INFLATIONARY PRESSURE ON HOUSEHOLDS

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Abstract

This paper examines the effects of price inflation on households by processing the Household Socio-Economic Survey data conducted by the National Statistical Office of Mongolia. Using the standard methods, we calculate the monthly, annual and cumulative CPI inflation rates for individual households and consumption quintiles between 2009 and 2012. It is found that monthly CPIs were volatile due to seasonal changes in the prices of goods such as meat, milk products and vegetables. Households with high consumption share of food items faced with lower price inflation in the summer months relative to those with high non-food consumption shares, but higher price inflation in the other months. Although there were differences in the rates of monthly and annual inflation rates across households, the cumulative general inflation rate over the four year were more or less the same across the households representing quintiles. It also studies the real consumption of representative households of quintiles which grew at rather questionable rates over the period.

Keywords: Consumer price index, consumption, consumption shares of goods and services

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1. Introduction

Inflation receives regular media attention in Mongolia as being one of the main determinants of the standard of living. The National Statistical Office (NSO) calls for a press conference every month and reports the consumer price index (CPI) inflation rates in past periods – in last month, since the beginning of the year and since the same time last year. Some tend to ignore NSO's inflation figures instead refer to increases in the prices of individual or group of items as inflation which can be acceptable as such items could account for large shares in one's consumption basket.

Inflation has been studied well in Mongolia but at the aggregate level. Many researchers consider the effect of various shocks such as money aggregates on inflation (Gan-Ochir and Borkhuu, 2004; Davaajargal, 2005; Khulan, 2005; Gan-Ochir, 2008). Some considers the relationship between the inflation rates and nominal wages (Gan-Ochir, 2006). On the hand, some propose a method to calculate the seasonality in the inflation rates and choose other impulse mechanisms (Batsukh, 2008). A related research to our study is Batmunkh and Enkh-Amgalan (2013) which uses the NSO's inflation data, studies the seasonality in food prices, calculates various types of core inflation measures and examines the effect of the exchange rate on the inflation rate.

The objective of this paper is to examine the effect of inflation on various types of households which differ in terms of their level of consumption. The hypothesis is that different households face with different price inflation depending on the structure of their consumption. This could be studied in both short and long-run. In the short-run, the difference could be large, but there could be mechanisms to reduce the difference in the long-run. With this in mind, we employ NSO's Household Socio-Economic Survey (HSES) data and study the relationship consumption and inflation for the households participated in the survey. HSES has been conducted on a regular basis since 2009. At the time of start of this project, the available data was until the end of 2012. Every month, HSES samples over 500 households in urban areas, implying that we have 48-month of data. HSES, however, does not repeat the same households every month – we have the information of over 25000 households. We collect the consumption expenditure of each household in the survey on 123 food items and 10 non-food groups to calculate their consumption shares (or weights). We find that the consumption share of food group gets higher as the level of consumption falls. Each household in the survey reports the price and quantity of food items they purchased. Using the reported prices, we generate the time series of average prices for food items. For non-food groups, we use NSO's monthly CPIs as households only report the total cost of non-food items. We find that the prices of food items are much more volatile and seasonal than non-food groups. Especially those of meat and milk products tend to decrease in the summer months. Using the consumption shares and the price series, we generate the CPI inflation (general, food and non-food) for each households in different time frames – monthly and annual. The results show that households, indeed, faced with different rates of inflation depending on their consumption, especially the consumption share of food group. When the food CPI was less than the general CPI (e.g., in the summer months), households with high food consumption shares benefit more and vice versa. Although there were differences in the monthly and annual rates of inflation across the households, the cumulative inflation rates between January 2009 and December 2012 for the representative households of the quintiles were found to be similar.

Another piece of research we have conducted is to divide all the households in quintiles and study the real consumption of households over time. In doing so, we divide households in each

month into quintiles and obtain the average consumption of food and non-food items – we call it the consumption of a representative household of each quintile. Then we divide the nominal consumption of each representative household by current prices and find the real quantities of all 133 items. By expressing the quantities by a set of constant prices (January 2009 is the base period), we then obtain the real aggregated expenditure. We find that the real consumption of the representative households in all quintiles grew, but the one in quintile 5 grew at the fastest rate, 0.42 percent per month after fitting exponential functions to the data. The real consumption of quintile 1 grew faster (0.26 percent per month) than those in quintiles 2 (0.17 percent), 3 (0.18 percent) and 4 (0.19 percent). One might say that the gap between the rich and the others will grow and the poor might catch up with those in quintile 2 in terms of their real consumption. This answers that although there could be a difference in the rates of inflation in the short-run due to seasonality, the rates of inflation in the long-run seem to be similar. These growth rates are, however, quite questionable as the R^2 of each regression equation is very low.

The paper is organized as follows. Section 2 presents the data and its summary statistics. Section 3 briefly discusses the methodology used in the analyses. Section 4 has various consumption shares of goods and service – e.g., annual and monthly aggregate and household specific. Section 5 has the prices of goods and services. Section 6 discusses the relationship between consumption and the rate inflation. Section 7 has the results based on real consumption analyses and Section 8 concludes the paper.

2. Data

We employ the data from the HSES, which has been conducted on a regular basis since 2009, as the main source of information to examine the effect of inflation on households.[2] It is conducted on a yearly basis covering over 12000 households in both rural and urban areas. In this research, we only consider urban (Ulaanbaatar and aimag centers) households (over 6200) due to a time constraint and 67.2 percent of population live in urban areas so that leaving rural households for future research.

Data availability allows us to consider the HSES data for the period of 2009-12. In the HSES, households report their consumption on about 500 goods and services of which 122 is food items.[3] They report the quantities and prices of food items they purchased, but the total cost of non-food items rather than prices and quantities. In the following table, we show the overview of the data (the number of households and monthly average consumption expenditure per household) being considered in this research. As can be seen, the average nominal consumption per household increased over time. We find that the standard deviations are greater than the average, implying that the distribution is right-tailed – i.e., there are a few households with very high level of consumption in each year.

[2] The objectives of the HSES are to determine the subsistence level of population and poverty, to calculate household income and expenditure and to renew the goods and services in the consumption basket and their related weights.

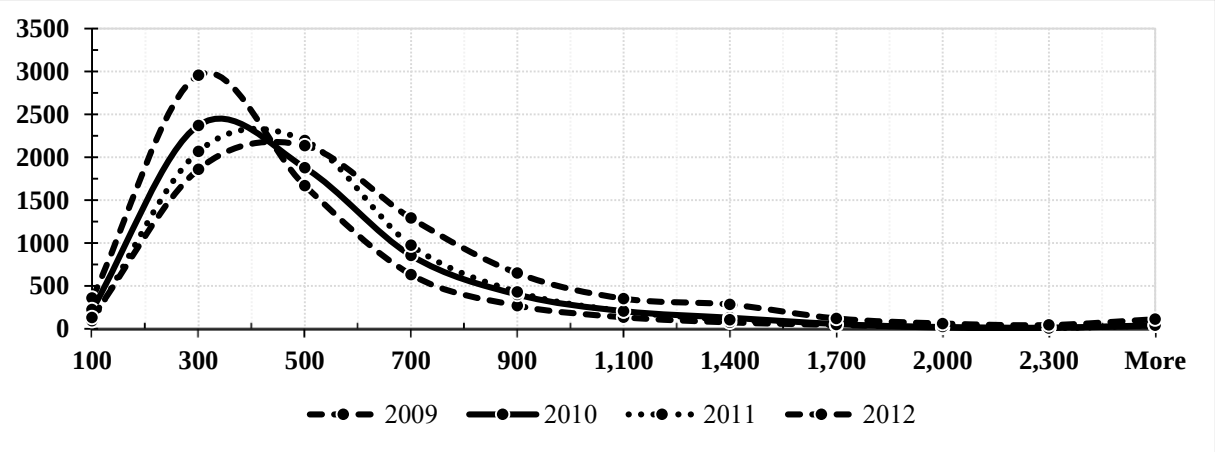
[3] There were 495 goods and services (of which 122 is food items) in the 2009-11 questionnaire but increased to 506 (123 food items) in 2012.

TABLE 1. HSES OVERVIEW

Year	Number of households	Monthly nominal consumption expenditure (MNT)			
		Average	Max	Min	STD
2009	6,223	397,250	32,884,038	2,500	798,315
2010	6,211	453,434	30,188,541	4,800	687,457
2011	6,205	477,705	30,175,222	16,700	672,227
2012	7,051	610,147	60,720,097	1,300	1,259,590
Total	**25,690**				

To expose the information in Table 1, we show the distribution of nominal monthly consumption expenditure per household for the period of 2009-12 in the following figure.

FIGURE 1. HOUSEHOLD NOMINAL CONSUMPTION EXPENDITURE HISTOGRAM (HOUSEHOLD NUMBERS, THOUSANDS MNT)



According to Figure 1, the entire distribution shifted to the right. For example, most households (over 2000 households out of over 6000) had nominal consumption of 100-300 thousand MNT in 2009 while it increased to 300-500 thousand MNT increased in 2012.

The level of monthly consumption reported by households is measured by expenses on those 495 and 506 goods and services in 2009-11 and 2012 respectively according to the survey questionnaires. There are 122 and 123 food items respectively and the rest are non-food items.[4] Table 2 has the aggregate consumption shares of food and non-food groups for all households in each year. One may conclude that the consumption share of food group was more or less the same around 37 percent over the four-year period.[5]

[4] NSO has used 329 specific goods and services in the consumption basket to calculate the CPI inflation in urban areas since 2012. That number was 287 before 2012. Our research, on the other hand, is based on all the goods and services in the questionnaire consumed by particular households in particular months rather than those used by NSO for its CPI calculation. Consequently, one should expect differences in the CPIs calculated by us and NSO.

[5] By contrast, the consumption share of food group in urban areas calculated by NSO in those 4 years was between 27.7 and 33.3 percent.

TABLE 2. CONSUMPTION STRUCTURE OF AN AVERAGE HOUSEHOLD[6]

	2009	2010	2011	2012
Total consumption expenditure (%)	100.0	100.0	100.0	100.0
Food	36.4	35.8	40.8	37.2
Purchased	35.8	35.2	38.0	34.2
Received from others free of charge	0.4	0.4	2.5	2.9
Foodstuff, which consumed from private farm and enterprise	0.3	0.2	0.3	0.1
Non-food	63.6	64.2	59.2	62.8
Purchased	61.2	61.7	57.0	59.3
Received from others free of charge	2.4	2.5	2.2	3.4

Also from Table 2, we see that purchased expenses account for the most in both food and non-food expenses. The consumption share of gifts and benefits in non-food expenses was relatively stable while that in food expense increased noticeably in last two years. In the following analyses, we focus only on the purchased expenses.

3. Methodology

We follow the NSO's "Method of calculating CPI" to calculate household specific CPIs which takes the following steps:

1. Allocate goods and services consumed by households into 122 food items and 10 non-food groups – i.e., we consider 132 items in total. The reason for considering 10 non-food groups is that households report on their expenditure rather than quantity and price of non-food items. Since there is no other source than the NSO's non-food CPIs, we aggregate non-food items into 10 groups as in the survey.
2. Calculate the consumption shares, W_{ij} for $i = 1,...,132$ and $j = 1,...,N$ where N is the number of households in the sample period.
3. Calculate the price indices of 132 items, P_i by using individually reported food prices in the HSES and the NSO's non-food CPIs.

The general CPI_j for an individual household j is then calculated by the following formula:

$$CPI_j = \sum_{i=1}^{132} W_{ij} P_i \qquad j = 1,...,N \tag{1}$$

where $\sum_{i=1}^{132} W_{ij} = 1$ for each j.

Decomposing Eq. (1) it into the food and non-food groups, we have:

$$CPI_j = \sum_{k=1}^{122} W_{kj} P_k + \sum_{i=1}^{10} W_{ij} P_i \ , \qquad j = 1,...,N \tag{2}$$

where W_{kj} is the consumption share of food item k, P_k is the price index of food item k which is based on the average of the reported prices by households, W_{ij} is the consumption share of

[6] Average household size is 3.8 and 3.7 in 2009-2010 and 2011-2012 respectively.

non-food group item i and P_i is the NSO's price index of i. The condition $\sum_{k=1}^{122} W_{kj} + \sum_{i=1}^{10} W_{ij} = 1$ must be met. Another way to look at the above formula is that 2 food groups out of 12 in the usual NSO's CPI calculation are disaggregated into 122 items and the remaining 10 subgroups are non-food which are considered as aggregate in our study.

