools. Apart from schools there is a need of building more hospitals (health centers) with qualified doctors and other medical staff. Government should provide the awareness regarding the benefits of immunization to the uneducated parents to protect their children from many life-threatening diseases in childhood. These diseases may occur due to the consumption of less nutritional food during the period of high volatility in food prices. These policies would help the households from welfare deprivation.

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6 Appendix

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A1: Units of Commodities

Commodity	Units
Beef	1 kg
Chicken	1 kg
Pulse Mash	1 kg
Pulse Masoor	1 kg
Pulse Moong	1 kg
Rice IRI	1 kg
Wheat	1 kg
Garlic	1 kg
Ginger	1 kg
Potato	1 kg
Onion	1 kg
Tomato	1 kg
Milk	1 liter
Egg	1dozen
Sugar	1 kg
Tea (Lipton Yellow Label)	200 gm.

Source: Pakistan Bureau of Statistics

A2:Product Share 2007-08 part 1

	Bahawalpur	Faisalabad	Hyderabad	Islamabad	Karachi	Lahore
Beef	2.08	2.48	2.24	2.26	5.3	1.49
Chicken	4.31	2.96	3.5	4.56	4.57	2.95
Egg	1.02	0.81	0.7	1.05	1.01	0.78
Garlic	0.22	0.4	0.27	0.42	0.43	0.45
Ginger	0.16	0.25	0.22	0.38	0.4	0.43
Milk	19.04	19.52	14.55	10.48	14.57	16.97
Onion	2.04	1.41	1.25	1.51	1.27	1.35
Potatoes	1.98	1.29	0.95	1.59	1.28	1.58
Pulse Mash	0.28	0.47	0.07	0.24	0.3	0.25
Pulse Masoor	0.4	0.51	0.42	0.15	0.52	0.37
Pulse Moong	0.65	0.46	0.5	0.23	0.55	0.31
Rice IRI	3.01	1.67	4	2.59	2.98	3.75
Sugar	4.11	3.59	6.9	2.88	2.72	2.67
Tea	1.29	0.98	3.42	1.63	1.86	1.01
Tomatoes	1.07	0.64	0.66	0.97	0.93	0.71
Wheat	10.41	11.68	12.76	6.93	6.98	8.84

Source: Author's calculation

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A2:Product Share 2007-08 part 2

	Multan	Peshawar	Quetta	Rawalpindi	Sargodha	Sialkot	Sukkur
Beef	2.52	5.52	5.09	2.89	2.11	1.93	1.75
Chicken	2.69	2.22	4.23	4.57	4.42	3.71	3.29
Egg	0.81	0.92	0.9	0.91	0.99	1.13	0.84
Garlic	0.35	0.33	0.24	0.42	0.31	0.71	0.29
Ginger	0.24	0.13	0.2	0.3	0.19	0.48	0.18
Milk	19.76	12.28	6.82	14.67	22.29	20.5	15.95
Onion	1.66	1.28	1.77	2	1.54	1.62	1.61
Potatoes	1.13	1.29	1.74	1.72	1.39	1.98	2.09
Pulse Mash	0.28	0.63	0.63	0.32	0.39	0.46	0
Pulse Masoor	0.29	0.17	0.33	0.15	0.4	0.32	0.25
Pulse Moong	0.27	0.29	0.46	0.26	0.42	0.25	0.59
Rice IRI	1.79	1.59	1.56	2.35	2.32	6.06	8.99
Sugar	3.67	4.18	5.65	3.19	3.64	2.94	2.73
Tea	0.92	1.74	1.87	1.7	1.84	1.18	1.86
Tomatoes	0.83	1.46	1.87	0.91	0.66	0.66	0.95
Wheat	13.93	15.55	16.05	8.11	9.92	9.1	10.86