In addition to the general CPIs for all households, we consider the relationship between the food CPI inflation and the general CPI inflation for each household. First, we decompose the consumption expenditure of each household, TC_j, into food expenses, C_j^{food}, and non-food expenses, $C_j^{non-food}$, as follows:

$$C_j^{food} + C_j^{non-food} = TC_j \ , \qquad j = 1,...,N \tag{3}$$

Dividing both sides of Eq. (3) by TC_j and considering the price percentage changes in each group, we derive the following expression:

$$\pi_j = s_j^{food} \pi_j^{food} + s_j^{non-food} \pi_j^{non-food} \tag{4}$$

where π_j^{food} is the food price inflation rate, $\pi_j^{non-food}$ is the non-food price inflation rate, π_j is the general CPI inflation rate and $s_j^{food} = \frac{c_j^{food}}{TC_j}$ is the consumption share of food group and $s_j^{non-food} = \frac{c_j^{non-food}}{TC_j} = 1 - s_j^{food}$ is the consumption share of non-food group for household j.

From Eq. (4), we obtain the following relationship between the general inflation rate and the consumption share of food group:

$$\frac{\partial \pi_j}{\partial s_j^{food}} = \left(\pi_j^{food} - \pi_j^{non-food} \right) \gtreqless 0 \tag{5}$$

According to Eq. (5), whether the relationship between π_j and s_j^{food} is positive or negative depends on whether π_j^{food} is greater or lower than $\pi_j^{non-food}$. Suppose that $\frac{\partial \pi_j}{\partial s_j^{food}} > 0$. This implies that as the food share in consumption expenditure increases, the CPI inflation rate tends to be higher if households face with higher food price inflation than non-food price inflation. Alternatively, households with higher shares of food consumption tends to face with higher price inflation if the food price inflation rate is higher than that of non-food group.

4. Consumption shares of goods and services

As mentioned earlier, we consider all the goods and services in the HSES questionnaire rather than 329 specific items used by the NSO for the calculation of its CPI inflation. The HSES had 122 food items and 373 non-food items in 2009-11, but 123 and 383 in 2012.

NSO uses 2010 as the base (reference) year and takes the aggregate consumption shares or weights of 329 goods and services in 2010 HSES. We, on the other hand, calculate monthly, yearly aggregate and household specific consumption shares from the survey.

In the following table, we show the aggregate consumption shares of 12 major groups of goods in 2009-12 obtained from the total purchased consumption of goods and services in the HSES.

TABLE 3. COST STRUCTURE OF PURCHASED CONSUMPTION (BY 12 MAJOR GROUPS OF GOODS)

		2009	2010	2011	2012
	Purchased consumption (%)	**100**	**100**	**100**	**100**
1	Food and non-alcoholic beverages	35.6	35.2	38.9	35.2
2	Alcoholic beverages and tobacco	1.3	1.2	1.2	1.4
3	Clothing, footwear and cloth	6.7	7.9	7.4	8.2
4	Housing, water, electricity and fuels	9.0	8.6	9.1	9.2
5	Furnishings, household equipment and tool	2.5	2.6	2.5	3.1
6	Health, medical care and services	2.8	3.0	2.9	3.3
7	Transport	8.5	8.3	7.9	13.2
8	Communication	8.5	8.5	7.7	8.7
9	Recreation and culture	1.9	1.8	1.7	2.0
10	Education	2.3	1.8	1.7	1.3
11	Restaurants and hotels	2.9	3.1	2.7	0.1
12	Miscellaneous goods and services	18.1	18.2	16.4	14.2

"Food and non-alcoholic beverages" accounts for around 35 percent. In 2012, the consumption share of "Transport" increased sharply to 13 percent. The reason is that the number of vehicles purchased by households in 2012 and related consumption of fuel increased dramatically. The reason why the consumption share of "Restaurants and hotels" decreased to 0.1 percent in 2012 is that spending in restaurants, cafes and refectories at schools and work places decreased sharply for some reason. In addition, the consumption share of "Miscellaneous goods and services" stayed constant at 18 percent in 2009-10 but fell continuously to 14 percent in 2012. For the other major groups, the consumption shares remained rather stable over the four years.

Looking closely at "Food and non-alcoholic beverages" by sub-groups (Table 4), we find:

- ✓ The share of "Meat and related products" increased from 28 percent to 40 percent between 2009 and 2012.
- ✓ The share of "Bread, flour and rice" fell from 29 percent in 2009 to 21 percent in 2012.
- ✓ Other sub-groups kept their shares more or less the same.

TABLE 4. STRUCTURE OF FOOD GROUP (BY SUB-GROUPS)

	2009	2010	2011	2012
Purchased consumption (%)	**100**	**100**	**100**	**100**
1. Food and non-alcoholic beverages	**96.5**	**96.8**	**97.1**	**96.3**
1.1 Bread, flour, rice	28.9	26.7	25.0	21.4
1.2 Meat and related products	28.0	31.2	31.7	39.6
1.3 Milk and related products	11.6	11.5	12.0	11.2
1.4 Oil, vegetable oil	5.5	4.7	4.0	3.4
1.5 Fruits	2.3	2.5	3.1	2.9
1.6 Vegetables	9.2	9.2	9.0	7.3
1.7 Sugar, jam, sweets, cholates	5.2	4.9	5.7	4.7
1.8 Other food items	1.6	1.5	1.5	1.0
1.9 Non-alcoholic beverages	4.2	4.5	5.0	4.8

2. Alcohol beverages and tobacco	**3.5**	**3.2**	**2.9**	**3.7**
2.1 Alcohol beverages	1.8	1.8	1.6	1.5
2.2 Tobacco	1.7	1.4	1.3	2.2

We also divide the total number of households in 2012 into quintiles in terms of their consumption and summarize the consumption shares of the 12 major groups of goods and services (Table 5).[7] As can be seen, the consumption share of "Food and non-alcoholic beverages" for the lowest consumption quintile (Q1) is around 60 percent while that of the highest consumption quintile (Q5) is about 23 percent. Except for the likes of "Food and non-alcoholic beverages", "Housing, water, electricity and fuels", "Alcoholic beverages and tobacco" and "Communication", the consumption shares of other groups tend to increase with the level of consumption.

TABLE 5. COMPOSITION OF CONSUMPTION BY HOUSEHOLD QUINTILES (CONSUMPTION SHARES, 2012)

		Q1	Q2	Q3	Q4	Q5
1	Food and non-alcoholic beverages	60.2	56.1	50.7	43.5	23.2
2	Alcoholic beverages and tobacco	2.0	2.1	1.9	1.8	1.0
3	Clothing, footwear and cloth	3.1	4.8	6.4	8.2	11.7
4	Housing, water, electricity and fuels	12.3	12.4	11.8	10.7	7.8
5	Furnishings, household equipment and tool	2.6	2.2	2.1	2.3	4.5
6	Health, medical care and services	1.9	2.2	2.6	3.2	4.5
7	Transport	1.6	2.6	4.5	8.1	15.3
8	Communication	9.6	10.6	11.2	10.3	7.9
9	Recreation and culture	0.7	1.0	1.2	1.5	3.3
10	Education	0.0	0.0	0.0	0.2	2.9
11	Restaurants and hotels	0.0	0.0	0.1	0.1	0.2
12	Miscellaneous goods and services	5.8	6.1	7.5	10.1	17.7

In general, one may conclude that there is a significant negative relationship between the consumption share of food group and the level of consumption. This result is consistent with the findings of Hymans and Shapiro (1976) and De Hoyos and Lessem (2008). The former finds that 50 percent of income of poor households spend on food consumption while the highest income households spend 3/10 of their income on food. Based on households of different countries, the latter confirms a negative relationship between food consumption share and household income.

5. Price indices of goods and services

This section has two parts. The first part deals with the reported prices of food items in the HSES by collecting, obtaining the averages, calculating the standard deviations and filling any missing information. The second part discusses the rationale for using NSO's CPI inflation of non-food groups.

5.1. Food CPIs

Households in the HSES report the prices of food items in the survey questionnaire. We collect those prices from the survey and calculate the monthly average price of each food item.[8] In

[7] See Appendix 1 for the same calculations for the other years.
[8] As mentioned earlier, households in the HSES report only the cost of non-food items.

collecting and processing the price data, we find that there were no reported prices for some food items in some months as the households in the survey did not consume them.[9] These items are given in Table 6 together with their aggregate consumption shares.

TABLE 6. CONSUMPTION SHARE OF GOODS, MISSING PRICE INFORMATION

	Food items	2009	2010	2011	2012
1	Pizza - Piece	0.04	0.10	0.17	0.22
2	Game - kg	0.01	0.32	0.18	0.01
3	Dried, smoked, salted fish - kg	0.01	0.01	0.01	0.01
4	Other fish and seafood - kg	0.01	0.01	0.02	0.01
5	Dried eggs - kg	0.00	0.00	0.00	0.00
6	Olive oil - lt	0.03	0.02	0.04	0.03
7	Other oils and fats - kg	0.01	0.01	0.01	0.01
8	Wild nuts,kg - kg	0.01	0.16	0.08	0.04
9	Sugar substitution - gr	0.00	0.00	0.01	0.00

To fill the gap in the time series of such prices, we use the following corrections:

1) If those goods have counterparts in the NSO's consumption basket, we use the monthly price indices reported by NSO for those items.

2) If those goods do not have counterparts in the NSO's consumption basket, we simply assume that the prices of those did not change over the missing month from the previous month.

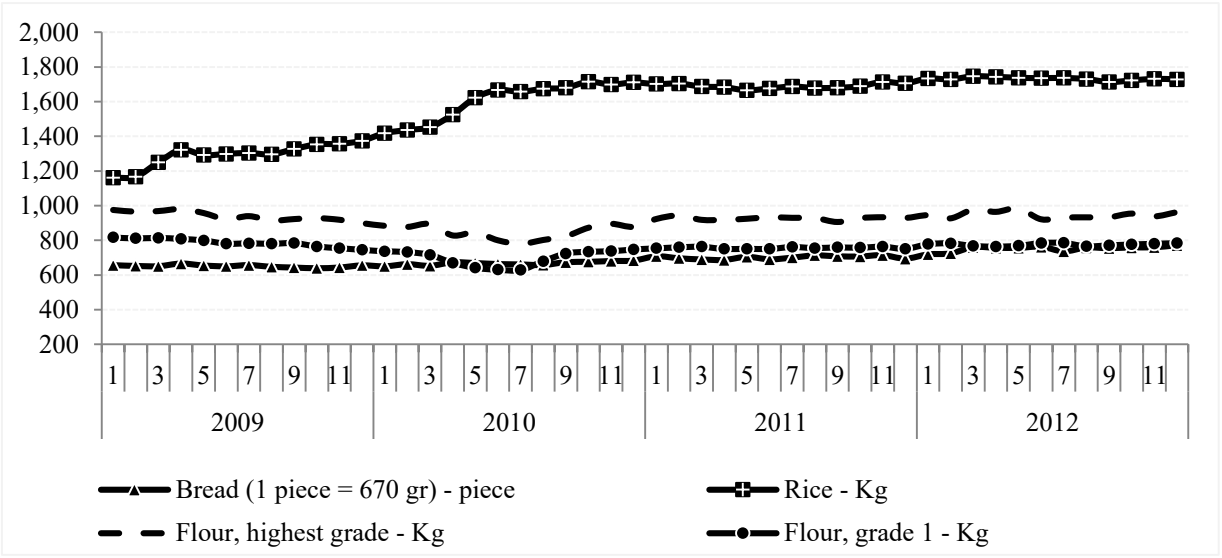
3) For the yearly analyses, we substitute the NSO's general CPI inflation for them.

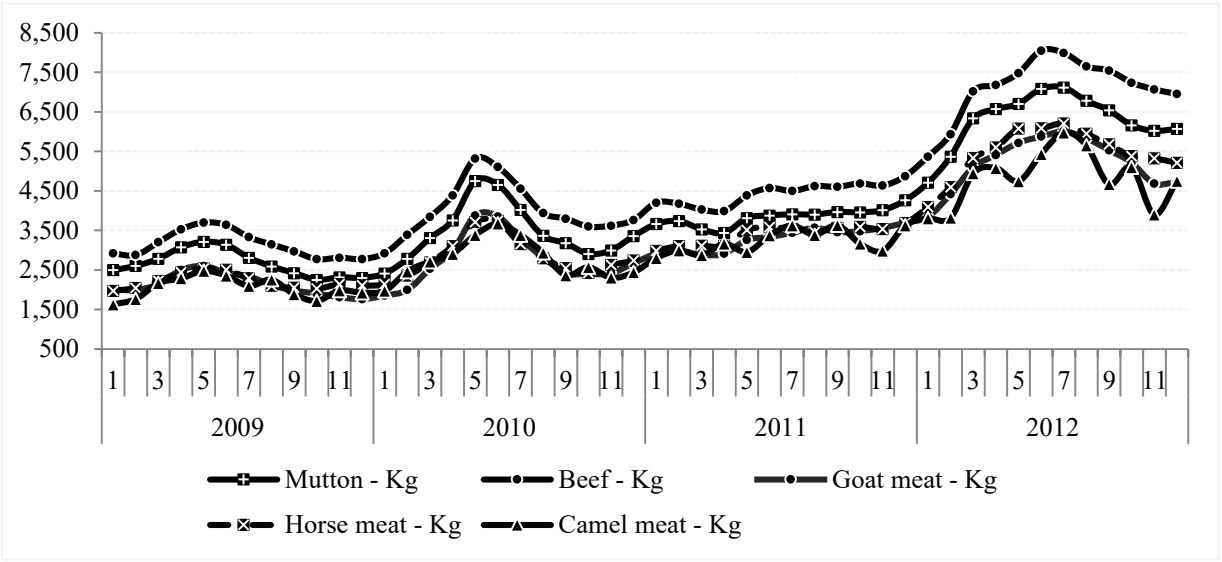
It is worthwhile emphasizing that these food items account for small shares in the consumption of an average household. For that reason, changing the above corrections would not make a significant difference in the results.

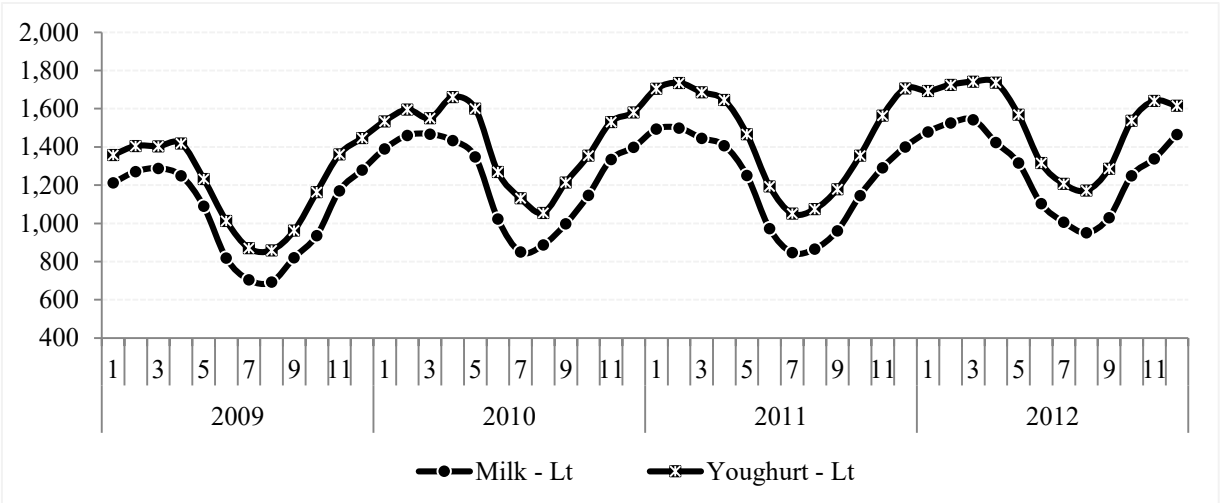
In the following figure, we show the dynamics of the average prices of selected food items for 2009-12.

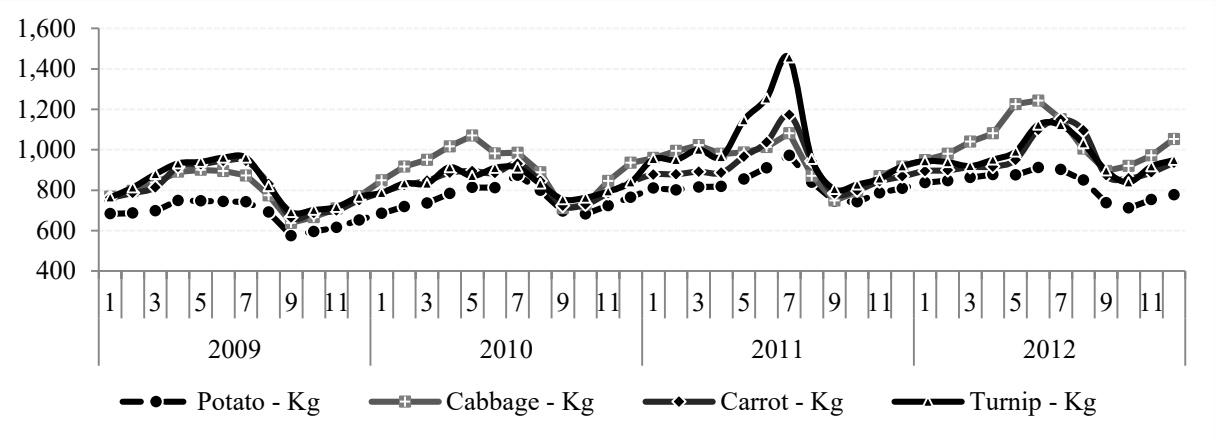
[9] For example, the average reported price of milk was 1044 MNT per liter in 2009 and increased by 22 percent to 1276 MNT in 2012. The price of yogurt increased by approximately 25 percent. The price meat showed a dramatic increase. In 2009, mutton was 2663 MNT per kg and increased to 6354 MNT in 2012. Beef price showed 2.2 fold increase over the same period and reached 7169 MNT per kg.

FIGURE 3. PRICE DYNAMICS OF SELECTED FOOD ITEMS (MNT)





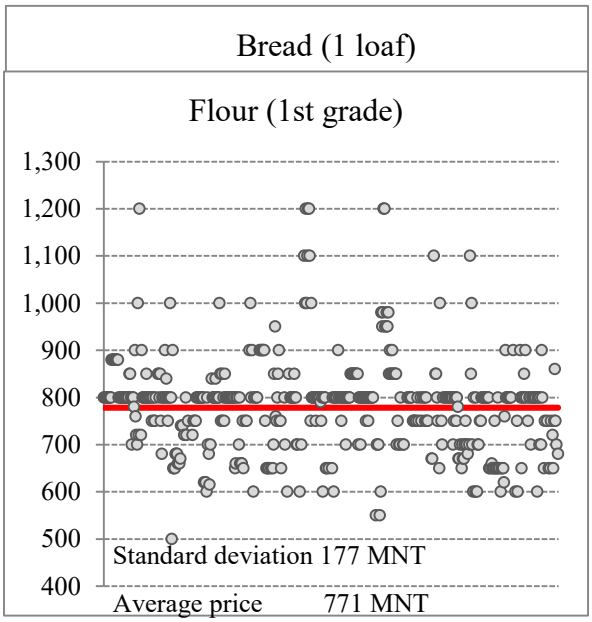




From Figure 3, we can clearly see the seasonality of milk and meat products and vegetables as well their time trends.

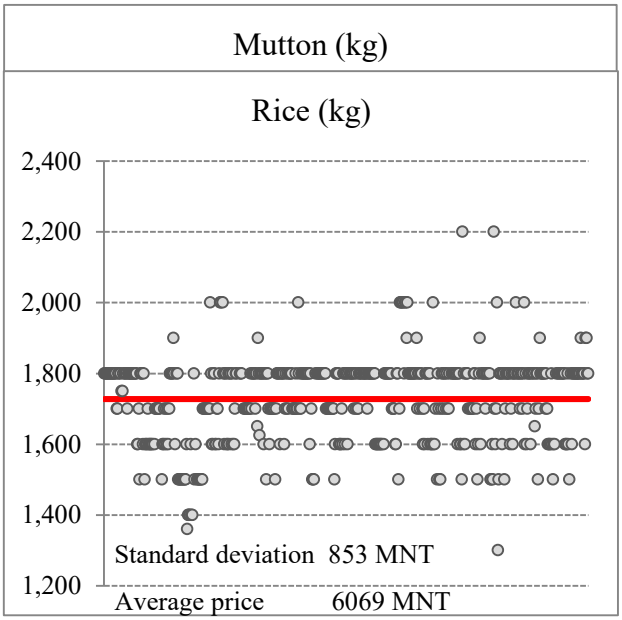
To calculate monthly CPI inflation, NSO follows a specific procedure in collecting price data – i.e., the prices of certain items are collected from certain market places at certain times. Our reported prices, on the other hand, could be noisy as being reported by individuals who purchased goods and services with different quality at different places and at different times over the month period. For this reason, we examine the price data to see if we could use the average prices for our further analyses. We calculate the standard deviation of the prices for each food items and find that the results are reasonable enough to use the average prices for the further analyses. Below we show some examples.

FIGURE 4. REPORTED PRICES OF SOME PRODUCTS (DEC 2012, AVERAGE AND STANDARD DEVIATIONS, MNT)