Source: Author's calculation

A3: Product Share 2011-12 part 1

	Bahawalpur	Faisalabad	Hyderabad	Islamabad	Karachi	Lahore
Beef	1.42	1.47	2.46	4.18	5.48	2.27
Chicken	4.31	3.86	3.95	4.89	5.43	3.17
Egg	1.08	0.74	0.98	1.16	1.13	0.99
Garlic	0.36	0.47	0.34	0.31	0.42	0.43
Ginger	0.33	0.3	0.26	0.24	0.35	0.32
Milk	16.55	17.39	16.42	9.67	12.95	17.25
Onion	2.05	1.51	1.29	1.96	1.39	1.41
Potatoes	1.76	1.37	1.15	1.56	0.9	1.45
Pulse Mash	0.24	0.27	0.04	0.39	0.25	0.3
Pulse Masoor	0.26	0.34	0.46	0.2	0.57	0.42
Pulse Moong	0.55	0.44	0.73	0.22	0.71	0.43
Rice IRI	2.12	1.83	2.93	2.64	2.85	3.16
Sugar	3.97	3.65	7.1	3.61	3.07	2.7
Tea	1.16	1.15	4.14	1.91	2.86	1.29
Tomatoes	1.17	0.49	1.11	1.23	0.79	0.7
Wheat	10.88	11.49	11.46	7.79	7.66	7.75

Source: Author's calculation

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A3: Product Share 2011-12 part 2

	Multan	Peshawar	Quetta	Rawalpindi	Sargodha	Sialkot	Sukkur
Beef	1.12	6.5	4.22	4.03	2.2	3.03	1.71
Chicken	3.15	2.01	4.54	4.82	4.61	3.62	3.16
Egg	0.71	0.98	0.71	1.01	1.39	0.91	1.14
Garlic	0.43	0.31	0.35	0.33	0.5	0.43	0.36
Ginger	0.27	0.1	0.23	0.23	0.22	0.35	0.12
Milk	21.57	11.27	7.7	13.24	27.13	18.22	15.67
Onion	1.67	1.46	1.95	1.9	2.57	1.76	2.13
Potatoes	1.11	1.26	1.37	1.51	1.87	1.65	2.73
Pulse Mash	0.26	0.48	0.61	0.29	0.68	0.24	0.09
Pulse Masoor	0.2	0.11	0.48	0.2	0.74	0.19	0.42
Pulse Moong	0.35	0.21	0.53	0.26	0.74	0.15	0.72
Rice IRI	1.73	1.26	2.41	2.47	2.71	5.36	10.11
Sugar	3.96	4.89	5.36	3.41	5.32	3.64	3.56
Tea	1.35	1.34	2.02	1.92	2.34	1.46	2.28
Tomatoes	1.06	1.98	1.75	1.08	0.8	0.53	1.12
Wheat	12.71	12.13	12.86	8.41	12.14	9.67	11.03

Source: Author's calculation

A4: Product Share 2013-14 part 1

	Bahawalpur	Faisalabad	Hyderabad	Islamabad	Karachi	Lahore
Beef	0.81	1.79	3.72	3.01	7.08	0.75
Chicken	3.22	3.02	3.57	5.23	4.7	2.96
Egg	0.98	1.03	1.62	0.97	1.31	1.19
Garlic	0.44	0.51	0.46	0.27	0.48	0.62
Ginger	0.2	0.35	0.54	0.2	0.44	0.57
Milk	27.92	18.29	17.44	9.06	13.19	16.75
Onion	3.01	1.67	1.79	1.72	1.35	1.61
Potatoes	3.9	1.98	1.44	1.92	1.52	2.31
Pulse Mash	0.08	0.29	0.05	0.37	0.24	0.42
Pulse Masoor	0.4	0.51	0.5	0.18	0.49	0.46
Pulse Moong	0.28	0.48	0.26	0.13	0.55	0.49
Rice IRI	2.25	2.43	2.85	2.18	3.04	3.89
Sugar	4.86	2.7	5.04	2.4	2.57	2.93
Tea	1.36	1.51	3.48	1.77	2.38	1.4
Tomatoes	0.69	0.49	1.61	1.21	0.72	0.4
Wheat	15.39	16.23	12.97	11.34	8.89	11.82

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A4: Product Share 2013-14 part 2

	Multan	Peshawar	Quetta	Rawalpindi	Sargodha	Sialkot	Sukkur
Beef	1.4	7.13	4.06	1.73	1.62	1.9	1.65
Chicken	3.42	3.55	5.12	5.06	2.71	3.71	3.17
Egg	1.06	1.31	0.36	1.69	1.01	1.51	0.55
Garlic	0.42	0.47	0.46	0.32	0.35	0.59	0.25
Ginger	0.28	0.1	0.22	0.37	0.28	0.48	0.09
Milk	23.05	8.2	3.68	16.65	23.57	15.02	17.07
Onion	1.86	1.94	2.37	2.01	1.56	2.06	2.14
Potatoes	1.38	2.22	2.36	1.74	1.7	1.77	2.91
Pulse Mash	0.28	0.27	0.45	0.27	0.67	0.33	0.06
Pulse Masoor	0.21	0.12	0.53	0.29	0.75	0.24	0.05
Pulse Moong	0.22	0.13	0.39	0.27	0.68	0.05	0.51
Rice IRI	1.27	2.06	1.89	3.23	2.3	5.38	10.4
Sugar	4.13	3.4	4.51	2.81	4.37	2.86	2.75
Tea	1.49	1.7	2.24	2.18	2.14	1.37	1.91
Tomatoes	1.06	1.95	2	0.83	0.69	0.93	1.12
Wheat	16.87	15.17	23.62	13.15	16.76	11.51	12.66

A5: Weighted Food Price Volatility of Thirteen Cities

Cities	Year	Weighted Volatility	Cities	Year	Weighted Volatility
Bahawalpur	200708	0.163	Multan	200708	0.142
Bahawalpur	201314	0.255	Multan	201314	0.243
Bahawalpur	201112	0.275	Multan	201112	0.272
Bahawalpur	201415	0.173	Multan	201415	0.198
Faisalabad	200708	0.158	Peshawar	200708	0.149
Faisalabad	201314	0.238	Peshawar	201314	0.247
Faisalabad	201112	0.25	Peshawar	201112	0.313
Faisalabad	201415	0.166	Peshawar	201415	0.221
Hyderabad	200708	0.168	Quetta	200708	0.204
Hyderabad	201314	0.285	Quetta	201314	0.286
Hyderabad	201112	0.319	Quetta	201112	0.314
Hyderabad	201415	0.208	Quetta	201415	0.261
Islamabad	200708	0.153	Rawalpindi	200708	0.153
Islamabad	201314	0.269	Rawalpindi	201314	0.317
Islamabad	201112	0.34	Rawalpindi	201112	0.309
Islamabad	201415	0.178	Rawalpindi	201415	0.213
Karachi	200708	0.191	Sargodha	200708	0.167
Karachi	201314	0.35	Sargodha	201314	0.264
Karachi	201112	0.385	Sargodha	201112	0.324
Karachi	201415	0.219	Sargodha	201415	0.245
Lahore	200708	0.148	Sialkot	200708	0.184
Lahore	201314	0.227	Sialkot	201314	0.239
Lahore	201112	0.272	Sialkot	201112	0.282
Lahore	201415	0.225	Sialkot	201415	0.179
Sukkur	200708	0.172			
Sukkur	201314	0.257			
Sukkur	201112	0.255			
Sukkur	201415	0.151			

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A6: Deprived Welfare Index in Thirteen Large Cities of Pakistan