Standard deviation 101 MNT

Average price 784 MNT



Standard deviation 120 MNT

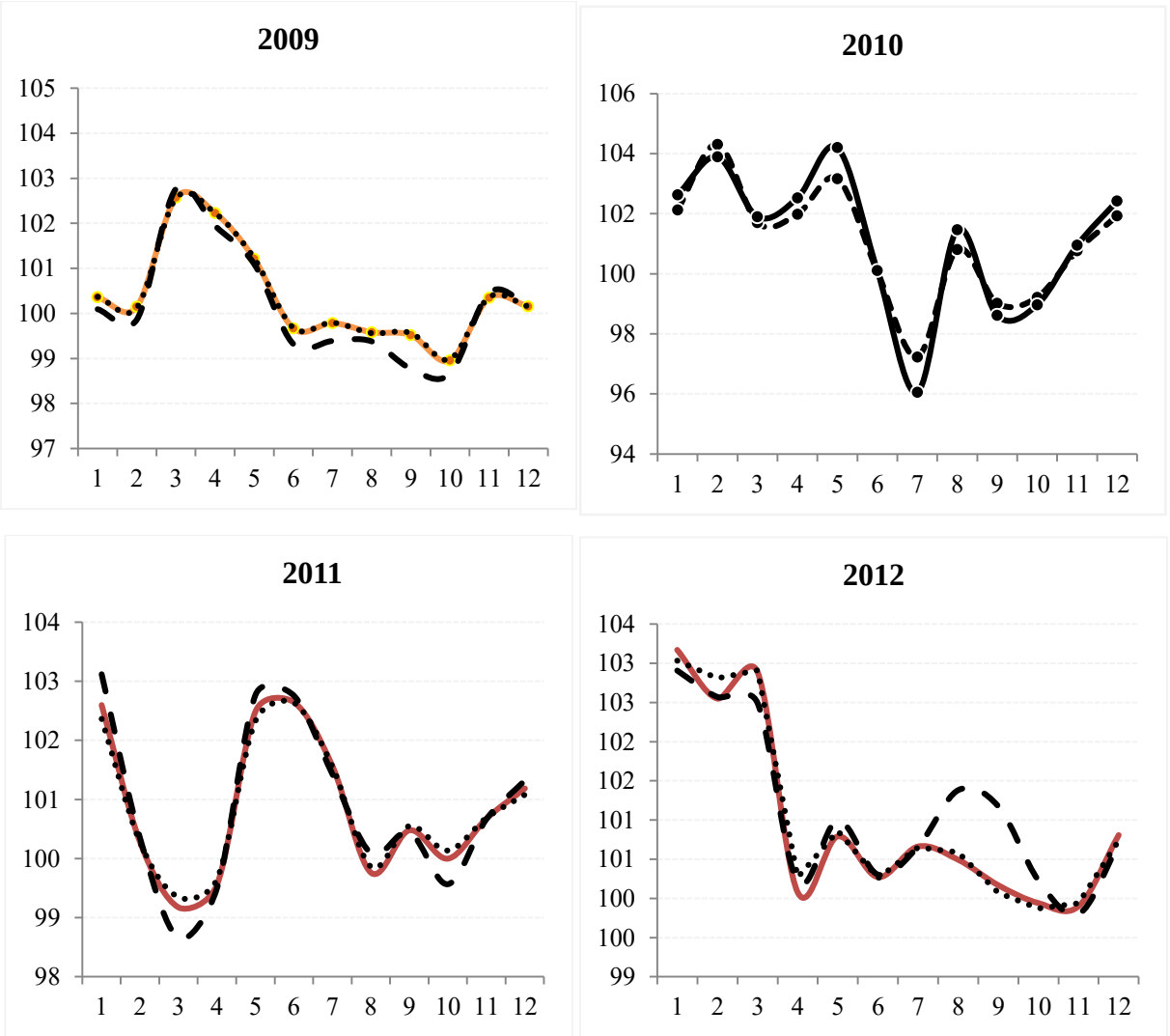
Average price 1727 MNT

5.2. Non-food CPIs

The HSES does not reflect the prices and quantities of non-food items, instead it collects data on the expenditure. Consequently, we had to find the information about their prices from other sources. In this case, we use the NSO's price indices for 10 non-food groups. However, to examine if the NSO's price indices for the 10 non-food groups can be used for the further analyses, we employ the monthly aggregate consumption shares of all 12 groups (of which 2 are food groups) derived from the HSES together with the NSO's price indices for all 12 groups to calculate monthly CPIs for the 4 years. The results are given in Figure 5 which compares 3 different scenarios.

a. The dashed line indicates the CPIs calculated by NSO.
b. The solid line is the CPIs calculated by us on the basis of current year aggregate consumption shares.
c. The dotted line is the CPIs calculated by us on the basis of the 2010 (the reference year) aggregate consumption shares.

FIGURE 5. MONTHLY CPI COMPARISONS



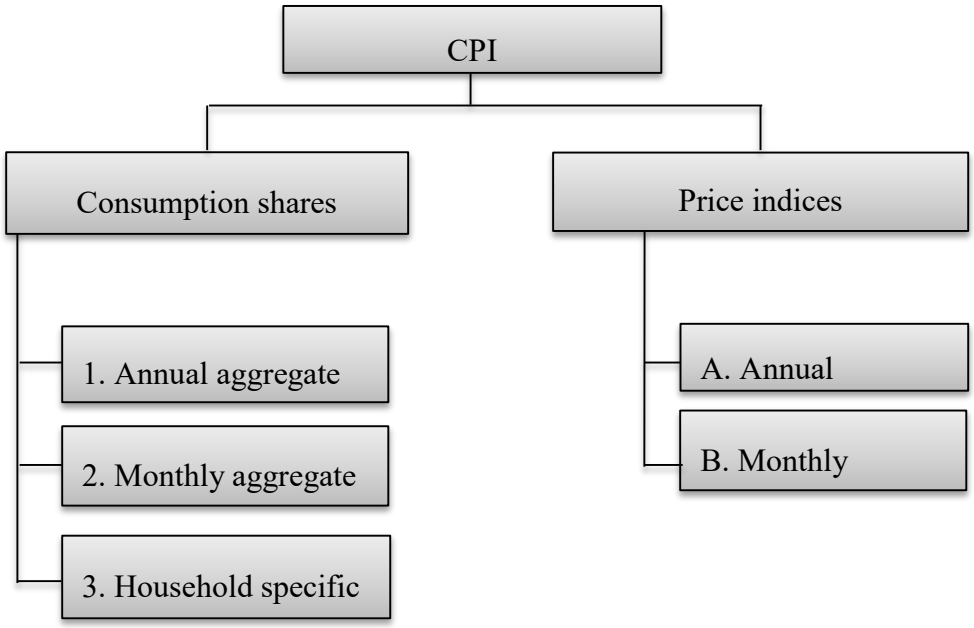
As can be seen from the figure above, the consumption shares did not change much over the 4 years as the solid and dotted lines overlap for most of the time. Since there are no significant

difference in terms of patterns, we use the NSO's price indices for non-food groups in the further analyses.

6. CPI calculation

In this section, we try to analyze the effect of inflation on households. In doing so, we calculate monthly and yearly CPIs for each household in the survey using various consumption shares – more specifically, annual aggregate, monthly aggregate and household specific. The reason is that the different set of households are selected in each survey. These are summarized in the following figure.

FIGURE 6. CALCULATING CPIS



Clearly, there are many versions of CPIs (A1, A2, B1, B2 and B3) calculated depending on the combinations of the consumption shares and the price indices.

A. Annual inflation

A1. Using the annual changes in the prices and the aggregate annual consumption shares, we calculate the annual average CPI inflation.

A2. Using the consumption shares of each household, we calculate their annual CPI inflation.

B. Monthly inflation

B1. Using the annual aggregate consumption shares as in A1 and monthly changes in the prices, we calculate monthly average CPI inflation.

B2. We calculate the monthly aggregate consumption shares using the consumption of all households in a current month (roughly 600 households) and the monthly CPI inflation.

B3. Using the consumption shares of each household, we calculate their monthly CPI inflation using the price data obtained from the HSES.

Let us now consider these 5 cases individually.

Case A1

In this case, we first obtain the annual aggregate consumption shares using the information of all households in a current year survey and then calculate the annual average CPI inflation using the annual changes in the prices. The results, the calculated inflation rates, are given in the following table.

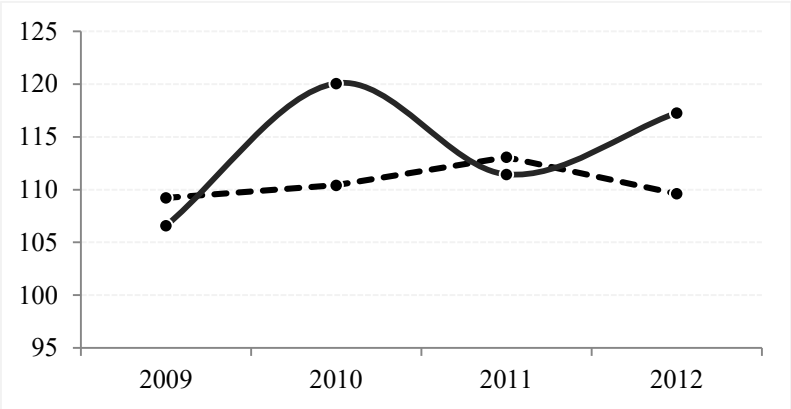
TABLE 7. ANNUAL INFLATION RATES (%, END OF THE YEAR)

Year	2009	2010	2011	2012
Inflation rate	9.2	10.4	13.1	9.6
Inflation rate*	4.2	13.0	10.2	14.0

*Reported by NSO

As can been from the results, our annual inflation rates are different from those reported by NSO. The reason for this could be the prices coming from different sources as mentioned earlier. Decomposing the general CPIs further into food and non-food groups, we find the following results in the following figure where the dashed line is for the food CPIs and the solid line is for the general CPIs. In 2009 and 2011, the general CPIs were greater than the food CPI while it is smaller in the other two years. The food CPI was much more volatile than the non-food one so that the general CPI is relatively stable.

FIGURE 7. GENERAL CPI AND FOOD CPI



Case A2

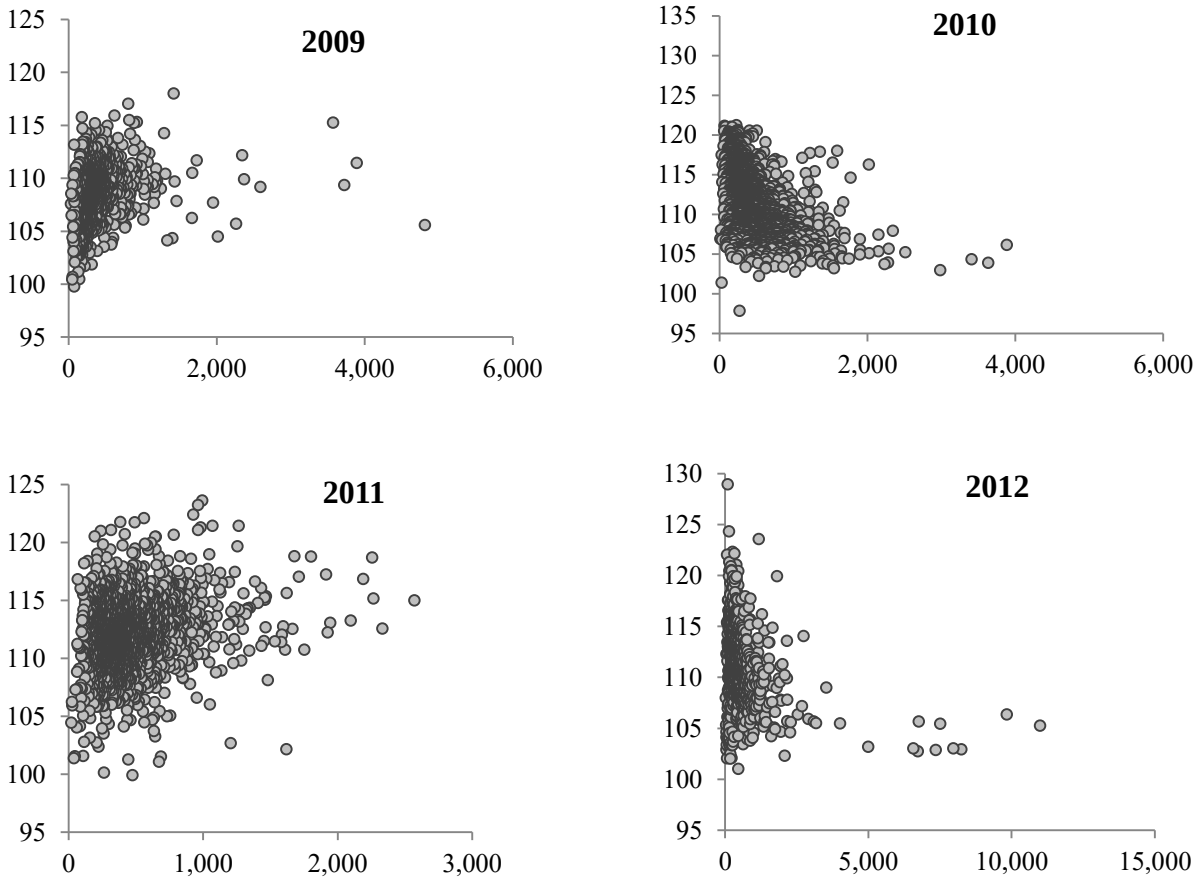
In this case, we calculate annual CPI for each household in the survey (25690 households) using the annual price changes. In doing so, we assume that all households in a particular year (over 6200 households) experience their own consumption shares at the beginning of the year despite the fact that they were selected in different months. The results are summarized in the following table.

TABLE 8. DISTRIBUTION OF INFLATION RATES (BY THE NUMBER OF HOUSEHOLDS)

		Inflation rate (%)				
Year	**Number of households**	**< 0**	**0-6**	**6.1-10**	**10.1-15**	**15.1<**
2009	6223	29	1021	3274	1851	48
2010	6211	4	339	1767	2590	1511
2011	6205	7	127	1099	4029	943
2012	7051	2	480	2157	3511	901

In 2009, most households faced with the inflation rate of 6-10 percent while the majority of households experienced the inflation rate of 10-15 percent in the other years. Then the question is about the consumption structure of households who are experiencing different inflation rates. We find that the correlation coefficient of the inflation rates of all households and their consumption expenditure is 0.31 in 2009, -0.47 in 2010, 0.22 in 2011 and -0.28 in 2012 (see the scatter diagrams in Figure 8). It implies that the rich faced higher inflation in 2009 and 2011 while the poor faced higher inflation in 2010 and 2012. This can be explained by Figure 7 in which the general CPI is greater than the food CPI in 2009 and 2011 but lower in 2010 and 2012 with the help of Eq. (5) – i.e., the consumption share of food for the poor is greater than that of richer households. When the poor face higher food price inflation than non-food groups, their general CPI tends to be higher than those of richer households.

FIGURE 8. RELATIONSHIP BETWEEN HOUSEHOLD LEVEL CPIS AND THEIR CONSUMPTION EXPENDITURE (THOUSANDS MNT)



To see how much price inflation households experienced over the four years, we have conducted the following exercise. We first divide households into quintiles in terms of their level of consumption. We then aggregate the consumption expenditure on 122 food items and 10 non-food groups for each quintile. Using the time series of average prices of food items and price indices of non-food groups, we calculate the real quantities of each item consumed by each quintile in the sample period. Then choosing any month as a base period, we form a constant basket of quantities. We calculate the cost of the basket over time. We choose January 2009 as the base period and multiply the quantities in the basket by the corresponding prices in each month. In other words, the quantities in the basket do not change, only the prices change. As one can imagine, the quantities of each food item consumed by households in different

quintiles differ reflecting the difference in income and preference. We sum up the nominal cost of the basket and calculate the inflation rates between January and December in each year. We calculate the inflation rate for all households in each year using the same method.[10] In this way, we find the following results.

TABLE 9. ANNUAL CPIS (QUINTILES)

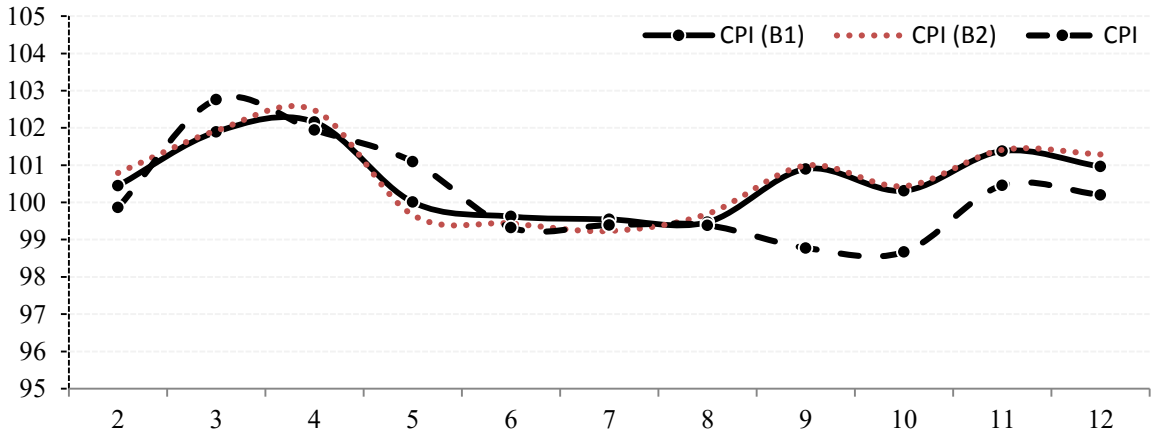
	2009	2010	2011	2012
Quintile 1	3.4	12.1	7.9	9.2
Quintile 2	3.8	11.5	9.6	11.1
Quintile 3	4.6	11.2	9.0	9.7
Quintile 4	5.3	10.4	10.2	11.5
Quintile 5	6.8	7.5	8.4	6.7
All households	5.6	9.4	9.0	9.7

According to the results in the above table, the level of CPIs increased monotonically with quintiles in 2009, decreased monotonically in 2010, but more or less symmetric around the average in 2011 and 2012.

Cases B1 and B2

In these two cases, the monthly average CPI inflation rates are calculated by using annual aggregate and current monthly aggregate consumption shares. Notice that both annual and monthly aggregate consumption shares change over time. We show the results in the following figures graphically in which the solid line (B1) is based on the annual aggregate consumption shares, the dotted line (B2) is based on the current month's aggregate consumption shares and the dashed line is the monthly CPIs reported by NSO. Notice that the former two overlap for most of the time, indicating that there is no significant difference between the annual aggregate and monthly aggregate consumption shares. In all years, it looks as if our calculated CPIs deviate from those of NSO, but the difference is small.

FIGURE 9. MONTHLY CPIS IN 2009



[10] The annual inflation rates for all households calculated in this way is different from those in Table 6 as the methods are different.

FIGURE 10. MONTHLY CPIS IN 2010

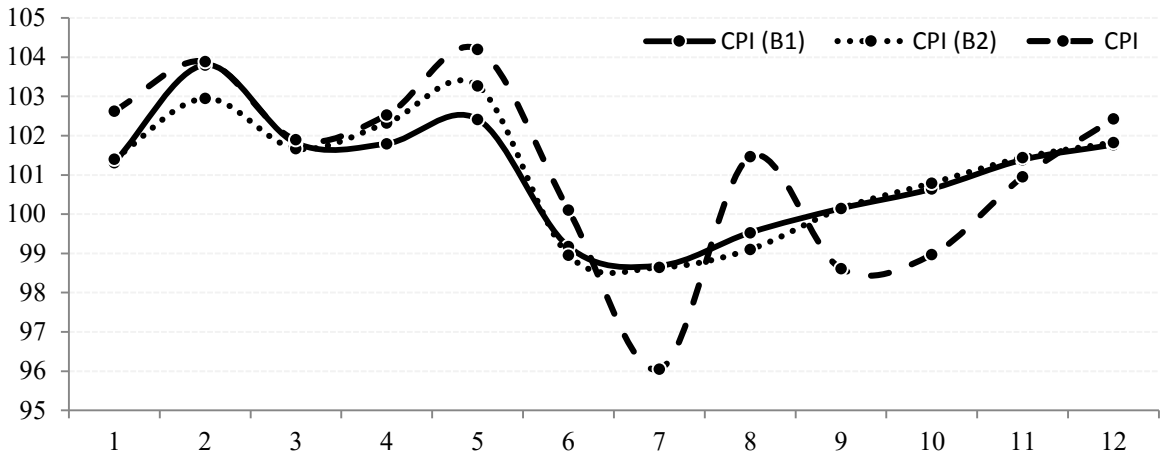


FIGURE 11. MONTHLY CPIS IN 2011

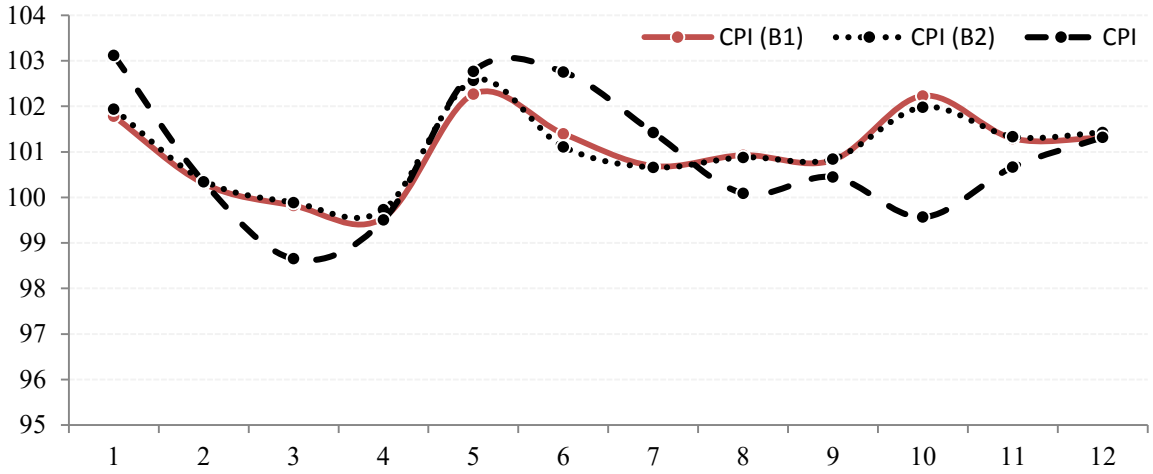
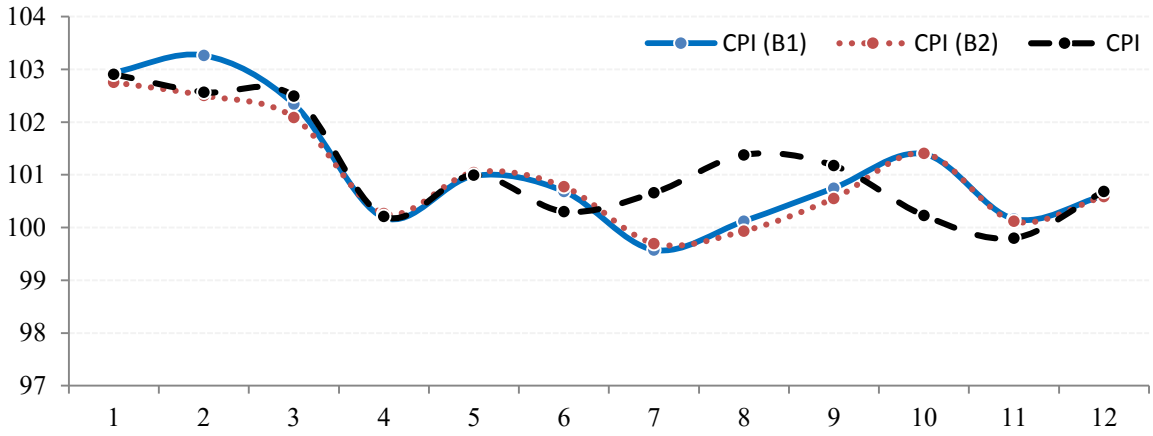


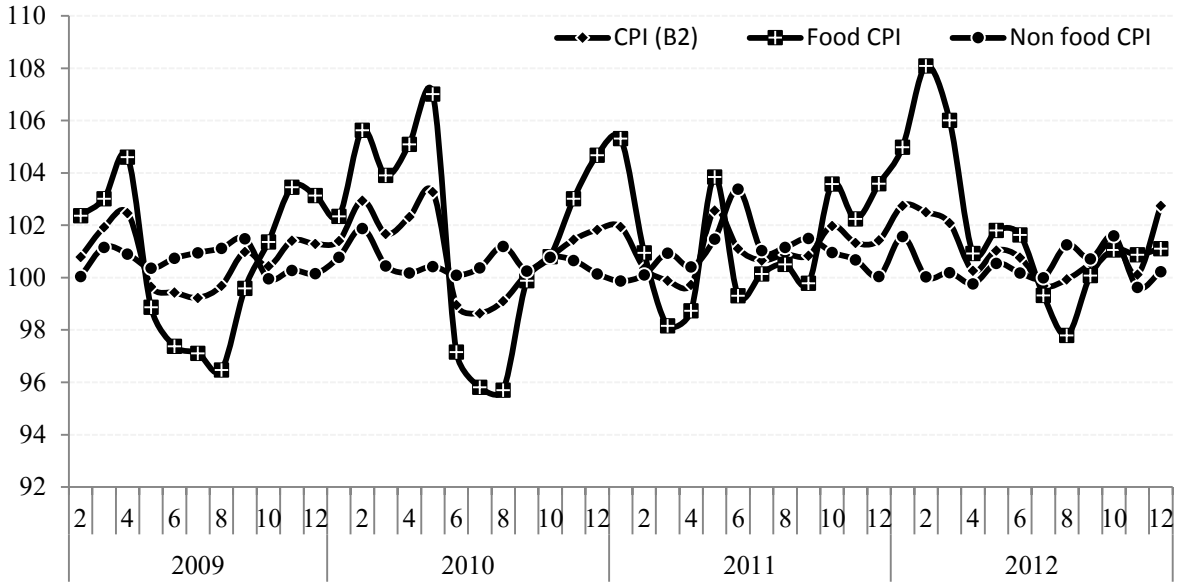
FIGURE 12. MONTHLY CPIS IN 2012



In Mongolia, the food CPI has the highest degree of volatility. The main contributor is the seasonality in the prices of some food items. In the summer and early autumn months (from