Cities	Year	Ranking	Head Count	DWI	DEI	DHI	DSI
Lahore	200708	7	0.079	0.032	0.072	0.196	0.022
Lahore	201112	9	0.047	0.018	0.058	0.009	0.012
Lahore	201314	11	0.045	0.019	0.06	0.014	0.021
Lahore	201415	12	0.167	0.066	0.034	0.174	0.012
Faisalabad	200708	9	0.056	0.022	0.065	0.194	0.037
Faisalabad	201112	8	0.053	0.02	0.059	0.011	0.026
Faisalabad	201314	10	0.091	0.038	0.079	0.016	0.054
Faisalabad	201415	7	0.229	0.096	0.044	0.177	0.036
Rawalpindi	200708	8	0.057	0.023	0.061	0.181	0.028
Rawalpindi	201112	11	0.025	0.01	0.063	0.005	0.012
Rawalpindi	201314	13	0.014	0.005	0.063	0.01	0.043
Rawalpindi	201415	11	0.174	0.067	0.034	0.174	0.01
Multan	200708	6	0.087	0.037	0.086	0.215	0.026
Multan	201112	7	0.061	0.024	0.069	0.011	0.015
Multan	201314	4	0.287	0.112	0.127	0.022	0.05
Multan	201415	6	0.268	0.106	0.053	0.177	0.016
Sargodha	200708	11	0.023	0.008	0.04	0.204	0.023
Sargodha	201112	12	0.016	0.006	0.039	0.011	0.017
Sargodha	201314	6	0.14	0.057	0.097	0.017	0.049
Sargodha	201415	8	0.229	0.093	0.043	0.173	0.02
Sialkot	200708	12	0.012	0.005	0.058	0.206	0.008
Sialkot	201112	13	0.012	0.005	0.045	0.011	0.01
Sialkot	201314	12	0.041	0.017	0.055	0.016	0.036
Sialkot	201415	10	0.185	0.071	0.037	0.178	0.011
Bahawalpur	200708	4	0.137	0.054	0.081	0.222	0.033
Bahawalpur	201112	2	0.111	0.043	0.094	0.013	0.021
Bahawalpur	201314	3	0.282	0.114	0.143	0.015	0.068
Bahawalpur	201415	3	0.395	0.17	0.081	0.182	0.018
Islamabad	200708	10	0.047	0.018	0.056	0.167	0.028
Islamabad	201112	3	0.093	0.036	0.066	0.006	0.018
Islamabad	201314	7	0.127	0.051	0.069	0.001	0.033
Islamabad	201415	13	0.139	0.053	0.028	0.171	0.009
Karachi	200708	10	0.048	0.018	0.064	0.191	0.02
Karachi	201112	10	0.04	0.015	0.055	0.009	0.009
Karachi	201314	8	0.11	0.047	0.074	0.014	0.033
Karachi	201415	9	0.211	0.086	0.041	0.174	0.018
Hyderabad	200708	3	0.15	0.065	0.09	0.218	0.029
Hyderabad	201112	4	0.082	0.035	0.095	0.014	0.02
Hyderabad	201314	5	0.165	0.073	0.113	0.013	0.047
Hyderabad	201415	4	0.357	0.159	0.08	0.177	0.018
Sukkur	200708	5	0.115	0.045	0.077	0.201	0.03
Sukkur	201112	6	0.067	0.027	0.088	0.011	0.021
Sukkur	201314	2	0.319	0.134	0.118	0.036	0.062
Sukkur	201415	2	0.411	0.172	0.082	0.18	0.021
Peshawar	200708	1	0.21	0.087	0.137	0.188	0.032
Peshawar	201112	5	0.074	0.029	0.12	0.011	0.014
Peshawar	201314	9	0.174	0.073	0.129	0.022	0.029
Peshawar	201415	5	0.423	0.158	0.084	0.175	0.007
Quetta	200708	2	0.164	0.068	0.107	0.167	0.019
Quetta	201112	1	0.116	0.044	0.127	0.006	0.015
Quetta	201314	1	0.327	0.138	0.163	0.019	0.039
Quetta	201415	1	0.541	0.239	0.126	0.174	0.028

Source: Authors calculation using PSLM/HIES 2007-08, 2011-12, 2013-14 and 2014-15.

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