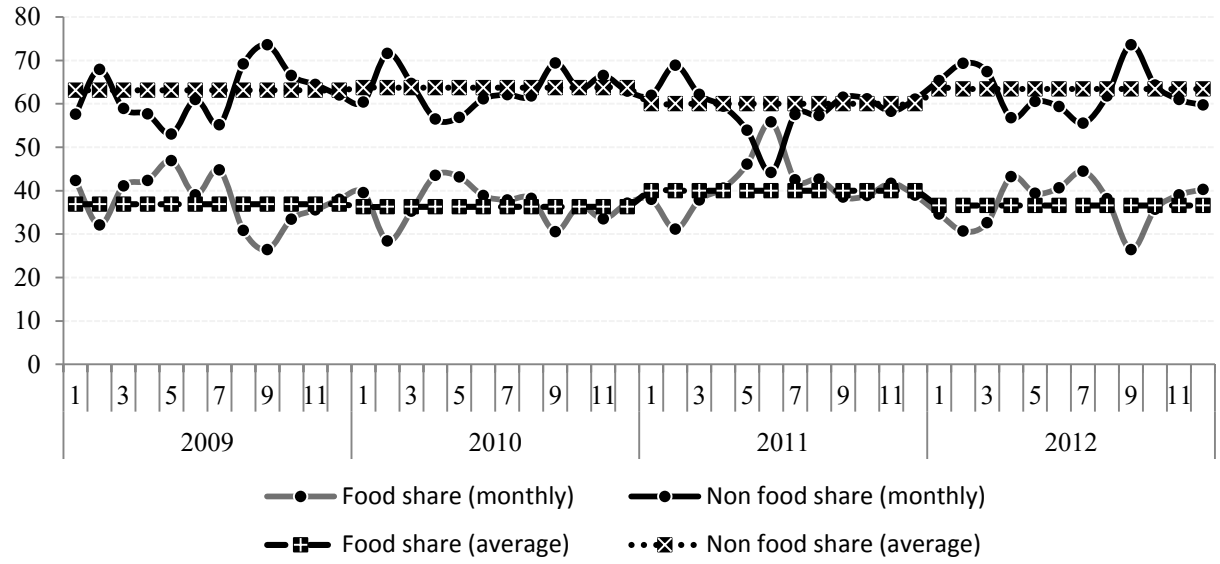
June to October), the food CPI tends to decrease and become lower than the non-food CPI so that the general CPI tends to be higher than the food CPI. The reason is that the prices of meat, milk products and flour which have high consumption shares tend to decrease in these months (see Figure 3). In the following figure, we show the monthly general, food and non-food CPIs over the whole sample period (48 months) using the monthly consumption shares. As can be seen, the dashed line (the food CPI) is much more volatile than the dotted line (the non-food CPI) so that the general CPI (the solid line) takes the weighted average of these two.

FIGURE 13. MONTHLY GENERAL, FOOD AND NON-FOOD CPIS



There is a strong co-movement in the food and general CPIs, indicating that the food prices are important for households. In addition, the food CPI is most likely to be leading the general CPI as containing cyclically exogenous elements. Moreover, changes in the consumption shares can be contributing to the food, non-food and general CPIs in the above figure. In the following figure, we show the monthly aggregate consumption shares of food (grey line) and non-food (black line) groups. According to these, the average (trend) shares (the dotted line is for the non-food group and dashed line is for the food group) are fairly stable over the period while the actual shares are highly cyclical and seasonal. As being summed to unity, the share of one group increases (decreases), the other falls (increases). It looks as if the consumption share of the food group tends to fall below the trend in February and September but go over the trend between April and August and be around the trend in the other months for all 4 years. The reason for the lower consumption share of the food group in February and September could be Tsagaan Sar (Mongolian New Year celebration) and the school year. Without such increases in non-food consumption, the average or the trend consumption share of the food group would be higher and close to its values in the other months.

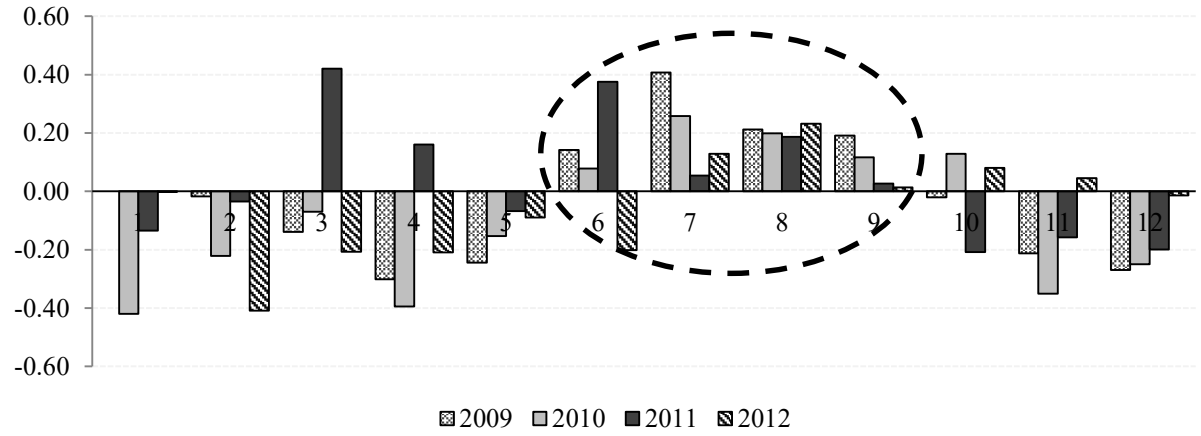
FIGURE 14. MONTHLY AGGREGATE CONSUMPTION SHARES OF FOOD AND NON-FOOD GROUPS



Case B3

Using the consumption shares of each household, we calculate their monthly CPI inflation. More specifically, we calculate the consumption shares of each item for the households selected in each month. Then we use the price changes between the month in which they were selected and the following month to calculate their monthly CPIs. The following figure shows the monthly correlation coefficients between the household specific CPI inflation rates and the level of consumption for all 4 years.

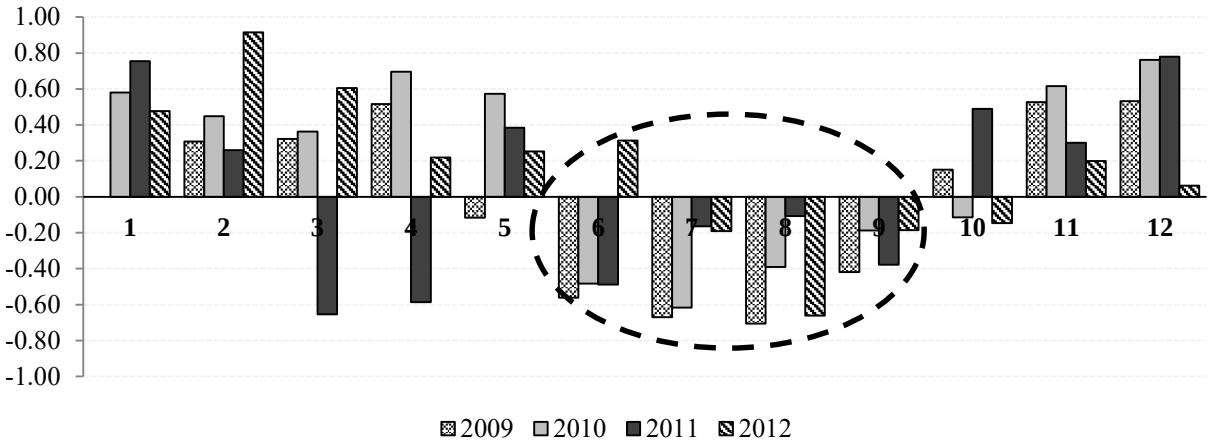
FIGURE 15. CORRELATION COEFFICIENTS BETWEEN HOUSEHOLD CPI INFLATION AND CONSUMPTION



Although it is not strong, the correlation coefficient between the level of consumption and the household specific monthly CPI inflation rate is between -0.5 and 0.5 depending on the season. In the summer months, the correlation tends to be positive while negative in the other months.

In the following graph, we show the correlation coefficients between the household specific monthly CPI inflation rates and the consumption shares of food group of all households.

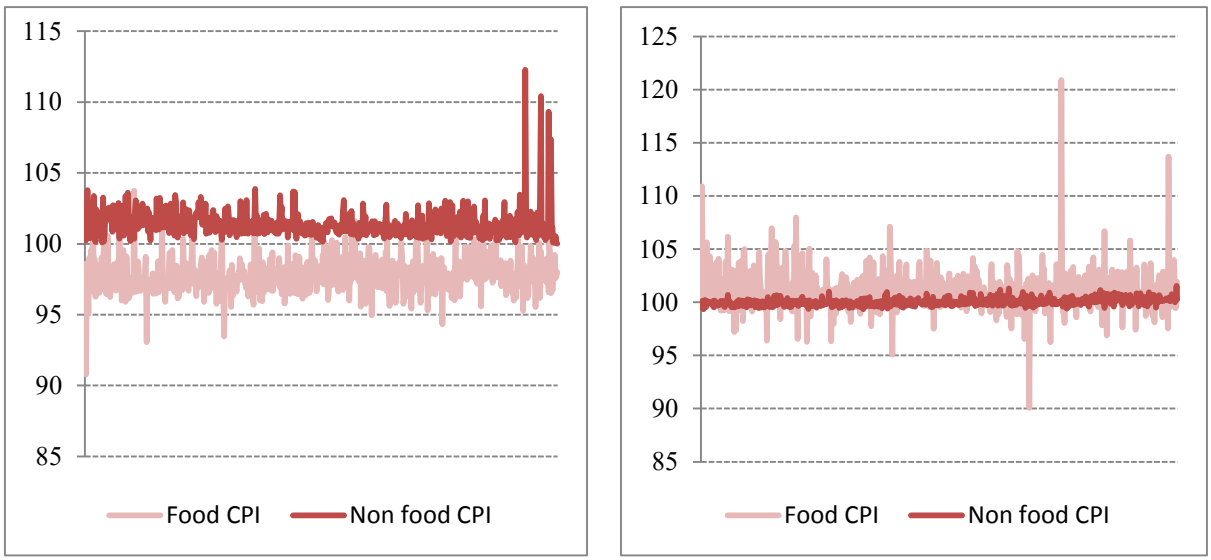
FIGURE 16. CORRELATION BETWEEN HOUSEHOLD CPI AND THE CONSUMPTION SHARE OF FOOD GROUP



As you see, the household specific CPI inflation rates are highly correlated with the consumption share of food group – i.e., the correlation coefficients range between -0.7 and 0.8 depending on the season. In the summer months, the correlation tends to be negative, implying that households with high food consumption shares face with low CPI inflation and vice versa.

The seasonal effects can be seen more clearly from the following figure which has the food and non-food CPIs of all households in those months of 2012. For all households, the non-food CPIs are higher than the food CPIs between July and August while it is the opposite between November and December.

FIGURE 17. HOUSEHOLD SPECIFIC MONTHLY FOOD AND NON-FOOD CPIS



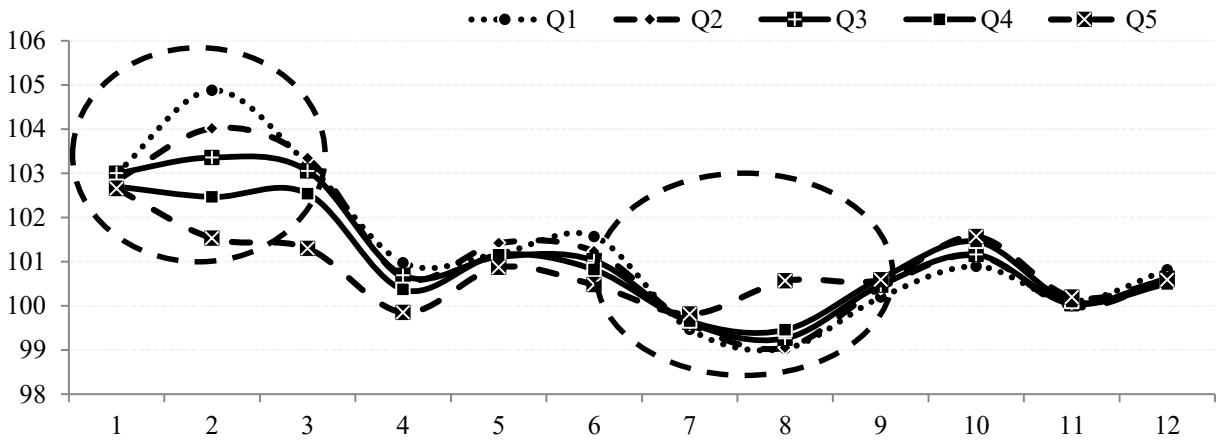
(2012)

July-August November-December

We also calculate the CPIs of quintiles using the monthly price changes. The following figure shows the monthly CPIs for each quintile in 2012 (see Appendix 2 for the other years). In this particular case, poor households experienced the highest price inflation for the first 3.5 months of the year. In addition, the inflation rates for all quintiles were the highest in these months of the year compared to the other months. In the following months, the difference in inflation

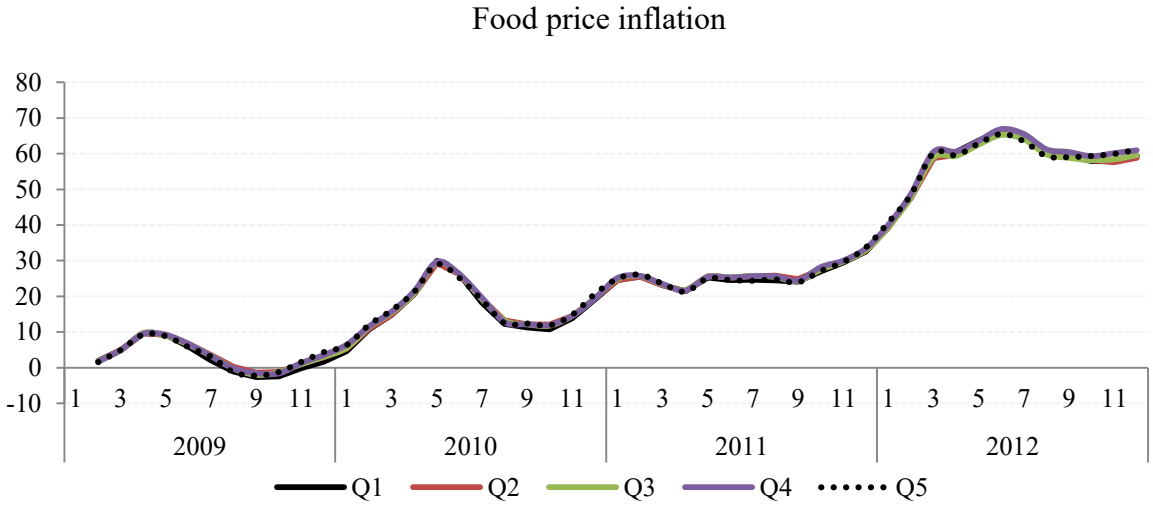
facing households shrunk, but lower quintiles faced lower inflation between July and mid-October.

FIGURE 18. MONTHLY CPIS FOR QUINTILES (2012)

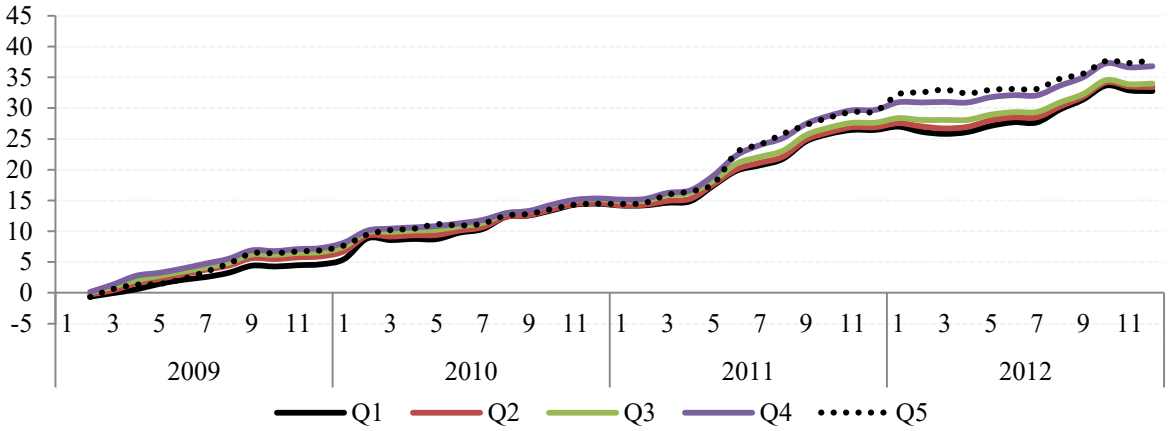


Although there is a difference in monthly and annual CPIs across quintiles, one would be interested in the cumulative measure of inflation between January 2009 and December 2012. Below we show the food, non-food and general cumulative CPI inflation rates for quintiles. As can be seen, households experienced more or less the same rate inflation over the four year period.

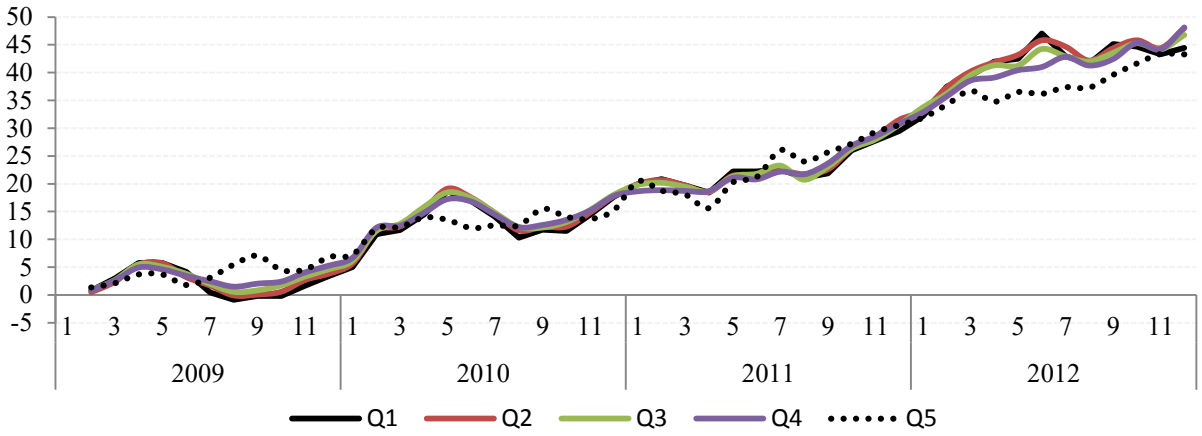
FIGURE 19. FOOD, NON-FOOD AND GENERAL CUMULATIVE CPI INFLATION RATES



Non-food CPI inflation



General price inflation



Insofar, we have found the following results:

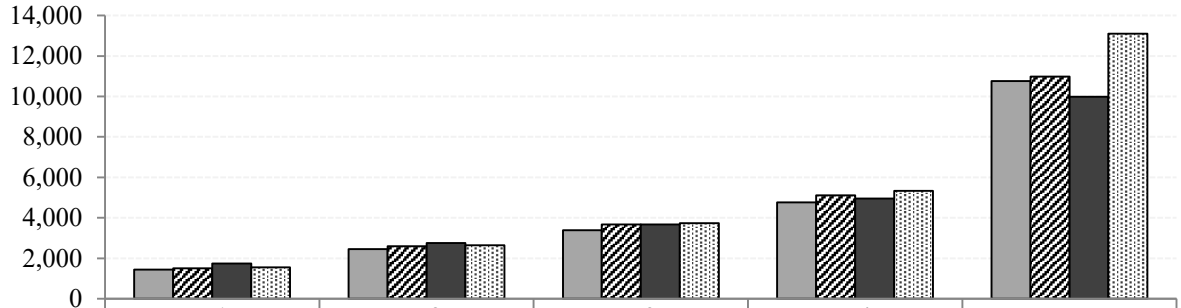
1. There is a negative relationship between the level of consumption and the consumption share of food group.
2. For the months between June and October, food CPI falls, leading to a decrease in the general CPI while the opposite is observed in the other months.
3. Given the above two, the lower is the quintile, the lower will be the inflation rate in the summer months as their consumption share of food group is higher.
4. Despite monthly and annual differences in the CPI inflation rates across households, there seems to be a mechanism which leads to a similar cumulative inflation rate for all quintiles between January 2009 and December 2012 – roughly 45 percent.

7. Real consumption

So far we have calculated the CPIs for all households and quintiles in the survey. In this section, we consider the real consumption of quintiles. In doing so, we divide households in each month into quintiles, aggregate their consumption by goods and find the consumption of an average (representative) household of each quintile on all items. Households are not repeatedly selected

but we are focusing on the consumption of an average household in each quintile. Dividing the nominal consumption of the representative household in each quintile by the actual prices, we can obtain the real quantities of each item consumed by her in each month. We then multiply the quantities of the representative household in each quintile in all 48 months by the set of prices observed in January 2009 (which is considered as the base period). Summing up the consumption expenditure on goods and services expressed by the same prices enables us to calculate the growth rate of the real consumption of representative households. In the following table, we show the annual real consumption of the representative household in each quintile.

TABLE 10. AVERAGE REAL CONSUMPTION OF QUINTILES (THOUSANDS MNT)



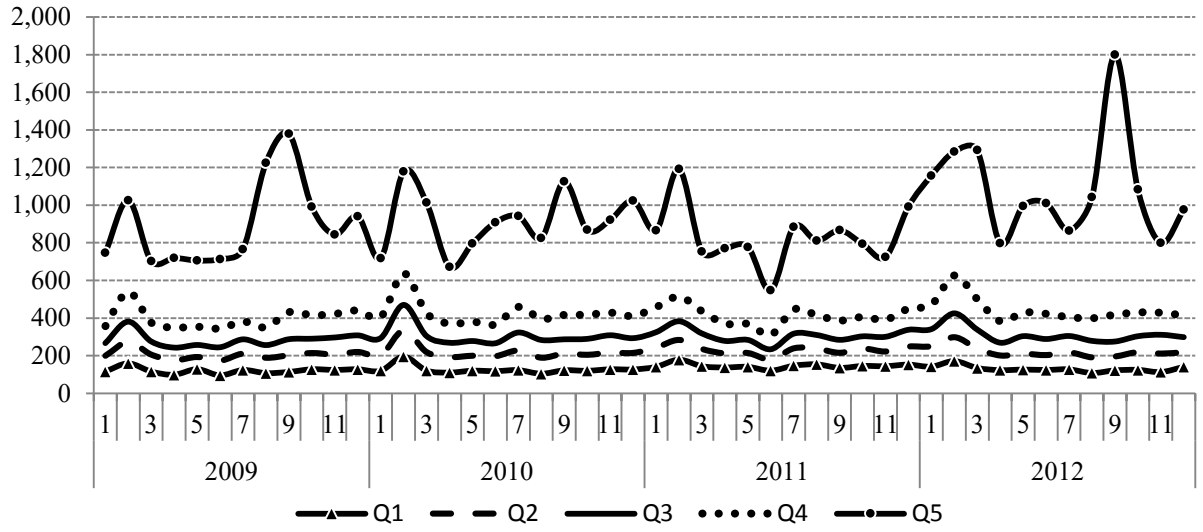
	Q1	Q2	Q3	Q4	Q5
2009	1,435,801	2,457,225	3,393,235	4,760,291	10,759,074
2010	1,505,888	2,604,369	3,664,606	5,115,386	10,987,660
2011	1,737,876	2,761,798	3,673,864	4,954,710	9,977,411
2012	1,554,761	2,647,043	3,736,965	5,325,733	13,098,556

The following figure shows the time series of the real consumption of the representative households. It is straightforward to see the difference in real consumption of households in each quintile. We fit trends line using an exponential function to the data and estimate the monthly growth rates of real consumption of each representative household (see Table 11). As can be seen, the real consumption of quintile 1 and 5 grew at the fastest rates per month while those of other three quintiles grew at more or less the same rate. Given these growth rates, one may forecast that the gap between the rich and the others will widen but the poor is likely to catch up with the upper quintiles. However, the R^2 for each fitted equation is very low (under 1 percent) so it is hard justify that these growth rates are correct.

TABLE 11. MONTHLY GROWTH RATES OF REAL CONSUMPTION (QUINTILES)

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Growth rate (%)	0.26	0.17	0.18	0.19	0.42

FIGURE 20. REAL CONSUMPTION DYNAMICS OF QUINTILES (THOUSANDS MNT)



Another feature from Figure 20 is that the real consumption of quintile 5 is relatively noisier as including all the households with the highest level of consumption. We can also see the seasonality in all quintiles – i.e., the real consumption in all quintiles tend to increase relative to the trend in February and July reflecting the festive seasons, Tsagaan Sar and Naadam respectively.

8. Conclusion

We have come to the point where we can draw conclusions on our research. To see the effect of inflation on households, we studied the consumption behavior of 25690 households in 123 food items and 10 non-food groups in period of 2009-12. We calculated the consumption share of all 133 items by individual households and quintiles as well as aggregate (monthly and annual) shares. For example, the average consumption share of food group for quintile 1 is over 60 percent while it is about 25 percent for those in quintile 5. Consequently, those with high consumption share of food items are prone to food price inflation and vice versa. The aggregate consumption share of food group was, on the other hand, around 35-39 percent. Within food group, meat, milk products, bread, flour and rice account for the largest shares. For example, the food share of meat was about 40 percent in 2012. It was also found that both monthly and annual aggregate consumption shares were close to each other and consistent over time.

We then analyzed the prices of food items reported by the households and the price indices published by NSO. We used the monthly average reported prices for food items. Although the quality and purchasing time and places for food items differ, we found that the standard deviations are not overly large. As households in the HSES do not report the quantities and prices of non-food items but the cost, we had to use the price indices by NSO.

Given the consumption shares and price data, we calculated monthly and annual CPI inflation for individual households, quintiles and for all households. It was found that monthly CPIs showed significant seasonality due to increased supply of meat, milk products and vegetables over the summer and early autumn. Between May and September of all years, household specific CPIs fell but rose in the other months. The correlation coefficients between the level of consumption and household specific CPIs averaged around 0.25 in the summers but -0.25 in the other months. On the other hand, the correlation coefficients between the consumption share of food group and household specific CPIs averaged -0.5 in the summer months but 0.5 in the other months. These results indicate that households with high consumption share of food group or low levels of consumption actually benefited in the summer months as their CPIs were relatively lower than others. However, they faced with relatively higher CPI inflation in the other months. In general, food CPIs tended to lower than non-food CPIs in the summer months as meat and milk products account for significant shares in food expenses.

For annual CPIs, the results are mixed. In 2009 and 2011, households with low levels of consumption had relatively low rate of inflation – i.e., there were negative correlations between the level of consumption and the household specific annual CPIs. In the other two years, we reached the opposite outcome. These again can be explained by annual food and general CPIs. In 2009 and 2011, the food CPIs were lower than the general CPIs but higher in 2010 and 2012. For quintiles, households in quintile 1 had the lowest level of CPIs in 2009 and 2011 but the highest in 2010. For 2012, we did not find any systematic pattern.

Although households faced with different CPI inflation in each month and each year due to seasonal effects and others, it was interesting to see the difference at the end of long period. For this, we calculated the cumulative inflation rates for quintiles and found that there was no significant difference. In other words, households in quintiles faced similar rate of inflation between January 2009 and December 2012. More specifically, the quintile specific inflation rates were 44.4, 48.0, 46.8, 48.1 and 43.3 percent respectively.

We also studied the real consumption of households in quintiles and found that it grew at the highest rate for quintiles 1 and 5. More specifically, the quintile specific monthly growth rate of real consumption were 0.26, 0.17, 0.18, 0.19 and 0.42 percent respectively. This result indicates that the rich is likely widen its difference from the others while the poor is likely to

catch up with those in quintile 2. However, measuring the growth rates is highly debatable as there is no reliable one.

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10. Appendix 1

A1.1. CONSUMPTION SHARES (QUINTILES, 2009)

		Q1	Q2	Q3	Q4	Q5
1	Food and non-alcoholic beverages	62.9	55.8	49.1	41.4	24.2
2	Alcoholic beverages and tobacco	2.0	1.5	1.6	1.5	1.1
3	Clothing, footwear and cloth	3.3	4.5	5.6	7.5	8.4
4	Housing, water, electricity and fuels	11.2	12.0	11.8	10.1	7.5
5	Furnishings, household equipment and tool	2.5	2.0	1.9	1.9	3.3
6	Health, medical care and services	1.8	1.8	2.0	2.6	3.8
7	Transport	0.9	1.2	2.8	4.9	11.2
8	Communication	7.3	9.9	10.2	10.2	7.9
9	Recreation and culture	0.8	1.1	1.2	1.6	2.7
10	Education	0.0	0.1	0.1	0.2	5.2
11	Restaurants and hotels	0.7	1.6	2.3	3.2	3.9
12	Miscellaneous goods and services	6.4	8.6	11.4	14.9	20.8

A1.2. CONSUMPTION SHARES (QUINTILES, 2010)

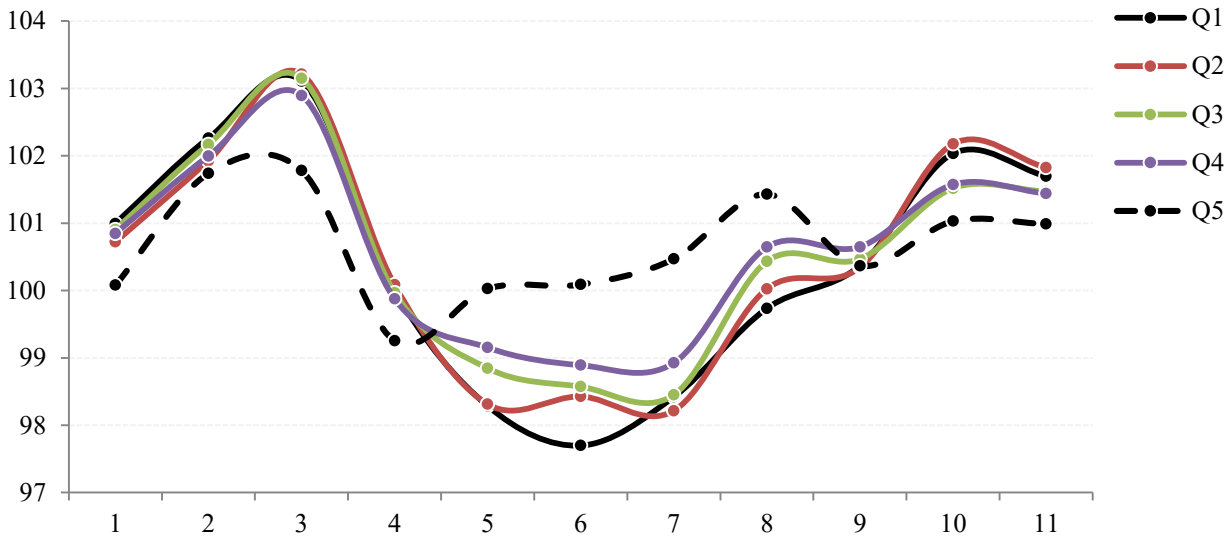
		Q1	Q2	Q3	Q4	Q5
1	Food and non-alcoholic beverages	61.6	54.4	47.3	38.4	24.4
2	Alcoholic beverages and tobacco	1.8	1.5	1.5	1.2	1.0
3	Clothing, footwear and cloth	4.8	6.1	7.2	8.5	9.6
4	Housing, water, electricity and fuels	10.9	11.1	10.8	9.7	7.0
5	Furnishings, household equipment and tool	2.5	2.2	2.1	2.2	3.4
6	Health, medical care and services	1.8	1.8	2.5	2.8	3.4
7	Transport	0.7	1.4	2.5	5.4	9.9
8	Communication	7.7	9.5	9.7	9.9	7.9
9	Recreation and culture	0.9	0.9	1.1	1.3	2.5
10	Education	0.0	0.0	0.1	0.4	3.2
11	Restaurants and hotels	0.7	1.7	2.5	3.7	4.0
12	Miscellaneous goods and services	6.6	9.4	12.6	16.4	23.5

A1.3. CONSUMPTION SHARES (QUINTILES, 2011)

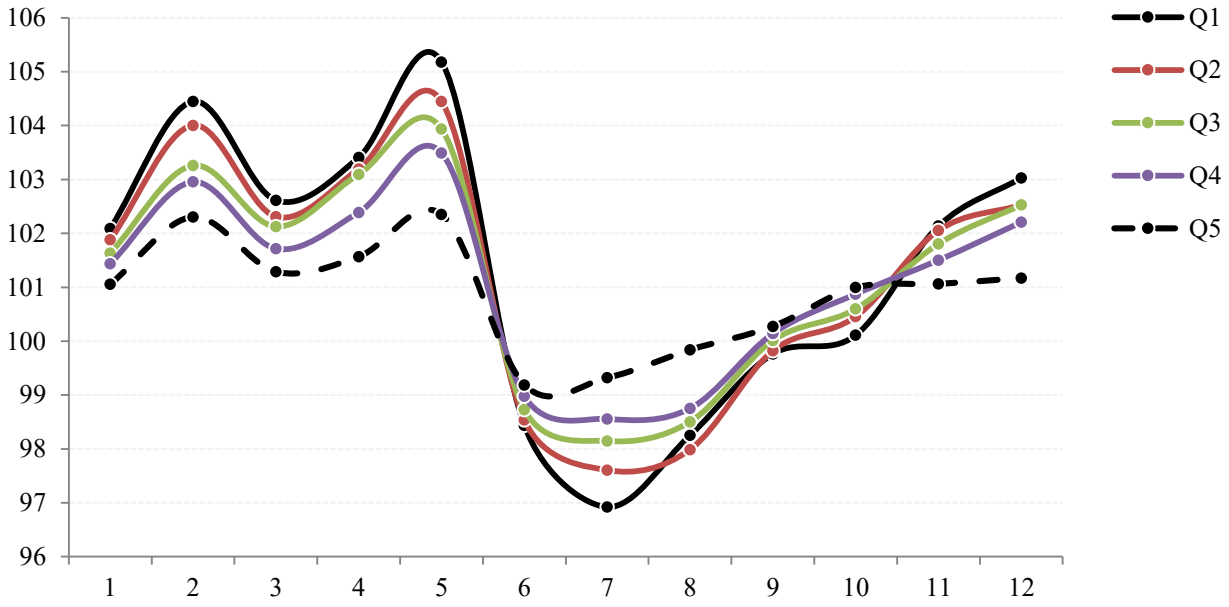
		Q1	Q2	Q3	Q4	Q5
1	Food and non-alcoholic beverages	62.4	57.0	51.9	42.4	27.2
2	Alcoholic beverages and tobacco	1.8	1.5	1.6	1.4	0.8
3	Clothing, footwear and cloth	5.0	6.0	6.8	7.4	9.5
4	Housing, water, electricity and fuels	10.5	11.8	10.7	11.0	7.6
5	Furnishings, household equipment and tool	2.3	1.9	2.1	2.2	3.4
6	Health, medical care and services	1.8	1.8	2.3	2.5	3.4
7	Transport	1.8	2.1	2.8	5.5	9.4
8	Communication	7.7	8.5	8.3	8.6	7.6
9	Recreation and culture	0.8	0.9	0.9	1.1	2.5
10	Education	0.0	0.0	0.2	0.4	3.3
11	Restaurants and hotels	0.6	1.4	2.0	3.1	3.6
12	Miscellaneous goods and services	5.3	7.2	10.4	14.4	21.7

11. Appendix 2

A2.1. MONTHLY CPIS FOR QUINTILES, 2009



A2.2. MONTHLY CPIS FOR QUINTILES, 2010



A2.3. MONTHLY CPIS FOR QUINTILES, 2011